American Machinist

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

ISSUED WEEKLY

VOLUME LVII

July 1 to December 31, 1922

McGRAW-HILL COMPANY, INC.
10TH AVENUE AT 36TH STREET
NEW YORK

AMERICAN MACHINIST

INDEX TO VOLUME LVII

July 1 to December 31, 1922

EXPLANATORY NOTE

Illustrated articles are m... e. with an asterisk (*). New shop equipment as described in the departments "Shop Equipment News" and "Condensed Clipping Index of Equipment" with a double dagger (‡). Cross references to a particular initial work may apply also to its derivatives. The cross references condense the matter and assist the reader but are not to be regarded as complete or conclusive. So, if there were a reference from "Milling" to "Jigs and Fixtures," and if the searcher failed to find the required article under the latter topic, he should look through the "Milling" entries, or others that the subject might suggest, as he would have done had there been no cross reference. The plural of any given item may not necessarily follow the singular immediately, as the items are listed in alphabetical order. All articles written by any given author are listed directly under his name in the special author's index which starts on page 13. Articles that are not credited to any author may be found under the heading "No author," listed under "N" in the Author's Index.

Following is a list of the pages included in the several numbers of the volume by date and number.

July	6—No. 1	Pages	1-44
"	13—No. 2	"	45-84
"	20—No. 3	"	85-124
"	27—No. 4	"	125-168
Aug.	3—No. 5	"	169-204
"	10—No. 6	"	205-244
"	17—No. 7	"	245-280
"	24—No. 8	"	281-320
"	31—No. 9	"	321-360
Sept.	7—No. 10	"	361-396
"	14—No. 11	"	397-436
"	21—No. 12	"	437-472
"	28—No. 13	"	473-516
Oct.	5—No. 14	"	517-556
"	12—No. 15	"	557-596
"	19—No. 16	"	597-632
"	26—No. 17	"	633-676
Nov.	2—No. 18	"	677-712
"	9—No. 19	"	713-752
"	16—No. 20	"	753-788
"	23—No. 21	"	789-828
"	30—No. 22	"	829-868
Dec.	7—No. 23	"	869-908
"	14—No. 24	"	909-944
"	21—No. 25	"	945-980
"	28—No. 26	"	981-1016

A

NEWS SECTION

AUTHORS' INDEX

American Machinist

Volume 57 NEW YORK, JULY 6, 1922 Number 1

Melting and Pouring Aluminum Alloys

Proper Care of Furnace—Effect of Melting and Pouring Temperatures on Castings—How To Overcome Foundry Difficulties

FROM SALES DEPARTMENT CONDENSED DATA PREPARED BY THE TECHNICAL DEPARTMENT, ALUMINUM COMPANY OF AMERICA

WHEN the peculiarities are mastered, foundry work in aluminum is very satisfactory due to its response to constant manipulation. Among the peculiarities to be considered, the effect of melting and pouring temperatures upon the casting is of greatest importance. The necessity for careful temperature control at all stages of the melting and pouring process cannot be over-emphasized, for disregard of temperature regulation undoubtedly is one of the most prolific causes of foundry troubles. Experience has shown that melting and pouring temperatures of the metal influence the physical properties and structures of a casting to an almost unbelievable extent. Aluminum should preferably be melted in ordinary plumbago crucibles, and, if not overheated, it will absorb no appreciable amount of silicon from the crucible. Aluminum remelted twenty times in such a crucible showed an addition of only one-tenth of one per cent of silicon. Nor does aluminum unite with carbon to any considerable extent when heated in contact with it, unless the metal is heated much above its melting point. However, plumbago crucibles are short-lived and, consequently, expensive. They are also not very well suited to large-scale foundry work. As a result, cast-iron pots are probably more generally used for remelting purposes. If the iron pots are well cared for there is no danger of an excessively large amount of iron being taken up by the metal.

> THE PHYSICAL properties and casting structure are affected by the melting and pouring temperatures and require accurate temperature control in foundry work. Excessive oxidation and gas absorption are the results of overheating aluminum alloys.
>
> Temperature regulation and better care of remelting receptacles diminish hard spots and harmful high iron content.
>
> Checking and drawing are eliminated by softer cores, larger gating and fillets, risers or chills, uniform ladle temperature as well as better casting designs.

As a matter of fact, the furnace must be carefully attended if the metal is not to be contaminated. After each heat, or at the end of the day, if a continuous heat is run, the crucible or pot should be thorougly cleaned. The interior of the crucible should then be covered with a carbon wash. The iron pot should be given a plumbago wash followed by a lime wash. These coatings serve as a protection against the action of the molten metal, and their importance will be more clearly seen in the subsequent treatment of foundry troubles.

Gas and oil are the best fuels for remelting aluminum because their use gives the best possible control over the temperature in the furnace. Coke is also used.

No charcoal or carbonaceous covering should be used on aluminum, because the charcoal is liable to become incorporated in the metal and find its way into the casting. A better way to prevent oxidation is to prevent overheating of the metal by means of accurate temperature control.

The charge should be stirred frequently in order to thoroughly disseminate the alloying metal through the aluminum. It should not be allowed to remain long on the fire after the metal is thoroughly fused and mixed, for it has been found that the longer any metal is held in the furnace the more unsound are the resultant castings, regardless of the melting and pouring temperatures. Before being removed from the furnace and again in the ladle just before pouring, the metal should be carefully skimmed. As stated before, aluminum oxidizes rapidly and consequently has considerable dross on it. Unless great care is exercised in removing this dross, it may become immersed in the body of metal and pass into the casting with the consequent poor results.

The mold should be poured slowly and carefully; otherwise, the thinner sections of the mold may not be filled; and also, the mold may wash, incorporating sand in the casting. When the casting is machined or polished the grains of the sand drop out leaving small pinholes in the surface of the metal. In order to prevent cracking the casting should be stripped as soon as it has set.

Fluxes are not generally used in good aluminum foundry practice. A flux is not needed with virgin aluminum or alloys because of their freedom from impurities and oxides. However, when scrap metal, particularly in the form of borings and turnings, is remelted a zinc chloride flux may often be used to advantage in order to increase the amount of metal recovered. The flux serves to promote union by removing the coating of oxide which surrounds each small piece of metal.

Alloys of the same chemical composition melted and cast under different temperature conditions display markedly different characteristics. A realization of this accounts for the fact that most progressive foundries are now pouring all aluminum castings under strict

pyrometric control. A reliable pyrometer today is considered an absolute necessity in every up-to-date foundry. Good practice favors keeping the temperature of the metal during melting at a point but slightly above its melting point by control of the furnace heat or continuous addition of solid metal. At no time should this temperature exceed the pouring temperature except just previous to pouring, when it may be raised sufficiently to allow for the cooling which takes place during the time the metal is being removed from the furnace, skimmed and carried to the molds.

The reason for this is the excessive oxidation of aluminum at high temperatures. In as much as aluminum has a great affinity for oxygen of the air, its oxidation can never be entirely prevented, but it can always be maintained at a minimum by keeping the temperature of the charge low. Regardless of the thoroughness with which the metal is skimmed, if it has been overheated, excess oxides will become incorporated in the metal producing unsound and weak castings. Another reason why the charge should not be overheated is the tendency toward gas absorption at high temperatures.

However, should the charge become overheated in spite of frequent use of the pyrometer, the harmful effects of overheating may be minimized by the exercise of care in cooling the metal down. The charge should never be violently disturbed while in this state. The metal to be added, instead of being thrown into the charge, should be taken up with a pair of tongs and quietly stirred in the center of it. Care should be taken not to touch the sides of the crucible or pot, for this may chip the protective coating and expose the vessel to the intensified action of the metal at this temperature, introducing "hard spots" in the casting.

Some founders claim that the melting temperature is not so important provided the metal is poured at the right temperature. This is a serious error, for experience shows that the higher the temperature to which the charge is heated, the more unsound are the castings, irrespective of the pouring temperature.

Pouring Temperature and Tensile Strength

The following paragraph embodies most important suggestions for the foundryman, and is especially commended to his careful consideration:

The metal should be poured at the lowest possible temperature consistent with sufficient fluidity to completely fill the mold and at the same time allow air bubbles and gases to escape from the metal before it solidifies. This temperature will vary with the type of casting. A small thin casting must be poured hotter than a large thick one. Pouring the metal too cold causes cold shots, blow holes and lack of sharpness in the finished casting. Pouring the metal too hot causes low tensile strength, coarse grained and porous structure, rough surface, blow holes and very often shrinkage cracks.

The influence of the pouring temperature on the tensile strength of the metal is illustrated in certain tests made by H. W. Gillett. He obtained the following results from an experiment conducted to determine the relation between the pouring temperature and the tensile strength of No. 12 alloy:

Pouring Temperature in Degrees, Fahrenheit	Tensile Strength in Lb. Per Square Inch	Pouring Temperature in Degrees, Fahrenheit	Tensile Strength in Lb. Per Square Inch
1,250	20,000	1,450	17,600
1,300	19,500	1,500	17,[illegible]
1,350	18,500	1,550	17,000
1,400	18,000	1,600	16,000

It will be noticed that the tensile strength decreases as the pouring temperature increases. The explanation for this is that metal poured at a high temperature requires more time to solidify than the same kind of metal poured at a low temperature. Slow crystallization allows the crystals formed to increase in size, and large crystal growth means weak castings. The finer the grain, the stronger the metal. The rate of solidifying is also influenced by the size and thickness of the castings and by the heat conductivity of the mold. But as neither of these are entirely subject to the control of the foundryman, he is chiefly concerned with seeing that the metal is never poured at a higher temperature than is absolutely necessary for the casting in question.

Melting No. 12 Alloy

Though the practice of making No. 12 alloy in small heats by melting down the virgin aluminum and copper is not a good one, in emergencies it is sometimes resorted to by foundrymen. When this is done, certain precautions must be taken in introducing the copper into the aluminum. Because of its high melting point copper is usually introduced in the form of a rich copper alloy or hardener containing 50 per cent copper and 50 per cent aluminum, the melting point of which is lower than that of pure aluminum.

This alloy is made by melting down pure copper in one crucible and an equal amount of pure aluminum in another. When both metals are thoroughly melted the molten copper is poured into the molten aluminum. The union of the two metals produces a rise in temperature, and it has been found to be a good practice instead of melting down all of the aluminum at first to reserve a part of it and add it in the solid form at this time to offset the rise. The two metals should then be thoroughly mixed either by pouring the metal from one vessel to the other, or by stirring. The metal should be cast in the form of convenient ingots. The resulting alloy is very brittle, an ingot breaking readily on being dropped to the floor. This is an advantage in weighing out small quantities of the alloy to add to the metal.

The introduction of this alloy into the pure aluminum is easily done because of its low melting point. In order to obtain 8 per cent copper in the resulting alloy, 84 parts of pure aluminum to 16 parts of the 50-50 rich copper alloy are used. The pure aluminum is melted down first and then the alloy is added. The mixture should be thoroughly stirred to insure complete dissemination of the copper throughout the alloy. Although the alloy is now ready to pour into castings, a better practice is to cast the metal in ingot form and remelt later. The remelting gives the aluminum a better chance to form a uniform alloy with the copper.

Hard Spots from Overheating

Hard spots are small pieces of a small flint-like foreign substance in the casting which readily take the edge off any machining tool. They have their origin primarily in the plumbago crucibles or iron pots used in remelting the alloys in the foundry. In the plumbago crucibles the molten aluminum attacks the clay, reducing the silica to silicon to some extent, and permitting small pieces of the graphite to become dislodged and fall into the metal. Under the high heat of the furnace, these pieces are baked to a consistency closely resembling that of corundum, and find their way into the casting, forming hard spots. In cast-iron pots the action of the aluminum on the iron forms a hard ferro-

aluminum alloy. Pieces of this alloy break off, become incorporated in the metal and are cast with it. It has been found, however, that hard spots from this source are never so hard as those formed in plumbago crucibles.

The formation of these hard spots is increased by overheating the metal, for the action of aluminum on the crucible or pot is intensified at higher temperatures. Failure to clean the remelting receptacles frequently and to cover them with a protective wash also provides conditions favorable to their formation. In order to prevent hard spots care must be exercised in every step of the remelting process. Attention to no one detail will eliminate them entirely. Thus, though it may be said their remedy lies principally in the better care of the remelting receptacles and proper temperature control, no absolute assurance can be given that they may not develop from other sources.

The following suggestions have proved helpful where trouble from hard spots has arisen:

(1) Clean the plumbago crucibles or iron pots after each heat or at the end of each day.

(2) Give the plumbago crucibles a carbon wash and the iron pots a plumbago wash followed by a lime wash at the end of each day.

(3) Never overheat the metal. Use a good pyrometer.

(4) Discard remelting pots and crucibles before they get too old.

(5) Remelt skulls from discarded pots and crucibles separately so as not to contaminate the good metal.

(6) Skim the metal well before pouring. Then let it become quiet before dipping.

(7) Never dip near the bottom of the pot or crucible in removing metal. Hard spots, being heavy, sink to the bottom of the pot.

(8) For the same reason, never drain the pot except after each heat or at the end of the day when the metal in the bottom of the pot should be cast in ingot form and used later for low-grade casting work.

Checking and Drawing

Checking and drawing of castings may be caused by cores that are too hard, overheated metal, improper gating or uneven shrinkage of different sections of the casting. The importance of making the cores as soft as is consistent with safe handling has been emphasized before. If cores offer any resistance to the metal on contraction, especially when the metal is in its hot short state, a cracked casting is almost sure to result.

Drawing of the metal due to improper gating is a frequent occurrence. A porous, spongy appearance is often seen below the place at which the gate joins the casting, especially if this be at a heavy section of the casting. The reason for this is that the gate or fillet where the gate joins the casting is made so small that the gate cools faster than the casting itself and consequently draws away from the liquid casting adjoining it. The remedy lies in a larger gate and more liberal fillet.

Uneven shrinkage of the metal in different sections of the casting probably causes more checking and drawing than any other one thing. One of the best illustrations of shrinkage of this nature exists at the point where a light section of the casting joins a heavy section. Here the light section cools first and the heavy section, which is still liquid, will "draw" from the light section, causing shrinks or cracks. One method of overcoming this is to place a riser over the heavy section so that on cooling the heavy section will draw metal from the riser above it. Another method is to hasten the cooling of the heavy section so that it will set as fast as the light section. This is usually accomplished by setting chills in the mold next to the heavy section.

Another illustration of the evil effects of uneven shrinkage is often seen in large castings which are poured from two different ladles or crucibles of metal. The temperature of the metal poured into one sprue was not the same as that of the metal poured into the other sprue, and as a result of the uneven contraction, large cracks, sometimes extending entirely through the casting, are seen. When two ladles must be used in pouring a casting, care should always be taken to see that the temperature of the metal in each of the ladles is the same before pouring begins. Still another method for reducing the evil effects of uneven shrinkage of two sections of a casting lies in better design of the casting. Castings are often designed with unnecessary variations in the thickness of the various sections and with such a multiplicity of ribs, gussets and brackets that the inharmonious contraction of the several sections entirely defeats the intention of the designer.

High Iron Content

As previously stated, a small amount of iron in aluminum is not detrimental. However, when the iron content rises over 1½ to 2 per cent trouble is liable to start, for a high percentage of iron is usually attended with certain harmful effects. Chief among these is probably the tendency toward brittleness.

High iron also gives a coarse grained, spongy structure to the metal. The reason for this is that iron makes the molten aluminum sluggish, and as a result it must be poured at an abnormally high temperature with the usual bad results. High iron content can generally be detected by the spangled or crystalline appearance of the surface of the casting. It is also indicated by the fracture of the casting which exhibits a coarse, crystalline structure. However, inasmuch as iron may exist in the metal in sufficient quantities to be detrimental, but not in large enough amounts to be evident from the surface or fracture, absence of these visible signs does not necessarily prove that the iron is low enough to cause no trouble. Chemical analysis must always be resorted to if there is any doubt as to the presence of injurious quantities of iron. Obviously, the only sources of iron are the iron pots, ladles and stirring rods used in remelting, and the remelted metal. Any measures taken to protect the iron receptacles or tools from the action of the molten aluminum or to improve the quality of the metal which goes into the remelt will prove useful in keeping the iron content at a minimum.

The precautions suggested for avoiding hard spots are also helpful in limiting the iron content, and together with the following represent a few of the measures which have been tried and found effective:

(1) Never overheat the metal—overheating increases the action of aluminum or iron.

(2) Never use too high a percentage of sprues and gates in the remelt—each additional melting adds more iron to the metal. If high iron has a good start in the foundry, melt all foundry scrap separately.

(3) Never use scrap from indeterminate sources without first subjecting it to chemical analysis.

The importance of always keeping the iron pots and

ladles clean and covered with the protective coating of plumbago and lime cannot be over-emphasized. Aluminum will take up a certain amount of iron no matter what precautionary measures are taken, but the amount so absorbed can always be kept at a minimum by preventing, so far as possible, actual contact of the molten aluminum and its iron containers.

Particular attention is also called to the cumulative effect of adding sprues, gates, fins and other foundry scrap, already high in iron, to the charge of metal. If the foundry is experiencing troubles from high iron, the amount of iron normally absorbed from the pots and ladles is augmented by the introduction of high-iron foundry scrap, and, as a result, each succeeding crop of gates and sprues contains more iron than its predecessor. The only way to put an end to such a state of affairs in the foundry is to remelt the sprues, gates, fins and other foundry scrap separately and use the resulting metal, probably in combination with a small quantity of good metal, for the production of low-grade castings which do not call for a metal that is able to withstand severe shocks and strains.

Automotive Service Methods and Equipment

XIII. Service Welding and Machining Operations in the Yellow Cab Plant—The Lathe as a Boring Machine—Economical Salvaging Methods

BY HOWARD CAMPBELL
Western Editor, American Machinist

A RECENT issue of AMERICAN MACHINIST contained an article describing some of the tools and fixtures in use in one of the service assembling plants of the Yellow Cab Co., of Chicago. In the present article, a number of welding and machining operations are described, these methods having been found by the Yellow Cab Co. to be the most inexpensive for making repairs on the parts described.

The operation of re-seating valve ports in cylinders

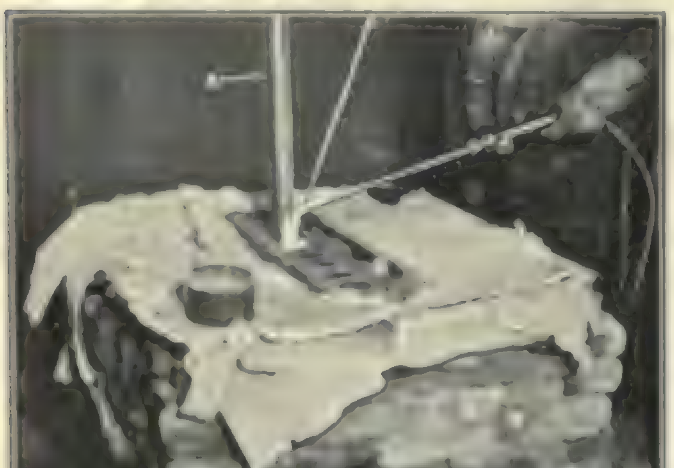


FIG. 1. WELDING A VALVE SEAT

is one with which most service men are familiar, and all know that when the cylinder can no longer be re-seated, it is usually thrown away. When a cylinder has reached such a point in the Yellow Cab plant, the entire valve port is welded over and rebored and re-seated. In Fig. 1 an operator is shown welding one of these ports. The cylinder is placed in a brick oven, as shown, and is heated by burning as much charcoal as can be packed around the cylinder. This is to prevent distortion, cracking, etc., of the cylinder, while welding. When the cylinder is sufficiently heated, the operator inserts a pipe, shown at *A*, in the port next to the one that is to be welded, this pipe acting as a sort of chimney for the gases to escape. If the valve is 1½ in. in diameter, a ½-in. section is cut off the end of a 1½-in. round bar of carbon and this section is placed under the valve opening and braced there with a handful of asbestos. The carbon will not melt, and thus prevents the hot metal from running down through the hole. Then the operator, using the welding torch and a bar of practically pure iron, proceeds to build the valve port full of metal. The hole is gradually built up from the edge to the center, and when it is entirely filled, the metal is puddled very carefully in order to make it as uniform as possible. Sheets of asbestos are placed around the cylinder, over the oven, to retain as much of the heat as possible. The port is then bored and seated in the usual manner.

REPAIRING A SCORED CYLINDER

When a cylinder bore is scored, if the score is perpendicular, as is usually the case, it is repaired by the method shown in Fig. 2. The operator sets the cylinder up as shown, and using the tool shown at *A*, cleans out the score and makes a groove in the cylinder bore. Then zinc chloride is applied in the same manner as for soldering, and what is known as "Ever-Stick" metal is fused into the groove. This metal is a special alloy which has been developed by the Great Western Smelting Co., of Chicago, for this purpose. The torch in use by the operator shown in Fig. 2 is a "Rego" gas welding torch, and the flame is produced from a combination of hydrogen and oxygen.

After the groove has been filled with metal, the tool indicated at *B* is used to clean off the superfluous metal and smooth the surface of the bore. The cutting edge of this tool is ground to the same radius as the bore of the cylinder, and when the operator gets through scraping the mended spot, it is nearly as good as new.

The operation of pre-heating a crankcase preparatory to repairing by welding is shown in Fig. 3. Cracks are mended and holes are filled in with the aid of the gas-torch and aluminum solder. Before the actual operation of welding the broken spot is started, however, the case is heated all around the vicinity of the break so that the repair will be effective. In order to prevent the case from warping due to this pre-heating, the shaft *A*

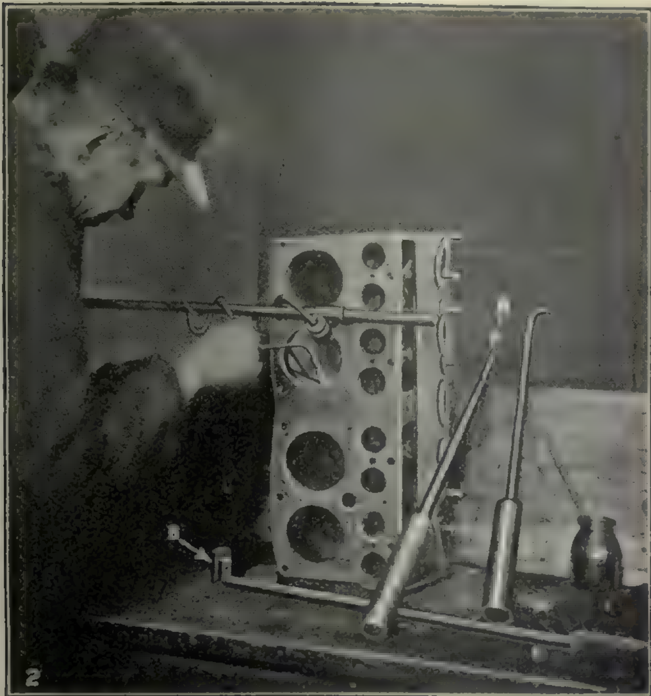


FIG. 2. REPAIRING A SCORED CYLINDER

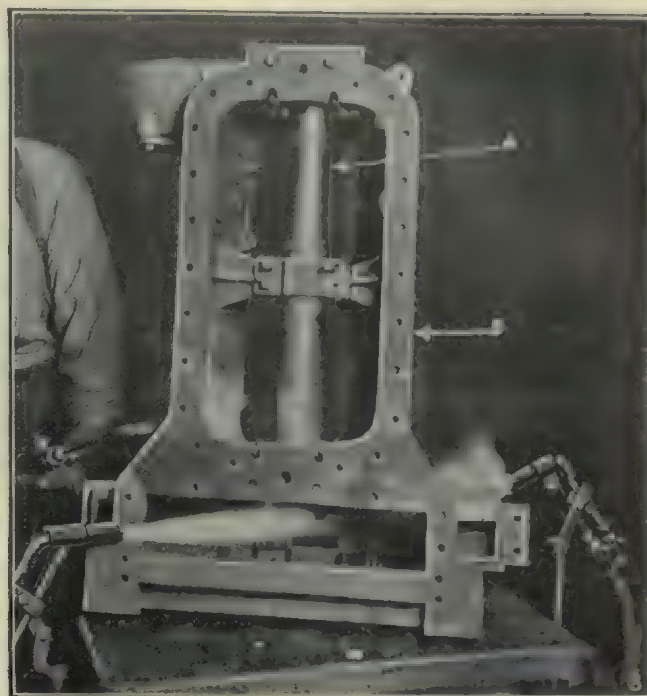


FIG. 3. PRE-HEATING A CRANKCASE BEFORE WELDING

is bolted in to the bearings and the plate *B* is bolted to the flange in the manner shown. The shaft is 2⅞ in. in diameter and the plate is 1 in. thick. The use of this shaft and plate are very effective in preventing distortion of the case.

The Lathe As a Horizontal Boring Machine

The reboring of a crankcase bearing that has been built up with aluminum solder is shown in Fig. 4. The case is held in position by two posts at the rear end, one of which can be seen at *A*, and by the boring bar itself at the center and rear bearings. This is accomplished by the use of two sleeve bushings which are bolted into the center and rear main bearings, the bushings containing bronze shells which are bored to a running fit for the bar. The bar is 1½ in. in diameter and has openings for toolbits in three places so that any one of the three bearings can be bored.

It is seldom that more than one bearing has to be rebored, which makes it possible to align the bar by using the sleeve bushings in the other two bearings.

The operation shown in Fig. 5 is that of remilling the face of a transmission case that has become so badly worn that it had to be built up with aluminum solder. The piece is held in position by means of the arbor *A* and the clamp *B*. The arbor, which fits the main transmission shaft hole, is 3⅜ in. in diameter and 12 in. long. It is attached with screws at the lower end to a plate which is bolted to the table of the machine.

The sleeves which are used to align the boring bar for boring out the transmission case bearings can be seen in Fig. 6. The bar, which is held between the centers of the lathe, is a sliding fit in the bushing of the sleeve shown at *A*. The bar shown in the toolholder is bent up on the end and is drilled so that it can be bolted to the flange of the case at the point indicated at *B*. This not only holds the case from turning, but also makes possible the use of the automatic feed. The cutting tool itself can be seen in Fig. 7, and the reverse end of the upper one of the two bushings can be seen at *A*. Inspection of the flange of the case will show where it has been built up in places that had become badly worn. To face this off, an arbor is put into the hole *A* and the piece is swung between centers and faced in the usual manner.

Salvaging Worn-Out Parts

Some of the methods of re-claiming worn-out parts are shown in Fig. 8. The piece indicated at *A* is a drive shaft that is entirely worn out in the bearings, as can

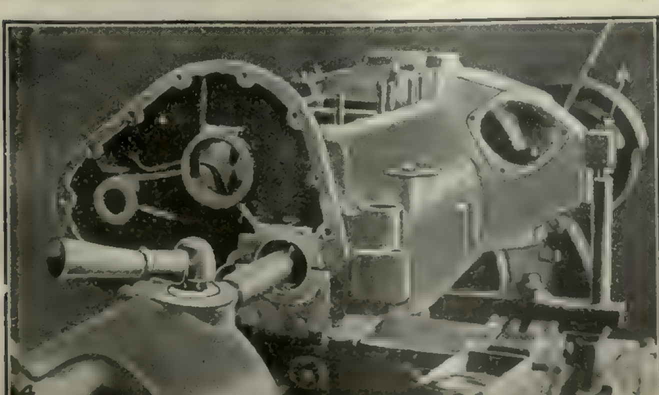


FIG. 4. RE-BORING A CRANKCASE BEARING IN THE LATHE

FIG. 5. RE-MACHINING A BUILT-UP TRANSMISSION CASE

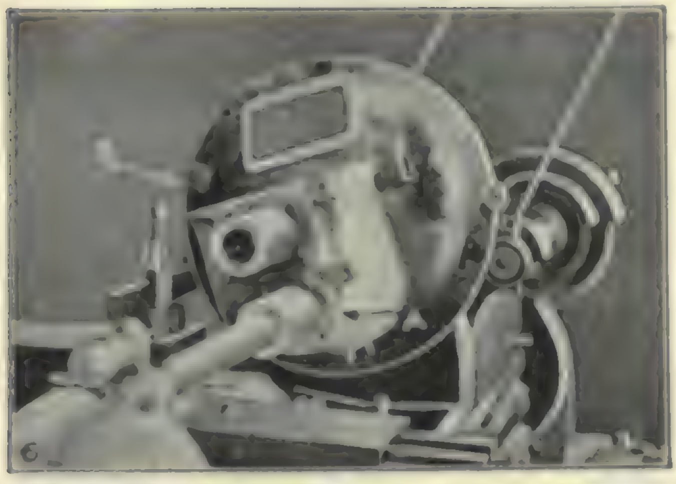


FIG. 6. RE-BORING A TRANSMISSION CASE

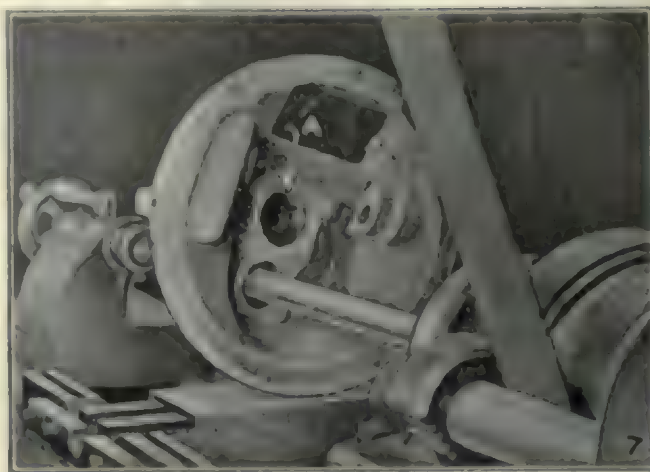


FIG. 7. VIEW OF THE BORING TOOL

be seen. Instead of scrapping this, new metal is welded into the bearing and the piece is re-machined so that when finished it appears as shown at *B*. This only takes care of one end, however. When the splined end *C* becomes badly worn, it is built up and the splines are remilled. Occasionally a shaft is twisted or broken in two, in which case the ends are inserted into a length of tubing and welded in, which makes it as solid as before. The pieces indicated at *A* and *B* are both examples of this, and the joints where the splined end enters into the tubing can be seen on the piece *C*.

In cases where an axle shaft becomes badly worn at

FIG. 8. SALVAGED PARTS

one end and the other end is still good, the shaft is cut in two and the good end is saved. One good splined end is then welded to one end on which the taper is still good, thus making a complete good shaft. Two such ends are shown at *D* and *E*. The shaft indicated at *F* was one on which the splined end wore completely out and as there were no other splined shaft ends in stock, a section of shaft was welded on as shown, and this section will later have the splines milled in the regular way. Those sections of shaft which cannot be used further as axle shafts, are cut to length as shown at *G* and turned down to make transmission countershafts similar to the piece shown at *H*.

It can be seen that nothing is ever thrown away in this shop until every possible use has been made of it and it has reached the point where further repair would be wasteful.

Why Machine Tool Prices Cannot Come Down

BY B. B. QUILLEN
President, Cincinnati Planer Co.

The average buyer does not stop to think why prices of machine tools are high, and must continue high. He has in mind only the fact that he bought a machine at a certain price back in 1914, and thinks that he should be able to buy at that price again; but he overlooks the following items which enter into the cost of our product, and which will make it impossible to ever again buy at pre-war prices:

(1) Taxes now comprise a very important part of the cost of our product, and they will continue as one of the important items for many years to come.

(2) Freight rates are practically double what they were, and it will be a long time before they will come down to any great extent.

(3) Passenger rates are also higher, and will continue so, making selling expenses much higher than ever before.

(4) Wages will continue higher than ever before, for the reason that we are all living on a higher level, and will not go back to pre-war conditions.

(5) The working hours have been lowered to 48, and will remain on that basis, which means added cost.

(6) All manufacturers have greatly improved their product; the machines are heavier, and many attachments have been added, increasing the cost, which must be a permanent addition to the selling price.

(7) Prices have already been greatly reduced on machine tools, and there can be very little hope of their going lower. They may go up.

Factory Storekeeping and Material Control

The Fifth Article—Storeroom Layout—Benefits of Centralized Storage—How the Materials Should Be Arranged and Indexed

BY HENRY H. FARQUHAR

AS IS true of most other phases of material handling, the details of the arrangement and operation of the storeroom must naturally be developed to meet local needs. The storeroom, however, serves the same purpose in the factory that the bank vault does in the storage and safeguarding of money, and no material procedure can be considered complete unless a thorough study of the storeroom needs has been made and unless storeroom operation has been systematically tied into the rest of the routine. The requirements for the storage of different materials in different types of industry may vary tremendously. Thus, in some cases, much material may be stored in the open and under such conditions it would be money wasted to build a house for its accommodation. Other supplies may be stored out-of-doors provided a roof is erected to keep the rain and snow from coming into direct contact with the material. In other cases, however, adequate housing must be provided if losses are to be prevented. It is with particular reference to this latter class of goods that the following remarks apply, although in general the problems of storage outside or inside are in many respects similar.

> THE LOCATION and layout of a storeroom may be compared with the location and layout of a modern city, and any item in the storeroom should be as easily located by its index number as a numbered room in a given house number on any street in a city.
>
> Centralized storage has the advantages of stricter supervision, more accurate inventory, less chance for duplication, better space utilization and less clerical work.
>
> These advantages are offset by the additional transportation necessary and the less intimate knowledge of the local departmental needs and customs otherwise acquired by the storekeeper.

THE BEST LOCATION FOR STORING MATERIALS

In considering the physical location of the one or more storerooms which may be necessary and the responsibility for the operation of each one, a great many different things must be taken into account. On the one hand, the obvious benefits of centralization in one storage place should be weighed carefully against the offsetting cost of transportation and the less efficient service often given to the departments where materials are needed if complete centralization is in effect. A careful study of the floor plans and of the paths of travel of materials must be made to give the best location for the storeroom, all things considered. At best, in any large factory this question is a perplexing one.

Somewhat akin to the foregoing considerations are those affecting the determination of whether raw materials and partly worked or finished parts are to be stored in the same room. Are factory supplies, such as clean cotton waste, oils, lubricants, etc., to be kept in the same storeroom with raw materials? Are special stores used only in one department to be stored in or contiguous to that particular department, or are they to be stored in the central storeroom?

If, through considerations of service to the departments concerned, departmental supplies are to be stored in the department, how is accurate control of inventory and of receiving and issuing in general, to be maintained? On the other hand, if such supplies are to be kept in the central storeroom because of the concentration and more accurate control possible through such an arrangement, how is the procedure to be arranged so that service to the departments themselves will not be sacrificed?

The same questions arise in the storage and responsibility of spare parts for machines and of all the miscellaneous items of supplies used in the maintenance department. Since the latter department is itself strictly a service department for the whole establishment, very careful consideration must be given to the storage and handling of maintenance supplies so that this department may not be handicapped through restrictions or regulations in the material supply.

One may not safely generalize in answer to such questions. On the other hand, however, there are certain considerations which must not be overlooked in the answer to any one of these questions under given conditions. I trust that the following observations may assist in avoiding some of the mistakes frequently encountered in practice because of superficial attention to the various points involved.

ADVANTAGES OF ONE STOREROOM AND ONE HEAD

There are many undoubted advantages of centralizing the storage of *all* materials in one place. Serious consideration, particularly in small and medium sized plants, should be given to this possibility. Foremost among these advantages is that of being able to fix the responsibility for all functions which a storeroom is supposed to perform. Supervision under such circumstances may be much more easily obtained and of a stricter and more detailed nature than is possible with scattered storage. Furthermore, inventory may be kept not only more accurately but also at a lower figure by avoiding the duplication almost inevitable with several storerooms. Better space utilization may be secured for the same reason. Also the clerical help needed in storeroom attendance and in balance sheet and all other clerical operations may be lessened.

As opposed to these advantages are the disadvantages of additional transportation and of a less intimate knowledge of local departmental needs and customs on the part of the central storekeepers.

Whether centralized or decentralized storage is

For the author's forthcoming book.

adopted, the responsibility for all receipts into stores, storage, custody while in stores, and issue from stores, should be strictly centralized. If we have subsidiary storerooms, therefore, they should all be definitely placed under the supervision of a head material man for the whole establishment. In no other way can the uniformity in practice necessary to strict control be secured.

There may be one storekeeper required on full time for each subsidiary storeroom, possibly more, but all of the storekeepers and assistants should look up to one man, who in turn is held responsible by the manager for the upkeep of the whole material storage system. Just so far as possible the same routine in receiving, accounting for, and issuing materials should be followed throughout all the storerooms.

How to Control Departmental Supplies

In general it has been my experience that whether we have departmental storerooms from which articles are issued to the workplace, or whether we have no departmental storerooms but have everything centralized, the best way to handle departmental supplies is to issue to the department (whether to the workplace itself or to the subsidiary departmental storeroom) only enough supplies to last a reasonable length of time, say from one to two weeks. The main reservoir of material for this department should be retained in the central storeroom.

Depending upon the type of material used in the department, after supplies have been forwarded from the central storeroom, no further paper records of the transaction are necessary when these supplies are put to use. As an example, nails, bolts, tacks, and similar articles may be issued to the department in considerable quantities, and may be charged at the time simply to departmental supplies and issued thereafter to the workmen as needed without additional paper work.

Or again, where it is desirable from a cost-finding standpoint to charge each job with its exact amount of material used, it is necessary to require a stores issue for each lot of material furnished. In this case, the original stores issue made out when the materials were transferred from the central to the departmental storeroom may serve simply as records for the balance sheet, and the stores issues made out in the department when goods are issued to specific orders form the basis of cost records. Additional discussion of this question will be found in a later installment under the heading of Maintenance Stores.

The important point in this connection, however, is that a simple yet sufficient procedure should be worked out and standardized. Responsibility should not be lessened through having as many different systems as there are persons concerned with the handling of materials.

Arrangement of Storage Equipment

The requirements of the storeroom in regard to the varieties of articles to be stored and therefore in regard to the size and exact arrangement of aisles, bins, and other storeroom equipment, are so varying that it is out of the question to indicate any arrangement which will be best under all circumstances. Some general points in regard to the arrangement of the storeroom will be discussed, but the question of equipment will be taken up in detail in the next installment.

The location and layout of a storeroom are in many respects analogous to the location and layout of a modern city. After a location with maximum accessibility to the various lines of travel has been selected, it is necessary to have an internal layout which will best serve the needs of the travel and general convenience of the articles to be accommodated.

In the storeroom there must be a definite and preferably only one point of ingress for all material. There must be provided broad avenues for the heavy traffic back and forth from the various "streets," and a systematic method of numbering racks and bins is just as necessary as in numbering streets and houses. It should be just as easy for a stranger in the storeroom to find a given item by knowing its index location as it would be for him to find a particular room number in a given house number on any street in a city.

Adequate provision must be made for plenty of receiving and unpacking room, for office space, and for all auxiliary equipment needed in the transaction of business. Adequate protection must be insured through the exclusion of combustible material, through sprinklers, fire extinguishers and similar measures, and through all other precautions against damage by fire. Means must also be taken that unauthorized persons be excluded from the storeroom, that the whole place be adequately lighted and heated, and that cleanliness and neatness be maintained.

Making Floor Plans for Racks and Bins

After information covering these numerous points has been collected, and after the requirements in kinds and amounts of storeroom equipment have been determined, the actual process of arranging all of these in proper relation begins. For this purpose, acurate floor plans on a scale of one inch equaling, say 10 ft. should be prepared. On these plans should be carefully located all permanent obstructions such as columns, stairways, elevator shafts and the like, as well as all windows and doorways.

On the same scale on another tracing, so that templates may later be cut out, should be drawn plan views of each different kind of equipment to be used, such as standard racks and bins, bar stock racks, belting racks, trucks and all other movable apparatus. As many templates as there are actual pieces of equipment should be provided. On floor plans showing permanent obstructions, these templates are arranged tentatively and held in place by pins, being shifted experimentally to finally obtain the best possible arrangement.

The necessary width of the aisles, and the location of equipment relative to windows must be carefully considered, the general object being, of course, to get the maximum equipment suitably arranged in a minimum floor space. A little ingenuity in arrangement will often save many square feet of floor space. When the final layout has been worked out on paper, the templates may be fastened securely to the floor plans and this paper layout used as a basis for the actual moving. The transition from the existing to the new arrangement may then actually occupy as long or as short a time as seems desirable to prevent disrupting continuous and effective service to the shop.

In Fig. 9 is illustrated a method of indexing which will be found convenient under many conditions. It will be noticed that the following general principles are taken into consideration:

(1) Letters and numbers are used alternately.

(2) Letters are used for those things of which there

are the fewest to designate, such as different buildings, different positions of the storeroom, different rows of racks along the shortest dimensions, etc.

(3) Numbers are used for those things of which there are many to designate, such as the number of storeroom, the different rows of racks along largest dimensions.

(4) Lettering and numbering always start from the permanent obstruction, such as the walls and floors, and proceed outward and upward in lines of probable expansion. This system allows the addition or elimination of racks and bins on the end or on top without confusion due to vacant designations for missing positions.

Thus the shaded area in Fig. 9 represents, in plan, the area occupied by one section of a standard rack,

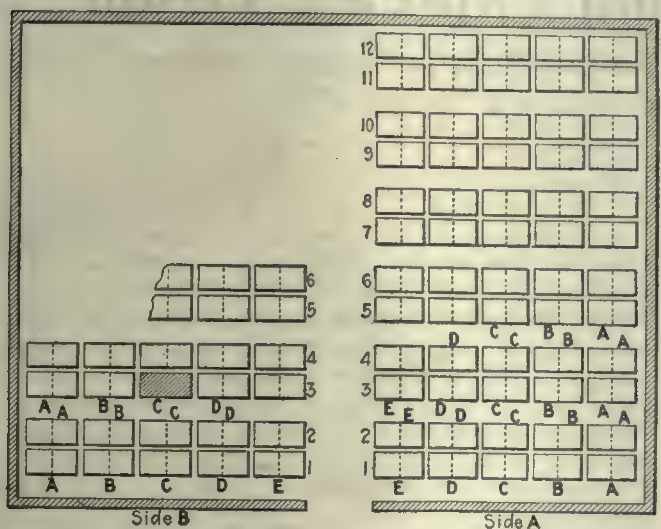


FIG. 9. METHOD OF INDEXING RACKS AND BINS

corresponding to one house of several stories on a street. Its index is B 3 C, that is, position B of the storeroom, row 3 down the main aisle, row C out from the wall. This rack may be four stories high, the location of an article in a bin in the second story from the section would be B 3 C 2. It is well to have such designation on the bins themselves.

The location, in case it is reasonably permanent, should be entered on the balance sheet for each article of material. Where locations are constantly changing it may not be practicable to keep the balance sheets posted for locations, but the permanent index should be on the bin. The storekeeper should be required to keep a current card file showing just where each article may be found, so that a new man may immediately locate any article in stock.

Where a good system of stores and worked material symbols is in use, it will often be found that the most satisfactory method of storage is alphabetically by symbol. With standard interchangeable racks and bins such an arrangement, particularly in the metal-working storeroom, is easily maintained. Aside from the symbols which are with each article and identify it, no other indexing scheme is necessary. However, even in this case a card index of the location by name of the article is often good insurance against lost time on the part of a new attendant or where the symbol does not appear on the issue slip.

With mnemonic symbols, however, the symbol of one item may be SV-SS, the next SV-ST, the next SV-SW and so on. Each of these items would be placed alphabetically in the bins exactly as their symbols would appear in a dictionary and when the symbol appears on the issue slip the attendant may readily locate the article required.

Such a systematic arrangement by symbol is not always possible for all items nor desirable for all portions of the room, however, and common sense must govern in assigning locations and indexing. It would be foolish, if not impossible, to store bar stock in long lengths between screws and nuts, for instance, just because its symbol might fall between the symbols of these articles, nor would one logically store heavy, much used castings away back from the door or elevator.

Exceptions can be readily made in such cases without destroying the advantages of storage by symbol where this seems otherwise desirable. In such cases, the rows of racks, the individual racks themselves, and the separate compartments within each rack must be numbered and lettered with a cross index for each item, according to some such definite plan as that outlined.

Machine Tools in Chinese Shops

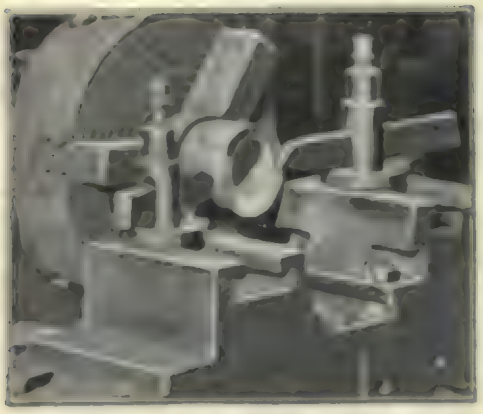
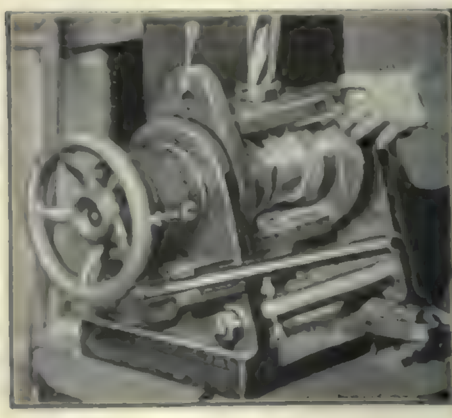
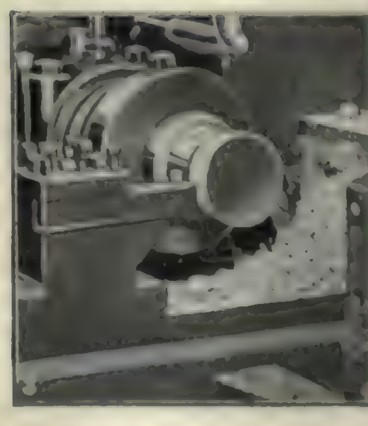
By Sam Dean
Peking, China

Many Americans do not know that there are in China several Chinese companies which make good gap lathes, drill presses and planers for rough work, and make them so cheaply that they supply practically all the repair shops of the country. Only the larger shops such as the railway shops have foreign tools, and these are mostly equipped with English machines.

There is a large and increasing demand in China for machine tools of the repair shop type, but the Chinese have to be educated to the fact that one good foreign tool is worth several cheap Chinese made machines. Perhaps the most popular American machine tool here is the lathe. This is rather too light for the work it is made to do, but accuracy doesn't matter on the jobs put through in most cases so it does fairly well.

The expensive machines with gear boxes, electric drives and all that are quite outside the present demand and pocket book. Now and then a large mill will buy good machine tools, but there are comparatively few such mills. However, every city now has an increasing number of small machine shops and this is the trade which has volume and now uses Chinese and Japanese goods. These shops are run in many cases by graduates of Chinese technical schools and Chinese technical schools are mostly equipped with Chinese or Japanese, or at most English made or German, made tools. Naturally the students buy for their own shops what they have learned to use. Also the schools with their small incomes buy the cheapest machines.

Personally, I feel that there are two lines which American machine tool manufacturers could follow in order to get the Chinese market. One is to put their tools in technical schools out here at prices that would enable them to be bought, rather than shoddy Japanese or Chinese machines. The other is to find out the companies that are supplying the Chinese repair shops with machines and in these shops at least work hard to put in American machines. I doubt very much whether we can compete with the Chinese made machine for the makeshift repair shop, but we certainly ought to be able to furnish the machines that make China's machine tools.

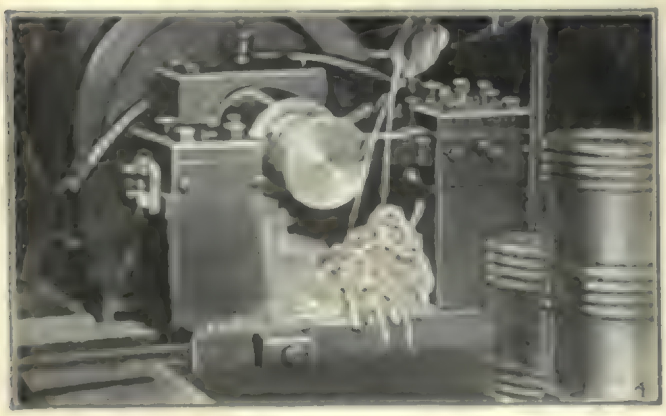




Machining the Marmon Two-Part Piston

Operations on Aluminum Head and Cast-Iron Skirt — Turning, Drilling and Grinding — Lapping End-Joint to a Surface Plate

By FRED H. COLVIN
Editor, American Machinist

THE Marmon motor uses a combination piston of aluminum and cast iron, the head being of aluminum to more readily dissipate heat, while the skirt is a cast-iron shell in order to secure the advantages of that material as a wearing surface. This construction allows the use of a floating piston pin without the necessity of using any special retaining device to prevent the end of the pin from scoring the cylinder wall. In this case, the cast-iron skirt slips over the ends of the pin and naturally prevents any possibility of contact with the cylinder wall.



In the making of the aluminum alloy portion of the piston we have the turning operation as shown in Fig. 1 where an engine lathe with two toolposts has been specially arranged for this purpose. The rear tool is turned upside down. The cross drilling of the piston pin hole is done in the indexing fixture shown in Fig. 2, only one side being drilled at each spindle movement, instead of drilling clear through the piston. The indexing lever is shown at *A* and the opposite index hole at *B*. The piston is easily turned by means of the handwheel *C*.

Drilling Operations

Using a crosspin in the piston-pin hole to hold the piston back against the face of the skirt, the skirt end is faced off and the ring grooves cut on the lathe shown in Figs. 3 and 4. Here again, special toolposts with suitable tools are provided on an ordinary lathe carriage. Then the piston goes to the fixture shown in Fig. 5, where smaller holes are drilled. Here the piston is located by means of the hollow plug *A* through the piston-pin holes, the fixture being one of simple design. The two parts of the piston are held together by four bolts, the holes for these being drilled as in **Fig. 6**. These holes are in the thick wall of the piston center and are then tapped for the retaining screws.



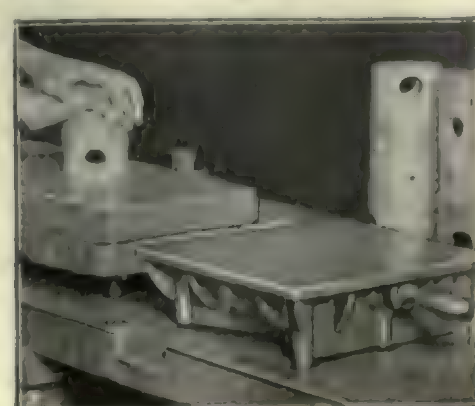
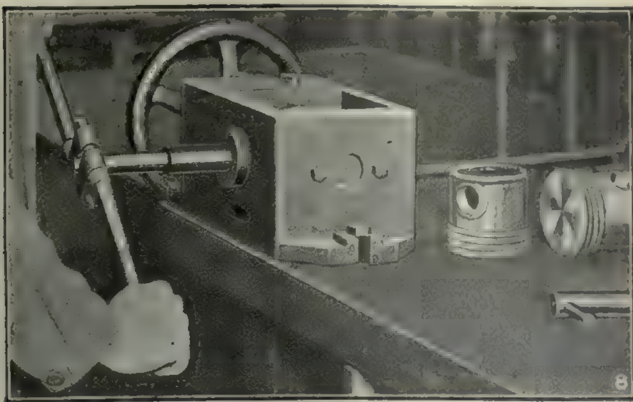
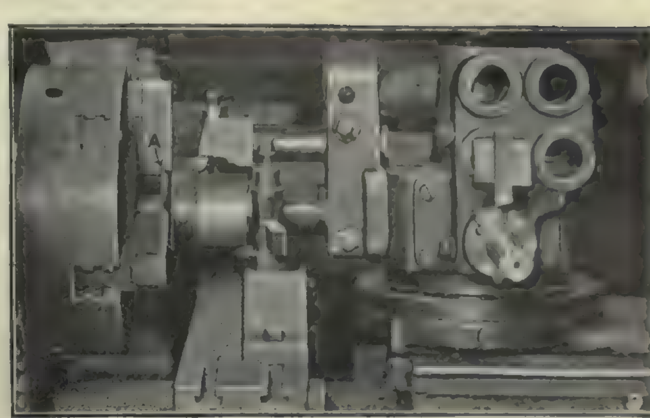


FIG. 1. ROUGH-FACING PISTON CENTER. FIG. 2. DRILLING PISTON-PIN HOLE. FIG. 3. ROUGH-TURNING PISTON CENTER. FIG. 4. FACING AND CUTTING GROOVES. FIG. 5. ANOTHER DRILLING OPERATION. FIG. 6. DRILLING FOR HOLDING SCREW. FIG. 7. LAPPING THE FACE FLAT





The end of the piston where the skirt joins the inner portion is then carefully lapped as shown in Fig. 7, in order to insure proper contact between the two portions. The small surface plate beside the cast-iron lap is used in testing the flatness of the end surface.

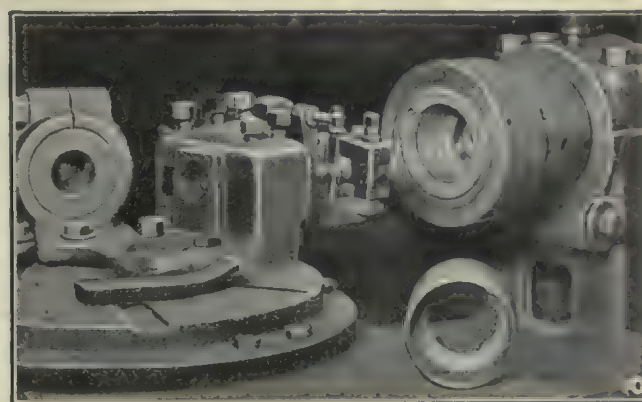
A piston is then placed in the box-like fixture shown in Fig. 8 and held firmly against the lapped surface so that the final reaming of the piston-pin hole will bring it square with the piston skirt. This completes the inner portion of the piston.

The turning and boring of the cast-iron skirt is done on the Potter & Johnson lathe, shown in Fig. 9. It will be noted that a beveled flange is cast at the end of the skirt, so as to afford an easy means of holding it firmly in the chuck as shown at *A*. Held in this manner, a substantial cut can be taken without danger of pulling the work out of the chuck. The tool used can be plainly seen.

Finishing the Skirt

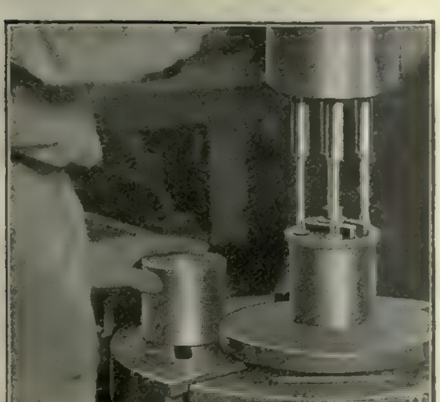
Clamping the skirt in a split chuck, the inside is then bored and faced on a turret lathe as shown in Fig. 10. The finished skirt shows the shape of the flange with the projections which allow for the bolt holes. The drilling and reaming of these holes is shown in Fig. 11, a special four-spindle drilling head being used for the purpose. The reamers are guided to insure accuracy.

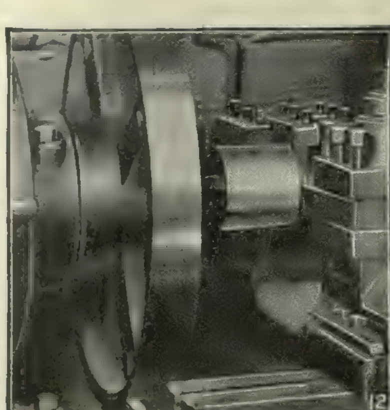
The final finish cut is then taken in a Lodge & Shipley lathe with the skirts mounted on a suitable mandrel, positioned against the inner side of the flange, and located and driven by plugs through the bolt holes, as shown in Fig. 12. The final finish is by grinding as shown in Fig. 13. Here the skirt is mounted on the same mandrel as for the final turning operation, thus avoiding one handling and the possibility of a difference in the two mandrels.



Those who were familiar with the older methods of manufacturing motor pistons and who have not kept pace with the newer developments, will perhaps think that the methods here described are unnecessarily complicated and that undue care is taken in a number of the operations. But one of the lines of improvement in the construction of the automobile motor has been in the production of better pistons to fit the improved cylinder bores, and careful tests, as well as the results of long experience in actual service, have shown that it pays to have them as near right as possible, even though a greater expense is necessary to do it.

Pistons that are so designed as to expand uniformly, that not only maintain compression but also prevent the pumping of oil and the consequent formation of carbon in the cylinders, are a great asset to any motor. Proper bearing of the skirt, as well as suitable rings, is necessary for the best results. So that operations which seem to border on "fussiness" have proved to be worth while in high-grade motors.





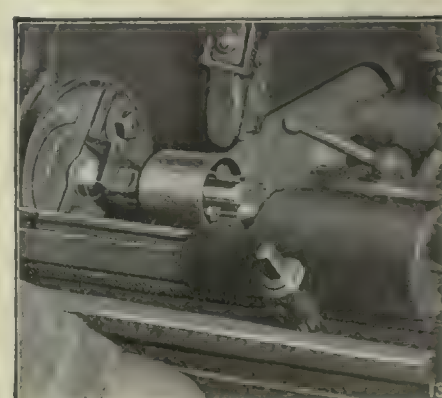


FIG. 8. THE FINAL REAMING. FIG. 9. TURNING THE SKIRT. FIG. 10. BORING THE INSIDE. FIG. 11. REAMING STUD HOLES. FIG. 12. FINISH-TURNING. FIG. 13. GRINDING THE SKIRT

Methods of Machine Tool Design

Conclusion of the Fourth Article—Variable Speed Planer Drives of Various Types—Electric Motor Drive for Planers—Best Type of Motor to Use

BY A. L. DELEEUW

THERE are a number of arrangements in existence for the purpose of giving variable cutting speeds to the planer. The simplest arrangement would be to give two or more speeds to the countershaft, but doing so would change the return as well as the cutting speed. As it is desirable to have the highest possible return speed at all times, such arrangements are not economical and should be avoided.

Practically all variable speed planer drives have a single speed for the return and variable speeds for the cut. One of the well-known existing constructions is that of the G. A. Gray Planer Co. which is illustrated in Fig. 61. The countershaft pulleys that drive the

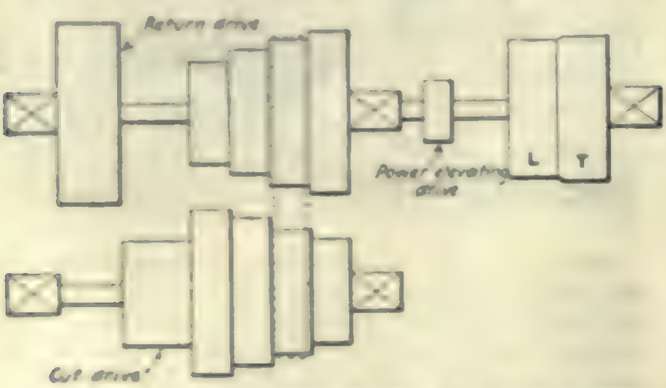


FIG. 61 VARIABLE SPEED DRIVE OF GRAY PLANER

return and the cut are not on the same shaft, but are mounted on two different shafts, each of which is provided with a cone pulley. If we consider one of these cone pulleys as the driver and one as the driven cone, then we can say that the return pulley is mounted on the shaft of the driver, and the cutting pulley on the driven shaft. The driver itself is driven either from a countershaft, a motor or any other source of power. This arrangement furnishes a constant return and a variable cutting speed. Instead of cone pulleys some other speed varying device might have been used, such as change gears or a gear box.

A rather interesting manner of furnishing variable speed to the cut is exemplified by the Cincinnati two-speed planer drive. This device is shown diagrammatically in Fig. 62. There is only one countershaft on which six pulleys are mounted. Pulleys *A*, *B* and *C* are loose; while *D*, *E* and *F* are tight. *A* and *B* receive the belts which come from the line shaft and are run at different speeds. As a matter of fact, pulley *B* runs at half the speed of pulley *A*. Two shifter forks are provided which are operated by one shifter rod and which shift both belts at the same time, so that when the left-hand belt is on pulley *D* (tight), the right-hand belt is on pulley *C* (loose). Pulley *F* is as wide as the ordinary return pulley, that is, twice as wide as the return belt plus something for clearance. Pulley *E*, on the other hand, is only wide enough for the cutting belt and does not permit this belt to shift sideways. This belt is held in position by a special fork which can be operated from the floor. If this fork holds the cutting belt on pulley *E*, we have the following condition:

The left-hand belt drives pulley *D* which drives the shaft at the high speed. Both cut and return take place, therefore, at the high speed. When the special fork is shifted to the left it takes the cutting belt with it and places it on pulley *C*. This pulley is wide enough to admit the belt coming from the line shaft and also the cutting belt. With this cutting belt in this position we have the following conditions: The left-hand belt still drives the shaft and with it pulley *F*, so that the return still takes place at the high speed. The cutting belt, however, is no longer on pulley *E* but is driven by pulley *C* which is the low-speed pulley. We see, then, that the cutting takes place at low speed and the return at the original high speed. The fact that the belt does not come straight down to the machine is not a serious matter. Countershafts of this nature are applied to the smaller sizes of planers where the belt is narrow and the distance between countershafts and machine pulley relatively large. Besides, both top and bottom of the belt are positively controlled by belt eyes.

When it becomes advisable to speed up an existing planer, all points mentioned in the previous paragraphs should be carefully considered. As a rule it will be found impossible to speed up the entire planer horizontally. Even when it is possible at all to increase the return speed, it will generally be found that this cannot be increased as much as the cutting speed.

In addition to the points considered above, such as belt speed, rim speed, speed of shifting, etc., there is still one other point which should be considered when speeding up an existing planer. In many planers the

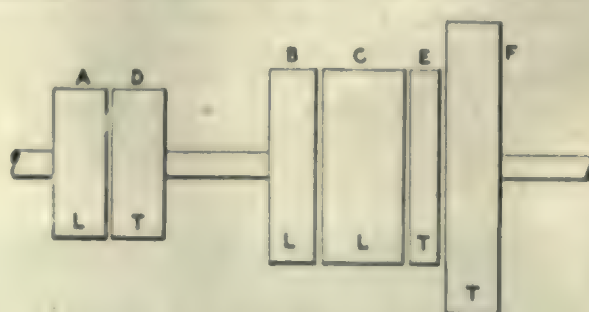


FIG. 62. VARIABLE SPEED DRIVE OF CINCINNATI PLANER

feed is driven from a device which makes a partial turn at every reversal. This device is generally geared so as to get the highest permissible speed when the belt starts the return stroke. If it is possible at all to increase this return stroke, considering belt speed, etc., it remains yet to be investigated whether the feeding mechanism will permit of such increased speed. If not, it may be necessary to change the gearing so as to bring the speed of the feed mechanism back to the original amount.

When a planer countershaft is driven by an electric motor, either direct or through gearing, we will find the same problems as we found before and in addition certain problems due to the characteristics of the motor. With direct current we will have a series, a compound, or a shunt-wound motor. Of course a series-wound motor is out of the question on account of the unstable speed; the planer would run faster with a light than with a heavy load. Both the weight of the piece to be planed and the size of the cut to be taken would affect the cutting speed, and this is not permissible. In all machine tools we must maintain automatically the speed for which the machine is set. If we wish the machine to run at a speed of 50 ft. per minute, this 50 ft. must be maintained until the time when we wish to run at a different speed. This is the reason why a series-wound motor is unfit for practically all machine tools. It is also the reason why the shunt-wound motor lends itself particularly for machine-tool drives.

Characteristics of Shunt-wound Motor

A shunt-wound motor maintains its speed with wide fluctuations of load. Though there is some variation, it is so small as to be negligible for practical purposes. A large load means a large amount of current going through the motor. The heavier this current the greater the drop of speed of the shunt-wound motor, though it should be remembered that at all times this drop of speed is quite small. Vice versa, when there is a relatively large drop in speed we may expect a heavy current to flow through the motor. The amount of current which may flow through the motor when the armature is retarded by some mechanical means may be so great as to cause serious trouble. For this reason we must never subject a shunt-wound motor to conditions where its speed may be much retarded by mechanical conditions. This, however, is exactly what happens when we employ a shunt-wound motor for a planer drive. At the moment of reversal there is an enormous slip between belt and pulleys. This may be either between the lower pulley and the belt or between the upper pulley and the belt, or it may be a combination of the two. There is, then, a strong tendency to retard the motor, which we will find to be the case when we apply a tachometer to the motor shaft and which will show up by a heavy peak load if we insert an ammeter in the circuit. The reading one gets at this peak does not necessarily indicate the amount of power required at the moment of maximum load.

A motor with an efficiency of 88 per cent at full load may have a much lower efficiency at 50 per cent overload and may have an efficiency approaching zero when the overload is several hundred per cent. Such an overload of several hundred per cent may well happen where a shunt-wound motor is used for planer drives. If a 25-hp. motor takes in an amount of current sufficient for the full load of a 75-hp. motor, it does not indicate that 75 hp. is required for the work done, but that the motor has become so inefficient that it requires a current of 75 hp. input for, let us say, 40 hp. output.

A 65-hp. motor driving a 14 x 12 x 30-ft. planer registered at the moment of reversal an amount of current equivalent to 180 hp. When the motor was replaced by a 90-hp. motor, an amount of current was registered at the moment of reversal equivalent to 120 hp., thus showing that the smaller motor, on account of the large overload, had become so inefficient that it required an input of 50 per cent more current than was needed to carry the load. It is very essential that a shunt-wound motor should be of sufficient size to carry the peak load without too great a loss of efficiency.

The compound-wound motor, having some of the characteristics of both the series and shunt-wound motor, will permit of a certain amount of fluctuation of speed without an excessive amount of current going through the armature. At the same time its speed will not be entirely reliable; whereas a shunt-wound motor under ordinary working conditions would have a fluctuation of speed of not more than 5 per cent, a compound-wound motor might show a variation of 20 per cent. On the other hand, if a momentary excessive load should come on the motor, the compound winding will protect it against an excessive input of current.

For these reasons compound-wound motors were thought at one time to be the logical solution of the problem of planer drive by means of a motor. However, it was found that a new difficulty had entered. If we have a piece of work which can be cut at 45 ft. per minute and we use a compound-wound motor permitting a fluctuation in speed of 20 per cent, then the table will run at a speed of 54 ft. before the tool enters the cut and at 45 ft. afterward. Now, if anything, a tool should enter the work slowly, after which it might be brought up to its ultimate cutting speed, but the reverse should never be done. Striking the work at a speed in excess of the speed at which it is run is apt to destroy the tool very rapidly. To overcome this difficulty a flywheel was put on the motor shaft.

The combination of compound-wound motor and flywheel may still be found on many planers. A moment's thought, however, will convince anyone that this combination has no right of existence. To use a motor with compound winding in order to permit speed fluctuations and then to put on a flywheel so as to prevent these same fluctuations does not seem to be good logic.

The thing to do is this: *To select a shunt-wound motor of sufficient size so that the input of current is not excessive at peak load, thus retaining the efficiency of the motor.*

As a rule when the motor is geared or directly connected to the countershaft we will find the countershaft attached to the planer itself. Such a construction necessarily limits the distance between countershaft and planer pulley shaft, and the belts will be shorter than is desirable. Where the motor is placed on the floor and the countershaft is attached to the planer so that there will be a belt from the motor to the countershaft and another one from the countershaft down to the machine pulley, the effect of slippage is minimized, due to the great length of belt between motor and machine.

Same Rule for Induction Motors

Induction motors act much like shunt-wound motors and the same rule should be applied in regard to their use for planer drives as we found for shunt-wound motors.

It has been pointed out that the main reason why it is difficult to obtain a high return speed for a planer lies in the fact that a large amount of energy must be given to the pulleys in a very short time. Driving the planer by a direct-current motor offers a means of overcoming this difficulty. The author applied and patented the following method in 1903:

An adjustable-speed motor was used to drive the countershaft. A special dog would cut out all field resistance, just before reversing, so that the planer would run at low speed at the moment of reversal. After reversal a certain amount of resistance was cut in, the speed of the motor depending on the amount. As a result it was possible to run at any desired cutting or return speed. This same principle is now used with certain modifications and improvements in the direct electric planer drive.

The Mitchell Planer Drive

A drive to which we have referred before is the Mitchell planer drive. This drive has certain interesting features, especially for the larger sizes of planers, but has, nevertheless, not come into common use, probably due to the fact that shortly after its introduction the direct planer drive was perfected and proved to be very acceptable, particularly for heavy planers. The Mitchell drive is illustrated diagrammatically in Fig. 63. Originally these drives were applied to 7, 8 and 10-ft. planers of the British Westinghouse Electric Co. They were illustrated in *American Machinist* of June 2, 1904. A countershaft *A* (which itself might be driven from a motor, either direct or through belt or gearing) drove two countershafts, *B* and *C*, in opposite directions and at different speeds, as may be clearly seen in the illustration. The pulleys *D* and *E* would drive the machine pulleys *F* and *G*, one for the cut and the other for the return. Both pulleys *F* and *G* were tight on the planer shaft, but the belts connecting *D* and *F*, or *E* and *G*, were slack unless one of the idlers, *H* or *I*, was pressed against the corresponding belt. If this were done, that belt would become a driving belt. On the 7-ft. planer the idler was brought against the belt by means of the action of a dog, but on the 8 and 10-ft. planers the idler was operated by a pneumatic cylinder of which the valve was actuated by the table dog. The advantages of this drive will readily be recognized. The belts can be made as wide as one desires because they do not shift. There is consequently the possibility of unlimited power. Furthermore, when applying the idler by means of a pneumatic cylinder, it is possible to make that device act in such a way as to bring the idler as rapidly or as slowly against the belt as one may wish. It is therefore possible to start the planer without shock, regardless of the speed. As a matter of fact, the 8-ft. planer had a return speed of 125 ft. per minute which was, at that time, exceedingly high and would be considered high even at the present.

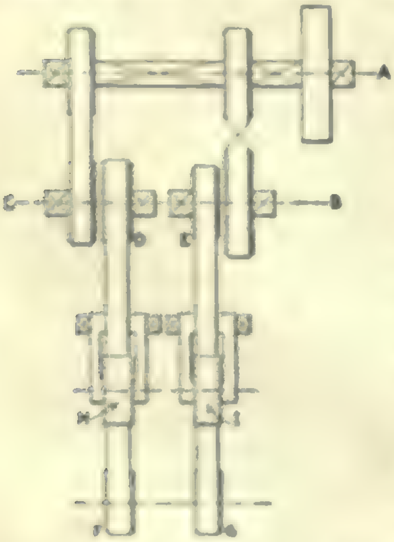


FIG. 63. DIAGRAM OF MITCHELL DRIVE

One of the disadvantages of this arrangement lies in the possibility of the planer starting up unexpectedly, due to the fact that the belt may be somewhat shorter than it was meant to be, something which may happen due to excessive moisture in the atmosphere, or for other reasons. A more serious objection is caused by the pneumatic control. The direct control by means of a dog is not suitable for the larger sizes of planers and a pneumatic control depends so largely on the air pressure in the line that it is not safe to count on an exact reproduction of the shifting action every time. In other words, the planer may shift sooner or later according to the air pressure at hand.

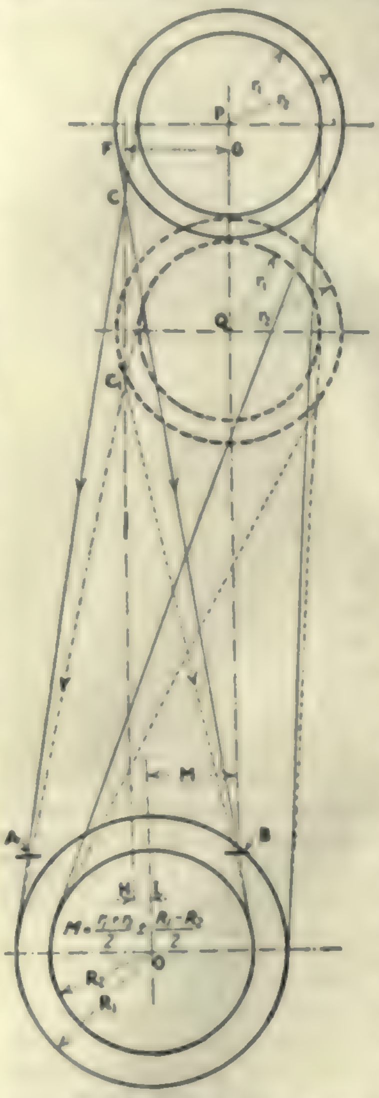


FIG. 64. DIAGRAM TO SHOW EFFECT OF CHANGING POSITION OF COUNTERSHAFT

In Fig. 64 is shown a planer drive with the machine shaft at *O* and the countershaft at *P*. The cutting belt approaches the machine pulley through belt eye *A*, while the return belt goes through eye *B*. A belt eye is the end of a lever of which the short arm is moved by means of a cam while the long arm describes an arc of a circle, thus moving the belt from one pulley to the other. The distance the belt moves depends on the length of the lever arm to which the belt eye is attached. Or rather we should say, it depends on the distance from the belt to the fulcrum of that lever, which is very much the same so long as the belt is located in one positive position.

However, if, for one reason or another, the belt would sometimes be nearer to, and sometimes farther from, the fulcrum, the distance which it would travel would be variable. Such a condition might be brought about by a change of location of the countershaft. If, for instance, countershaft *P* should be moved to the right, both belts would also move to the right, and as a result the travel of the cutting belt would become less and of the return belt more. In order to avoid this condition we must see to it that, if we have to change the location of the countershaft, we maintain a certain relation to the machine.

We see at once that if we move the countershaft to the right or to the left it must have the effect of lengthening one and shortening the other movement; whereas if we move it in a vertical plane we increase or decrease the travel of both belts. We cannot entirely avoid such increasing or decreasing of the belt travel, but we can hold it down to a minimum and in order to do so and, at the same time, to make the variation the same for both belts, we should have conditions so that

the angle made by the two belts—namely ACB—is bisected by a vertical line. If then we move countershaft P to the position Q, the bisector will remain the same but the angle will now become AC_1B. We see that both belts where they go through the belt eyes have come somewhat closer together but that the movement is exceedingly small, and we will find that it is well within practical limits.

A General Formula

It is customary to dimension the distance between the vertical plane of the countershaft and that of the machine shaft, which distance is indicated in the sketch by M.

We see from the drawing that the distance $FG = \frac{r_1 + r_2}{2}$. We see also that the distance $HI = \frac{R_1 - R_2}{2}$, and as the distance M is the difference between FG and HI we find $M = \frac{r_1 + r_2}{2} - \frac{R_1 - R_2}{2}$.

As shown in the illustration the crossed belt is used for the return, which causes HI to be at the same side of the vertical bisecting line as FG. If the crossed belt were on the cutting pulley, HI and FG would be on opposite sides and the formula would become

$M = \frac{r_1 + r_2}{2} + \frac{R_1 - R_2}{2}$, so that the general formula is

$M = \frac{r_1 + r_2}{2} \pm \frac{R_1 - R_2}{2}$.

All that applies to planer belt drives applies equally well to any other machine in which a reciprocating member receives its drive from shifting belts. Such is the case with some slotters, some shapers, some keyseaters, and a few other machines. None of these machines, however, presents the problems of the planer in such large proportions as the planer itself, so that one who can successfully design a planer drive does not need to fear the difficulties of a slotter or shaper drive.

Base the Selling Prices of Stock Machines on the Cost of Replacement

By S. Owen Livingston
President, Grand Rapids Grinding Machine Co.

It seems as if the time has arrived when both machine tool builders and machine tool users should give some definite thought to the question of machine tool prices.

Many builders of machine tools, during the year 1921, at the bottom of the slump, canvassed the situation, and found that they could buy both their material and their labor at very great reductions from the peak cost. This was followed by what undoubtedly was a wise plan, of revaluing their finished machines, manufactured parts, and raw materials on a replacement basis. That was at that time figured as the cost of the material on hand. The loss was written off and as far as possible forgotten. On the basis of these reduced estimated costs, reduced selling prices were established.

Drastic Reductions

In some cases these were about half of what the peak selling prices had been, and in a majority of cases drastic reductions from the peak were put into effect. How many of them have advanced prices since then? And yet how many of them can go onto the market today and buy labor or material at the prices they used as a basis for figuring those reduced prices?

If it was wise for manufacturers of machine tools to write down their inventories to replacement costs at the bottom of the depression, certainly it will be wise for those same manufacturers to keep track of current replacement costs on the rising market. With the automobile industry in full swing, feverish activities among the radio manufacturers, a very healthy demand in the car-building field, and a far from negligible demand in most other fields, those machine tool builders who are finding it necessary to again enter the active manufacturing field, find it very difficult to obtain labor having the desired degree of skill and ability. (It should never be forgotten that machine tool builders require higher degree of skill in their employees than do most of the industries with which they have to compete for labor.) I venture the assertion that the machine tool builders going into the market for labor today, will find themselves compelled to pay up to within an average of about 10 per cent of peak prices for labor, and the tendency is upward rather than downward. Reduction of material costs amounts to only a very trifling percentage in the total cost of most machine tools.

Selling at Less Than Cost Will Eventually Prove Ruinous

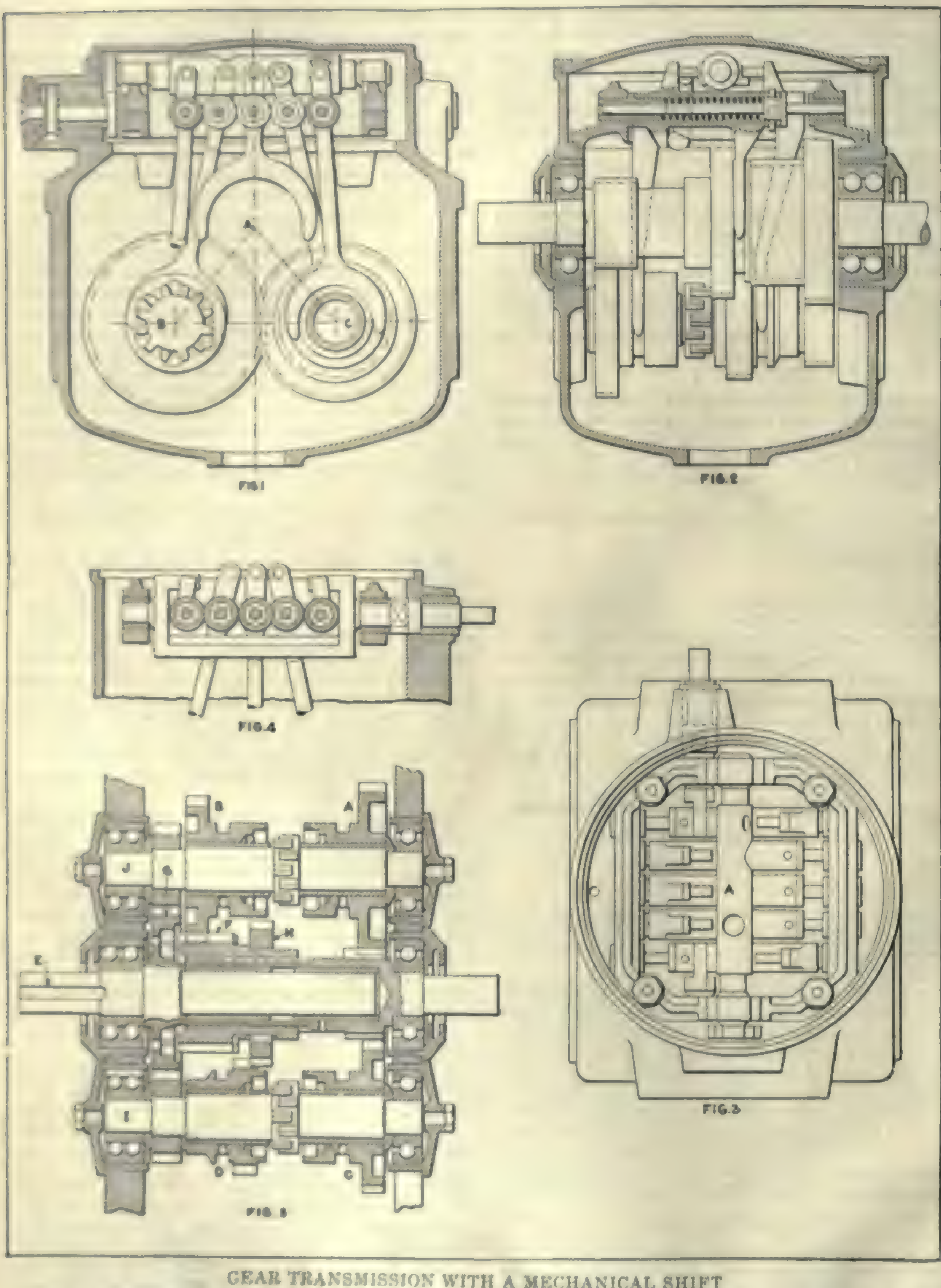
No sane machine tool manufacturer wants to sell equipment at less than it costs him to built it. The concern that is now selling equipment which was manufactured prior to the slump, on the basis of his depreciated valuations, established at the bottom of the slump, is fooling himself. There are unquestionably a lot of manufacturers who today are selling equipment for less than it will cost them to replace it on their floors. They will only come to realize this by either trying to manufacture it and checking up on their costs after the replacement has been completed, or by carefully checking up on present conditions both for labor and material.

There may be concerns who were getting a profit during the boom times that will enable them to make a more drastic cut in selling prices, but I am convinced that those manufacturers who were only obtaining a reasonable profit during the peak times, and who are now selling at prices which are cut more than 10 per cent under the peak selling prices, are in a fair way to find they have done business without a profit, or, in other words, that any cut in excess of 10 per cent at the present time represents a diminution of the profits that were made at the peak.

The Time to Buy

It is high time that manufacturers of all kinds should establish their selling prices, for goods on hand, on a basis of what it would cost to replace them. New business should be taken on the basis of what the probable cost of production will be at the time such new material is ready to ship.

And to the machine tool users, isn't it high time that they came onto the market, took advantage of the many undoubted bargains in the machine tool equipment that now exists, rather than to wait until the machine tool builders wake up and re-establish their prices for machine tools on a basis that will yield an adequate profit, everything considered, based on present manufacturing costs.



GEAR TRANSMISSION WITH A MECHANICAL SHIFT

FIG. 1. CROSS-SECTION OF GEAR BOX. FIG. 2. LONGITUDINAL SECTION OF GEAR BOX. FIG. 3. TOP VIEW SHOWING SELECTOR BAR. FIG. 4. DETAIL OF SELECTOR PINS. FIG. 5. CONVENTIONALIZED SECTION TO SHOW OPERATION

Gear Transmission with a Mechanical Shift

A Design Giving Four Speeds and Reverse—The Operator Merely Selects the Speed Desired, the Shift Is Mechanical

By H. O. Herzog

WE HAVE learned much from automobile design regarding gear shifting mechanisms, and many machines of various kinds now embody compact gear boxes for speed and feed changes. Efforts have been made to secure mechanical or electrical gear shifting, both to relieve the operator and to avoid the clashing of gears due to unskillful handling. The illustration shows a late German device, known as the Soden gear shift, and shown at the automobile exhibit in Berlin. While primarily intended for automobile use it can be adapted to other machinery as well. The gearing is completely inclosed in an oil-tight case and connected with the index or selecting lever, by wire. Fig. 1 is a cross-section; Fig. 2 a longitudinal section; Fig. 3 a view from the top; Fig. 4 a section through the top; while Fig. 5 represents two sections between the axis of the main shaft and the two back gear shafts which, for the purpose of illustration, are flattened into one plane.

The device consists mainly of the driving shaft *A*, Fig. 1, with its gears and two back gear shafts *B* and *C*, situated below it, all three shafts being almost equidistant. The driving shaft consists of two parts which telescope inside of the gear box.

The driving part of the shaft *E*, Fig. 5, enters the box at the left, the hollow end forming a sleeve around the driven end, with a bushing between. This sleeve has teeth cut on one side. On the right-hand side a pinion *F* is splined to allow a sliding motion. The teeth of this pinion engage with the clutch teeth cut in the inside of the spur gear *G*, fitting on the shaft. A pinion of larger diameter is keyed on at *H*. Clutch teeth are cut in the middle of the back gear shafts opening alternately to the right and to the left. The shape of these teeth can be clearly seen in Fig. 1. Each back gear shaft has two change gears which are bushed, and are a running fit on the shaft. There is also a driving gear keyed to the shaft. Each of the change gears has inside clutch teeth, which when the gears are slid over the corresponding teeth on the shaft, provide for their positive engagement with the latter.

For the first and second speeds, gears *C* or *D*, Fig. 5, are slid towards the center, engaging back gear shaft *I*. For the third speed, change gear *B* is clutched to countershaft *J*. The fourth speed is secured by the direct coupling of both ends of the driving shaft, by means of the clutch already mentioned. For reversing, both gears *A* and *C*, which are constantly in mesh, are moved so far towards the middle that gear *A* clutches while gear *C* still rotates loosely on its shaft.

On the top of the box, Fig. 3, is seen the mechanism which controls the clutching of the change gears. For each of the five motions a stud is provided which fits into a hole in the cylindrical shaft *A*. This shaft is connected by a wire and two small gears, the wire being operated by the index lever. The holes in the studs for the shaft are not arranged in one line, but so that they occupy different positions along the circumference. At any of the five positions of the shaft, one of the five holes becomes aligned with one of the five studs.

By pushing down the clutch treadle all five studs are simultaneously withdrawn from the shaft. When the treadle is released they return under spring pressure towards the shaft and the stud which finds a corresponding hole, snaps in. By so doing the fork with which the respective stud is connected is shifted and the chosen gear is put into engagement. A spring mechanism can be set to turn the index shaft to the angle required to bring the new hole into alignment with one of the studs, as soon as the index shaft is released. Upon pushing down the clutch the index shaft will automatically snap into the position corresponding with the position marked on the index box.

Labor Turnover

By A. W. Brown

One of the greatest sources of expense and annoyance in a manufacturing business is the necessity of hiring and breaking in such a large percentage of new workers, especially in the unskilled and semi-skilled classes. While this is largely due to the spirit of change among young people, the turnover is also greater than it would be if employers would use more tact, would recognize their obligations to interest, supervise and encourage their hands, and would be more careful in selecting and assigning new workers. To have 100 new names on the roll in the course of a year, in order to keep 500 hands seems ridiculous, and yet such a labor turnover is the rule rather than the exception.

The main thing is the remedy—or rather the prevention. As far as the employer is able to help, the remedy lies in the education and instruction of the working classes. Since many hands are apt to be employed more than once, even in the course of a year, the personnel card should give full data concerning each applicant and employee, so as to avoid making the same mistakes in re-hiring an undesirable worker. Every manufacturer should calculate the cost of hiring, examining, instructing and supervising workers, as well as the cost of inspecting and throwing out defective work. Besides this, he should consider the evil influence of poor workers upon their neighbors.

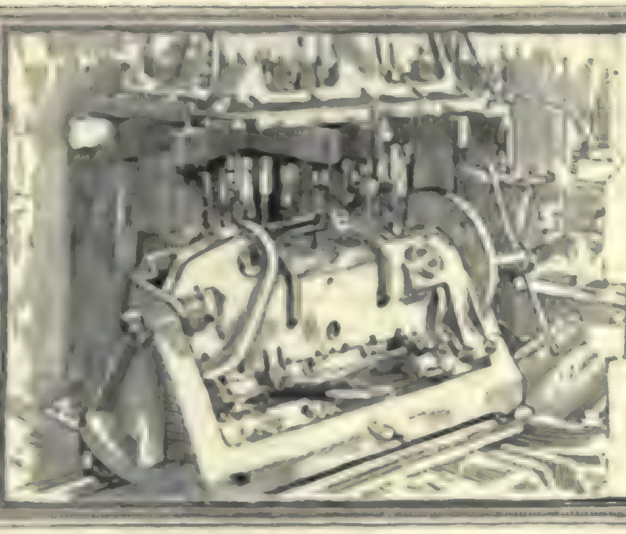
The Passaic Print Works has a sign in its employment bureau which reads:

"We seldom re-hire;
We never re-hire twice."

Self Inspection

By Robert Grimshaw

The best worth-while inspection that the foreman—or any other man—can make, is of his own nature and his own progress or lack of progress. The oftener and more thorough that inspection, the better worth while. No haphazard inspection will suffice; no mere superficial qualitative analysis; he must ask himself just how many points out of a possible maximum he has; how many more he has gained since the last inspection; and what he is doing to get the rest of the maximum.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Tooling of Vertical Turret Lathes and Boring Mills Continued—Adaptability of Vertical Machines—Use of Forged Tools—Sliding Fixtures and Reamers—Taper Turning and Facing

WHEN work has been machined partially in a previous setting, any other operations on the work may require it to be set up from the previously machined surfaces. As work which is handled on boring mills is usually of rather large size, the fixtures used are often of a somewhat different nature than those which would be utilized for smaller work on a horizontal turret lathe. Locating rings or plugs can often be used when they are of small diameter; but when of large size the amount of surface which would be in contact with the work prohibits their use.

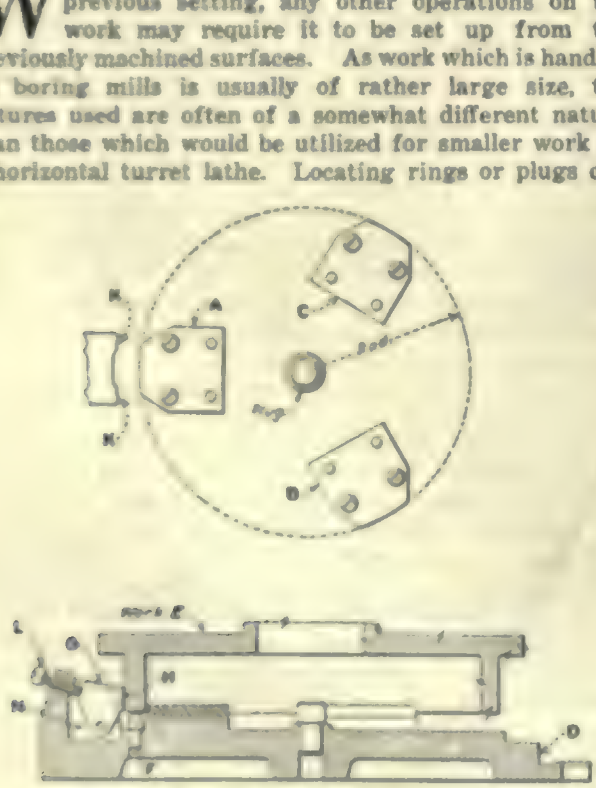


FIG. 392. SECOND-OPERATION FIXTURE FOR VERTICAL TURRET LATHE

A great deal of trouble might be experienced in placing a piece of work on a large locating ring of, say, 15 or 18 in. diameter. In order to avoid this trouble, three or four blocks can be screwed and doweled to the fixture in the proper positions, like those shown in Fig. 392 at *A*, *B* and *C*. If these blades are fastened securely to the baseplate *D* which is located on the table, the outside of the work can be easily turned to the correct diameter while on the machine. Measurements can be readily made across the central plugs. There may be cases when these locating blocks need to be hardened, but often the production is not high enough to require anything of this kind.

The work shown at *E* locates by the inside finished surface on these blocks and rests on three studs *F*, which give the work the correct vertical position. The method of driving is by means of three dogs set opposite to the locating blocks, as shown at *G*. The surface *H* which comes in contact with the work is made as shown at *K*, and it is serrated much like a chuck jaw, so that it will grip and hold the work firmly when pressure is exerted by means of the screw *L*. This example gives a very good illustration of a simple fixture of a type often useful for boring mill work.

In Fig. 393 is shown another example of a fixture used for second-operation work when the portion from which the location is to be obtained is of comparatively small diameter. The piece shown at *A* has been previously machined in the hole *B* and on the undersurface *C* and *D*. The work to be performed in this operation is the facing, turning and undercutting of the flange *E*, the piece being located from the previously finished surfaces mentioned. The fixture base *F* is of cast iron and has a central locating plug *G* which fits the hole in the table. The upper part of this plug is enlarged at *H* and made to a diameter corresponding to that of the hole *B*. The work slips over the plug and rests on two fixed studs *K*, which are located opposite to each other. Midway between them are spring jacks *L* of a type which has been mentioned in another article. The spring jacks are clamped in place by thumbscrews *M*.

The method of driving the work is by means of swinging clamps *N* of somewhat similar design to those used on the previously described fixture. There is, of course, one point which does not need to be considered when work is held on a boring mill table. This point is the matter of holding the work from falling off. Naturally as the work is laid down on the table, its own weight will hold it in place. This fact makes the design of fixtures for boring mills considerably simpler than for horizontal turret lathes.

When making indexing fixtures or those which require the turning or boring of eccentric surfaces, a horizontal turret lathe requires fixtures which are carefully balanced; but with a vertical boring mill it is unnecessary to be so particular in this regard. The table is very heavy, and if the weight is more on one side than on the other it does not make a great amount of difference. If it were found necessary to use a fixture on a boring mill which was very much heavier on one side than on another and to use this fixture continuously over a long period, it might be advisable to counterbalance it so that it would not cause inaccuracies on account of its eccentricity.

In Fig. 394 is shown a piece of work *A* having two holes *B* and *C* which are to be bored parallel to each other and some distance apart. A piece of work like this can often be handled on an upright double-head boring machine of a type in which the spindles revolve. This arrangement would allow both holes to be bored at one time, and the production obtained would undoubtedly be somewhat greater than by the method which we show. The work has been finished along the surface *D* and the six bolt holes *E*, *F*, *G*, *H*, *K* and *L* have been drilled. The two holes *E* and *L* have likewise been reamed, and they are used to locate the work for this operation.

The method of clamping is by means of straps at *M*,

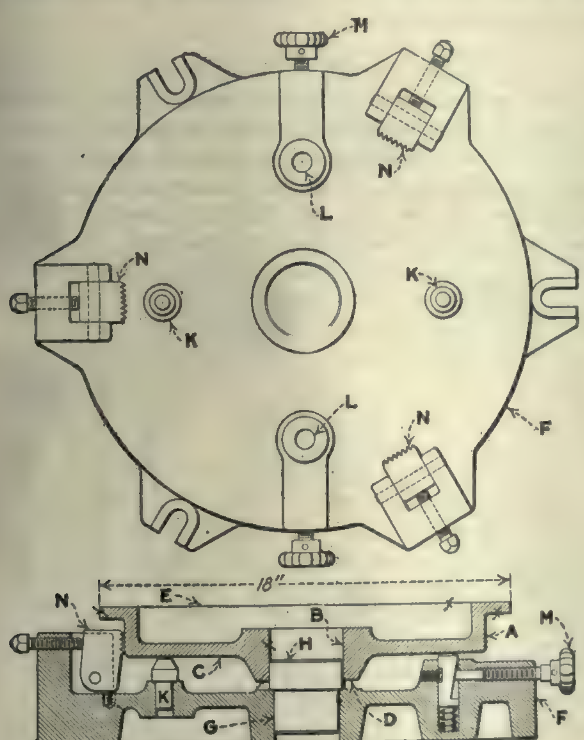


FIG. 393. SECOND-OPERATION FIXTURE LOCATING FROM A CENTRAL PLUG

N, *O* and *P*. The work rests on suitable pads with spaces between them, so that the chips will not accumulate. The sliding member *Q* is fitted to the base *R* so that it can be moved horizontally. Due to the weight of the slide the application of considerable power is necessary to move it, but this is obtained through a shaft *S* operating a pair of bevel gears and a pinion *T* which meshes with a rack *U* cut along the side of the sliding member. Heavy straps *V* and *W* are used to hold the slide down and an index pin *X* operated by a lever *Y* gives the correct location for boring the two holes.

Care must be taken when making fixtures of this kind to relieve the bearing surface of the slide so that there will not be too great an amount of surface in contact, as this would cause friction in indexing from one position to the other. If the amount of indexing necessary is small, other means can be provided which would

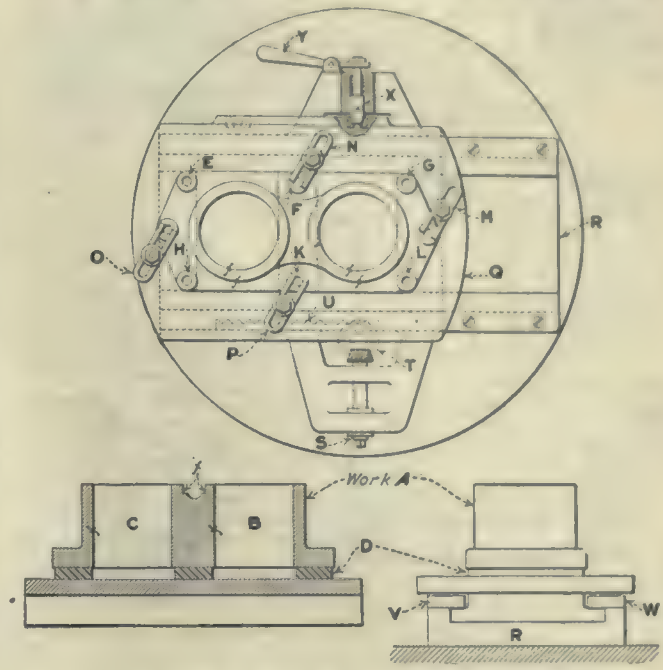


FIG. 394. SLIDING INDEX FIXTURE

do away with the necessity of the rack and pinion Even this mechanism could be simplified considerably by using a plain rack and pinion with a ratchet handle

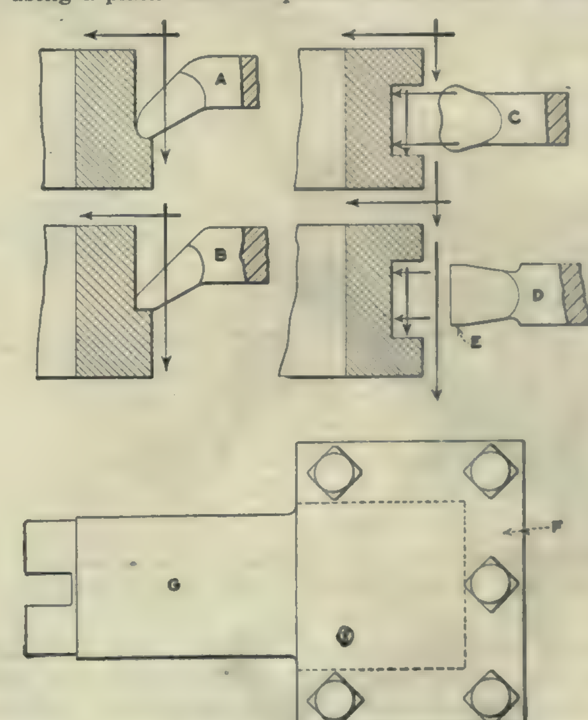


FIG. 395. TOOLS AND TOOLHOLDER FOR VERTICAL TURRET LATHE

but the latter method would take considerable more time to operate than the device shown.

We have not previously taken up the use of forged

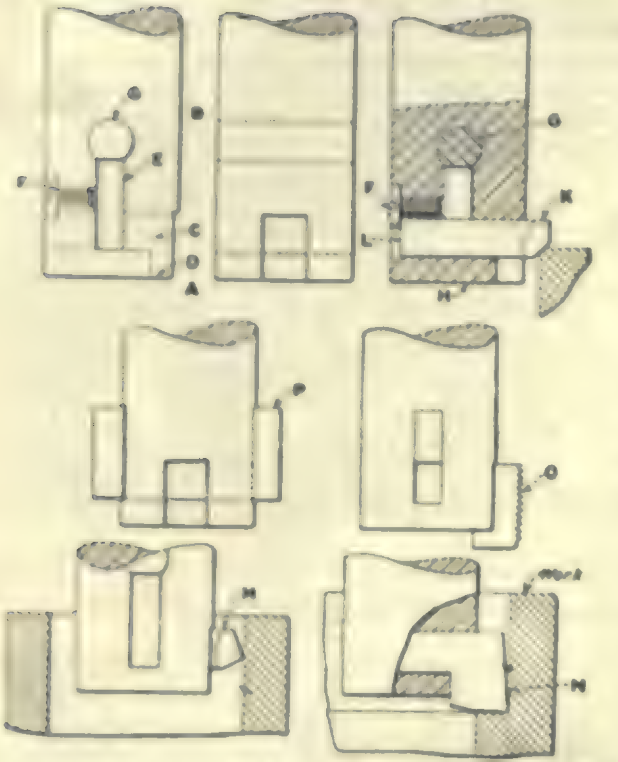


FIG. 396. TYPE OF BORING BAR USED ON VERTICAL TURRET LATHE

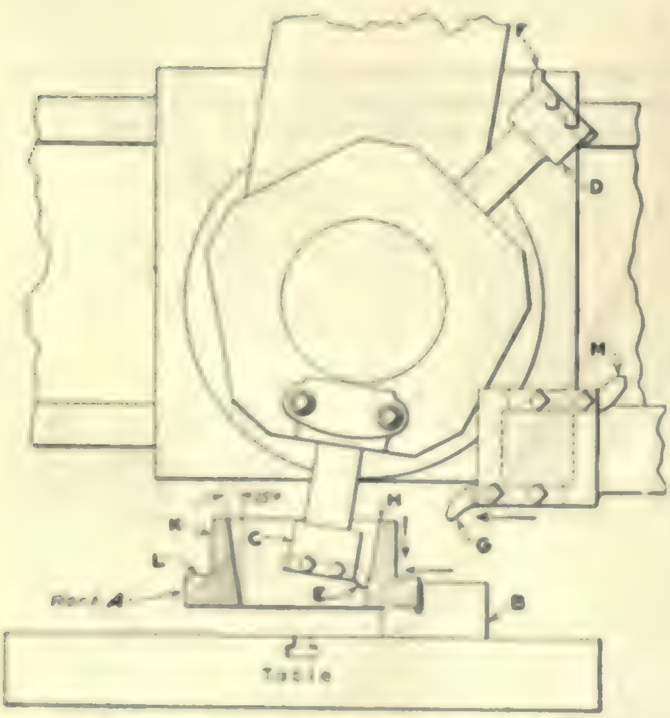


FIG. 397. GENERATING A TAPER INSIDE SURFACE

tools to any extent; but in vertical boring mill work they are used a great deal, and standards have been developed for different varieties which make it possible andle a large amount of turning, facing and boring by the use of standard tools. A great many of the d tools used are so designed that they will cut in more than one direction equally well. In order to illustrate their possibilities, a diagram is shown in Fig. 395 which will give a very good idea of the utility of the tools.

For example, the tool *A* is used for rough-turning and facing as indicated by the two arrows shown. The tool *B* is used for finish-turning and facing and can be used in both directions as indicated by the arrows. These tools are made both right-hand and left-hand, and they can be used in either the turret toolholder or the sidehead.

The tool *C* can be used for rough-turning, rough-facing and roughing out a pocket or groove. This tool has a double lip and will cut in any of the directions shown by the arrows. It is not used for finishing and it does not produce an exceptionally good surface, but it will remove stock rapidly and the cutting action is good. The tool *D* is used for finishing cuts or for grooving and it may be ground with a slight land at the corners as shown at *E* so that it will do a very good facing job. It can be operated in all of the directions indicated by the arrows.

These are the principal tools used in turning and facing and their simplicity is apparent, yet they are adaptable to a great variety of conditions. For the sidehead the tools are held directly in the turret toolpost, but when used in the turret a toolholder like that shown at *F* is employed. This holder is a heavy forging fitting the turret hole and slotted so that tools can be placed in it in several different positions. It is sometimes made with the stem *G* considerably longer to take care of special lengths.

Boring and Reaming Bars

A special type of boring and reaming bar has been developed for use in vertical boring mills. It is a multi-cutting bar and its construction makes it well worthy of careful consideration. Fig. 396 illustrates a number of applications of the bar to different uses and shows clearly its general features of construction. It must be

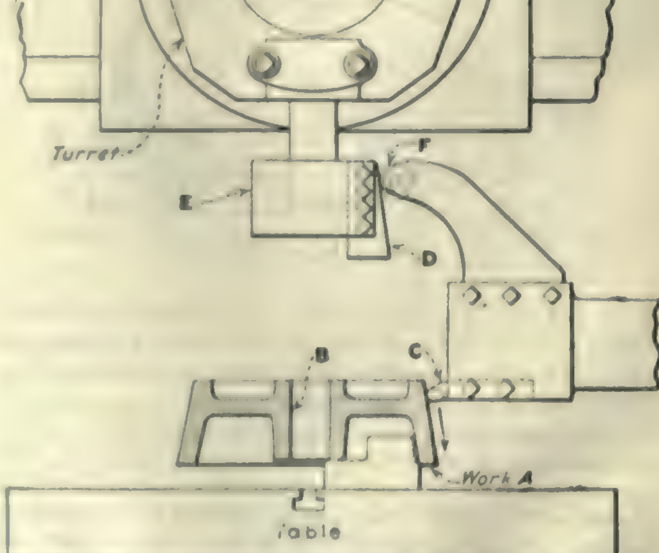


FIG. 398. ATTACHMENT FOR TURNING AN OUTSIDE TAPER

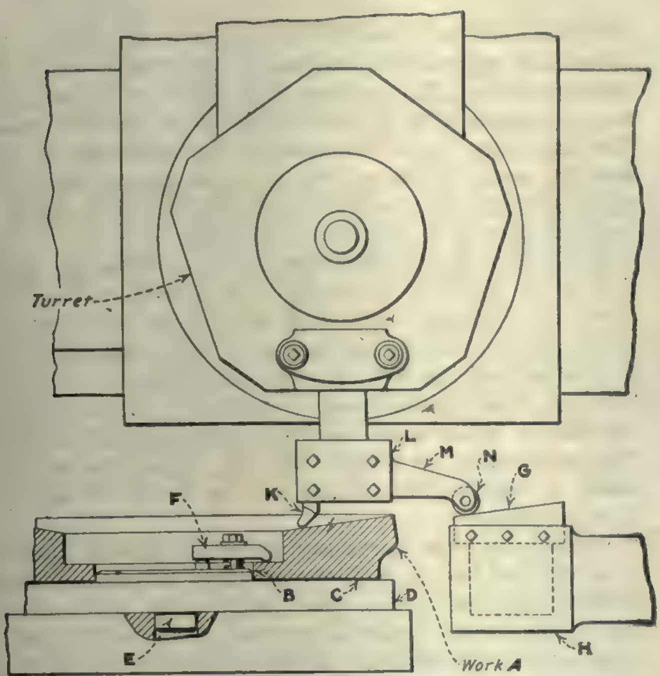


FIG. 399. FACING AN ANGULAR SURFACE BY MEANS OF A SIMPLE ATTACHMENT

remembered that boring tools and reamers used on a vertical boring mill are normally held when in use, in a vertical position, and that this position permits a type of construction to be used which would not prove satisfactory on a horizontal type of machine.

The diagram at *A* shows two views of the bar *B*, which is slotted at *C* and *D* to receive cutters of different kinds. The slot *E* is used for the reamer blade and is at right-angles to the boring tool slot which it intersects. A special setscrew *F* is used as a backing-up screw for the various boring tools and a hardened plug *G* is flatted on one side to back up the reamer blade when it is used.

The illustration at *H* shows a chamfering tool *K* in position in the bar. The end of the tool *L* strikes against the head of the screw *F*, which gives it the proper location. The tools are ground so that they fit the slot accurately, yet they are free enough so that they can be removed by hand without difficulty. The pressure of the cut keeps them in position. In boring a piece of work, after the turret position has been determined there is no change made in it while chamfering, rough-boring, finish-boring or reaming. The tools are ground to different lengths, so that various diameters can be produced according to the particular tool which is used.

The application of a boring tool is shown at *M*, and another type *N* illustrates the method of cutting a recess or a shoulder when it is necessary to face the bottom of the hole. The cutter shown at *O* is used for chasing a thread on the inside of a piece of work. All of these tools are ground to pre-determined lengths in special fixtures and the amount of finish allowance between cutters is pre-determined. The reamer blade *P* does not float in the ordinary way, but the blade itself fits the slot loosely, so that it centers itself and naturally follows the correctly generated hole. Special types of tools can be used in this bar when found necessary.

We have discussed the attachments used on a horizontal turret lathe for various pieces of work which require the generation of tapers. On the vertical turret lathe and vertical boring mill provision is made in the construction to handle a certain amount of this work without the use of special attachments. We have mentioned the fact that the head is arranged so that it can be swiveled to an angle of 45 deg. on each side of the center line. This makes it possible to set the head over so that different angles can be bored or turned without great difficulty.

Generating Inside Tapers

In Fig. 397 is shown a piece of work *A* held in chuck jaws *B* on the outside diameter. The work which is to be performed is indicated by the various arrows. The angle of the taper is 15 deg. and the head is therefore set over to this angle. The toolholders *C* and *D* carry, respectively, the roughing tool *E* and the finishing tool *F*. After the correct angle has been obtained, it is only necessary to start the down feed to the turret slide, and the tools will generate a correct taper on the inside of the work. While this operation is taking place, the tool *G* in the sidehead is used to rough off the surfaces *H*, *K* and *L*, the feeds used being in the directions indicated by arrows. The tool M is used for finishing the same surfaces. The simplicity of this arrangement will be readily seen, and the possibility of adapting it to a variety of conditions is apparent.

The work *A* shown in Fig. 398 requires the turning of the outside taper surface. This work could be done by means of the turret slide, which could be set to the proper angle; but if this were to be done a re-setting would be necessary when boring the hole *B*. In order to avoid this contingency the sidehead tool *C* is used for turning, the correct angle of the taper being determined by a special block *D* held in the holder *E* in the turret. The latter is locked in position during the operation, and the sidehead movement is controlled by the contact of the roll *F* against the forming plate.

In order to hold the roll against the plate, the binder on the sidehead is set up tightly enough, so that the head can be forced outward as the down feed of it continues. Various applications can be made of this same principle in handling tapers on a vertical turret lathe.

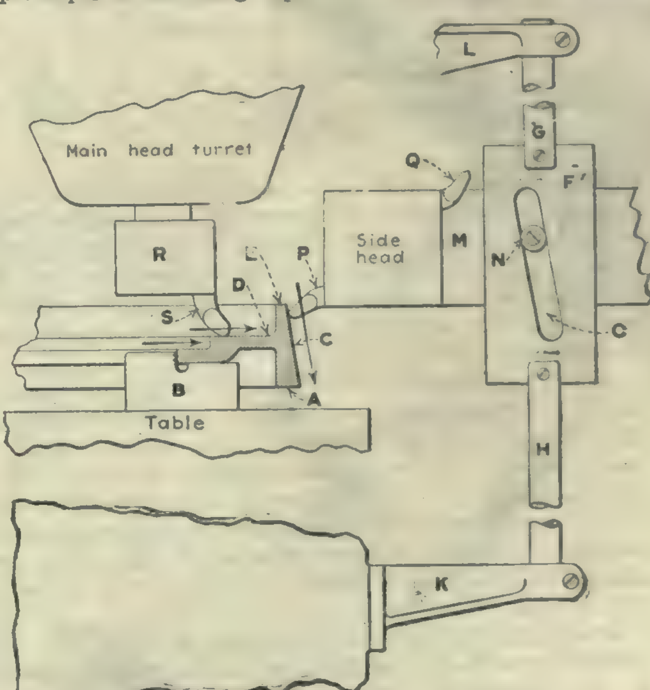


FIG. 400. TAPER TURNING WITH SIDEHEAD

There may be occasional instances when it is not desirable to tie up both turret and sidehead, as is necessary when using this method. Other means will be described later to avoid such a condition.

Taper Facing

When a taper surface is to be machined in a horizontal plane, a reversal of the principle just described can sometimes be used. Fig. 399 shows a piece of work *A* which has previously been machined at *B* and *C*. It is located on the fixture *D*, the central position of which is assured by means of the plug *E* which enters the hole in the table. The work locates at *B* and is clamped down by means of straps *F*. A taper block *G* of special form is held in the sidehead turret *H*, the latter being firmly locked so that it does not move during the operation. The tool *K* is held in the holder *L*, at one side of which is a roll holder *M* carrying a roll *N* which

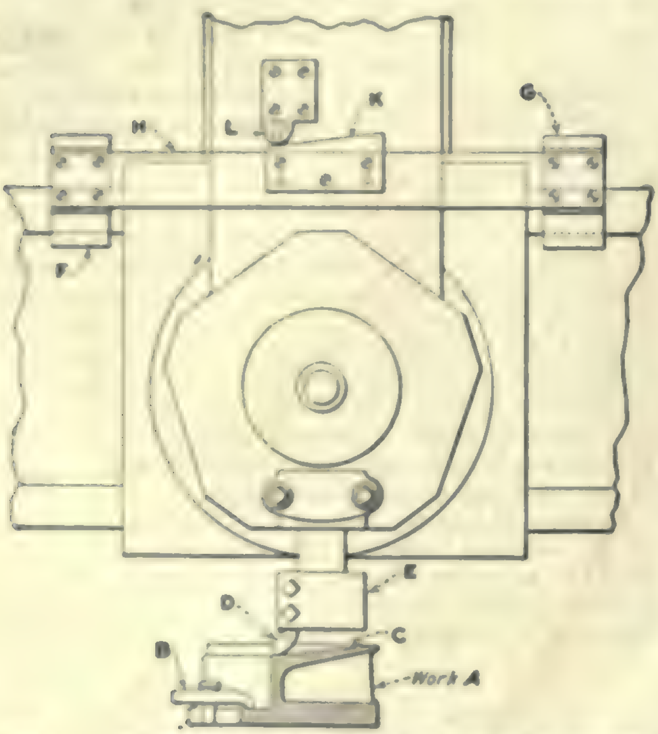


FIG. 401. GENERATING A TAPER SURFACE BY USING A FORM PLATE CARRIED ON THE RAIL

travels along the angle of the taper block, thus generating the proper angle. The operator is obliged to keep pressure in a downward direction on the turret slide when using this method, in order to keep the tool in continual contact with the form. The simplicity of this device and the ease with which it can be set up are recommendations in its favor.

All of the methods illustrated here for turning tapers, with the exception of the first, have necessitated tying up the sidehead and turret. This is not always desirable, as it decreases the production time. If both sidehead and turret can be used at the same time, the production is naturally increased to a considerable extent. Therefore a taper attachment can often be applied to advantage if there is sufficient work to warrant its use.

An example of this sort is shown in Fig. 400, in which the work *A* is held by the inside in special jaws *B*. It is desired to turn the taper *C* and face the surfaces *D* and *E* in the same setting. The plate *F* is supported at each end by rods *G* and *H*, which are adjustably mounted in brackets *K* and *L* attached to the machine body. The sidehead *M* is fitted with a roller *N* which engages with an angular slot *O* in the form plate. The roughing tool *P* is used in the sidehead of the machine and a finishing tool *Q* can be swung into place when needed. The holder *R* contains a tool *S* which is used for facing the surfaces *D* and *E*.

While this facing operation is in process the down feed of the sidehead is started and the roller *N* travels along the angular slot, thus generating the outside taper. For the finishing operation the sidehead turret is indexed and the tool *Q* completes the work. A principle like this can be used in finishing various forms, the plate *F* being made special to suit the requirements. This attachment is simple and the plates are easy to make, so that various angles can be machined without great trouble.

When it becomes necessary to face a tapered surface on a vertical boring mill the problem is slightly more difficult, yet even here a few simple parts can be made and applied to the machine so that good results can be obtained. In the example shown in Fig. 401 the work *A* is similar to that indicated in Fig. 399, but it is of much larger diameter and is handled on a different type of machine having no sidehead. The work is located on a fixture and clamped by means of straps *B* in the same manner as that previously described. The taper surface *C* is to be generated and the tool *D* held in a standard holder *E* is used for the purpose.

Two brackets at *F* and *G* are fitted to the cross-rail of the machine and carry a flat bar *H*, on the back of which a taper plate *K* is fastened. The toolslide carries a roll *L* which comes in contact with the taper plate, thus making it possible to control the angle of the taper. The pressure is kept on the toolslide in a downward direction, so as to keep the roll in contact with the form plate while the longitudinal or crossfeed of the toolslide is in use. It must be remembered when designing an attachment of this kind that the parts must all be made sufficiently strong to withstand the pressure to which they are subjected.

Tapers of various kinds may occasionally require machining, and the method most suitable is dependent largely upon the number of pieces which are to be machined, the accuracy required and the other operations which are to be performed in the same setting. It is advisable to select a method which will take these points into consideration, and if production will be greatly increased by the use of a special attachment, it can be designed according to the requirements. Many devices for taper turning have been described and the mechanical principles involved can be adapted to suit various types of machines.

Idle Equipment

By C. E. Jensen

The same remarks that apply to idle workers are appropriate for idle equipment, in so far as the employer loses the profit that the idle equipment should have earned during the time in question. But, in addition, cost calculation is rendered inaccurate, and the overhead percentage is unduly increased. A machine costing $10,000, and normally used eight hours a day, must earn 27c. an hour to cover 6 per cent interest charges alone.

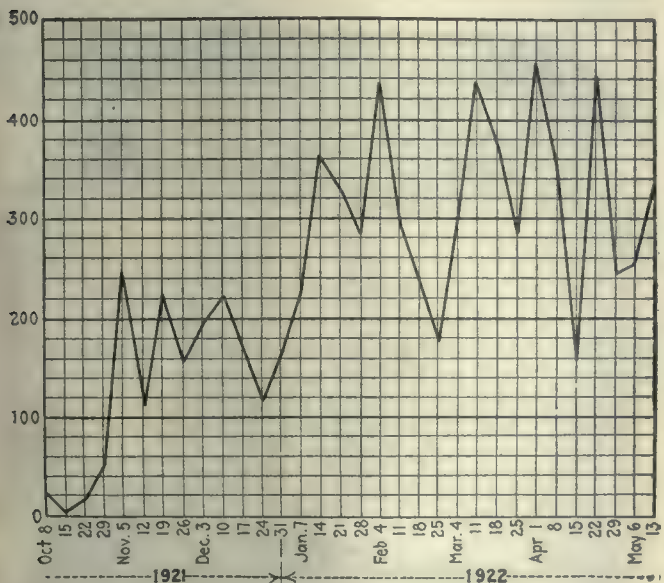
Inquiries in the Industrial Machinery Division, Bureau of Foreign and Domestic Commerce

By W. H. Rastall, Chief

An indication of the steady increase in activity of the industrial machinery division of the Bureau of Foreign and Domestic Commerce in Washington, is afforded by the accompanying chart which is a copy of one that I keep on my desk to cheer me up.

Although the curve has some rather violent fluctuations, it is encouraging to note that the general trend is constantly upward, showing that more and more people are bringing their machinery export problems to the Government for counsel.

Although this matter of the number of our commer-



COMMERCIAL INQUIRIES ANSWERED BY INDUSTRIAL MACHINERY DIVISION

cial inquiries is one of great importance, I have come to feel that it is far more useful to persuade the manufacturer to call at this office, and for some months we have been conducting a campaign directed toward getting our machinery exporters into this building in order that they may note what we have, how we work, and how we can be used. The campaign has been very successful and is becoming increasingly so; the result is that manufacturers who come here spend anywhere from three hours to three weeks in studying the possibility of their export market.

Increasing Usefulness

To show how successful this campaign has been I might say that we had eight visitors in October, ten in November, twenty-three in December (a five-week month), sixteen in January, fifteen in February, twenty-one in March and thirty-five in April.

As the man on the job, I have come to feel that week by week we are becoming increasingly useful to the machinery manufacturing exporter, and each week brings us a little closer to the concrete export problems that really deserve consideration. We are really making far more progress than these tabular statements would indicate.

The Worker's Prospects in the Machinery Building Industry—Discussion

By A. W. Forbes

In an article published on page 511, Vol. 56, of *American Machinist*, Geo. J. Buckner disagrees with my estimate of the relative earning capacity of the college graduate as compared with that of the average young man without such training, for the reason, I believe, that he does not fully grasp my contention.

I am in thorough accord with Mr. Buckner in his opinion that the college bred boy is superior to the boy whose education is obtained in the shop—superior in every way, mentally, morally and physically—but it is one thing to admit his superiority and quite another to contend that the college should have the credit of causing or helping him to attain it.

It is only the better class of boys that go to college, and if the best boys enter college we have a reasonable right to expect that the best men will come out of it. My own opinion is that the superiority is due to inheritance and early environment and is in despite rather than because of his college training.

I am reminded of the story of the man who decided to teach chickens to swim. Being an educator instead of a farmer or naturalist this man did not notice that two of his selected "chicks" were ducklings, and began by giving them all regular practice in the water. He soon discovered, however, that only two of his brood gave promise of learning and so abandoned the others and devoted his entire attention to the favored ones.

Uuder these circumstances he was soon able to demonstrate not only that chickens were susceptible to aquatic training, but that such training was capable of changing their physical as well as temperamental characteristics, for his two favored pupils learned to love the water and grew webbed feet to help them in their swimming.

This is about what our educators are doing with boys. Those who lack ambition do not enter college; those without ability are not allowed to stay. And yet the college officials persist in comparing the average of their graduates with the average of the boys who do not enter.

If I may add a personal word to this discussion to show my position, I would say that I hold degrees from two colleges, that my brothers and sisters have studied in seven colleges and taught in four; therefore, I claim to be not entirely without inside knowledge.

While in college I was, of course, a firm believer in its advantages, and it was not until several years after graduation that my doubts were awakened by the difficulty of obtaining boys for my shop who possessed anything like the ability of those that I saw entering college.

I have not succeeded in obtaining evidence that the colleges are really doing any good, nor have I presented any definite evidence to the contrary. This is not the place to present such evidence.

We can prove the value of college training only by comparing the graduates with men of equal character and ability without the training. In view of the fact that the colleges are constantly calling upon us through taxes and personal solicitation to provide more funds, it would seem to me that it was up to these institutions to demonstrate their real value in order to justify their demands.

Ideas from Practical Men

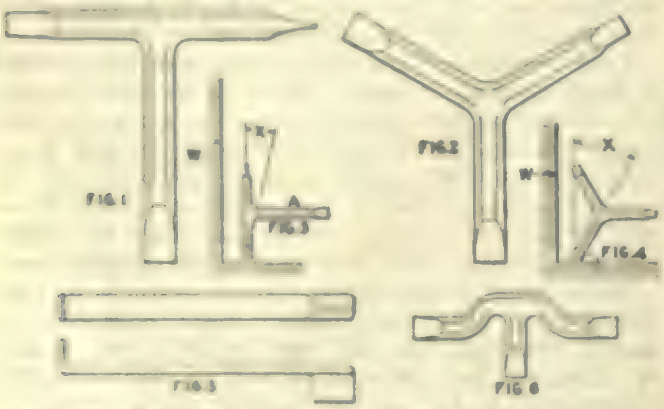
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Handy Screwdriver

By W. S. Rowell

Under the above title on page 938, Vol. 55, of *American Machinist*, Mr. Wiley has shown us how to get results with smith work of a simple kind; on page 226, Vol. 56, Mr. Gregory showed us how not to get the effect he really wants. Mr. Gregory is right in saying screwdrivers require heavy end pressure, but wrong in designing his screwdriver so it is difficult of application.

A few years ago there came into a shop where I was employed, a tool dresser who usually made things the



TYPES OF HANDY AND UNHANDY SCREW DRIVERS

way he thought right, regardless of such little things as orders, sketches, etc. Before he was fired he was ordered to make two screwdrivers to sketch, like Fig. 1, which is usually called a T-screwdriver; when they were finished they were like Fig. 2, which might be called trifurcated. These *beautiful* things are rarely used because of their several inconveniences, though they are much like, but better, than Mr. Gregory's design.

A screwdriver working close to a surface parallel to the center line of a screw is shown in Fig. 3. The arrow shows an easily possible line of end pressure almost in line with the screw. The trifurcated screwdriver in Fig. 4 is shown encountering great difficulties in the same position. In this case the angle X is much greater and the blade will enter the screw slot properly only when it is parallel with surface W.

We all know how easily end pressure is applied to the screwdriver shown in Fig. 5. Some one please furnish it a name. The screwdriver shown in Fig. 6 makes straight line end pressure easy, but it will not work so nicely close to a surface parallel with the center line of a screw and is not so good in close quarters as the T-screwdriver.

All screwdrivers should be made from square or "hex" stock to provide ready means of applying a wrench on occasions. In these days of torch welding, the making of T-screwdrivers is easy. One should almost have a driver for each screw size.

Sine Bars for Use on Machines

By Matthew Harris

The use of the sine bar has been generally restricted to the toolroom for laying out work to be done, or for checking the accuracy of work in process or after completion. However, the Pratt & Whitney Co. has carried

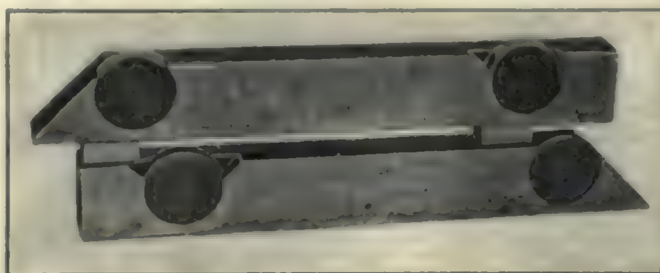


FIG. 1—A PAIR OF SINE BAR PARALLELS

the application of sine bars a step further and uses them in the shop in many ways, among others for the angular setting of work on machine tables.

In the illustrations herewith are shown a pair of

FIG. 2—ANGLE PLATE WITH SINE BAR BASE

sine bar parallels and an angle plate, the base of which has been converted into a permanent sine bar.

The use of both these devices is so obvious and their construction is so plain that no further description is necessary.

Temporary Crankpins for Use in Counterbalancing Locomotive Drivers

By J. Robert Phelps

A good start may often be gained when fitting up a pair of main wheels in the locomotive shop, if the wheels can be weighed for counterbalancing before the pins are made and pressed in. The drawing, Fig. 1, shows an arrangement for this purpose that has proved to be

very useful in this shop and has made possible a considerable saving in time and labor, and also in the distillate which we use to heat the tires for setting.

For example: If we were weighing a pair of wheels

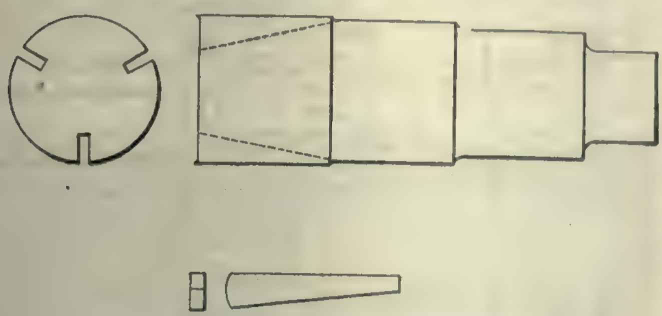


FIG. 1. TEMPORARY PIN FOR BALANCING DRIVING WHEELS

for counterbalancing in which it was required that the tires be in place when the pins were pressed in, we would have to wait for the pins to be made. Then when the wheels were put on the balancing ways we would very likely find that the tires would have to

FIG. 2. THE PIN AND TAPERED KEYS. FIG. 3. A PAIR OF WHEELS ON THE WEIGHING RACK

come off again in order to get the necessary amount of lead into or out of the counterweight pockets.

With the arrangement here illustrated and described, the tires may be put on to stay, even before the pins

FIG. 4. SHOWING HOW THE PIN IS HELD IN THE WHEEL

are made. Two scrap pins should be fitted up in accordance with the drawing for each type of engine handled in the shop. The cut, Fig. 2, shows one such pin with the three tapered keys and an eyebolt, which latter will be found very handy in handling the heavy pin with the crane.

In Fig. 3 is shown the outside of one of a pair of wheels on the rack with the temporary pin in place and the necessary counterbalancing weights hung upon it. Note the two rollers upon which the sling bears to relieve the friction at this point. It should be understood that the eccentric arm must be in place at this stage. It was left off while photographing in order to secure a clear view.

In Fig. 4 is shown the inside of the same wheel and indicates how the temporary pin is held by means of the keys. This shoulder of the pin should be about $\frac{1}{16}$ in. smaller in diameter than the hole at the first quartering. Then as the hole is enlarged the tapered keys take up the difference and keep the pin always in the center.

Method of Locating Holes for Boring

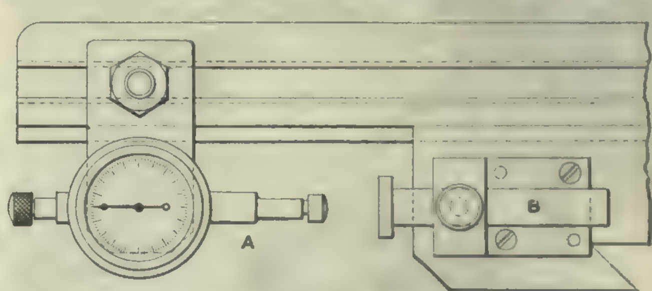
By W. MacPherson

I have found the following described method of locating work for boring holes on the milling machine, such as in jig and fixture work of the ordinary type, to be convenient and accurate.

A dial indicator, shown at *A* in the sketch, is attached to a holder made to slide in the T-slot on the front of the milling machine table that is provided for the table stops. An adjustable stop *B* is fastened to the saddle of the machine in line with the stem of the indicator.

To move the table any desired amount, as when spacing from one hole to another, the indicator stem is brought into contact with the stop and the dial turned to zero. Then with the table run out to the approximate position, the exact distance is determined by means of gage blocks of the Hoke type between the stop and the indicator. Converse movements are made by using the desired combination of blocks first and then bringing the indicator to contact with the stop.

The advantage of the Hoke blocks will be apparent, as with them any dimension from 0.200 to 10 in. can be obtained in increments of 0.0001 in. The blocks,



ADJUSTABLE STOPS FOR CLOSE MEASUREMENTS

after being wrung together, are further secured by means of a tie rod through the center. This rod, especially when long lengths are required, makes the blocks more secure and easily handled.

The method can be applied to vertical measurements by using an indicator attached in some convenient position to the column of the machine.

A Special Chuck for Holding a Thin Awkward Casting

By Edward H. Tingley

The type of casting to be machined is shown in Fig. 1. It will be noted that the casting is well cored out and that the walls are quite thin. Originally a plain chuck was used to hold the piece while machining, but the taper on the rim due to draft on the pattern and the frailness of the walls, did not allow the operator to clamp it tight enough to keep it from slipping. Too much pressure distorted the piece or broke the casting. To provide the centering feature and clamp the piece tight, the chuck shown in Fig. 2 was developed and has been in use for three years, giving excellent satisfaction.

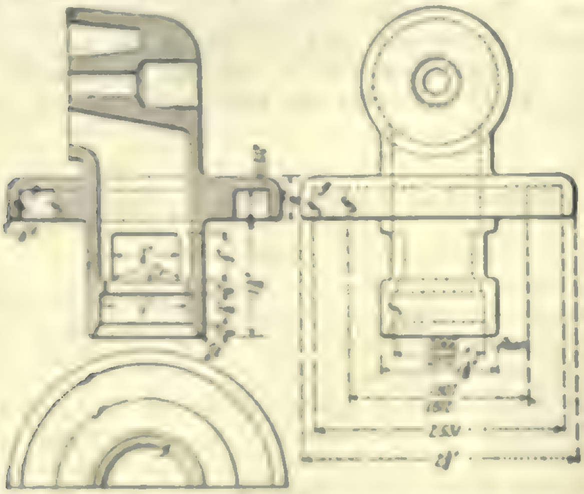


FIG. 1. THE CASTING TO BE CHUCKED

The chuck is easy and quick to operate and broken or distorted castings are rare.

With the casting in the chuck, the bell-mouthed center *A*, which is held in the turret of a hand screw machine, is brought up and pushes the casting back against the stop *B* and also centers the projecting end. Tightening the scroll plate *C* clamps and centers the outside rim of the piece by the inward movement of jaws *D*. The double acting screw *E* is then tightened, bringing jaws *G* and *H* down upon the rear projection of the piece in whatever position the bell center and the jaws *D* have located it. These jaws *G* and *H*, with the screw *E*, float in guides which permit motion in a direction at right-angles to the surfaces on the rear projection of the casting. To hold these floating jaws stationary after they have clamped the part in position, the double threaded screw *I* is tightened and pushes the two wedges *K* and *L* toward the center, thus crowding jaws *G* and *H* against the guides. With these three clamping arrangements, the casting is held securely and centrally.

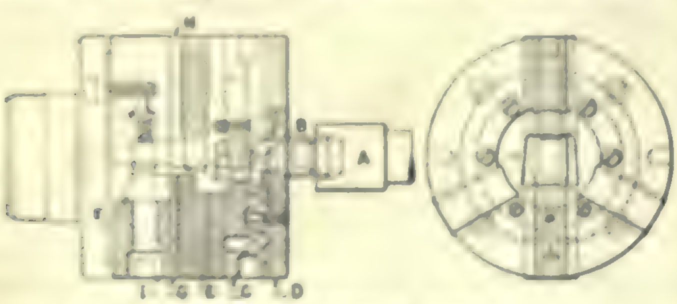


FIG. 2. THE SPECIAL CHUCK

The tools designed to perform the operations on the piece are shown in Fig. 3. The tool shown at *A* bores out the inner recess and at the same time breaks the scale on the surface where the counterbored recess will be cut. The circular tool *B*, in finishing the counterbored recess, balances the thrusts on the toolholder and the piece.

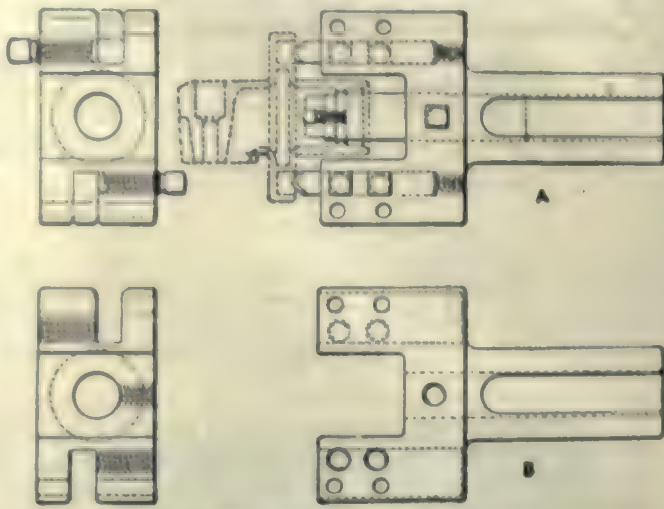


FIG. 3. BORING AND FACING TOOLS

Scotch and Pinch Bar for Handling Machines

By Matthew Harris

In barring up machines to put rollers under the skids for moving, blocks of all sorts are usually hunted up to be used as scotches on which to fulcrum the pinch bar. Every man who has handled a pinch bar in moving machinery knows that at times the scotch will slip from under the bar and let the machine down on the floor. Especially is this true when a machine is being lifted to such a height as to require the use of one or more blocks on top of each other.

SCOTCH AND PINCH BAR

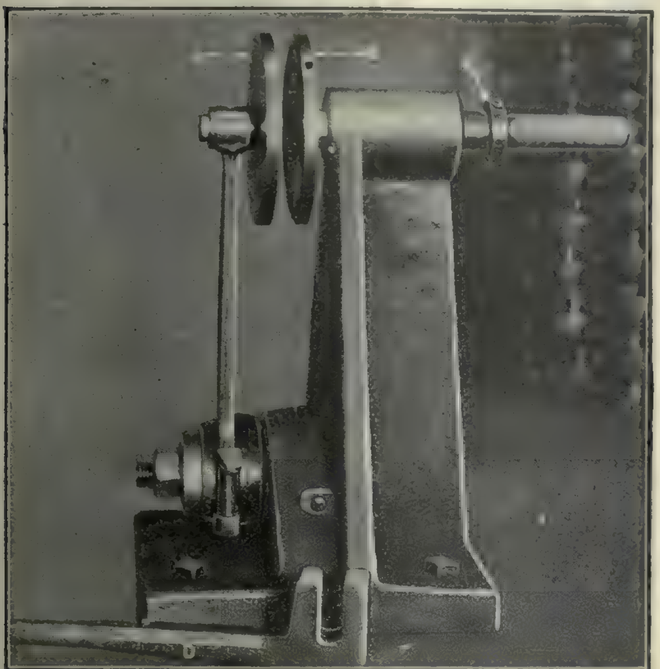
The scotch and bar shown in the accompanying illustration are used in the plant of Gould & Eberhardt, Newark, N. J.

As will be seen, the pin through the bar fits in the notches cast at varying heights in the scotch. This arrangement permits of a fairly high lift in progressive stages without the necessity for having blocks of different sizes.

Inspecting Connecting Rods

By Herbert Crawford

A connecting-rod inspection fixture used by the Peerless Motor Car Co. of Cleveland, Ohio, while resembling those used for the same purpose in other shops has one or two features which are somewhat different. The fixture is shown in the illustration and consists of the usual stand with a stud on which the large end of the rod is held by a substantial flange and nut. The large disk *A*, with a central stud representing the piston pin, is slipped into the small end of the rod and the rod is swung up into the position shown. The disk *B* is then moved forward until the collar *C* contacts with the back end of the fixture. In this position the large disk *B* should just meet the disk *A* and, if the rod is square, they should just pass each other with a full bearing on each disk. By relieving the centers of the disks so as to leave a raised edge, it is very easy to see just what contact is being made. Any slight twist is easily corrected by the wrench shown at *D*.



CONNECTING-ROD INSPECTING FIXTURE

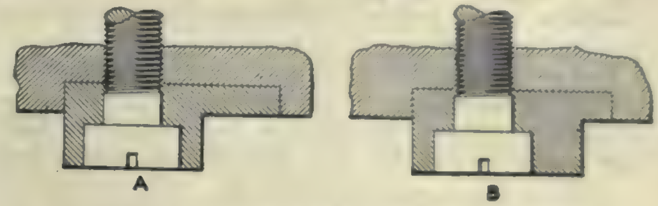
Utilizing Fixtures on Different Machines

By Frank C. Hudson

The lack of uniform dimensions in the T-slots in machine tool tables is, fortunately, being considered by a committee of machine tool builders and members of the A. S. M. E. Such standardization will be of great help to many users of machine tools and save thousands of dollars, especially for the man running a small shop.

In the meantime we must make the best of the situation and here is the way the Lucas Machine Tool Co., Cleveland, Ohio, gets around the difficulty of different width T-slots. Whenever a fixture is made for use on a milling machine or other table, the tongue is made as shown in the accompanying illustration. The tongue has a wide base set into the fixture itself, the projecting part being made to suit the machine table it is to be used on.

It will be noted, however, that the projecting part of the tongue is not central with the slot in the base but flush with one edge of it. These tongues are held in place by round-head capscrews located centrally with the narrowest tongue as seen at *A*. This prevents getting the tongue in the wrong way, which sometimes counts when the fixture is designed to overhang the table on one side.



INTERCHANGEABLE TONGUES FOR FIXTURES

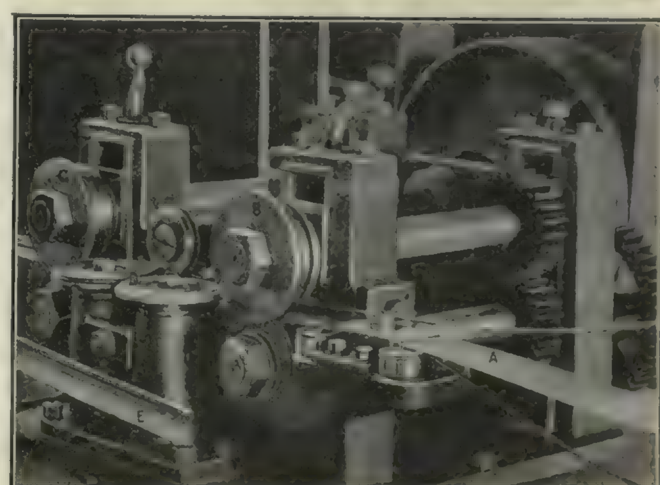
Should it be desirable to use this fixture on another machine at any time, another tongue is made as at *B*. The base is of course the same, but the tongue is wider to fit another designer's idea of a T-slot. The screw location is the same as before and insures getting either tongue in as it should be.

This is a very clever scheme for making the best of our present hodge-podge of T-slots and saves a lot of time and expense.

Wiring Fender Strips

By R. E. Marks

Here is an interesting little special wiring machine I ran across in the fender shop of the Winton Motor Car Co., in Cleveland, some time ago. It is for rolling wires into the edges of a rather narrow strip. The wires are on opposite sides of the strip, the edges of which are turned in opposite directions. The steel strip feeds in from *A* with one wire above and the other below. The wires feed through the rollers shown and the strip is passed between them at *B* and *C*. The rollers at *D* support the upper wire while the edge of the strip is being turned over it. Part of a completed strip is shown at *E*. It is interesting to note how a designer who understands this sort of work can arrange a few rollers and gears in a compact frame and secure just the result he desires.



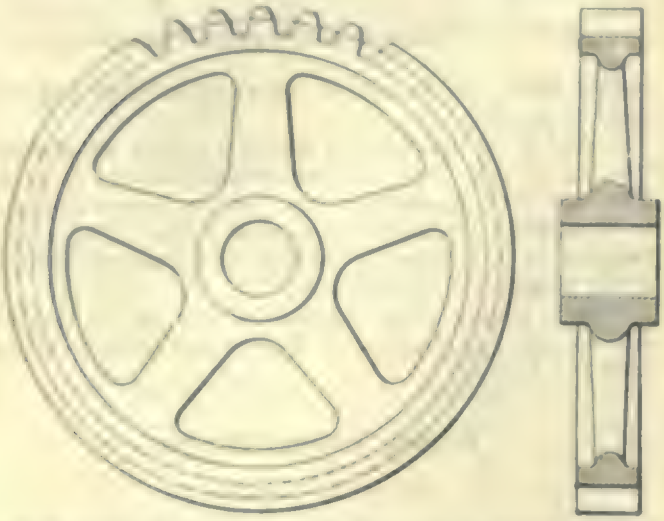
ROLLING IN TWO WIRES ON OPPOSITE SIDES OF A STRIP

Best Way to Show Section Through Ribs

By F. L. Sylvester

On page 787 of *American Machinist* an article by Aloysius Wilks, under the above heading invites discussion. As a preliminary measure it would seem to be well to consider the purpose of a drawing from the viewpoint of the one most interested and directly concerned—the workman who is to use it.

The primary object of a drawing is, of course, to convey the conceptions of the designer to the men who are to bring them into material being, and the ideal drawing is the one that does this with the fewest possible lines consistent with complete and comprehensive information.



SHOWING A SECTION WITH FEWEST POSSIBLE LINES

Judged from this standpoint it would seem that Mr. Wilks, in selecting the object with which to illustrate his remarks, had chosen unfortunately. Of his three views showing various ways of indicating a section through the middle of an angle plate having a rib in it he chooses the third method which really shows the section taken elsewhere, as he has omitted the cross-hatching entirely where it should have passed through the rib.

In order the better to "keep on good terms with the efficiency expert" and "put one over on old Father Time," as he expresses it, why not omit the cross-hatching altogether and show two views of the object; one an end view as is his third example and the other a front view as shown in the lower left-hand corner of his sketch, the two views, of course, to be arranged in correct relative position on the drawing.

As an instance of what is right or best in displaying a section through a rib, I am submitting the accompanying drawing, which shows the section of a gear wheel having five arms, or spokes. It is clear that the drawing does not represent the gear correctly according to theory, for this would demand that the upper spoke be cross-hatched and the lower one foreshortened to indicate its angular position.

The patternmaker may, for the sake of getting a laugh on the draftsman, criticize such a drawing as not being theoretically correct, but it does, nevertheless, give him the clearest representation of the object desired, and with the fewest possible lines, which is what he really wants.

Simple Guard and Feed for Punch Presses

By I. B. Rich

The illustration herewith shows a guard and a simple feed for a press, the latter only good for flattening work as shown.

The press guard at *A*, Fig. 1, lifts the operator's hand out of harm's way before the punch can catch it. It is a simple device, the guard being raised by the small crank *B*, connected to the mechanism that runs the press. This guard has an easy motion which prevents injury to the operator even when it forces the hand out of the way, differing from some of the older guards in this respect. It has proved very efficient in this shop.

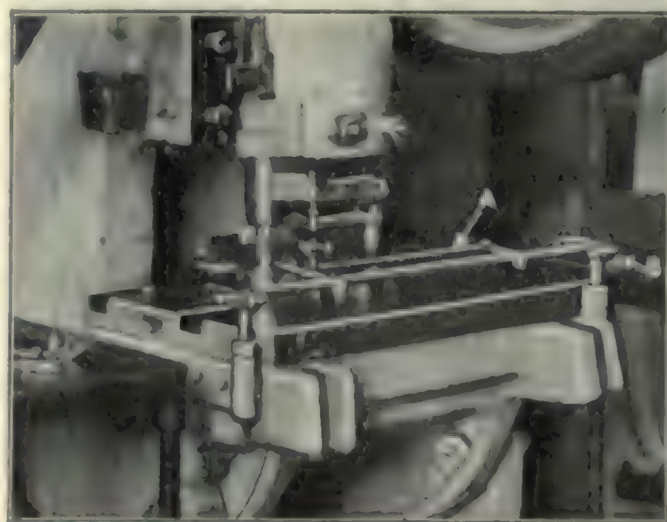


FIG. 1—A SAFETY GUARD FOR A PUNCH PRESS

The feed shown in Fig. 2 is extremely simple, consisting of a piece of sheet metal bent up as at *A*. It is only necessary to place the washers to be flattened on the incline and they naturally slide under the ram to be flattened at the next stroke. They are poked out of the way with a thin piece of sheet metal.

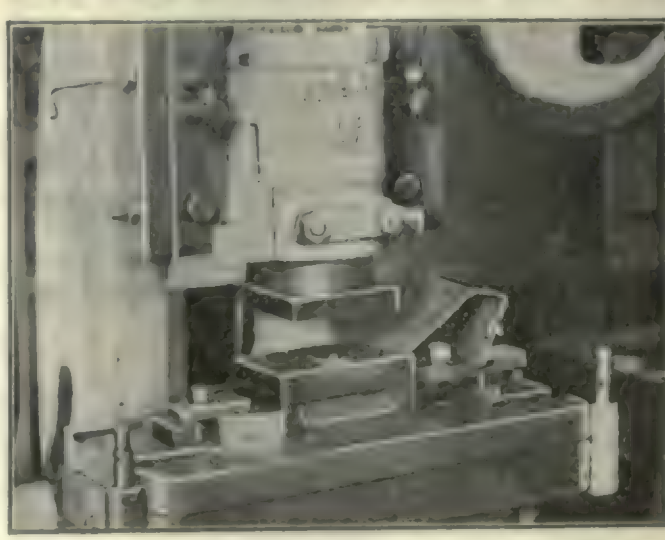


FIG. 2—A SIMPLE PUNCH-PRESS FEED

These devices are used by the Monroe Calculating Machine Co., Orange, N. J. The presses are painted white, even though they are in a very light shop and are kept remarkably clean with apparently little effort.

A Good Casting from a Bad Pattern

By M. E. Duggan

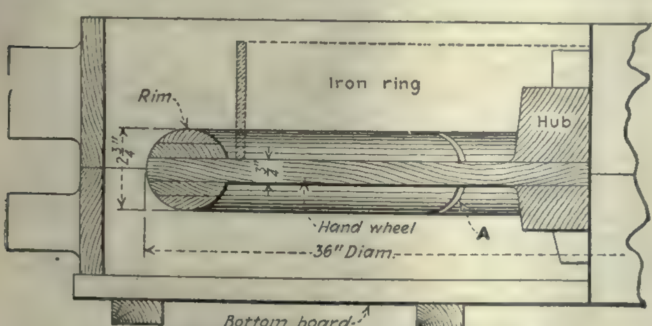
Did you ever make a pattern for a wheel—gear, band, fly, hand, or any old kind of wheel—with a web center instead of spokes?

If so, you were probably very careful to have the web flat and true, and you glued the two, three, or four pieces that made up the web nicely and firmly together to make sure that they would retain their original shape. Then you built up on each side of this web a double row of segments to form the rim, well glued, and perhaps additionally secured with nails or screws; and then you turned up and finished this pattern in a way to do any good pattern maker proud.

When the pattern was returned from the foundry you stored it in the average kind of pattern loft under the roof where it was subjected to all degrees of temperature and perhaps to dampness, so that when you wanted it the second time, very likely for a rush repair job, you found it warped and twisted almost beyond recognition.

Did all these things ever happen to you?—and if so, what did you do about it? Here is the way it was handled in one such case.

The warped pattern was sent to the foundry with instructions to make the best of it. The rim was sawed through at eight places as shown at *A*, and the pattern bedded in molding sand in the flask. A heavy ring of iron (a circular flask) was then laid upon the pattern and by hammering and manipulating the ring and pattern the latter was eventually coaxed to lie flat so that the iron ring would bear upon the web all around.



MOLDING FROM A WARPED PATTERN

Enough sand was then shoveled into the flask to hold the pattern, and the iron ring removed.

More sand was then shoveled in and the drag side of the mold completed, the mold rolled over and the cope side finished. A very satisfactory casting resulted.

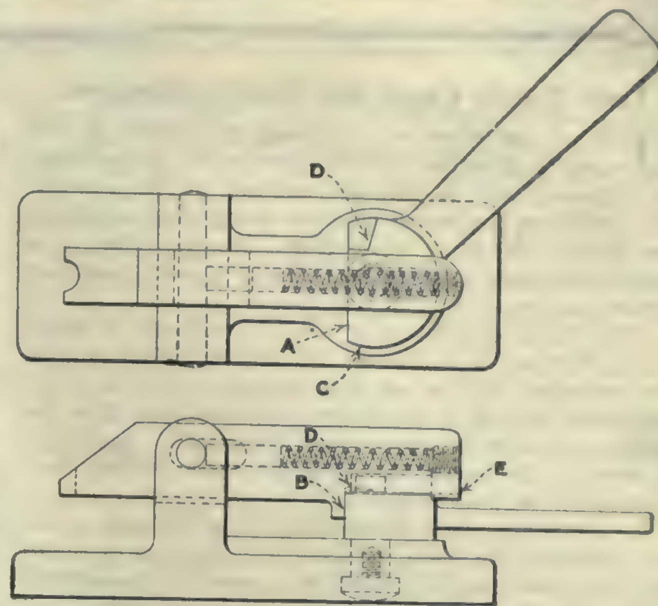
Double-Action Clamp for Jigs and Fixtures

By R. F. Moore

The double-acting clamping device here shown and described is a very simple and effective means of applying the clamping pressure to work held in a jig or fixture, and may easily be incorporated into such tools. When the writer saw the device it was a part of a drilling jig, and it attracted his attention because of its easy and rapid action.

The first movement of the handle causes the cam surface *A* to push the clamp forward by reason of contact with the lug *B* of the clamp. When point *C* of the cam has reached the lug and there is no further forward movement of the clamp, the face cam *D* comes under the heel of the clamp at *E* and applies the clamping pressure, all in a single movement.

The stud upon which the handle turns extends a sufficient distance above the latter to enter a slot in the under side of the clamp to prevent any sidewise movement. A suitable spring returns the clamp to its original position when the handle is turned back.



DOUBLE-ACTING CLAMPING DEVICE

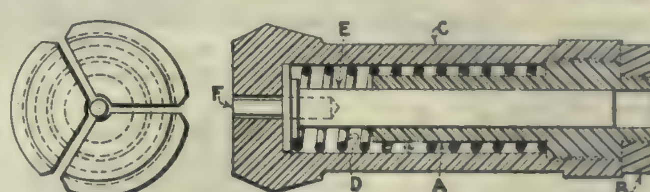
Ejecting Collet for Automatic Screw Machines

By E. W. LaRue

In second operation work on automatic screw machines, the work is generally fed from a magazine into the collet, and often a means must be found for ejecting it when completed.

An ejecting collet for use on a No. 00 B. & S. automatic screw machine is shown herewith.

Parts *A* and *B* are made of tool steel and hardened.



AN EJECTING COLLET

Part *C* is a standard double-angle collet, hardened, tempered and tapped out at the rear end to receive part *A*. Parts *E* and *F* are tool steel and the spring *D* is made of music wire and tempered. Part *F* is a light drive fit in part *E* which in turn is a sliding fit in part *A*. After part *A* has been screwed into the collet the proper distance, the locknut *B* is screwed tightly in place.

The work is forced into the collet against the pressure of the spring by the turret and magazine mechanisms and the collet tightened by the usual cam. When the collet is loosened the work is ejected by the plunger *F*.

Editorial

Low Repair Costs and Future Business

ONE of the signs of returning prosperity is the ordering of parts for machines which are already in various plants in different sections of the country. This indicates that manufacturers using these machines are getting ready to start them on production once more, and gives promise of orders for new machines in the future.

With the probabilities of future business in mind it behooves us to so handle the orders for parts that the customer will be so well pleased with his treatment that he will at least give the same machines the preference when the new orders are placed. And there is more to the proper handling of repair orders than many seem to realize.

It is probable that, in common with the rest of us, the customer has deferred ordering until he actually needs the machine for which the parts are ordered. In that case time is an element to be considered and prompt service will create a favorable impression. If an appreciable delay is necessary, a courteous letter explaining the reason will help to keep him good natured. Silence, which is constructed as ignoring his order, is a great barrier to future relations. There is a whole lot more to letter writing in regard to repair part orders than appears on the surface. Such orders generally do not permit personal contact of buyer and seller and the letters have to be the best that can be written on that account.

The question of price is also to be considered, as this plays an important part in maintaining pleasant relations. No man expects to get repair parts for nothing but everyone resents being "done," to use a very expressive slang phrase. And too many manufacturers of machinery of all kinds, from coffee mills to automobiles, seem to feel justified in charging from two to ten times the value of a part to be used in making repairs.

Nothing will shift a man's allegiance from one make of machine more quickly than to be overcharged for parts. To be billed twenty dollars for a part which he knows did not cost a tenth of that, or which he can duplicate in his own shop for half the price asked, will do more to "rile" a man's temper than almost anything else. And with it often go the good impressions which the machine itself may have created.

The increasing demand for repair parts makes this an opportune time to carefully consider this phase of the sales problem. Now is the time to cultivate customers who are now using your machines and to handle their repair orders so that your machines stand first in their minds when the time comes to order more. It will pay to go over your price list on spare parts and ask yourself whether they are reasonable, when all phases of the question are considered. You must, of course, figure cost, overhead and the expense of carrying a reasonable stock. But it will pay to revise any fancy prices and to avoid the practice of some to get all they can out of repair parts. Prompt service and fair prices of spare parts go far toward keeping old customers lined up for all new orders in your line.

A Bill to Relieve Excessive Postal Rates

REPRESENTATIVE Clyde Kelly of Pennsylvania has introduced a bill for the repeal of a portion of the excess postage rates which were imposed as a measure for war revenue. This would not put the rates back to a pre-war basis, but only remove the last two, of the *four* increases imposed. Even the rates proposed by Mr. Kelly are 175 per cent higher than those paid before the war.

Mr. Kelly points out that the continuation of these high rates has seriously affected the entire publishing industry. This industry, he contends, is just as essential to business prosperity as are the highways and waterways. Both are channels which aid commerce in securing its necessary interchange of products and ideas. This applies just as much to the advertising as to the reading pages, as both chronicle advance in industrial achievement.

It must be remembered that the postal rates on publications were advanced 325 per cent over pre-war rates. The increase has not been apparent to subscribers because in most cases the cost has been borne entirely by the publishers. It should also be recalled that every other item carried in the war measure which imposed this great increase in postal rates, has been either modified or repealed. Only the publishers have been compelled to continue to pay the maximum rate imposed as a war measure.

But the matter is not entirely one of injustice to the publishing industry. The war time postal rates have driven millions of pounds of second-class matter from the mails and into private channels of distribution at lower rates. There is something radically wrong in our laws when a private company can make a profit at a lower rate than that charged for mail.

It may not be out of place to mention the valuable work done by many industrial periodicals during the war. They carried government messages to millions of readers at no cost. They helped to sell Liberty Bonds, to raise money for the Red Cross and other necessary purposes. They were of great aid in securing proper personnel in many departments. Their editors were at the government's disposal for special researches and the gathering and dissemination of special information, and at no cost for either salaries or traveling expenses. Furthermore, their publications may be called the source of both first-class and fourth-class mail. In other words, among the best and biggest customers of the Post Office Department themselves, they stimulate the use of the mails by other customers.

The publishing industry is not asking for special privileges. It merely asks to be relieved of special war charges as has been done in every other industry. It asks this that it may still better serve its millions of readers throughout the country.

The proposed bill still leaves the rates 175 per cent above the pre-war figure. We are sure you agree that this is sufficient to cover increased cost of handling the mail. A request to your Representative to consider House Bill No. 11,965 favorably will help to secure the desired change and be mutually beneficial.

Shop Equipment News

P. & H. No. 3-T Horizontal Boring, Drilling and Milling Machine

The Pawling & Harnischfeger Co., Milwaukee, Wis., has recently developed the No. 3-T horizontal boring, drilling and milling machine shown in Fig. 1. The machine is built for tool work especially. The square lock, narrow guides with taper gibs and heavy construction of the spindle, saddle and column are intended to give the accuracy necessary for such work.

All operating levers and handwheels are within easy reach of the operator and conveniently arranged, as can be seen in Fig. 2. The starting, stopping, reversing and changing of feeds or speeds, by either hand or power, are controlled by the operator without moving from his position. It is impossible to have two conflicting speeds or feeds in action at the same time.

The column is of box section and is tongued and grooved to the bed. The spindle-carrying saddle is of box section. All drive gearing and shaft bearings are phosphor-bronze bushed, and the main spindle sleeve bushing is phosphor bronze scraped to a slight taper for taking up wear. The saddle is guided on the column by a narrow guide at the front, nearest the cutting pressure. Two steel taper gibs are provided to allow adjustment for wear. The saddle can be raised or lowered on the column by either hand, power feed, or quick traverse. It is counterbalanced.

The spindle is forged from high-carbon hammered alloy steel. Power is applied at the front end, and the feed mechanism, consisting of a rack and pinion, is located at the rear end. This construction provides the spindle with large bearings at both front and rear. The feed change mechanism consists of spur gears and positive clutches, actuated through a frictional worm wheel.

The spindle can be driven through either a small plate with a wide-face, coarse-pitch gear, or a larger faceplate with an internal gear and tapped holes for the attachment of milling cutters and milling heads. The spindle driving sleeve has adjustable bronze taper shoes to take up wear due to the sliding of the spindle in the sleeve.

The bed is a one-piece box-section casting, and contains chutes for the quick removal of cuttings. It contains the feed, feed distributing and the rapid traverse mechanisms. The table carrying the platen is a box casting, and has a narrow guide and taper gibs for taking up wear.

The driving pulley is 14 in. in diameter, carries a 3-in. belt, and runs at 350 r.p.m. Sixteen spindle speeds are provided, ranging from 14.5 to 225 r.p.m. with the small faceplate, and from 8.7 to 136 r.p.m. with the large faceplate. Power is transmitted by belt direct from the line shaft to a pulley on the machine itself. Provision is made for attaching a motor at the rear of the machine. For motor drive, a 5-hp. constant-speed motor is recommended, with a speed of 1,200 to 1,400 r.p.m.

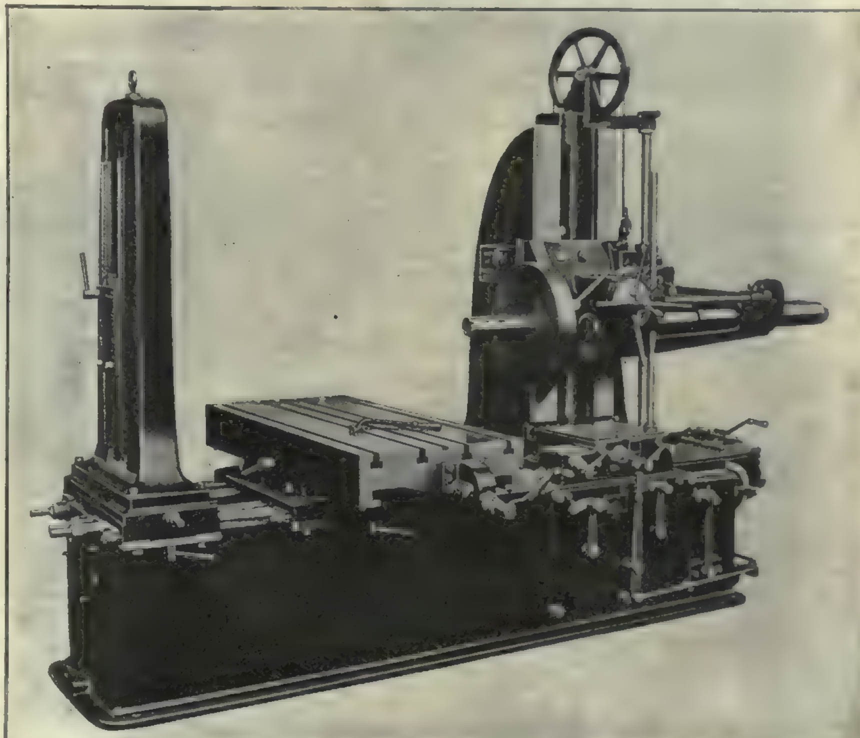


FIG. 1—P. & H. NO. 3-T HORIZONTAL BORING, DRILLING AND MILLING MACHINE

Specifications: Diameter of spindle, 3 in. Taper hole in spindle, No. 5 Morse. Travel of spindle, 23½ in. Greatest distance between faceplate and outer support for boring bar, 5 ft. Greatest distance froom top of platen to center of spindle, 28 in. Size of platen, 24 x 54 in. Crossfeed of platen, 36 in. with automatic trip. Weight, approximately 11,300 pounds.

Eight geared feeds are obtainable, ranging from 0.005 to 0.288 in. per revolution of the spindle for boring, and from 0.0084 to 0.44 in. per revolution of the spindle for milling when using the small faceplate. When using the large faceplate, the feeds range from 0.008 to 0.48 in. per revolution of the spindle for boring, and 0.013 in. to 0.73 in. per revolution of the spindle for milling.

The boring bar support can be removed from its base without disturbing any of its mechanism. Helical gearing is used between the support screw and the saddle screw. A thread-chasing attachment that will cut threads varying from two to sixteen per inch and to any length within the capacity of the machine can be furnished. The following attachments can also be supplied: Circular swiveling table, 24 in. in diameter, 6 in.

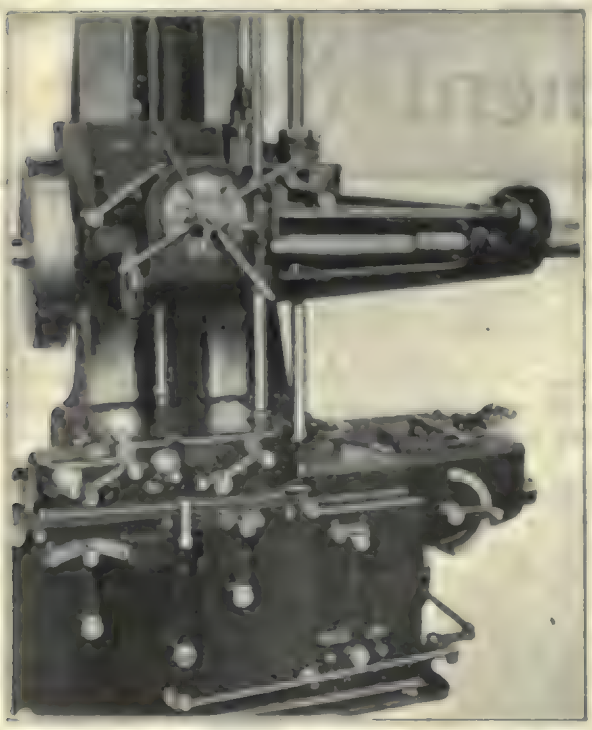


FIG. 2—CLOSE-UP VIEW OF OPERATING LEVERS

thick, graduated to minutes, with hand or power feed; auxiliary table, 5 ft. long, 5 in. wide, to support long work; boring bars, any diameter up to 3 in.; star-feed facing head to bolt to the faceplate or clamp to the spindle, for facing up to 16 in. in diameter.

Norton 10 x 18-In. Plain Cylindrical Grinding Machine

The machine shown in the accompanying illustration has recently been added to the line of plain cylindrical grinding machines made by the Norton Co. of Worcester, Mass. This machine is very similar in general characteristics to the other 10-in. Norton grinding machines, and is adapted to handling short work of the type ordinarily performed on such machines.

NORTON 10 x 18-IN. GRINDING MACHINE

The length of work that can be accommodated is 18 in., which gives suitable capacity for handling a large number of parts used in automobiles and accessories. The specifications of the headstock, footstock, wheel-slide, table-speed frame and wheel-feed mechanism are the same as in the former models of the 10-in. machine. The floor space, however, is considerably reduced because of the shortened distance between centers.

The wheel spindle is 28¾ in. in length and can carry a standard grinding wheel up to 18 in. in diameter. Four speeds are provided for the table. Each tooth on the index wheel represents a feed of the wheel of 0.00025 inch.

Steptoe "Standard" Engine Lathes

The John Steptoe Co., Cincinnati, Ohio, has recently brought out a series of engine lathes in both plain and quick-change types and known as the "Standard." The sizes made are 14-, 16-, 18- and 20-in. swing. One size of the quick-change type is illustrated herewith.

The beds are of the box-section type and are recessed to allow the tailstocks to overhang at the extreme ends. The lathes are equipped with feed rods in addition to lead screws, so that the lead screws are used only when cutting threads. The surfaces of the beds to which the

STEPTOE "STANDARD" QUICK-CHANGE ENGINE LATHE

quick-change gear boxes and lead screw hangers are attached are slotted to receive tongues in the boxes and hangers, insuring proper alignment. The racks are in one piece.

The aprons are of the box type, allowing the use of double supports for the gears and shafts.

All gears in the aprons, as well as the change gears, are made of steel cut from the solid bar.

In the quick-change lathe the entire range of threads and feeds is provided for by the operation of but two handles.

The 18-in. lathes are furnished with cabinet legs under the headstock, and the 20-in. lathes with cabinet legs at both ends. Lengths of beds for the 14- and 16-in. lathes are 6, 8 and 10 ft.; for the 18- and 20-in. lathes, 6, 8, 10, 12, 14 and 16 feet.

The regular equipment of each lathe includes two faceplates, steadyrest, follow rest, graduated compound rest, gear guards, and countershaft with two friction-clutch pulleys.

Taper attachments, thread indicators, draw-in attachments, and motor drives can be furnished as extras.

Pratt Grinding Gage

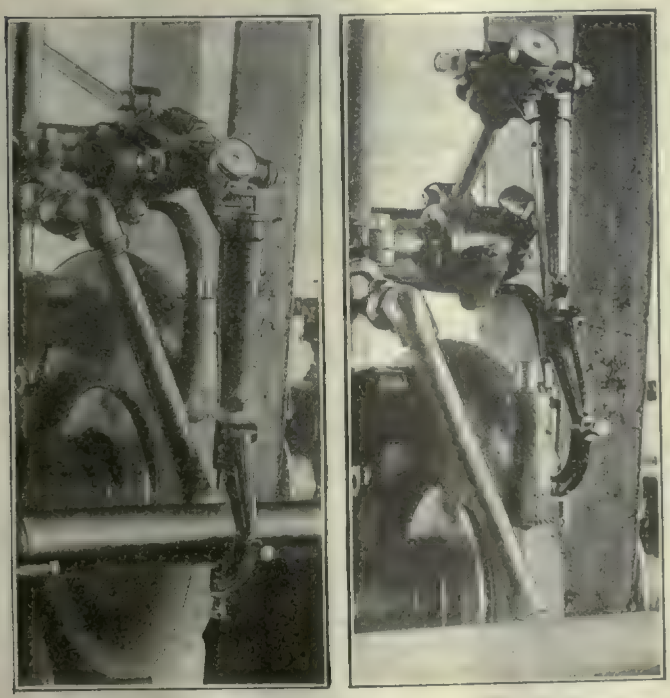
A gage for determining the size of work being ground, without stopping it to use snap gages or micrometers, has recently been placed on the market by Fred J. Pratt, 627 Wayne St., Detroit, Mich. The gage consists of a cast-iron body in which a plunger and spring are housed. On the top of the body an indicator is mounted, and heads to fit the work can be interchanged at the bottom. Each head has a range of 1⅛ in., and sizes up to 5 in. can be supplied from stock.

The gage is shown in the operating position at the left of the accompanying illustration. There are three diamond contact points, two of which are mounted in the ends of adjustable screws and the other in the end of the spring-actuated plunger. The screws are interchangeable in the heads. The diamonds have a conical form and do not mark the work. A very light spring pressure is all that is needed to keep the diamond points in contact with the surface being ground.

It is stated that tolerances of 0.0001 in. can be maintained by the use of the device. The indicator, which is set at an angle of 30 deg. at the top of the column, is plainly visible to the operator, so that he can watch the progress of the grinding as the work is reduced.

The gage is hung between cone-pointed screws in a fork which is adjustable to any position, and which is made so that the gage can be raised and lowered. At the right of the illustration the gage is shown in the raised position and out of the way, so that the work can be removed. The bracket provided is bolted to the grinding machine and supports the hanger mechanism. The gage itself can be changed from one machine to another by inserting it in the different hangers. Although the gage is usually hung in front of the grinding wheel, it can be mounted at the side or on the table.

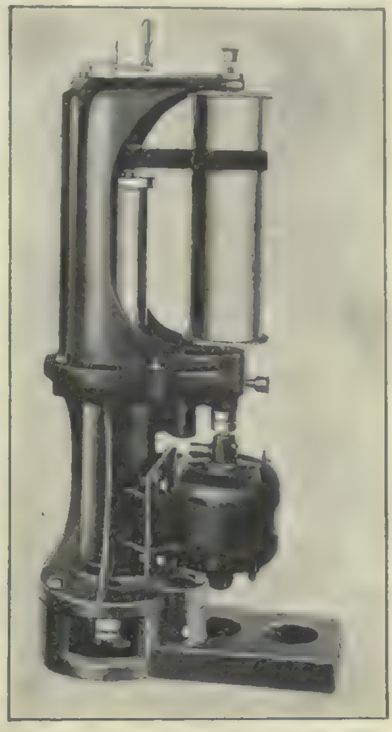
The gage is suitable for determining the size of all cylindrical ground work, as well as of taper work. Work with splines or holes can be calipered in the same manner as done with a snap gage. The operation is more quickly performed, because the gage is always held in position for the measurement.



PRATT GRINDING GAGE

"Simplicity" Cylinder Reboring and Grinding Machine

A portable machine for both reboring and grinding automotive cylinders has recently been brought out by the Simplicity Engine and Manufacturing Co., Fort Washington, Wis. The machine can be used on either open or closed cylinders up to 11½ in. in depth. Many types of cylinder blocks can be ground in the chassis without the necessity of removing them.



"SIMPLICITY" REBORING AND GRINDING MACHINE

The accompanying illustration shows the arrangement of the parts. The machine is driven by a 1¼-hp. motor and is ordinarily supplied for either 110- or 220-volt alternating or direct current. The boring bar is driven by means of gears at a normal speed of 40 r.p.m. It is 2¾ in. in diameter and has a bearing surface in the housing 10½ in. long. The grinding spindle is mounted inside the boring bar and runs on ball bearings at a speed of 5,000 r.p.m. It is driven by means of a belt from the long vertical pulley at the top of the machine.

The downward feed is automatic, and the boring bar can be elevated by means of the crank at the top of the frame. An adjustable automatic stop prevents the bar from going too low in the cylinder.

The base block is provided with holes so that it can be clamped to the cylinder block to be bored. The machine itself is pivoted on this base, so that it can be merely swung to the side when it is desired to center the cylinder bore or to change heads. Before clamping, the device is centered over the cylinder by dropping a conical plug into the top of the bore.

A boring head having three cutters adjustable simultaneously by means of a central tapered plug, is furnished. It can be easily secured to or removed from the end of the boring bar. The head has a range from 2⅝ to 3⅞ in. Larger heads can be furnished for bores up to 5$\frac{3}{16}$ in. Rings for use in setting the cutter head to size are furnished. Rings in oversizes of 0.010 and 0.020 in. for seven sizes of cylinders are supplied.

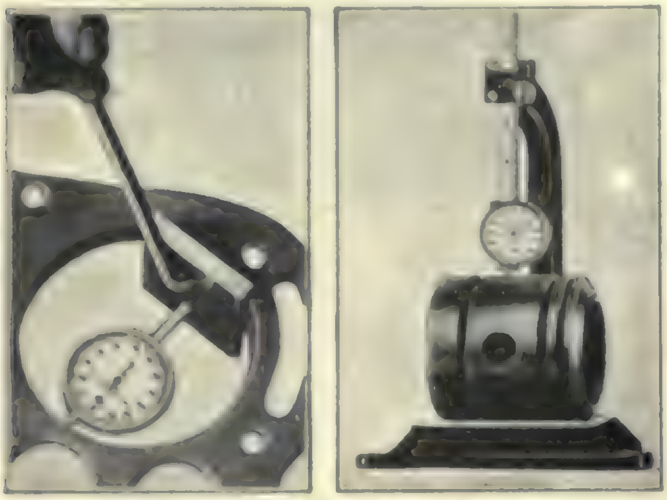
After the boring head has been passed through the cylinder, the device is merely swung on its base, so that the grinding head can be put in position. The shaft of this head is mounted on phosphor-bronze bearings. The head itself has an eccentric mechanism that can be adjusted up to ½-in. throw by means of a screw. The head is self-contained and is dust and dirt proof.

The device has a length of 17 in., a width of 8 in. and a height of 35 in. Since it weighs only 140 lb., it is easily portable and can be handled by one man.

Atlas "Mikro-Indicator" Cylinder and Piston Gages

The gages illustrated herewith have recently been placed on the market by the George H. Wilkins Co., 180 N. Market St., Chicago, Ill.

The cylinder gage, shown at the left, consists of a dial gage with two contact points and a saddle with a supporting stud on which the indicator is mounted and



ATLAS CYLINDER AND PISTON GAGES

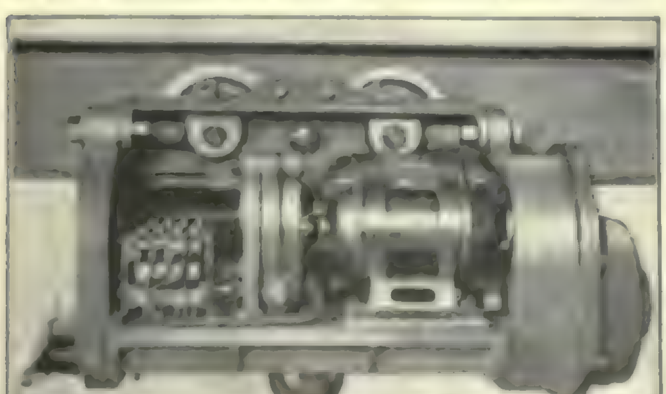
which holds the contact points at a right-angle to the axis of the cylinder. The gage can be used in cylinders of from 2¾ to 5 in. in diameter and indicates in thousandths of inches. In addition to testing cylinder bores, the indicator can be used for any purpose for which a dial gage can be used by dismounting it from the saddle. The dial can be set by revolving the bezel.

The piston gage, shown at the left, is a bench gage with a range of from 0 to 6 in. The dial indicator is mounted on a sliding scale graduated in inches and sixteenths. By use of this gage pistons and piston pins can be checked for diameter, roundness, and uniformity. Flat pieces can also be checked for thickness. The dial indicates by thousandths of an inch and can be set in the same manner as the dial on the cylinder gage.

"Standard" Electric Hoist

The electric hoist illustrated herewith has recently been brought out by the Standard Electric Crane and Hoist Co., 1420 Chestnut St., Philadelphia, Pa.

The hoist is rugged in design and the working parts are fully inclosed in a dust- and weather-proof case.



STANDARD ELECTRIC HOIST (COVER REMOVED)

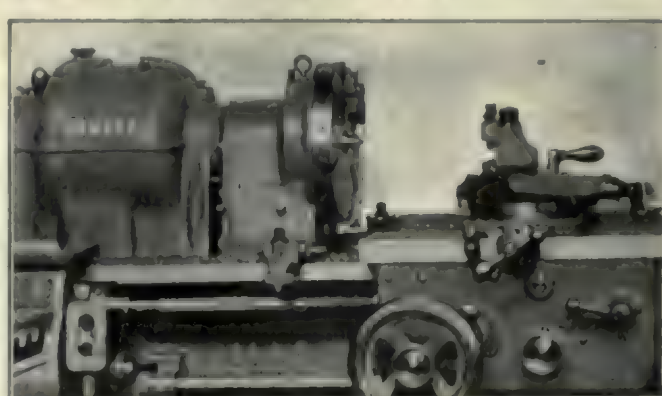
The drive is through spur gears which are cut from forged steel blanks and then heat-treated. All gears operate in an oil bath and automatically splash lubricate the main bearings. All bearings except the main are lubricated by the Alemite high pressure system. The hoist is equipped throughout with Hyatt high-duty bearings. The pins for the track wheels are made of manganese axle steel.

The hoisting motor is specially built for service and is guaranteed against overheating for a half hour's continuous run. The lowering brake is of the screw and disk type and runs in an oil bath. The holding brake is lined with asbestos brake-band lining. It is cam operated and will hold the load at any point. When the load block reaches its upper limit of travel an automatic device breaks the electric circuit and applies the holding brake. Either a two- or four-part rope block is supplied with each hoist. One of the main features of the hoist is the low headroom required. The hoist is made in two types, one type being moved along the rail by hand and the other type by motor. In both cases control is from the floor.

Each type is made in five sizes ranging from 2,000 to 10,000 lb. hoisting capacity. Heights of lift are from 15 to 50 ft. and hoisting speeds are from 10 to 70 ft. per minute. Weights are from 1,300 to 2,050 lb. Motors for either alternating or direct current can be furnished. The hoists are designed to travel on an I-beam of 10 in. minimum size and to go around a curve having a minimum radius of 8 feet.

Sub-Head for Hendey Lathes

The Hendey Machine Co., Torrington, Conn., has brought out an attachment for its standard lathes and which is known as a "sub-head" and is for the purpose of assisting in the cutting of worms, threads, hobs, etc.,



SUB-HEAD FOR HENDEY LATHES

of unusually rapid lead, and also in connection with the backing-off or relieving of cutters having a large number of teeth. The attachment is fitted to the inner Vs of the lathe and is set in place and clamped by means of a clamping bolt as easily as is the tailstock, no other bolts or screws being needed.

A small ring gear screws upon the spindle nose of the lathe so that when the attachment is moved into place against the headstock, it meshes with the first member of a quill gear the second member of which meshes with an annular gear upon the back of the faceplate, giving a six to one reduction in speed relative to the lathe spindle. The faceplate turns upon a hollow hub and therefore provides for the use of a dead center

at this end of the lathe, which center is in alignment with the regular tail center.

By the use of this attachment a helix having a lead of one turn in 6 in. may be cut with the same screw gears that would be used to produce a one to one lead, thereby relieving the gear train and leadscrew of much of the strain that would be imposed in the cutting of rapid leads. In relieving hobs or cutters having a large number of teeth the same advantage is gained. To relieve a 36-tooth cutter the relieving attachment would be geared the same as it would be for a 6-tooth cutter if the operation was to be performed without the sub-head.

The attachment is made for all Hendey lathes from 12 to 24 in., inclusive.

"Simplex" Ring Gage for Setting Reamers

The Ampco Twist Drill and Tool Co., 18th and Howard Sts., Detroit, Mich., has recently brought out a line of ring gages for use in setting expansion reamers of the Critchley type. These gages, designated as the "Simplex" gages, enable accurate setting of the size of a reamer without the use of a micrometer. A saving in time is thus possible. The desired size of gage is merely slipped over the reamer and the blades expanded, so that they fit the gage closely. The size is thus obtained without need of any other direct measurement. The shank of the reamer is held in a vise while the adjustment is being made. The gages are made of tool steel, tempered and then ground to size. They can be furnished in all standard sizes, and in the over- or under-sizes required.

"SIMPLEX" RING GAGE FOR SETTING REAMERS

The gages can be supplied singly or in sets, packed in wooden boxes. Sets consisting of Ampco adjustable Critchley reamers and Simplex gages can be supplied, for automotive purposes, especially. Thus, all of the reamers and bushings necessary for work on engine or transmission bearings are packed in one box, so that all parts are conveniently available.

Elwell-Parker Electric Industrial Crane Truck

The crane truck shown in the accompanying illustration is the product of the Elwell-Parker Electric Co., Cleveland, Ohio, and has just been placed on the market.

The crane is mounted on an industrial load-carrying truck and is adapted for use inside of buildings as well as out of doors.

The lifting capacity is 3,000 lb. at 6-ft. radius and 1,000 lb. at 12-ft. radius without outriggers. The stacking capacity is 12 ft. high with boom set to lift 3,000 lb. at 6-ft. radius.

The single motor, double-drum hoist handles separate lines to the boom and hook. The motor hoist-unit and battery in their compartment, form a counterbalance for the maximum load with the boom at 12-ft. radius.

The crane column is supported on a heavy, broad pillar and revolves on large ball and roller bearings. A geared slewing device swings the crane through 180 deg. The boom can be raised or lowered or swung to right or left and locked in any desired position. With the boom lowered, the crane will pass through an opening 6 ft. in height.

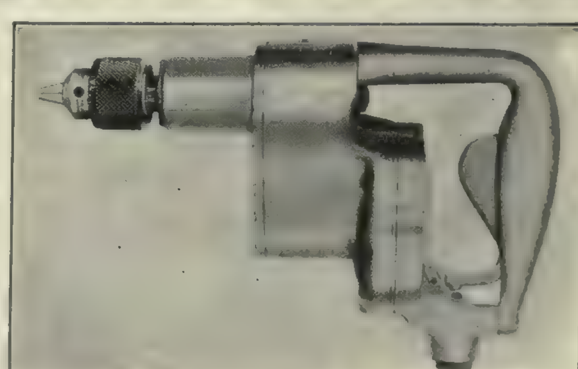
ELWELL-PARKER INDUSTRIAL CRANE TRUCK

Current for all motions is furnished from a single battery and to avoid swinging or twisting the cables they are brought up through the crane column. Only two motors are used and both controllers are in front of the operator.

The safety features incorporated in the outfit include: Crane trip-switch, truck automatic-control, worm drive, four wheel steer, and pressure lubrication.

Turbine Air Tool Co. "Tiny" Portable Drill

An air-driven portable drill, designated as the "Tiny" drill because of its small size, has recently been developed by the Turbine Air Tool Co., 710 Huron Road,



TURBINE NO. 2-A "TINY" PORTABLE DRILL

Cleveland, Ohio. The drill, the No. 2-A model of which is shown in the accompanying illustration, is driven by a small turbine. The rotor of the turbine is a solid piece of an aluminum manganese alloy and weighs less than $\frac{1}{2}$ lb. The rotor is mounted on ball bearings, but does not touch any other part of the mechanism. Thus there is no wear on the rotor, so that the air consumption does not increase with the age of the drill.

The reduction in speed is obtained by means of gears, both the gears and the shaft being made of high-carbon chrome-nickel steel. Ball bearings are used throughout the entire mechanism. Since all bearings and gears are contained in one housing, a semi-liquid lubricant that need be renewed only every three to six months is employed. The tool has a wide and easily controlled range of speed. The valve is operated by the trigger in the handle. The absence of vibration and the smoothness of operation are stressed by the maker.

The drill has a capacity for holes up to $\frac{3}{8}$ in. in metal and $\frac{1}{2}$ in. in wood. Its maximum speed is 2,000 r.p.m. Due largely to the fact that the housing is made of an aluminum alloy, the complete tool weighs only 5 lb. The part containing the nozzles is easily accessible, so that dirt or foreign matter may be easily removed.

Manufacturers' Consulting Engineers Nut Castellating and Hexing Machine

The castellating and hexing machine shown in the accompanying illustration has lately been placed on the market by the Manufacturers' Consulting Engineers, McCarthy Building, Syracuse, N. Y. The machine, as its name implies, is intended for the castellation of nuts and for milling the hex on spark plugs or for similar operations on other articles.

The work is contained in six collets carried by a revolving turret, the work in every alternate collet being operated on simultaneously. The turret is automatically oscillated to and from the cutters and is indexed 90 deg. on the back stroke.

NUT CASTELLATING AND HEXING MACHINE

After the turret has completed the first revolution and reached the position farthest away from the cutters, one piece of work has been completed and is ejected from its collet. Another piece can now be placed in the empty collet and thereafter a completed piece is ejected when the turret reaches each station, or six pieces at each complete revolution. As each piece is ejected another one is loaded, making the operation practically continuous.

Three cutters are spaced 120 deg. apart and take their cuts simultaneously.

Cutting compound is pumped through the turret spindle and distributed to the work through the collets in such a manner that only the collet in cutting position is receiving the compound. This method of distributing the compound keeps the collets clean as it forces out all chips and dirt. The machine is belt driven and is equipped with a clutch for stopping and starting.

The capacity of the machine is stated to be 1,000 nuts or 500 to 600 spark plugs per hour.

Ransom & Randolph Gasoline Blowpipe Outfit

The gasoline blowpipe outfit illustrated herewith has lately been brought out by Ransom & Randolph, Toledo, Ohio, and is intended for use in soldering by jewelers, electricians, battery-men and automotive mechanics.

The blowpipe is designed to use as fuel, the present-day gasoline by preheating the air. The operator is

GASOLINE BLOWPIPE OUTFIT

given a choice of gas-air ratio to suit either the required flame or the quality of fuel used, by simply directing the air through different ports by the control lever. The control lever is movable through an arc of 90 deg. and at one extreme the gas delivered is rich in fuel value, while at the other extreme it is very lean. All positions of the lever between the extremes result in gradual changes.

At the rich extreme, all the warmed air used is directed below the gasoline level and in passing attracts the very light hydrocarbons and also warms the heavier ones, lowering their specific gravity to a point where they can be carried away by the air when the light hydrocarbons are exhausted. At the lean extreme, all air is directed to the blowpipe and takes up fuel by evaporation from the exposed surface of the gasoline. At this extreme some cold air is passed into the blowpipe tube over the port leading to the fuel chamber and tends to chill and drop the excess of light fuel.

The flame at the blowpipe tip covers a wide variation from a jet of about $\frac{1}{4}$ in. in diameter and 1 in. long to an enveloping flame of 1 in. in diameter and 6 in. long.

It is claimed that this blowpipe will burn from 70 to 82 per cent of the volume of fuel.

Norton Model 81-B Crankpin Grinding Machine

The Norton Co., Worcester, Mass., has just placed on the market the Model 81, Type B crankpin grinding machine shown in Fig. 1. The machine is intended for working at high speed with great accuracy on the pins of crankshafts. The wheel spindle has flood lubrication and adjustment by means of thumbscrews. The end thrust bearings are also provided with automatic oiling facilities and adjustment by means of thumbscrews.

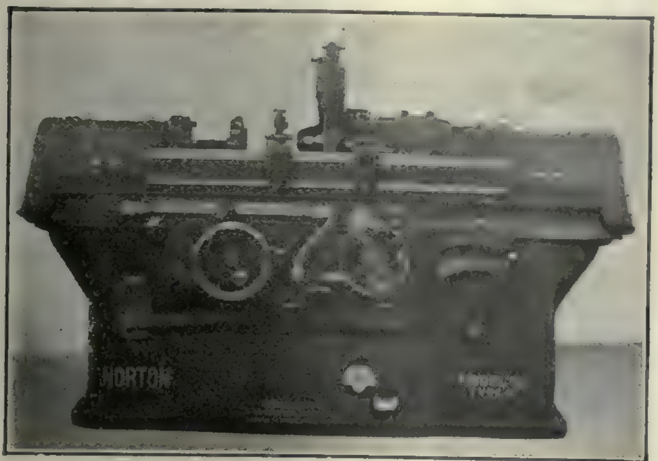


FIG. 1—NORTON MODEL 81-B CRANKPIN GRINDING MACHINE

The machine has a two-speed hand-operated table traverse, the slow speed being used for truing and the fast speed for moving the table from one pin to another. Six speeds of the work table are provided, the changes being made by heat-treated sliding gears running in an oil bath.

The machine is equipped with automatic power infeed for the wheel, which feed is independent of the work speed. The rate of the infeed is arranged to suit the work for which the machine is intended. A safety device is provided in the wheel-feed mechanism to prevent injury to the wheel or crank by bringing the wheel into contact with the work too suddenly when starting to grind the pin.

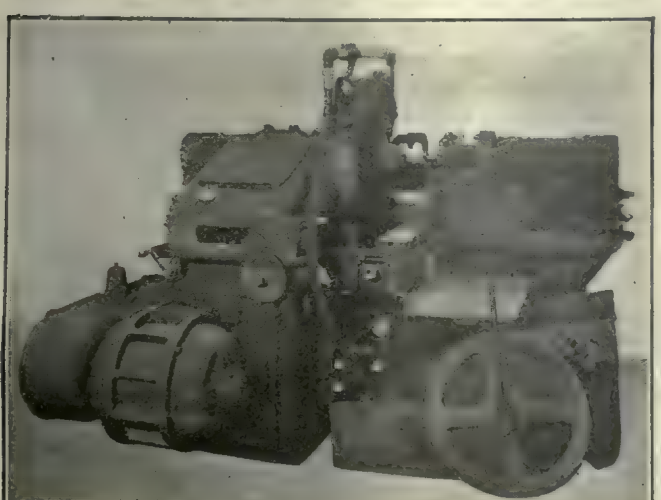


FIG. 2—REAR VIEW OF MODEL 81-B MACHINE

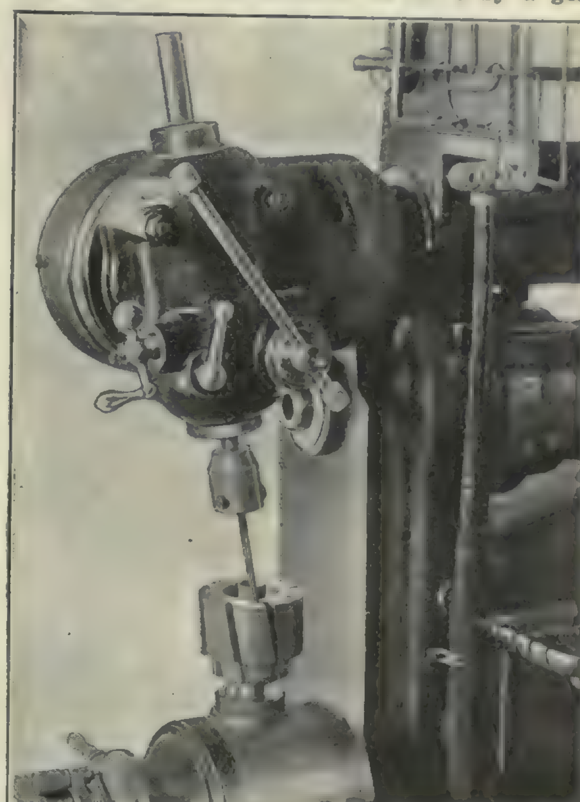
The rear base unit, which can be seen in Fig. 2, is the same as that employed on the 10-in. Type B grinding machine described on page 604 f, Vol. 53, of *American Machinist*. The arrangement of the motor and of the movable water tank should be noted.

The machine is made in four sizes, the swing of each being 14 in., and the work length varying from 24 to 48 in. The weights of the machines vary from 11,375 to 11,600 lb. with the motor. The floor space occupied by the largest size machine is 7 ft. 3 in x 10 feet.

Rockford Universal Milling and Drilling Attachment

The Rockford Milling Machine Co., Rockford, Ill., has lately brought out, for use on milling machines of its make, the universal milling and drilling attachment shown in the accompanying illustration.

The attachment is mounted on the face of the column above the spindle and receives its drive by a geared connection from the back end of the spindle through a driving sleeve substituted for the overarm. From the driving sleeve, motion is delivered to the attachment through bevel gears. The method of locating and driving the attachment does not interfere with the free use of the main spindle.



ROCKFORD UNIVERSAL MILLING AND DRILLING ATTACHMENT

The attachment has two graduated circular bases placed at right-angles to each other and both bases can be swiveled through 360 deg., hence there is no conceivable angle to which the spindle cannot be set.

The spindle of the attachment is mounted in a graduated quill and can be fed in or out either directly by rack and pinion or by driving the pinion by worm gearing, giving the choice of two feeds, one of which is 48 times faster than the other.

Sixteen spindle speeds are obtainable, ranging from 21 to 414 r.p.m. The hole in the spindle is No. 9 B. & S. taper.

Precision "Universal Model" Counter with Measuring Attachment

A counter which can be used on practically any machine where record of the number of moves made by any part of the machine, or of the number of pieces or loads which pass a given point is desired, has been placed on the market by the Precision Machine Co., 415 Chestnut St., Milwaukee, Wis.

The counter, which is shown in Fig. 1 attached to a punch press, can be used either as a revolution or

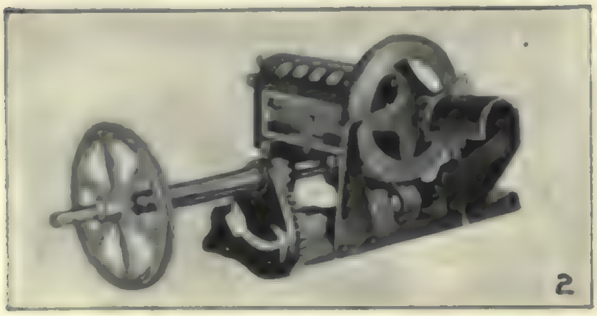


FIG 1—PRECISION COUNTER ON PUNCH PRESS
FIG. 2—COUNTER WITH ATTACHMENT FOR RECORDING LENGTH

stroke counter. By means of the attachment shown in Fig. 2, it can be used to record the number of feet of thread, twine, or wire that is being wound on a spool. The thread passes around the aluminum wheel, which acts as a pulley to operate the spur gears, which in turn drive the worm and worm wheel. The brass plate attached to the side of the worm wheel is graduated in feet, so that one complete revolution of the wheel records the passing of 100 ft. of material. The counter thus records hundreds of feet only.

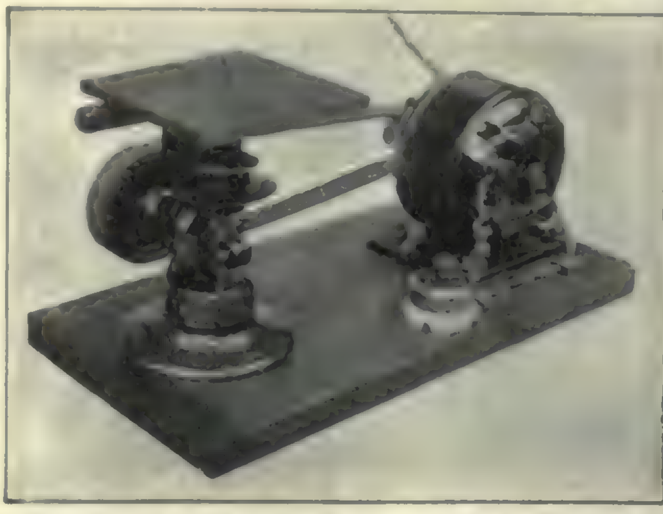
The counter is suitable for use on stamping machines, printing presses and conveyors, where its principal function is as a revolution or stroke indicator. As it has an unlimited amount of over-stroke, no particular care is necessary in setting the connection rod. All wheels are locked when not counting, so that they can operate only when the machine is operated.

No lead gear, lock washers, ratchets nor springs are used. All gears are made of steel and the important parts are hardened. A transparent, fireproof material is used to cover the numbers. The counter can be furnished with electrical contacts, if desired, which make it possible to locate it any desired distance from the machines, the operations of which it is desired to count.

"Hartford" Motor-Driven Bench Filing Machine

The Hartford bench filing machine made by the Robinson Tool Works, Waterbury, Conn., and illustrated herewith, has had some improvements added to it.

The top plate or table now has a double swing so that



IMPROVED "HARTFORD" BENCH FILING MACHINE

it can be tilted to angles up to 10 deg. in any direction. An improved dust guard has also been added.

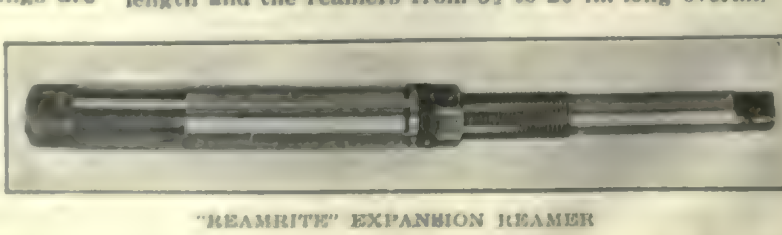
"Reamrite" Piston-Type Expansion Reamer

The Cronin-Waddell Co., 104 Portland St., Boston, Mass., has placed on the market an expansion reamer, shown in the accompanying illustration, that is intended especially for reaming the pin holes in automotive pistons. Though constructed upon the principle usual in such tools, the slots in which the blades are set are milled slightly wider than necessary to accommodate the thickness of the blades, and the extra space is filled by a liner, or shim, placed back of each blade.

One of the advantages claimed for this construction is the ease with which the reamer may be reground in a shop having but limited facilities for grinding. With the shims placed ahead of their respective blades, the tool may be ground between centers in a lathe as an ordinary concentric piece of work. Eccentric relief is obtained by reversing the shims to former positions.

The "pilot blade" feature is maintained in regrinding by first grinding the tool with the shims ahead of the blades, leaving a suitable length at the pilot end untouched. Reversing the position of the shims, this pilot portion is then ground to the required size. This leaves the tool with a concentric pilot and cutting blades having an eccentric relief, without the necessity for a relieving or backing-off attachment.

The reamer is made in seventeen sizes, the range of the smallest being 11/16 to 13/16 in., and of the largest 3 3/16 to 3 1/2 in. The blades vary from 1 3/4 to 6 in. in length and the reamers from 5 1/2 to 20 in. long overall.



"REAMRITE" EXPANSION REAMER

News Section

Research Council Plans Wide Activity

To arouse national interest in industrial research, Alfred D. Flinn, secretary of the Engineering Foundation and chairman of the division of ei neering of the National Research Council, is on a tour of several weeks to the Pacific coast.

Mr. Flinn goes as the emissary of organized research to enlist the aid of engineers of the far West in a nationwide plan of industrial research in which the Foundation, the Council, Government department and the industries will link their efforts. United action of this kind, according to leading engineers, is necessary if the United States is to retain its industrial supremacy and profit by the lessons of the war. Engineers pointed out that German efficiency both in war and peace was due largely to organized research.

A big research highway program and the movement to drive the shipworm from American ports, in which it has caused billions of damage, are among the projects to be explained by Mr. Flinn, whose itinerary, beginning at Salt Lake City June 26, will include Los Angeles, San Francisco, Sacramento, Riverside and Davis, Cal.; Portland, Ore.; Seattle and Bellingham, Wash.; Vancouver, B. C.; Prince Rupert, Jasper Park, Alta.; Winnipeg, Duluth, Minneapolis and Chicago.

Mr. Flinn, in addition to explaining the purposes of the Engineering Foundation and the National Research Council to the engineers of the West will deal with the place of the engineer in national and international affairs, more especially those questions now before Central Europe.

Marconi Awarded John Fritz Medal for Wireless Telegraphy

The John Fritz gold medal, one of the highest distinctions bestowed by the engineering profession in America and presented annually for signal achievement in applied science as a memorial to John Fritz, has been awarded for 1922 to Senator Guglielmo Marconi. The communication to Senator Marconi from Prof. Comfort A. Adams of Harvard, chairman and Charles F. Rand of New York, secretary of the John Fritz medal board says, "The medal is awarded to you for the invention of wireless telegraphy."

Formal presentation will be made to Senator Marconi in the Engineering Societies' Building in New York City, Thursday, July 6, at 8:30 p. m. The gathering will be largely in the nature of an international celebration, marking not only progress in scientific knowledge but the establishment of close relationship between the American and Italian engineering profession as well as other European countries.

With this issue we begin the publication of a new page in American Machinist. It will be our aim to present in tabloid form the various economic facts and statistics of value to men in the machinery manufacturing field. Four charts will be published each week, one showing general business conditions as indicated by an accepted economic barometer, such as revenue freight car loadings, one showing the trend of some element entering into the cost of building machinery, one showing the trend of a machinery market, and one showing the opinion of the investing public as indicated by stock quotation averages.

Short paragraphs on timely business subjects and tables of significant figures will fill up the balance of the space. As the first few pages are in the nature of an experiment it is sincerely hoped that readers of the paper will tell us where we are publishing useless material and what we are omitting that should be included.

A. L. DeLeeuw Joins Staff of "American Machinist"

The *American Machinist* takes pleasure in announcing that, beginning July 1, 1922, the services of A. L. DeLeeuw as consulting editor have been secured. Mr. DeLeeuw will devote half of his time to editorial work on the *American Machinist* and the remainder to his consulting practice.

Mr. DeLeeuw is well known to our readers through his articles on "Metal Cutting Tools" and "Methods of Machine Tool Design." His long experience as chief engineer of the Singer Manufacturing Co., the Cincinnati Milling Machine Co. and the Niles Tool Works, and as an independent consulting engineer will be turned to account in his editorial work.

Summer Industrial Course at Penn State

The seventh annual summer session in industrial organization and administration will be held at the Pennsylvania State College from August 28 to September 9 under the immediate direction of Professor Edward J. Kunze, assisted by Professors J. O. Keller and P. P. Henshall of the Department of Industrial Engineering.

The course is an intensive one, designed to meet the needs of manufacturers, superintendents, personnel directors, accountants, production managers and all others who pilot the affairs of industry.

Bulletins describing the course may be obtained by addressing Professor Edward J. Kunze, State College, Pa.

Machinery Exports Show Gain for May

Exports of metal working machinery for the month of May registered a slight increase as compared with the month of April. During May the total value of metal working machinery exported, amounted to $892,078 as compared with the April total of $786,951. Machine tools imported during the month were valued at $29,977 as compared with the total for May, 1921, of $7,711.

The detailed figures, taken from compilations just made by the Bureau of Foreign and Domestic Commerce are as follows:

EXPORTS METAL-WORKING MACHINERY

	April 1922	May 1922
Lathes	$45,608	$66,604
Boring and drilling machines	25,280	69,424
Planers, sharpers and slotters	25,685	17,590
Bending and power presses	644	15,806
Gear cutters	3,307	6,174
Milling machines	17,591	25,255
Sawing machines	1,329	2,930
Thread cutting and screw machines	15,229	17,668
Punching and shearing machines	8,700	12,610
Power hammers	5,723	13,188
Rolling machines	221	16,270
Wire-drawing machines	808	2,248
Polishing and burnishing machines	2,879	83
Sharpening and grinding machines	67,804	83,304
Chucks, centering, lathe, drill and other	10,105	26,028
Reamers, cutters, drills and other parts for machine tools	122,851	113,696
Pneumatic portable tools	17,919	18,930
Foundry and molding machinery	35,834	75,887
Other metal-working machinery and parts of	379,434	308,383
Total metal-working machinery	$786,951	$892,078
IMPORTS		
Machine tools	$7,711	$29,977

"Pittsburgh Plus" Case Before Federal Trade Body

Hearings before the federal trade commission in the "Pittsburgh Plus" case opened at Chattanooga last week before special examiner J. W. Bennett, and are expected to continue for three weeks during which time about thirty steel manufacturers and consumers of the southern territory will testify. Up to June 17, on which date an adjournment was taken, the commission had been in session in Chicago hearing the testimony of the western manufacturers for nearly three months.

The complainants in the Southern hearing are the Southern Association of Rolled Steel Consumers and the Birmingham Civic Association, while the United States Steel Corporation is the respondent. The Southern manufacturers are testifying that the basing of steel prices f.o.b. Pittsburgh is unfair and illegal when the steel is actually produced and shipped from Southern and Western points, and does not move from Pittsburgh. It is understood that witnesses at the Chattanooga hearing will include steel users from practically all of the larger industrial centers of the South.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

Looking back over the newspapers of this time a year ago we find that then as now the world had its troubles to contend with. The peace treaty with Germany had just been signed and was bitterly criticized. The tariff bill then in the House was vigorously assailed. Sir James Craig had refused to meet de Valera and peace in Ireland was despaired of. A railroad strike in this country threatened because the employees were unwilling to accept a 12 per cent reduction in wages ordered by the Labor Board.

There was an underproduction of coal and a winter famine was predicted. Unemployment was increasing. Middling cotton was quoted at 11¾ cents in New York and on June 20, 1921 the average price of 20 representative railroad stocks was lower than for 25 years.

But the railroad strike did not occur, the coal famine was averted, and the tariff bill has not yet been passed.

World Conditions Improving

There is now a scarcity of labor instead of unemployment. Cotton is quoted at 22 cents. Stocks are up from five to 100 points and the last six months have been reasonably prosperous throughout the country.

It is true that we are again threatened with a railroad strike and are in the midst of a coal strike. The Irish volcano is once more in a state of eruption and Mexican bandits are reported to have kidnapped some Americans. The financial condition of continental Europe is still troubled and the reparation question continues to be a bone of contention. But upon the whole the world is better off than it was a year ago and while something will always be out of gear reconstruction has progressed and is progressing.

An early settlement of the present coal strike has become probable because its menace is now generally appreciated, coal is arriving here from England and popular sympathy with the strikers has been destroyed by the brutal murders at Herrin, Ill.

Some of the irresponsible railway men may quit work but a general strike that will cripple the service is not likely. If it occurs it will be short lived and destroy the unions, for they are already in greater public disfavor than at any time previously in their history. In so far as these two major troubles are concerned the situation is more encouraging than it has been.

Most of the markets are in the summer doldrums. The only commodity that has moved much is rubber, which advanced nearly two cents a pound to 16¾ cents for the standard grade upon a reported agreement between the producers in the East Indies to restrict the output. Coming concurrently with an unprecedented demand for tires and automobile production in this country the effect upon the market has been marked and much higher prices are possible, for rubber has become one of the world's great staples.

Sugar is also firm, with every indication of a further advance for a small production in Java and Europe is inducing sharp competition for the Cuban supply. Wool, on the other hand, has been reactionary and one of the best informed men in the business writes me that he "thinks the top has been reached for the present as the proposed duty of 33 cents a pound on scoured wools will bring the cost of 'quarter bloods' up to 200 per cent above the foreign price and will inevitably reduce American Consumption." Cotton is somewhat lower on a reported improvement in the crop condition, which is to some extent offset by the widely proclaimed ravages of the boll weevil. It will be a weather market in cotton until the bales commence to move, for no one has any very definite conviction as to the size of the crop.

Silk is firm. So are lumber and building materials, including steel. Cattle are higher. The crude oil consumption for May was the largest on record. Copper is slowly moving upward. An active speculation and advancing prices for jute as a result of the short crop are reported from India. Wheat is about the only important staple that is not tending upward or well above the average of the last seven or eight years.

Trade reports are generally optimistic both as to the present and the future. The labor shortage is increasing. Speaking at Dayton, Ohio, last week R. H. Grant, of the Delco Lighting Co., prophesied that there will be a buyers panic this fall.

Money Market Easy

Railroad traffic continues remarkably good considering the coal strike. A shortage of cars in the autumn seems probable and the amount of building and new construction in progress all over the country is really amazing. All this is fundamentally due to the ease of money which promises to continue throughout the year unless a revival of speculation in stocks and commodities or a freight blockade or both absorb the loanable supply of bank credit.

The only change of importance shown by the weekly Federal Reserve statement is a reduction of 1.6 per cent in the reserve ratio, which now stands at 77.5. The slight reduction is due to increased rediscounting following the reduction in the rate. An abundance of bank credit is therefore indicated, but a great revival of speculation with a concurrent advance in prices would absorb the supply. The weekly bank statement should therefore be carefully watched. A sharp decline in the reserve ratio would be a danger signal.

The stock market, somewhat shocked by the sensational gyrations of Mexican Petroleum, has been quiet but conservative speculators are buying the railway stocks upon the expectation of better earnings and more consolidations. But in its application the principle of consolidation is not limited to railroads. Three banks in Los Angeles, having joint resources of over $200,000,000, have come together, the Consolidated Machine Tool Corporation, capitalized at $30,000,000, has been formed to acquire five machine tool companies in the East and Middle West, and the Simmons Hardware Co., of St. Louis, has acquired the Winchester Company.

Bonds have been quiet but with all the Liberty issues above par the investment demand has been sufficient to absorb all the first-class obligations offered. The $25,000,000 of 6½ per cent preferred stock offered by the New York Telephone Co. on the installment plan directly to its telephone subscribers was oversubscribed in a day.

Some indigestion is, however, reported among those who have partaken too freely of the second rate foreign bonds recently brought out. This is perhaps due to the assassination of Rathenau and the misgivings felt with regard to the future of the German Republic. The weakness in foreign exchange, especially francs and marks, may be ascribed to the same cause. On Thursday, when it was announced that the German Bank statement of June 23 showed that there were 156,553,669,000 paper marks in circulation the price fell to 26¾ cents per 100, the lowest figure thus far touched.

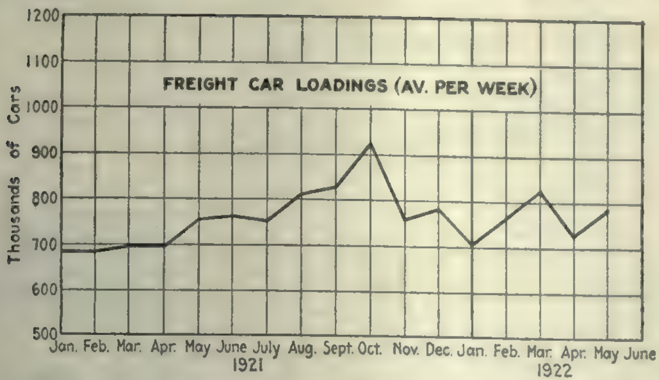
If the German Republic should fall the mark would in all probability be valueless, but those who hold that it is generally darkest before the dawn are disposed to believe that out of the very necessities of her own case France will consent to an abatement of her reparation demands that will make a German loan possible and so put continental Europe upon a more stable financial basis.

This cloud overseas is about the only shadowy spot on the horizon. If it disappears the outlook will indeed be bright.

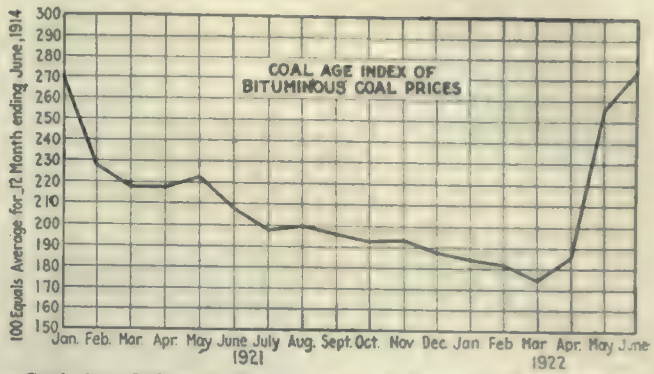
But if its brightness proves to be dazzling we may be wise to put on smoked glasses for vigilance in observation is more necessary when fair weather breeds over-confidence than when storms have made us careful.

British Aircraft Claims

The War Department plans to be represented, together with the Department of Justice, at meetings of the British commission in London, which will settle claims of Great Britain for use by the United States of British designs of aircraft engines and accessories during the World War.



Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the Ameican Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.

But for the immediate depressing effect of the coal strike and the threatened strike of railway workers, the general business situation would seem to hold promise for normally prosperous conditions during the second half of this year. The iron and steel industry is now operating at close to 75 per cent of normal capacity. In the textile industry there is shown an appreciable increase in the number of active spindles. Reports from many industries supplying material to the building and contracting trades indicate almost normal operation as compared with pre-war conditions. Unfortunately, the grain and cotton crop situation is not altogether clear at the moment, but hope is held out that during the next two months estimates will show conditions favorable, at least, to a normal yield.

Since the first of January, the total value of contracts awarded in the United States for the erection of water works, sewers, bridges, dredging, streets and roads, industrial works, buildings, Federal government work and miscellaneous construction, has reached the huge total of $779,766,747. The month of June alone shows contracts awarded and valued at $182,342,000. Contracts for the erection of industrial works of various kinds awarded during the month of June in the United States totalled $23,687,000, or an increase of approximately 57 per cent as compared with the month of May. The June figure brings the total value of contracts placed for the current year to July 1st up to $87,549,000.

Commercial failures in the United States for June show a continued decrease, according to Dun's Weekly Review. Reports show 364 failures as compared with 391 in the week previous and 303 in the corresponding week a year ago. Failures in which liabilities were $5,000 or more also show a decrease the percentage of the total being 55.5 as against 58.0 last year.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

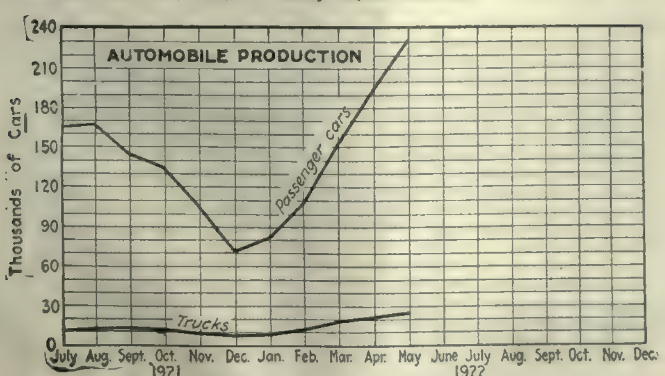
	Unit	June 1922	May 1922	June 1921
Soft steel bars	per lb	$0.025	$0.023	$0.031
Cold finished shafting	per lb	0.0325	0.032	0.045
Brass rods	per lb	0.155	0.15	0.166
Solder (½ and ½)	per lb	0.21	0.213	0.203
Cotton waste	per lb	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	4.00	4.06
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	....
Lard cutting oil	per gal	0.575	0.608	....
Machine oil	per gal	0.36	0.40	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in	off list	55% @60%	60%@ 60–10%	50%@ 60–10%

Labor rates reported from four cities show certain differences prevailing, but on the whole wages paid for skilled work indicate but slight decreases with imminent scarcity of efficient operatives. Tool makers in Philadelphia are being paid from 43 cents to 98 cents per hour depending upon the ability of the workman. In Detroit, the corresponding wage rate is from 75 to 80 cents while in and around New York City a rate of 85 cents prevails for high class men. Rates paid to bench hands vary from 37 to 65 cents in Philadelphia, 60 to 75 cents in New York City and 50 to 55 cents in Detroit. Lathe hands are being paid from 40 to 73½ cents in Philadelphia, 60 to 75 cents in New York City and from 70 to 75 cents in Detroit. Cleveland reports a rate of 78 cents for pattern makers.

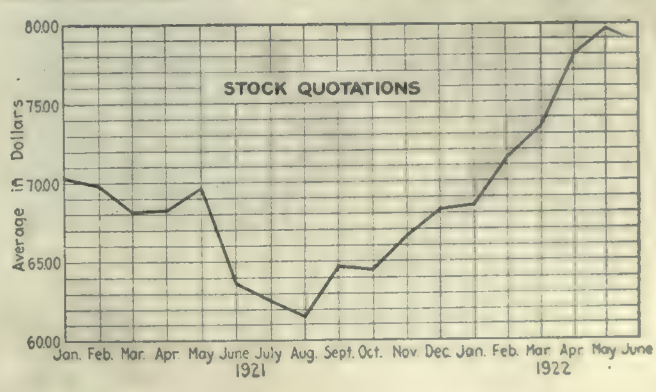
The situation abroad seems to be a little clearer than was the case a few months ago. Our foreign trade continues to improve and with an abandonment of political intrigue and squabble for a sane policy of reconstruction, there is every reason to expect substantial prosperity. For the past eight years the world's population has been but poorly fed, housed and clothed. On every hand and in all lands there is required goods of all classes and these wants cannot longer go unsatisfied.

The Foreign exchange situation improved during June. On June sixth sterling touched $4.515/8, this marking the highest point it has reached since July, 1919. The Scandanavian exchanges moved more or less sympathetically with sterling. In Argentina there has been some improvement during June, but in South America exchanges generally show there have been but moderate fluctuations. In continental Europe the financial situation is still in its greatly unsettled state and does not give any immediate indication of improvement.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Monthly average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.

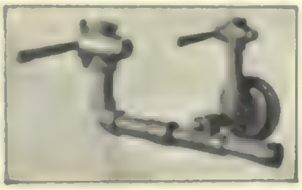


Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

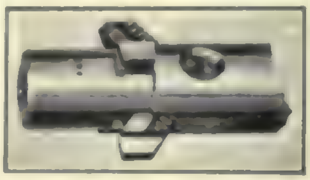
Inspirator, Air-Gas, Low-Pressure
[illegible] Combustion Co., Bronx, New York, N. Y.
"American Machinist," March 16, 1922

[illegible] device, a redesign of the [illegible] formerly used on the furnaces made by the company, is adaptable to any make of [illegible] gas furnace. The entire [illegible] is controlled by one valve. The gas [illegible] used when starting or stopping is either entirely closed or entirely open. A change of air supply [illegible] changes the amount of gas used. Gas and air are mixed only at the point of supply to the burners, being thoroughly mixed just before entering the furnace.



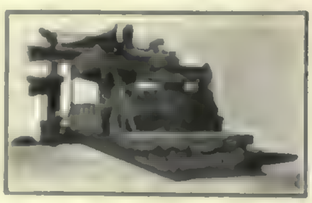
Boring Bar, Adjustable
[illegible] Manufacturing Co., Chicago, Ill.
"American Machinist," March 16, 1922

The bar is adaptable to rough-boring, finish-boring, and reaming. It can be furnished with [illegible] blade-type cutters and a grinding fixture. The cutters can be set out or withdrawn by turning the graduated screw. [illegible] straight or angle-type cutters may be used or a combination of both for boring different diameters, counter-boring or facing simultaneously. The cutters can be adjusted to cut on a common line. Combinations of cutters can be incorporated in the same bar.



Planer, 13 x 10 x 16-Ft.
[illegible] Machine Co., Rochester, N. Y.
"American Machinist," March 23, 1922

The machine is driven by a [illegible]-hp. reversing planer motor and has five toolheads, two on the crossrail, one [illegible] on each upright and one head on a separate column. The feed and power traverse of any head can be operated independently. The separate column carries a saddle equipped with vertical feed as well as power rapid traverse. The crossrail is raised or lowered by a [illegible]-hp. motor and has automatic tool lifters on the heads. The table is equipped with a device for automatically increasing or decreasing speed during the cutting stroke.



Molding Machine, Jolt, Direct-Draw, Roll-Over, Stationary
Osborn Manufacturing Co., Cleveland, Ohio
"American Machinist," March 23, 1922

The machine has the standard [illegible], an [illegible] operated [illegible], pattern-drawing [illegible] and runout car, and the necessary piping, valves and wiring. The drawing of the pattern is accomplished when the roll-over table and the pattern are in perfect balance. Two molds may be handled side by side. The stroke of the air-operated [illegible] may be adjusted from 1 to 2½ in. The entire operation is automatic, but the motion may be stopped at any position, and the speed may be regulated. The motor driving the [illegible] may be for either a.c. or d.c. and is equipped with an [illegible].

Pin Puller, Cotter
Tuban Manufacturing Co., Richmond Hill, N. Y.
"American Machinist," March 16, 1922

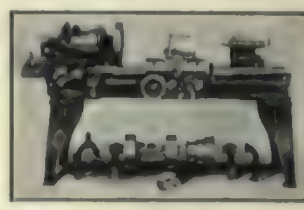
The tool is for pulling cotter pins and is made in two sizes for pulling pins up to ¼ in. and up to ½ in. in diameter, respectively. The lifting point of the device is hooked in the hole at the head of the pin, and the two handles of the puller squeezed together. Each tool is tested to withstand a pull on the point of 400 pounds. The motion of the movable or lifting point is about 1 in. The lifting point is hardened tool steel. The end of one handle is shaped to a screw-driver point.

Gage, Connecting-Rod, "Twistest"
J. S. Imlach, 324 Catherine St., Ottawa, Canada
"American Machinist," March 16, 1922

The device is used in aligning two bearings on the ends of rods, serves as a jig in scraping bearings, and is also used to test the alignment of the piston after assembling. It indicates at one setting the accuracy of alignment of the rod in both directions. The indicating part consisting of an arbor fixed in a four-armed casting, is attached to the wristpin end of the connecting rod. Capacity, rods from 6 to 12¾ in. long between centers. Interchangeable mandrels up to 2⅝ in. in diameter and indicating arbors up to 1½ in. in diameter can be furnished.

Lathes, Engine, Quick-Change
Carroll & Jamieson Machine Tool Co., Batavia, Ohio
"American Machinist," March 23, 1922

The lathe, supplied in 13, 14, or 16-in. size, is for toolroom and automotive service use. Single or double back gears can be supplied. Right or left-hand threads from 3 to 64 per in. can be cut, the feed being changed by a handle and knob on the front of the machine. The apron has a feed reversing lever and an interlocking device. On the semi-quick-change lathe, three feed changes are provided by shifting a lever. The carriage can be clamped to the bed when facing work. Swing: over bed, 13¼, 15¼ and 16¼ in.; over carriage, 8, 10⅝, and 11⅝ in., respectively. Weight, 1,300, 1,700 and 2,100 lb., respectively.



Grinder, Cutter, Crankpin Re-Turning Tool
Sawyer-Weber Tool Manufacturing Co., Los Angeles, Cal.
"American Machinist," March 23, 1922

The electric-driven cutter-grinding attachment enables rapid sharpening of the toolbit and can be easily applied without altering the re-turning tool. It is driven by a $\frac{1}{12}$-hp. motor running at 10,000 r.p.m. The cutter is passed in the groove of the guide blade, and micrometer adjustments are made by the handwheel and dial of the re-turning tool. The re-turning tool, when in operation, is fitted directly to one of the pins of the crank, and the tool handle rests on the lathe bed. The handwheel provides a feed for the tool, to adjust the size of the pin.

Clip, paste on 3 x 5-in. cards and file as desired

A Quarter Century for the A. S. T. M.

The twenty-fifth annual meeting of the American Society for Testing Materials was held at the Chalfonte-Haddan Hall, Atlantic City, N. J., June 26 to 30 in the Vernon room of the new building. The sessions, as usual, were full with papers and reports, and little time was lost in getting through the order of business. The first session was on Non-Ferrous Metals and Corrosion and included several reports such as that of Committee B-2 which presented new tentative specifications for brass pipe, copper tubing and condenser tubes and also for methods of chemical analysis of brass ingots and castings, and bronze bearing metals.

A paper on the remarkable casting qualities of some copper-silicon-aluminum alloys was presented by E. H. Dix, Jr., and A. J. Lyon. The corrosion problem received attention both in committee reports and at the hands of W. D. Bancroft, who believes that measurement of electromotive force is practically valueless in this connection and that the whole problem of retarded corrosion is essentially a question of film formation.

The second session was devoted to wrought, cast and malleable iron, beginning with a report of Committee A-2 recommending revision in existing tentative standards for wrought iron. The making of merchant bar iron by the Busheled scrap process was described in a paper by W. M. Myers. The "Nick-Bend" test for wrought iron was discussed by H. S. Rawdon and S. Epstein, who considered that the usual "nick and bend" clause in specifications is indefinite. Wm. R. Webster outlined a study of the physics of cast iron and suggested that the time has come to standardize existing practice as developed during the fifteen years operations under the society's specifications. Revised specifications for foundry pig iron and for chilled cast iron were suggested by Committee A-3 of which Richard Moldenke is chairman. This also included high test gray iron castings and semi-steel castings. The malleable castings committee, A-7, recommended a modification of the test specimen and an increase in the tensile requirements of the specifications.

The President's Address

The third session was opened with an address by C. D. Young, the retiring president, under the title of "A Quarter Century of Progress." In it he outlined the growth of the society and its work and spoke of the difficulties which lay in the path of the courageous group who formed it from among the American members of the ten existing International Association for Testing Materials. One of the main handicaps was the lack of appreciation of the benefits of standardization, of uniform methods of testing and a common nomenclature. A similar situation still confronts the advocates of standardization in other lines. Mr. Young touched with feeling on the necessity of an international association and urged that the American Society for Testing Materials strongly support any movement toward this end.

A session on steel included reports of Committees A-1 and A-4, the former presenting new specifications for carbon steel castings for railroads and the latter recommended practice for the heat treatment of such castings. The tensile properties of steel castings were treated of by Lawford H. Fry, having special regard for locomotive construction. A preliminary report on the Effect of Sulphur in Rivet Steel was made by G. K. Burgess while T. Spooner and I. Kinnard described laboratory tests on testing butt welded steel plates both electrically and magnetically.

Impact testing occupied the fifth session, being a sort of symposium in which H. L. Wittemore, D. J. McAdam, Jr., T. R. C. Wilson, Earl B. Smith, C. L. Warwick, T. D. Lynch, H. F. Moore, and F. C. Langenberg and N. Richardson participated. This was followed by a session on Fatigue of Metals, the first paper being by H. F. Moore, J. B. Kommers and T. M. Jasper. This paper was accompanied by an exhibit of tests which attracted much attention. The Measurement of the Shape of Brinell Ball Indentations was discussed by Fred E. Foss and R. C. Brumfield. The session included reports of Committees E-1 on Methods of Testing; C-5 on Fireproofing; D-15 on Thermometers and E-8 on Nomenclature. The remaining sessions dealt with such materials as coal, coke, road materials and others which have no direct bearing on machine work and are therefore omitted.

The new officers are: G. K. Burgess, president; W. H. Walker, vice-president, and the four new members of the executive committee are W. K. Hatt, J. R. Onderdonk, D. M. Buck and W. M. Corse.

Moffett Discusses Naval Aircraft Development

Admiral Moffett, Chief of the Bureau of Aeronautics of the Navy Department, appearing recently before the Senate committee on appropriations, discussed at length the great post-war work accomplished by the Navy in the development of naval aircraft and engines.

Speaking generally of aircraft development he said:

"The Navy has today a thoroughly developed and proved type of engine for every class of naval aircraft service, with complete detailed production plans and specifications for each type. The design of every type is an American development and is especially adapted to American quantity production and every type is in performance, weight, durability, dependability and general suitability at least equal to the best engine in the same class which has been developed in any other country in the world."

Automobile Exports Show Increase

Automobile exports for the month of May as compared with the corresponding month of 1921 indicate encouraging gains for this branch of American foreign trade. Figures just compiled by the Bureau of Foreign and Domestic Commerce are as follows:

EXPORTS OF AUTOMOBILES

	May, 1921		May, 1922	
	Number	Value	Number	Value
Automobiles, including chassis (Total)	2,941	$3,763,033	8,027	$5,763,539
Total motor trucks and busses, except electric	462	794,699	1,203	812,170
Total passenger cars, except electric	2,479	2,973,334	6,798	4,924,134
Station and warehouse motor trucks	11	9,386	42	29,970
Trailers	.....	....	34	6,149

Belgium To Hold Mechanical Exposition

According to W. H. Rastall, chief of the industrial machinery division of the Bureau of Foreign and Domestic Commerce, an international exposition of mechanical and electrical industries will be opened at Ghent, Belgium, on June 1, 1923, and will continue from June to October.

It is felt that this exposition should provide a splendid opportunity for American firms to exhibit machinery, equipment, etc., which they believe will be able to compete with the products of foreign manufacturers. The exposition will be held in the former buildings of the Ghent World's Exposition of 1913.

The various sections of the exposition and the classes of goods which will be exhibited, as announced by the Exposition Committee, are as follows: Metal working machinery of all classes, woodworking machinery, steam generators, boiler accessories, steam motors, mechanical devices of all kinds; telephone and telegraph equipment, electric lighting, chemical and metallurgical equipment and supplies of all classes.

Requests for information in regard to the exposition may be addressed to the "Comite de l'Exposition de 1923," Royal Casino, Parc, Ghent, Belgium.

Poland as a Machinery Market

That the iron and steel industry of Poland should develop considerably within the next few years is the opinion of H. B. Smith, acting commercial attaché, American legation, Warsaw. Present equipment is antiquated, and new equipment is needed to replace the machinery damaged or removed from the country during the war. While the industry is not as well organized or on as sound a basis as the textile industry, nevertheless there is an opportunity for the installation of American methods and machinery. This is particularly true if Polish ore deposits, upon which the Upper Silesian industry will soon have to depend for its ore supply, are to be opened up and developed.

Two obstacles stand in the way of American sales of finished goods and machinery in the Polish market: (1) The low value of the Polish mark makes it extremely difficult for Polish manufacturers and dealers to finance dollar purchases; (2) low production costs in Germany and proximity to the Polish market g[illegible] German manufacturers a distinct advantage. However, any reconstruction and development of the Polish iron and steel industry on a large scale will require credit accommodations Germany is unable to extend at this time, and if American manufacturers, after a thorough investigation of conditions in Poland, are satisfied with the security offered, there is no reason why they cannot obtain the business, notwithstanding the present condition of Polish currency and German competition.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Truck, Crane, Electric

Elwell-Parker Co., Cleveland, Ohio.

"American Machinist," March 23, 1922.

The crane truck is used for lifting and stacking material, and due to low [illegible] and long boom is applicable to many jobs. Out-riggers with jacks to adjust the height are furnished at each side. The 12-ft. boom may be raised and lowered from the driving position. The crane will pick up 1,000 lb. at an [illegible]-ft. radius and with the out-riggers in position, will lift 2,000 lb. at a [illegible]-ft. radius. The truck is equipped with a single storage battery for the motors operating the crane and propelling the truck.

Reamer, Adjustable, Helical, Inserted-Blade, "X-Cel, Shear-Cut"

Alvord Reamer and Tool Co., Millersburg, Pa.

"American Machinist," March 23, 1922.

The body of the reamer is made of alloy steel, and the shank is heat-treated. The blades are made of a special steel. Both ends of each set of blades are ground, so as to make all blades the same length, and to give proper contact with the nuts. The reamer is recommended for work on bearing metals, particularly bronze, and may be used for split bearings and holes provided with oil grooves or keyways. The tool is made in seventeen sizes for diameters from 15/32 to 4 1/16 in.

Holder, Tool and Tap, No. 90

Consolidated Tool Works, Inc., 296 Broadway, New York, N. Y.

"American Machinist," March 23, 1922.

The chuck has a maximum capacity for taps up to [illegible] in. in diameter and other tools in proportion. The jaws have V-grooves extending parallel to the axis of the holder, and they are serrated throughout the whole length to give a secure grip. They are adjusted by turning a knurled sleeve. Length of handle, 7½ in. Length of tool, 4 inches.

Drawing Table, Tubular-Frame

Hoffman Drawing Stand Co., 189 N. Water St., Rochester, N.

"American Machinist," March 23, 1922.

The board of the table can be tilted about a horizontal axis to almost a vertical position toward either the back or the front of the stand. Its height above the floor can be adjusted by turning the handwheel on the vertical screw in the center of the frame. The frame, although sturdy and rigid, is light in weight. A separate tray to carry the draftsman's instruments can be fastened to either side of the table and adjusted to a convenient height. Height, 44 inches.

Saw Bench, Tilting-Arbor, Type-J

Tannewitz Works, Grand Rapids, Mich.

"American Machinist," March 23, 1922.

The saw is driven directly by a motor mounted on a sliding bracket and supplied for either 2- or 3-phase, and for 220-, 440- or 550-volt current. The saw may be tilted by the handwheel at the right. Vertical adjustment of the motor is obtained by the hand wheel on the front of the machine. The machine has the necessary gages and a non-tilting rip fence. The saw is protected by a curved steel splitter guard. The starting box for controlling the motor is mounted on the side of the base. Table, 38 x 47 in.

Fixture, Angle, Universal, "Little Bob"

E. L. Krag & Co., 50 West Randolph St., Chicago, Ill.

"American Machinist," March 23, 1922.

The device is used when making angle set-ups on milling, drilling and grinding machines. The plate can be tilted 90 deg. to either the front or the back. The yoke carrying the plate can be revolved. The base and a flange on the horizontal pivot are graduated. Holes are provided in the plate for special clamps. Plate, 3½ x 4¾ in. Base, 8½ x 6¼ in. Height, 6¼ in. Weight, 25 pounds.

Angle Irons, Measuring, Precision

Simplex Tool Co., Woonsocket, R. I.

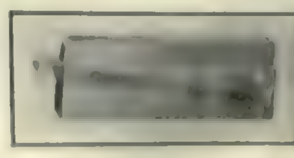
"American Machinist," March 23, 1922.

The angle iron shown at the left is used for holding work in place on a machine table. It has two slots, one for clamping one leg to the table, and the other for securing work to the angle iron. Two ribs brace the legs to keep the device from distorting. The iron is made in three sizes, 4 x 5 x 5 in., 6 x 6 x 8 in., and 8 x 10 x 12 inches. The precision measuring iron shown at the right is used when setting and aligning work, as for accurate boring operations. It has a bolt hole and a keyway, so that it can easily be secured to the table of the machine. The tool is made in two sizes, 2½ x 6 x 12 in. and 4 x 8 x 21 inches.

Toolholder, "Use-em-up"

Lovejoy Tool Works, 219-231 West Ohio St., Chicago, Ill.

"American Machinist," March 23, 1922.



This tool steel holder, designed to withstand heavy service, uses up short toolbits, and will hold full-length toolbits without danger of breaking them. Toolbits as short as ½ in. can be rigidly held, and the holder can be used very near the work. The No. 2 holder carries a bit ⅜ in. square in section, and is ⅜ x 1½ x 4 in. in size.

Clip, paste on 3 x 5-in. cards and file as desired

Washington Notes

By Paul Wooton

The conferees on the naval appropriation bill for the fiscal year beginning July 1 have agreed to the appropriation of $100,000 as proposed by the Senate for an addition to the machine shops at the naval station at Pearl Harbor, Hawaii.

The collector at New York has been reversed in his ruling which made certain metal drilling machines being imported by D. C. Andrews & Co., of New York, dutiable at 20 per cent ad valorem. The general appraisers pointed out that the machines are to be operated by electric power; are constructed and designed to drill holes in metal and, consequently, must be regarded as machine tools which take an import duty of 15 per cent ad valorem.

The conferees on the Naval appropriation bill for the year beginning July 1 adopted $14,795,000 as proposed by the Senate instead of $12,100,000 proposed by the House, for the Navy Bureau of Engineering. It fixed a limitation of $1,675,000 as proposed by the House on expenses for classified employees thereunder instead of $2,048,000 proposed by the Senate. The conference committee eliminated the $100,000 appropriation for the experimental and research laboratory.

The National Screw Thread Commission will meet at the Bureau of Standards in Washington on July 7.

In considering the tariff bill, the Senate on motion of Senator McCumber, chairman of the Finance Committee, in charge of the measure, reconsidered the sections previously adopted relating to various kinds of machinery. Upon his motion, a duty of 60 per cent ad valorem was placed on reamers, drilling cutters, caps, guys, twist drills, and metal cutting tools of all descriptions, not especially provided for, containing more than 6-10ths of 1 per cent of tungsten or molybdenum. An amendment by Senator King, reducing the duty to 30 per cent, was rejected.

Obituary

Thomas Devlin, president, Thomas Devlin Manufacturing Co., the Hardware and Malleable Iron Works, and the National Specialty Co., and for a number of years president of the Philadelphia Foundrymen's Association, died at his home in Philadelphia on June 23 at the age of 84 years. Mr. Devlin was not the only one of America's early trail blazers in the iron foundry industry but his entire career from its humble beginning on his arrival in the United States at the age of 16, fills one with admiration for his achievements against great odds. He leaves behind some worthy monuments to his energy and genius and real assets to Philadelphia's industrial life.

W. H. Holland, president and general manager Sibley Machine Co., South Bend, Ind., died on June 14.

William E. Snyder, chief mechanical engineer and for the past 26 years connected with American Steel and Wire Co., died at his home in Pittsburgh on June 24 at the age of 54. Mr. Snyder at the time of his death was president of the Pittsburgh section of the American Society of Mechanical Engineers.

Business Items

The Super-Seal Piston Ring Corporation, Muskegon, Mich., manufacturer of piston rings for automobile motors, has arranged for a change of company name to the Oil-Stopper Piston Ring Corporation.

The Waterbury Standard Tool and Machine Co., Waterbury, Conn., has filed a preliminary notice of company dissolution. All claims will be handled by H. B. Jenkins, 53 Euclid Ave., Waterbury.

The Lehigh Valley Railroad Co., New York, N. Y., it is reported, will conduct a series of tests at its shops at Sayre, Pa., to ascertain whether or not the workers can handle repair jobs cheaper and more efficiently than under the outside contract plan system. The demonstration will cover heavy repairs to 15 locomotives, and comparative figures as to cost and quality of work will be tabulated from day to day. The results will then be subjected to comparison with figures for contract work of a similar nature.

The Cleveland Cold Drawn Steel Co., Buffalo, N. Y., has arranged for a change of company name to the Buffalo Cold Drawn Steel Co.

The J. W. Pohlman Foundry Co., 205 Baitz Ave., Buffalo, N. Y., manufacturer of stoves, iron castings, etc., has arranged for an increase in capital from $25,000 to $85,000, for general expansion.

The Guy Disc Valve Motor Corporation, Chelsea, Mich., recently organized with a capital of $1,500,000, has acquired a portion of the local plant of the Lewis Spring and Axle Co., for its proposed works, including a general metalworking building, foundry and powerhouse. Operations will soon be inaugurated for the manufacture of valves and other equipment for automobile service.

The Remington Cutlery Works, Inc., of Bridgeport, Conn., recently incorporated to manufacture and deal in cutlery, etc., has increased its capital stock from $25,000 to $1,500,000. The company will operate in a part of the war-time plants of the Remington Arms-Union Metallic Cartridge Co., Bridgeport.

The Ramapo Iron Works, Hillburn, N. Y., has recently bought two Liberty planers through McCabe & Sheeran Machinery Corporation.

McCabe & Sheeran Machinery Corporation, 50 Church St., New York City, has been appointed New York City agents for Liberty Machine Tool Co., Hamilton, Ohio.

The George W. Hoar Co., of Waltham, Mass., has recently been incorporated under the laws of Massachusetts, to deal in machinery, metal goods, etc. The company has a capital stock of $25,000, and the incorporators are George W. Hoar, Waltham, Mass.: John J. Sullivan and James E. Cussen, both of Boston.

James Fleming and Sons, St. John, N. B., founded a century ago in that city and for the past two years, operating a boiler machine shop and iron foundry on a reduced scale, plan to resume more active work. They will engage in the manufacture and repair of motor car parts in additions to the construction and repair of boilers and engines.

T. McAvity and Sons, St. John, N. B., have moved their shop personnel and equipment from the plant on Water Street to the Rothesay Avenue plant, formerly used in the manufacture of ammunition. While it is planned, eventually to transfer all manufacturing activities to the latter, the brass factory for the present will be continued on the old street site.

The Kohler Co., of Kohler, Wis., manufacturers of plumbing ware and fixtures, has established a southeastern office and distributing point to cover Georgia, Tennessee, Mississippi, Alabama and Florida territory, at 84 North Pryor street, Atlanta, Ga.

The Tennessee Coal, Iron and Railroad Co. is preparing to resume operations shortly at its No. 4 blast furnace in Bessemer, Ala., to make foundry iron for a time, to be followed later by a production of manganese iron. A 40,000 ton cargo of this ore is now en route to the district from Brazil.

The Tennessee Coal, Iron and Railroad Co., it is announced will blow in the No. 1 furnace at Ensley immediately upon completion of the work of rebuilding. It is also announced that the No. 1 furnace of the company at Bessemer, Ala., will resume operations early in July.

The Monongahela Iron and Steel Co., Paden City, W. Va. is arranging for the immediate resumption of operations at its local plant, following a shutdown for the past eighteen months. Employment will be given to 150 men.

The Fulton Co., Knoxville, Tenn., has announced a reorganization of the company with W. M. Fulton as president and treasurer; Warren Webster, vice-president; C. N. Mynderse, executive manager, and Henry Hudson, secretary.

The U. S. Electro Galvanizing Co., 32 Stockton St., Brooklyn, N. Y., announces a change in its corporate name to U. S. Galvanizing and Plating Equipment Corporation.

The Thomas Spacing Machine Co., Fulton Building, Pittsburgh, Pa., makes the announcement that the Chicago office of the company, formerly at 1243 Monadnock Block, has been removed to Room 936 in the same building.

The Mechanical Appliance Co., Milwaukee, Wis., manufacturer of Watson electric motors, has announced through Louis Allis, president, a chan in its corporate name to the Louis Allis Co., with the factory and main office at Milwaukee, as formerly.

The George B. Miller and Sons' agricultural implement factory at Waterloo, Iowa, was destroyed by fire on June on June 21 with a loss, estimated by the owners, of $700,000.

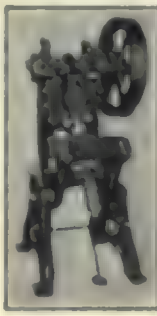
The Hartford Auto Parts Co., Hartford, Conn., recently incorporated to manufacture automatic parts, etc., was organized during the past week by the election of the following officers: Charles A. Dana, South Plainfield, N. J., president; John S. Berry, of Plainfield, N. J., vice-president; Paul D. Hawkins, of Plainfield, N. J., secretary and treasurer. The board of directors consists of Charles A. Dana; Ezra P. Prentice, New York City; and Lenore Carbaugh, of Colonia, N. J.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

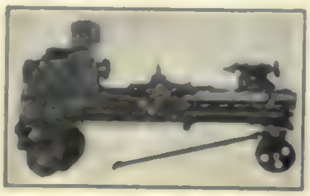
Cushion, Spring, Punch Press, "Even-Pressure"
Marquette Tool and Manufacturing Co., Chicago, Ill.
"American Machinist," March 23, 1922.

The attachment is adaptable to presses of small or medium size for drawing deep metal shells. It can be installed quickly without altering the dies or drilling holes in the press or bolster plate. It can be adjusted to different pressures, and retains its adjustment. The strain on the metal is reduced and back lash is prevented on the return stroke. The device is held in place by a bolt under the die or bolster plate. Four sizes for maximum depths of draw from 1½ to 4 in., and for maximum pressures from 1,500 to 6,000 lb. are furnished.



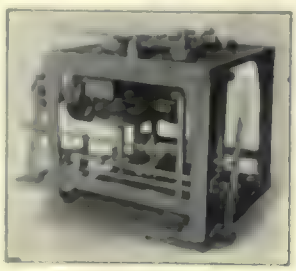

Lathe, Portable, Geared-Head, Motor-Driven
Lehmann Machine Co., St. Louis, Mo.
"American Machinist," March 30, 1922.

The lathe is adapted to use in railroad shops and in plants doing large work where it is desirable to bring the tool to the job. It is built in two sizes, having 16½ and 20½-in. swings, respectively. It is driven directly by an 1,500-r.p.m. motor mounted in the cabinet leg under the headstock. The headstock provides sixteen spindle speeds in almost geometrical progression with the use of only ten gears. Forward and reverse motions are obtained through friction clutches running in oil, and control handles for the reversing mechanism are located both at the apron and at the head end of the lathe.



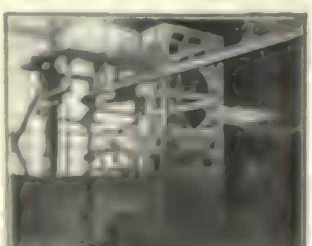
Bending Machine, Tube
Davis-Bournonville Co., Jersey City, N. J.
"American Machinist," March 30, 1922.

The machine is used for bending light tubing to special shapes, accomplishing the bending by two arms or cranks on the top of the table actuated by vertical oscillating shafts. Various arrangements of links and rollers can be applied to the arms to give the form necessary. The vertical shafts are driven by means of worm gearing and a crank motion underneath the table. The machine is driven by belt on a pulley that normally runs at 300 r.p.m. A clutch is provided for starting and stopping.



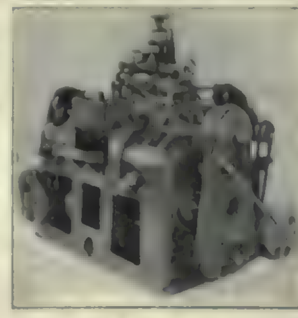
Elevator, Tramrail, Hand or Electric
Cleveland Crane and Engineering Co., Wickliffe, Ohio.
"American Machinist," March 30, 1922.

The elevator is used in dipping [illegible] in tanks or vats where hand or electric Tramrail systems are employed. It forms a section of the Tramrail system itself, and is composed of a riveted structural steel framework. The size of the elevator depends on the size of the tanks or vats employed, while the height is regulated by the height of the [illegible]. A [illegible] furnishes the motive power for raising and lowering the [illegible] [illegible] [illegible] [illegible] at the proper position on the elevator.



Grinding Machine, Cylindrical, Automatic
Warren F. Fraser Co., Westboro, Mass.
"American Machinist," March 30, 1922.

The machine is for grinding cylindrical parts with diameters larger than ½ in. and held on centers, such as shafts, bolts, valve tappets, piston pins and similar work. The maximum length of the grind is 6 in., while work up to 10 in. in length may be held between the centers. The work may also be held in draw-in chucks. The machine is entirely self-contained and is run by a 1½-hp. motor through a 4½-in. belt, or it can be driven by an overhead countershaft or a constant-speed pulley. All controls are easily accessible. Weight, 7,000 pounds.

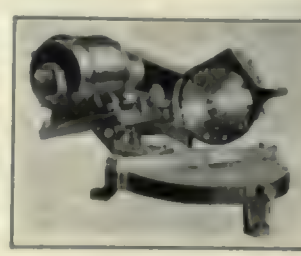


Press, Toggle, Double-Crank
E. W. Bliss Co., Brooklyn, N. Y.
"American Machinist," March 30, 1922.

The press is used for drawing pressed-steel axle housings for automobile trucks and for making heavy stampings of all types. It is of the tie-rod construction, is twin driven and triple geared with a gearing ratio of 65 to 1. The outside slide or blank holder is operated through a series of toggles with which a dwell of 120 deg. is obtained. The adjustment of the inner slide is made by a 15-hp. motor, while the machine itself is driven by a 100-hp. motor. Stroke: inner slide, 28 in.; outer slide, 20 in. Maximum distance from bed: to inner slide, 59 in.; to outer slide, 56 in. Bed, 80 x 116 in. Face size: blank holder, 60 x 102 in.; plunger, 36 x 86 in. Weight, 600,000 lb.

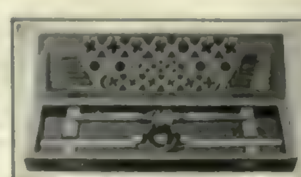
Saw, Bench, Portable, Motor-Driven, Self-Contained
Tannewitz Works, Grand Rapids, Mich.
"American Machinist," March 30, 1922.

The machine is adapted to light work in cutting and fitting wooden parts. The base carries a one-piece table, upon which the motor and saw are mounted. The table and saw can be swung to any angle up to 45 deg. in either direction, while the motor and the saw are mounted on a frame that swings about a horizontal axis. A spout at the rear of the saw carries off the dust. A permanent gage for positioning the work is secured on the stationary bed. The swiveling table can be locked in any position, and the saw at any height.



Screw-Plate, Set No. 300
Frank O. Wells Co., Inc., Greenfield, Mass.
"American Machinist," March 30, 1922.

The stock for holding the dies is made of an aluminum alloy. The dies are all of hexagon shape, adjustable to size by turning a fillister-head screw fitted in the side of the die. The die stock is provided with an adjustable guide held in place by two knurled-head screws. When the screws are loosened slightly, the guide can be swung to one side so that the dies can be changed. The set includes eight dies from ¼ to ¾ in. in size in both U.S.S. and S.A.E. threads. There are eight U.S.S. taper taps and eight S.A.E. plug taps. The complete set is packed in a wooden case.



Clip, paste on 3 x 5-in. cards and file as desired

Personals

HENRY R. COBLEIGH has been made secretary of the service committee of the National Automobile Chamber of Commerce. One of Mr. Cobleigh's most important duties will be in connection with the joint committee of the chamber and the Society of Automotive Engineers on simplified practice. The joint committee is working with the Department of Commerce to establish automotive standards throughout the industry.

A. A. THORSELL, for some time past connected with the engineering department of the Rockford Machine Tool Co., Rockford, Ill., has been promoted to the office of sales manager of that company with headquarters at Rockford.

H. B. HARPER of the Studebaker Corporation has been appointed a member of the simplified practice committee of the National Automobile Chamber of Commerce. This committee will work with a similar committee from the Society of Automotive Engineers and the Division of Simplified Practice of the Department of Commerce to establish automotive standards.

J. W. ROBINSON will succeed C. E. Allen as manager of the central station division of the Chicago office, Westinghouse Electric and Manufacturing Co.

EDGAR D. MASON has resigned his position as assistant sales manager of the Transcontinental Oil Co., and will resume his practice as consulting sales and advertising counsel, making his headquarters with the Albert P. Hill Co., Inc., Pittsburgh, Pa.

F. R. KOHNSTAMM has been appointed acting manager of the appliance section of the merchandising department of Westinghouse Electric and Manufacturing Co. and will be located in Mansfield, Ohio.

R. W. MORTON, for the past twenty-five years connected with the Fulton Iron Works, St. Louis, Mo., in various capacities, has recently resigned as shop superintendent.

H. A. LYNETTE has been appointed syndicate representative of the central station division of the Chicago office, Westinghouse Electric and Manufacturing Co.

L. H. BLOOM of the Hart-Parr Co., Charles City, Iowa, has been promoted to the office of general sales manager of the company to succeed Walter I. Frederickson, resigned.

G. A. SACCHI, formerly manager of the stoker section of the power department, Westinghouse Electric and Manufacturing Co., has been appointed manager of stoker sales and will have his headquarters at South Philadelphia.

G. F. SHERRATT has been appointed manager of the Pittsburgh sales office of the Chain Belt Co., Milwaukee, with headquarters in the Union Arcade Building, Pittsburgh, Pa.

LEONARD BONNER has just been appointed to the position of district manager for the Great Western Smelting and Refining Co., with headquarters at Pittsburgh, Pa.

C. C. CURRY, formerly branch manager of the Minneapolis office, Westinghouse Electric and Manufacturing Co., has been assigned to special work in connection with the St. Paul Electric Company.

CHARLES M. SCHWAB, it is announced, has been elected chairman of the board of directors of the Chicago Pneumatic Tool Co., to succeed John R. McGinley, resigned.

M. C. RYPINSKI of the radio sales division, Westinghouse Electric and Manufacturing Co., has transferred his headquarters to New York as a branch of the headquarters sales department.

WALTER S. FREDERICKSON, until recently connected with the Hart-Parr Co., Charles City, Iowa, has been appointed sales manger of the Auburn Motor Co., Auburn, Ind.

A. HECKMAN is now works electrical engineer for the East Pittsburgh works of the Westinghouse Electric and Manufacturing Co.

S. R. SHAVE has been appointed manager of the price section of the power and railway departments, Westinghouse Electric and Manufacturing Co., East Pittsburgh.

CLYDE L. KING, president of the Atlanta Plow Co., and the King Implement Co., of Atlanta, Ga., sailed for Europe on June 14 for a three months' business trip.

R. B. MILDON has been appointed general manager of the stoker department, Westinghouse Electric and Manufacturing Co.. with headquarters at South Philadelphia.

EDGAR WOODROW has been appointed manager of the contract division of the stoker department, Westinghouse Electric and Manufacturing Co.

Pamphlets Received

Pump Industry Standards. The Hydraulic Society, 50 Church St., New York City. A twenty-page pamphlet on the subject of standards in the pump industry, prepared by the society as a guide for buyers and sellers and containing definitions of terms in common usage in the industry. Copies may be had upon application to the secretary of the society, C. H. Rohrbach.

Paint for Steel. American Chemical Paint Co., New York City. Bulletin No. 10 containing directions for preparing steel for painting and for the use of deoxidine, manufactured by this company.

Carbon-Monoxide Poisoning. U. S. Bureau of Labor Bulletin No. 291, by Alice Hamilton, M. D., containing information relative to carbon-monoxide poisoning in the steel, coal, smelting and printing industries. Distributed by U. S. Department of Labor.

Workmen's Compensation. U. S. Department of Labor Bulletin No. 301, entitled "Comparison of Workmen's Compensation Insurance and Administration," by Carl Hookstadt, distributed by the U. S. Department of Labor.

Educational Bulletin. Institute of Technology, Pasadena, Cal. Bulletin No. 93, containing general information regarding the institute and complete descriptive matter relative to courses and subjects.

Sulphur in Coal Beds. University of Illinois, Urbana, Ill. Bulletin No. 125, entitled "The Distribution of the Forms of Sulphur in the Coal Bed," by H. F. Yancey and Thomas Fraser, prepared under the cooperative agreement between the U. S. Bureau of Mines and the engineering experiment station of the University of Illinois.

Trade Catalogs

Automatic Feeds. F. J. Littell Machine Co., 4125 Ravenswood Ave., Chicago, Ill. Annual catalog of the Littell company describing a line of automatic feeds built to fit all makes and sizes of punches, brushes and special machinery.

Ball and Roller Bearings. Compagnie d'Applications Mecaniques, 15 Avenue de la Grande Armee, Paris, France, represented by the Golden Company, 405 Lexington Ave., New York City. A twenty-page catalog in the French language describing the R-B-F type of ball bearing for which the Golden Company are sales agents in America. The catalog contains also technical data and load calculations.

Automobile Repair Tools. K. R. Wilson, 10 Lock St., Buffalo, N. Y. A booklet of thirty-two pages, designed for the garageman, containing descriptions of various tools and accessories for use in repairing automobile bearings, pistons, crankshafts, etc.

Thermaload Starter. Monitor Controller Co., Baltimore, Md. A circular descriptive of the themaload starters manufactured by this company for either momentary contact or maintained contact pilot control.

Spiral Pipe. American Spiral Pipe Works, Chicago, Ill. A wall circular with numerous illustrations of the uses of spiral pipe on one side, and blue prints of the many styles of fittings on the reverse side.

Chain Furnace Screens. E. J. Codd Co., 700 South Caroline St., Baltimore, Md. An eight-page bulletin descriptive of the Weigand chain furnace screens for furnaces and ovens.

Heating Specialties. The Fulton Co., Knoxville, Tenn. General catalog No. 100, covering the Sylphon line of heating specialties, comprising valves, temperature and pressure regulators made by this company.

Bolt and Hub Machinery. Pawtucket Manufacturing Co., Pawtucket, R. I. A bulletin of twenty-three pages, containing illustrations and specifications pertaining to the numerous sizes of cold-punched nut presses made by this company for the production of square and hexagon U. S. Standard nuts; a twelve-page bulletin descriptive of various sizes of bolt forging machines; a twelve-page bulletin containing data and illustrations on several sizes of bar, lever and cutting shears; a four-page circular describing the two sizes of Knowles key-seating machines.

Electrically Driven Tools. James Clark, Jr., Electric Co., Louisville, Ky. Catalog No. 28, containing descriptive matter, cuts and specifications on the line of electrically driven portable hand drills and grinders, sensitive bench drills and tool grinders.

Condensite. Condensite Company of America, Bloomfield, N. J. A descriptive bulletin containing information regarding the properties of condensite and illustrating the many uses of the material as applied to the automotive industry.

Optical Pyrometers. Scientific Materials Co., Pittsburgh, Pa. A fifteen-page bulletin describing optical pyrometers and containing technical data on the general theory of optical pyrometry as well as instructions for operating the instruments.

Snap Gages. Meldrum-Gabrielson Corporation, Syracuse, N. Y. Catalog and price list No. 4 covering the various sizes of Syracuse adjustable limit snap gages made by this company.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4,600 Prospect Ave., Cleveland, is secretary.

American Manufacturers Export Association annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

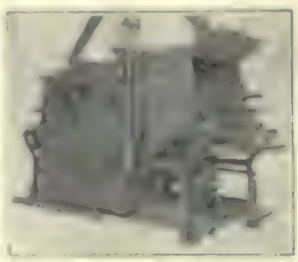
Grinding Machine, Combination, No. 1
Badger Tool Co., Beloit, Wis.
"American Machinist," March 30, 1922.

While various forms of equipment are adaptable to the machine, it is here shown equipped with a 16-in. disk wheel and a [illegible]. The [illegible] end of the spindle is extended to receive a 12-in. solid grinding wheel fitted with an adjustable work rest. The 3-hp. G.E. motor is fitted with special end frames. It is fully enclosed, has forced ventilation, and is controlled by push button and automatic starter. Weight, 1,300 pounds.

Brush, Wire, Air-Driven, "Little David," No. 601
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.
"American Machinist," March 30, 1922.

The tool is especially intended for removing paint, rust, dirt and scale from tanks, cars and structural steel frames. It differs from the former model in its high rotating speed and larger brush. The air motor is of the three-cylinder type. The average free speed of the brush when operating on 90 lb. per sq. in. air pressure is 4,200 r.p.m. Brush diameter, 6 in. Length overall 17½ in. Weight, 14 pounds.

Washing Machine, Metal-Parts, "Autosan"
Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.
"American Machinist," March 30, 1922.

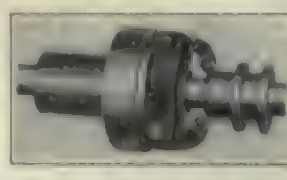


The machine is used to cleanse [illegible] and other parts not exceeding [illegible] in. in width and [illegible] in. in height. A [illegible] belt passes through the cleansing chamber and [illegible] at a constant slow rate of speed [illegible] motor. In the [illegible] chamber, the work passes through two separate types of sprays [illegible] through small nozzles by a power-ful rotary pump that is a part of the machine. Speed of travel can be varied from [illegible] ft. per minute. The machine is shown equipped with two sets of sprays. Floor space 116 x 44 in. Height, [illegible] in. Weight, [illegible] pounds.

Crane, Hand or Electric, Tramrail
Cleveland Crane and Engineering Co., Wickliffe, Ohio.
"American Machinist," March 30, 1922.

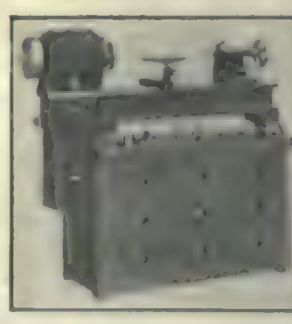
This [illegible] crane with a [illegible] capacity of two tons [illegible]. It consists of an I-beam suspended at each end from the bottom of two cast-steel carriers, which in turn are suspended in the wheel yoke [illegible]. The [illegible] of the wheels can be operated electrically by pull or floor control, or the whole unit can be pushed by hand. The hoist can climb inclines up to 12½ deg. The type of work carrier depends on the materials to be handled, the size or length of the system, and the total floor area served.

Clutch, Friction, Extended-Sleeve
L. W. Carroll Manufacturing Co., Batavia, Ohio.
"American Machinist," March 30, 1922.



The clutch can be used in driving wood, steel or cast-iron pulleys, gears, sprocket wheels or such parts placed on the sleeve. It can be erected by merely sliding it on the shaft and tightening one screw. The friction disk has a large diameter. The spider is keyed to the shaft, or held by a hollow setscrew. The friction is adjusted by turning one nut, which automatically adjusts the tension for both of the fingers. The clutch may be placed on the line shaft, driving directly to the machine. It is furnished in six sizes, from 5 to 12 in. in diameter. At 100 r.p.m., the horsepower transmitted is 2 to 13, depending on the size.

Lathe, Speed, Motor Headstock, A. C., 12-In.
J. G. Blount Co., Everett, Mass.
"American Machinist," March 30, 1922.

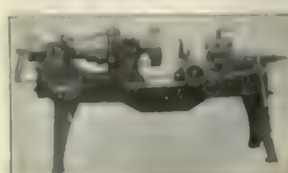


The lathe is used especially for wood turning in manual training schools and in pattern shops. A ½-hp. a.c. motor is mounted directly on the spindle of the headstock. Short legs for bench use are ordinarily fastened to the bed, or long legs for supporting the bed from the floor can be supplied. The speed of the motor is changed by a hand lever at the front. Bed length, 4, 5 or 6 ft. Distance between centers, 25, 35 and 49 in. Speeds, 575, 1,160, 1,750 and 3,450 r.p.m. Equipment: one spur and one cup center, three T-rests, 5½-in. faceplate, 3-in. screw chuck, knockout rod for head center and one right-angled rest.

Truck, Factory, Drop-Frame, Low-Platform, Electric
Elwell-Parker Electric Co., Cleveland, Ohio.
"American Machinist," March 30, 1922.

The truck is intended for handling barrels, bales and heavy material. A very low platform is the chief feature. Housings are placed over the rear or trailing wheels, which carry rubber tires 10½ in. in diameter and 5 in. wide. The driving wheels have tires 21½ x 3½ in. in size. Steering is accomplished with all four wheels. The storage battery is carried on the upper deck at the front of the truck, with the motor and worm drive axle below it. The truck travels from 15 to 20 miles on a single charge of the battery.

Lathe, Turret, Gap
Acme Machine Tool Co., Cincinnati, Ohio.
"American Machinist," March 30, 1922.



The lathe has all the regular dimensions of the 20-in. Cincinnati Acme turret lathe, excepting that the gap provides for a maximum swing over the bed of 28 in. The length of the gap from the end of the spindle is 9½ in. The machine is equipped with an air chuck, power feed for the cross travel of the cut-off rest, and power feed for the longitudinal travel of the turret. The arrangement of these feeds can be furnished as desired.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Cal., San Francisco—L. R. Lurie, Mills Bldg.—equipment for proposed machine shop.

Kan., Wichita—E. J. Drake, 253 North Market St., cabinet maker—wood lathe.

La., Shreveport—Cunningham Mch. Wks., L. T. Cunningham, Genl. Mgr.—machine tools and equipment for proposed factory for manufacture of acetylene equipment.

Mich., Munising—School Bd., T. W. Scholtes, Secy.—lathes, woodturning machinery, blacksmith shop equipment, for manual arts.

Mo., Kansas City—Kansas City Second Hand Box Co., 32 Ewing St.—one power planer.

Mo., St. Charles—F. Reinert, 314 South 2nd St.—power lathe and drill press.

N. J., Newark—Kreuter & Co., Inc., 583 18th Ave.—double disc grinder with counter-shaft, etc., complete.

N. Y., Buffalo—Peckham Vocational School, 321 Peckham St.—equipment for machine and woodworking shops.

N. Y., Buffalo—F. L. Whitney, 390 Ontario St.—tools and equipment for the repair of automobiles, also a 1,000 gal. gasoline tank.

N. Y., New York—J. Spengler, 229 West 28th St.—electric drill (Universal).

N. Y., New York—Thomsen & Co., 90 Wall St.—four Universal type radial drilling machines with 6 ft. arm.

O., Columbus—Arch City Machine Wks., 969 North Market St., C. L. Mahnick—grinders, lathe, press, shapers, etc., for machine works.

O., Columbus—Lawwell-McLeish Co., 241 N. 4th St.—lathe, drill press, grinder and milling machine for garage and service station.

O., Columbus—Lloyd-Hoffman Co., 1148 Mt. Vernon Ave., E. Lloyd, Purch. Agt.—one drill press, air compressor, and electric motor 15 or 20 hp.

Pa., Beaver Falls—Brighton Electric Steel Casting Co., E. D. Townsend—machinery and equipment for proposed shop for manufacture of iron, steel, brass and other castings.

Pa., New Castle—D. E. Frew—machinery and equipment for proposed shop, to manufacture metal shipping containers.

Pa., Sharon—G. C. Cross—machine tools, equipment, etc., for gas filling and service station on South Dock St. (now under construction).

Pa., Warren—City Taxi Co., R. Norris, Mgr.—machinery, tools and equipment for proposed service garage.

Va., Alexandria—Mt. Vernon Garage, 113 North St. Asaph St., J. Benton, Secy.—equipment and small tools for machine shop.

Wis., Milwaukee—V. Zillig, 1202 Chestnut St., manufacturer of special tools and machinery—lathe, drill presses, die room equipment.

Wis., Milwaukee—M. Zwoster, 708 National Ave.—drill press, air compressor, gasoline tank and pump for auto repair shop.

Que., Montreal—A. Ducas, 526 Ontario St. W.—small tools, grinder, etc. for garage and automobile repair shop.

Que., Montreal—J. Mathieu, 100 Rose de Lima St.—small lathe and general equipment for automobile repair.

Machinery Wanted

Cal., Fairoaks—Fairoaks Fruit Co., W. Hinsel, Genl. Mgr.—additional machinery for handling olives.

Cal., Haywood—A. La Cunha—machinery and equipment for proposed soap manufacturing plant.

Cal., Los Angeles—Joart Electric Co., Inc., Citizens Natl. Bank Bldg.—machinery and equipment for the manufacture of washing machines.

Ga., Macon—C. O. Carpenter, c/o 4th Natl. Bank—machinery and equipment for the manufacture of brooms and mattresses for proposed plant (new or used).

Kan., Grainfield—Cap Sheaf, F. J. Wolfe, Purch. Agt.—linotype machine and printing equipment for Junior linotype.

Kan., Wichita — Western Newspaper Union, 525 East William St., H W. Albright, Mgr.—one 7 column quarto cylinder press, and one linotype machine.

Kan., Wichita—Wichita Beacon, North Main St., H. J. Allen, Purch. Agt.—one newspaper press.

Kan., Wichita—Wichita Eagle, Market and William Sts., M. Murdock, Purch. Agt.—linotype machine for setting large newspaper heads and newspaper press.

Md., Hagerstown—Oakol Mfg. Co., c/o G. H. Stevenson, Dir.—machinery and equipment for the manufacture of fuel from the garbage supply of Hagerstown.

Mich., Midland—E. Mills—new machinery and equipment for remodeled foundry at Saginaw.

Mich., Plymouth—Detroit House of Correction, 1441 Alfred St., Detroit, J. O. Stutzman, Supt.—dry kilns and equipment, also woodworking machinery for proposed industrial building.

Minn., Cloquet—Northwest Paper Co.—one traveling crane.

Neb., Lincoln—Capital Bindery, 315 South 11th St., F. Reger, Purch. Agt.—power paper punching machine for loose leaf sheets (used).

Nev., Eureka—Holly Consolidated Mining Co.—equipment for proposed large flotation plant.

N. Y., Buffalo—E. Kubik, 960 Grant St.—machinery and equipment for bakery.

N. Y., Geneva—Geneva Brick Products Corp., R. A. Catchpoll, Dir.—machinery and equipment for the manufacture of brick, tile and roofing materials.

N. Y., Niagara Falls—New Goodyear Shoe Repairing Co., L. Scozzafana and T. Zagordi—machinery and equipment for shoe repairing.

N. C., Newland—T. J. Ray—electrically operated machinery and equipment for the manufacture of ice cream and ice (new or used).

N. C., Winston-Salem—J. Reich—machinery for proposed paint manufacturing plant.

O., Dayton—Bd. of Governors, Natl. Homes for Disabled Volunteer Soldiers, Genl. Headquarters, G. H. Wood, Pres.—ice making machinery, 25 ton capacity, for home in Wisconsin.

O., Winton Place (Cincinnati P. O.)—The Cincinnati Car Co., J. H. Elliott, Mgr.—one 500 ft., two stage, b... driven air compressor, one 50 in. table travel milling machine, 4 electric arc welders, 1 large size, belt driven blacksmith hammer, one warehouse shear for cutting rounds, squares, angles and channels.

Okla., Pawhuska—Amis & Nolan, Oil Products—steam drill runners.

Pa., Downington—Bd. of Educ., c/o Secy.—woodworking machinery for vocational department in new high school.

Pa., Franklin—Atlantic Refining Co.—equipment for proposed addition.

Pa., Phila.—F. H. Hosback, 2415 South St.—tenoning machines, planers, saws, etc., for woodworking and furniture manufacturing.

Pa., Phila.—J. F. Nolan & Sons, Church Lanne—vats, dryers, etc., for dye house.

Tenn., Chattanooga—M. B. Parker, 1912 Oak St., manufacturer of machinery, etc.—one belted air compressor (150-250 ft. capacity), one 36 in. gauge locomotive (used).

Wis., Delavan—The State Bd. of Control, Capitol, Madison, M. J. Tappins, Secy.—machinery and equipment for proposed laundry for state school for deaf.

Wis., Ingram—Hintz Bros.—saw mill machinery, belting, shafting, hangers.

Wis., Milwaukee—Milwaukee Co. Bd. of Trustees, W. L. Coffey, Mgr., Wauwatosa will receive bids until July 13th on refrigeration machinery.

Wis., Mondovi—P. K. Claflin—machinery and equipment for blacksmith shop.

Wis., Oconomowoc—Concord Dairy Products Co., c/o W. Kroll, Route 4—special creamery machinery, belting, etc.

Wis., Sheboygan—Keil Oil Co., c/o W. G. Keil, 1516 North 9th St.—pump, storage tanks, etc., for proposed filling station and garage.

N. S., North Sydney—Cape Breton Cold Storage Co.—machinery and equipment for proposed cold storage plant and packing house.

Ont., Burford—Apps Flour Mills—machinery for flour mills, partially destroyed by fire.

Ont., Ottawa—Stadium of Ottawa, Ltd., 198 Sparks St.—artificial ice plant for proposed large rink.

Ont., Toronto — Toronto Wet Wash Laundry Co., 11 Dundas St., W.—washers, boilers, driers and mangles for proposed laundry.

Ont., Welland—J. Stokes Rubber Co., c/o General Manager—machinery and equipment for the manufacture of radio parts, insulators, telephone receivers, etc.

Metal Working Shops

Cal., Merced—Merced Irrigation District, Shaffer Bldg., will build a 1 story garage and machine shop.

Conn., Hartford—H. A. Sillence, 19 Adelaide St., will soon award the contract for the construction of a 4 story, 50 x 60 ft. garage. Estimated cost $40,000. Toole & Katzenstein, 252 Asylum St., Archts.

Conn., Norwalk—Meeker Union Fdry., 34 Smith St., plans to rebuild its 1 story iron foundry and plant which was recently destroyed by fire. Estimated cost between $25,000 and $40,000. Private plans.

Ind., Michigan City—Sullivan Mchy. Co., 122 South Michigan Ave., and A. S. Coffin, Archt., 39 West Adams St., are receiving bids for the construction of a 2 story, 60 x 400 ft. and a 2 story, 400 x 550 ft. factory. Estimated cost $1,000,000.

Md., Hagerstown—Pennsylvania R.R. Co., 18th and Filbert St., Phila., Pa., has awarded the contract for the construction of a roundhouse and terminal facilities, here. Estimated cost $250,000.

Mass., Boston—Peterboro Realty Trust Co., 18 Tremont St., has awarded the contract for the construction of a 2 story, 75 x 170 ft. garage on Kilmarnock Rd. Estimated cost $70,000. Private plans.

Mass., Lynn — Ravin & Gorden has awarded the contract for the contruction of a 1 story, 79 x 201 ft. garage. Estimated cost $50,000.

Mass., Rockland—H. B. Vesper, 243 Union St., has awarded the contract for the construction of a 1 story, 100 x120 ft. garage and service station on West Water and Union Sts. Estimated cost $40,000.

Mass., Willimansett (Holyoke P. O.)—The Palmer Steel Co., 816 High St., Holyoke, has awarded the contract for the construction of a 1 story, 80 x 329 ft. steel plant, here. Estimated cost $75,000. Private plans. Noted May 4, 1922.

Mich., Ann Arbor—The Bd. of Regents, University of Michigan, has awarded the contract for the construction of a 4 story, 189 x 248 ft. engineering shop. Estimated cost about $700,000.

N. H., Manchester—J. Sullivan, 50 Granite St., will soon award the contract for the construction of a 1 story, 60 x 120 ft. garage, service station and repair shop. Estimated cost $25,000. J. E. Baker, 1008 Elm St., Archt.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances—Steel sheets up 10c., cold finished shafting, flats, squares, hexagons, etc., 30c. and tank plates, 17c. per 100 lb. in Cleveland warehouses. Mill price of steel shapes, plates and bars, $1.60@$1.70 per 100 lb., f.o.b. Pittsburgh. Gray iron machinery castings advanced 3c.@3½c. per lb. in Detroit. Copper and brass tubing up ½c. and zinc sheets, in casks, 1c. per lb. in New York. Raw linseed oil quoted in New York at 90c. as against 88c. per gal. in 5 bbl. lots.

Declines—Tin down ½c. and lead ½c. per lb. in New York warehouses. Copper market slack with downward tendency in zinc quotations.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.00
Northern Basic	26.52
Southern Ohio No. 2	26.02
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.16
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	27.[illegible]
Virginia No. 2	29.24
Basic	25.50
Grey Forge	25.50
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10.0	8.0	3.0
New York	[illegible]	6.0	3.0
Cleveland	[illegible]	4.5	2.6
Chicago	5.0	4.5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.40	3.63	3.25	3.63
No. 12	2.45	3.68	3.30	3.68
No. 14	2.50	3.73	3.35	3.73
No. 16	2.70	3.83	3.45	3.83
Black				
Nos. 17 and 21.	3.00	4.15	3.80	4.30
Nos. 22 and 24.	3.05	4.20	3.[illegible]	4.30
Nos. 25 and 26.	3.10	4.25	3.90	4.35
No. 28	3.15	4.35	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11.	3.15	4.35	3.85	4.45
Nos. 12 and 14.	3.25	4.45	3.95	4.55
Nos. 17 and 21.	3.55	4.75	4.25	4.85
Nos. 22 and 24.	3.70	4.90	4.55	5.00
No. 26	3.85	5.05	4.70	5.15
No. 28	4.15	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	3.63	2.81	3.48
Cold rolled strip steel	6.25	8.25	6.15
Floor plates	4.80	4.66	5.08
Cold finished shafting or screw	3.35	3.30	3.40
Cold finished flats, squares	3.85	3.80	3.90
Structural shapes (base)	2.68	2.51	2.68
Soft steel bars (base)	2.[illegible]	2.41	2.58
Soft steel bar shapes (base)	2.58	2.41	2.58
Soft steel bands (base)	3.23	3.06	3.23
Tank plates (base)	2.68	2.68	2.38
Bar iron (2.10@2.20 at mill)	2.58	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
[illegible]	8.00		12@13
[illegible]	6.50		11@12
[illegible] to [illegible]	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	31.50
Lead (up to carlots), St. Louis, 5.50; New York	6.12½
Zinc (up to carlots), St. Louis, 5.30; New York	6.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	6.00	7.50	6.25
Copper sheets, base	20.50	21.00	23.00
Copper wire (carlots)	16.00	17.00	16.25
Copper rods (ton lots)	19.00	22.00	19.50
Copper tubing (100-lb. lots)	23.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	18.00	18.75
Brass tubing (100-lb. lots)	20.50	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Brass wire (carlots)	17.25	17.75	.....
Zinc sheets (casks)	8.25	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....
Solder (½ and ½), (caselots)	21.00	22.00	20.00
Babbitt metal (fair grade)	24.00	41.50	36.00
Babbitt metal (commercial)	11.00	16.00	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.50	11.75	11.50
Copper, heavy, and wire	12.00	11.25	10.50
Copper, light, and bottoms	10.00	9.50	9.75
Lead, heavy	4.75	4.75	4.75
Lead, tea	4.25	3.50	3.75
Brass, heavy	7.00	6.00	....
Brass, light	6.00	5.00	6.00
No. 1 yellow brass turnings	6.50	6.00	6.50
Zinc	3.00	3.00	....

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7.25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.07½@\$0.10	\$0.12	\$0.11¼
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13¾x13¾	....	per M. 50.00	per lb. .10
Wiping cloths, 13¾x20½	....	per M. 55.00	per lb. .13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.07	.96
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville		per net ton	\$8.00
Coke, prompt foundry, Connellsville		per net ton	\$8.50

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	5-10%	60%
1⅛ and 1¼x3 in. up to 12 in.	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	.....	\$4.00 off
Button head bolts, with hex. nuts	25%	\$3.90 net	.....
Hex. head and hex. nut bolts	30%	....	65-5%
Lag screws, coach screws	50%	.....	60-5%
Square and hex. head cap screws	70-10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60%	50-5%
Bolt ends, with hot pressed nuts	50%	....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70-10%	80%
Case-hardened nuts	60%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$4.50	\$3.50	\$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	...	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	\$4.00	\$3.25	\$3.10
Cone heads, ditto (net)	4.10	3.35	3.20
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	.....	\$3.35 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.28@0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	35%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$3.85	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

N. J., Gloucester City—A. W. Grant, [illegible] Bldg., [illegible] received bids for [illegible] a 1 and 2 story [illegible] factory [illegible] for the manufacture of [illegible]. Estimated cost [illegible]. [illegible] Bldg., [illegible]

N. J., Mt. Holly—W. D. Marren has awarded the contract for the construction of a 1 story, 48 x 100 ft. garage. Estimated cost [illegible].

N. Y., Batavia—C. Mancuso & Son, 323 [illegible] St., plan to build a 2 story 51 x 160 ft. garage and salesroom on East Main St. Estimated cost [illegible]. Architect not announced.

N. Y., Brooklyn—[illegible] Motor Co. and Oakland Motor Cars Co., 1738 Bway, New York, has awarded the contract for the construction of a 6 story [illegible] building on 11th Ave. between 55th and [illegible] Sts., here. Private plans.

N. Y., New York—Dept. of Plants and [illegible] will re-advertise later for bids for the construction of a [illegible] at [illegible] St. and Ave. C. Former bids with[illegible].

N. Y., New York—North Dock Realty Co., Inc., c/o J. J. Dunnigan, Engr. and Archt., 394 East 150th St., will build a 1 story, 100 x 500 ft. garage on West 19th St.

O., Cleveland—Crucible Steel Castings Co., Canal Rd., is having plans prepared for the construction of a 1 story, foundry on Almira and West 35th Sts. Estimated cost [illegible]. W. H. [illegible], Pres. G. [illegible] & Co., Century Bldg., Engrs. and Archts.

O., Cleveland—P. Matzinger & Co., [illegible] Caxton Bldg., is receiving bids for the construction of a 3 story 52 x 70 ft. garage and commercial building on Chester and East [illegible] Sts., for A. Kohn & Sons Investment Co., 2100 Canal Rd. Estimated cost [illegible].

O., Cleveland—The Representative Constr. Co., [illegible] Bldg., will build a 1 story, 58 x [illegible] ft. garage and workshop at 4008 East [illegible] St. Estimated cost $50,000. Private plans.

O., Cleveland—M. [illegible] 10019 Parkgate Ave., has had plans prepared for the construction of a 1 story, 42 x 120 ft. garage at 2526 Cedar Ave. Estimated cost $40,-[illegible] Private plans.

O., Cleveland—F. B. Strawn, 43 The Arcade, is receiving bids for the construction of a 1 story, [illegible] x [illegible] ft. garage at [illegible] Ave. Estimated cost $40,-[illegible]. E. E. Smith, Williamson Bldg., Archt.

O., Cleveland—Studebaker Corp., 2020 [illegible] Ave., will soon award the contract for the construction of a 3 story 140 x 148 ft. service station on East 25th St. near [illegible] Ave. Estimated cost $250,000. E. J. [illegible] Dir. W. S. Ferguson Co., [illegible] Ave., Archts.

O., Cleveland—G. H. Thorn, 3104 East 22nd St., has awarded the contract for the construction of a 1 story, 26 x 96 ft. garage and sales room. Estimated cost $40,000.

Pa., Phila.—T. B. Martindale, Broad St. and Allegheny Ave., has awarded the contract for the construction of a 2 story, 100 x [illegible] ft. sales and service station. Estimated cost $105,000.

Pa., Phila.—[illegible] Bros., 4854 Lancaster Ave., will soon award the contract for the construction of a 1 story, 40 x 141 ft. garage. Estimated cost $50,000. Private plans.

Pa., Phila.—[illegible] Co., Broad St. and Lehigh Ave., has awarded the contract for the construction of an 8 story, 125 x [illegible] ft. sales and service station. Private plans.

Pa., Reading—The Reading [illegible] plans to build a 1 story [illegible] ft. addition to its [illegible] plant. Estimated cost [illegible].

R. I., Providence—W. P. Hamblin, Inc., [illegible] Archt., 45 Narragansett St., [illegible], Mass., plans to build a 1 story [illegible] ft. garage and service station, here. Estimated cost [illegible].

Tex., [illegible]—[illegible] Supply Co., [illegible] plans to build a large warehouse and machine shop, on a five acre tract of land, here.

W. Va., [illegible]—[illegible] has awarded the contract for the construction of a 4 story, 12 x 121 ft. garage. Estimated cost [illegible].

W. Va., Huntington—C. P. [illegible], 9th St., is having plans prepared for the construction of a 1 story [illegible] ft. [illegible]. Estimated cost $30,000. R. L. Willett, Robson and Prichard Bldg., Archt.

W. Va., Wheeling—Trimble & Lutz, 112 19th St., manufacturers of plumbing supplies, have awarded the contract for the construction of a 2 story, 120 x 120 ft. factory addition. Estimated cost $40,000.

Wis., Milwaukee—Sixth St. Garage Co., c/o M. Tullgren & Sons, Archts., 425 East Water St., has awarded the contract for the construction of a 3 story, 100 x 150 ft. garage on 6th St. and Grand Ave. Estimated cost $200,000.

Wis., Sheboygan—Kell Oil Co., c/o W. G. Kell, 1116 North 9th St., plans to build a 1 story, 60 x 90 ft. filling station and garage. Estimated cost $40,000. Architect not selected.

Mex., Coahuila—Amer. Smelting & Refining Co., 120 Bway, New York, will build a plant consisting of several buildings, here, for smelting and refining. Estimated cost $7,000,000. Private plans.

General Manufacturing

Ariz., Morenci—Stargo Mines, Inc., will build a cyanide mill. Estimated cost $75,000.

Cal., Colusa—California Prune and Apricot Growers' Assn., Market and San Antonio Sts., San Jose, has awarded the contract for the construction of a 1½ story cannery, on Cooper's Extension Tract, here. Estimated cost $80,000. Noted June 29.

Conn., Danbury—Tweedy Silk Mills, Inc., East Franklin St., has awarded the contract for the construction of a 1 story, 60 x 120 ft. weave shed, a 1 story, 40 x 60 ft. power house, a 1 story dye house and a 2 story office building. Estimated cost, between $40,000 and $50,000.

Conn., Hartford—R. S. Peck & Co., 26 High St., has awarded the contract for the construction of a 1 story, 100 x 104 ft. printing plant on Franklin Ave. and Bolton St. Estimated cost $40,000.

Conn., Manchester—The Orford Soap Co., Hillard St., plans to build a 2 and 3 story, 73 x 150 ft. addition to its plant. Estimated cost $60,000. Private plans.

Conn., Thompsonville — The Bigelow-Hartford Carpet Co., Tariff St., has awarded the contract for the construction of a 1 story, 111 x 227 ft. jacquard mill, a 1 story, 113 x 145 ft. worsted mill, and a 1 story, 82 x 142 ft. dyehouse. Estimated cost $1,000,000.

Fla., Auburndale — Auburndale Citrus Growers Assn. will soon award the contract for the construction of a 1 story, 80 x 125 ft. citrus packing plant. Estimated cost $25,000. R. Sands, Mgr. H. D. Mendenhall, Lakeland, Archt.

Fla., Jacksonville—Milldale Ice Co., 1010 East Bay St., plans to build an ice manufacturing plant. Estimated cost, including machinery, $35,000. S. S. Simmons, Mgr.

Ga., Macon—Case-Fowler Lumber Co., plans to rebuild its lumber mill destroyed by fire. Estimated cost $70,000. Private plans.

Me., Lisbon Center—Farnsworth Co. has awarded the contract for the construction of a 2 story, 80 x 100 ft. addition to its woolen mill. Estimated cost $25,000.

Me., Pejepscot—Pejepscot Paper Co., Brunswick, plans to build additions to its plant, here. Estimated cost $1,000,000.

Me., Pittsfield—Amer. Woolen Co., Lawrence, Mass., has awarded the contract for the construction of a 3 story, 50 x 90 ft. addition to its woolen mills here. Estimated cost $40,000. Private plans. Noted June 8, 1922.

Mass., Holyoke—Farr Alpaca Co., plans to build a spindle cotton mill. Estimated cost will exceed $40,000. Private plans. Engineer not announced.

Mass., Lawrence—Amer. Woolen Co., 245 State St., Boston, has awarded the contract for the construction of a 6 story, 100 x 500 ft. woolen mill addition to Washington Mills, here. Estimated cost $500,000.

Mass., Lowell—Massachusetts Mohair Plush Co., 122 Western Ave., will build a 2 story 40 x 140 ft. finishing plant addition. Estimated cost $45,000. Private plans.

Mass., Rockland—Rockland Webbing Co., Inc., plans to build a 1 story, 60 x 70 ft. addition to its webbing plant. Estimated cost $18,000. Private plans.

Mass., South Boston (Boston P. O.)—H. Norman, 20 Lawrence Ave., will build a 1 story, 50 x 1[illegible] ft. [illegible] factory, on A St. Estimated cost [illegible].

Mass., Southbridge—Hamilton Woolen Co., Mill St., plans to build a 1 story, 120 x 140 ft. addition to its woolen mill. Estimated cost $60,000. Private plans.

Mich., Plymouth—J. O. Stutsman, Supt. Detroit House of Correction, 1441 Alfred St., Detroit, will receive bids until July 10, for the construction of a 1 and 2 story, 408 x 840 ft. H shaped industrial building, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Mich., Sault Ste. Marie—The Cadillac Lumber & Chemical Co. will build a 1 story, 93 x 275 ft. and 110 x 116 ft. saw mill. Estimated cost $250,000. Noted June 1, 1922.

Minn., Minneapolis—Bd. of Park Comrs., J. A. Ridgway, Secy., City Hall, has awarded the contract for the construction of a 3 story, 43 x 144 ft. shops and warehouse on Lyndale Farmstead.

Minn., Minneapolis—The Fulton Bag and Cotton Mills, 643 Security Bldg., has awarded the contract for the construction of a 4 story factory and office building on East Hennepin Ave. and Taft St. V. C. Douglas in charge. Estimated cost $230,000.

Minn., Minneapolis—The Western Newspaper Union, 200 North 3rd St., is receiving bids until July 10th for the construction of a 2 story, 46 x 134 ft. printing plant and office building at 316 8th Ave. S. Estimated cost $100,000. A. L. Westerhagen, Mgr. Magney & Tusler, 126 South 9th St., Archts.

N. J., Trenton—Resolute Pottery Co., 3rd St., has awarded the contract for the construction of a 1 story, 40 x 70 ft. pottery. Estimated cost $10,000.

N. C., Cherryville—Carlton Yarn Mill, Inc., has awarded the contract for the construction of an addition to its cotton mill. Estimated cost $100,000.

N. C., Rutherfordton—Peoples Ice & Fuel Co. plans to build and equip an ice manufacturing plant, capacity 15 ton per day. Estimated cost $15,000. R. L. Taylor, Pres. Private plans.

N. C., Spindale—Spinners Processing Co. has awarded the contract for the construction of a 2 story, 137 x 234 ft. spinning mill. Estimated cost $80,000. S. E. Elmore, Treas.

O., Cleveland—Kronheim Furniture Mfg. Co., 2043 East 55th St., is having plans prepared for the construction of a 4 story 56 x 130 ft. factory and warehouse. Estimated cost $75,000. Steffens & Steffens, 1029 Williamson Bldg., Archts.

O., Dayton—Dayton Daily News, 4th and Ludlow Sts., plans to build a 3 story newspaper plant on 4th St. Estimated cost $150,000. Architect not selected.

Okla., Ardmore—Amerada Petroleum Co., 241 Kennedy Bldg., Tulsa, plans to construct a large gasoline extraction plant near here, in the Amerada oil fields. Estimated cost $100,000. W. M. Lovejoy, Mgr.

Pa., Phila.—F. Hosebach, 2415 South St., has awarded the contract for the construction of a 2 story, 64 x 76 ft. woodworking factory, at 12th and Brown Sts.

Tex., Mineral Wells—Great Texas Oil & Refining Co., Fort Worth, is having pains prepared for a refinery here, capacity 1,000 barrels. F. O. Stevenson, c/o owner, Engr.

Vt., Bellows Falls—Monarch Mfg. Co. plans to build a 1 story, 80 x 100 ft. plant for the manufacture of paper. Estimated cost $30,000. Private plans.

W. Va., Parkersburg—Apex Rubber Sundries Co., Citizens Bank Bldg., plans to build a 1 story, 100 x 300 ft. pant for the manufacture of rubber goods. H. H. Cooper, Mgr. Architect not selected.

Wis., Delavan—The State Bd. of Control, Capitol, Madison, will receive bids until July 11th for the construction of a 2 story 75 x 90 ft. laundry, at state school for deaf. Estimated cost, $50,000. M. J. Tappins, Secy. A. Peabody, Capitol, Madison, Archt.

Wis., Merrill—Wisconsin Valley Co., Inc., c/o W. H. Au Buchon, Secy., 400 Mills St., plans to build a 2 story, 50 x 60 ft. factory for the manufacture of excelsior. Estimated cost $40,000. Private plans.

Wis., Racine—H & M Body Corp., 608 Center St., is receiving bids for the construction of 1 story dry kilns. Estimated cost $125,000. Private plans.

Wis., Racine—J. Horlick, Route 2, Box 10, Horlicksville (Racine P. O.), has awarded the contract for the construction of a 3 story grist mill. Estimated cost $15,000. Private plans.

Wis., Wautoma—L. Chaimson, c/o Fair Store, plans to build a 1 and 2 story, 50 x 150 ft. feed and grist mill. Estimated cost $50,000. Architect not selected.

Ont., Welland—The St. Thomas Packing Co., Ltd., plans to build a cold storage plant. Estimated cost $50,000.

American Machinist

Volume 57 NEW YORK, JULY 13, 1922 Number 2

Building Gas Engines for the Navy

Developing the Engine and Special Plant—Equipment of the Shop—Machining the Engine Parts—Handling the Work—Assembling the Engine

By S. W. BRINSON

Assistant Shop Superintendent, U. S. Navy Yard, Norfolk, Va.

VERY few people know that the U. S. Navy Yard at Norfolk, Va., is building gasoline engines for the Navy Department, and those who do know probably have no idea of the magnitude of the work. In the writer's opinion this plant will compare favorably in equipment and methods of production with any marine gas-engine plant in the country.

The first experimental engine was built in the yard during the years 1906 and 1907. It did not prove a success. After further work and experimentation on commercial engines, a two-cycle, three-port, single-cylinder engine was built in 1910. Later on, two,- three- and four-cylinder engines of the same general type were built. The engines were originally developed for the purpose of motorizing the sailing launches.

In 1912 a single-cylinder model of the engine was built with the upper half of the crankcase and the cylinder cast in one piece. The water jacket was made round instead of square, thus altering the appearance of the engine considerably. After this, multi-cylinder engines were built, the upper crankcase and cylinders being cast separately, however. This type of engine with slight modifications is the one which is being built at present, although a new model four-cylinder engine is being tested. All of the present engines have a 4½-in. bore and 5-in. stroke; they are rated at 5 hp. per cylinder at 500 r.p.m., and will consistently develop this on test.

At the beginning of manufacture it became obvious that certain commercial parts, such as magnetos, carburetors and spark plugs, could be more cheaply purchased than manufactured. Also, the shop equipment was more adapted for the repair work which the yard had been doing than for the manufacturing work which it then faced.

The pattern shop was well equipped, however, and proceeded with the patterns, which were almost entirely made of steel and were mounted on molding machine plates. Suitable molding machines were purchased for the foundry in order to handle this work. The production of engines continued at the rate of from ten to twenty a month until after the outbreak of the war in Europe. During this time a number of jigs and fixtures were built which would do credit to any manufacturing plant.

To meet the war needs, the bureau at Washington asked for an increase of production of approximately 1,000 per cent, so that additional space was secured in other buildings to meet this increase. Even further demands were made, and the yard fulfilled them successfully by enlarging and reorganizing. The question did not involve only the production of new engines, but also the furnishing of a considerable number of spare parts with these engines, the supplying of repair parts to about 2,000 engines already in the service, and the repairing of old engines.

It was realized that the maximum production from machines which were working entirely on gas-engine work could be obtained only by segregating them in a separate building and placing them under the supervision of one man. Space was secured in another building, and the machines were moved from the main shop. They were arranged so that parts would move in a straight line toward the group assembly section and

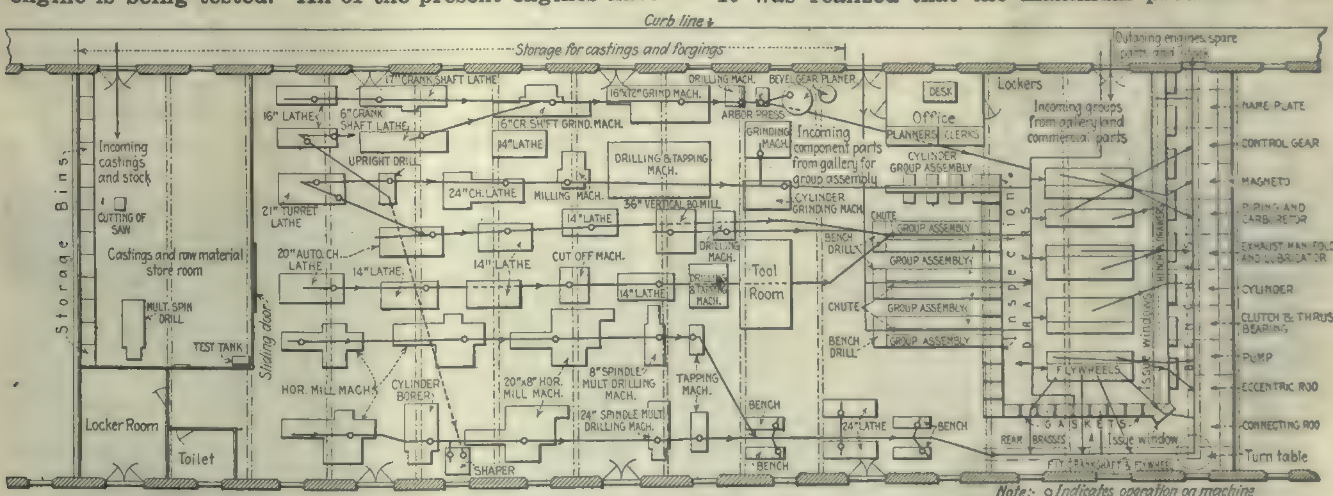


FIG. 1. LAYOUT OF GAS ENGINE PLANT

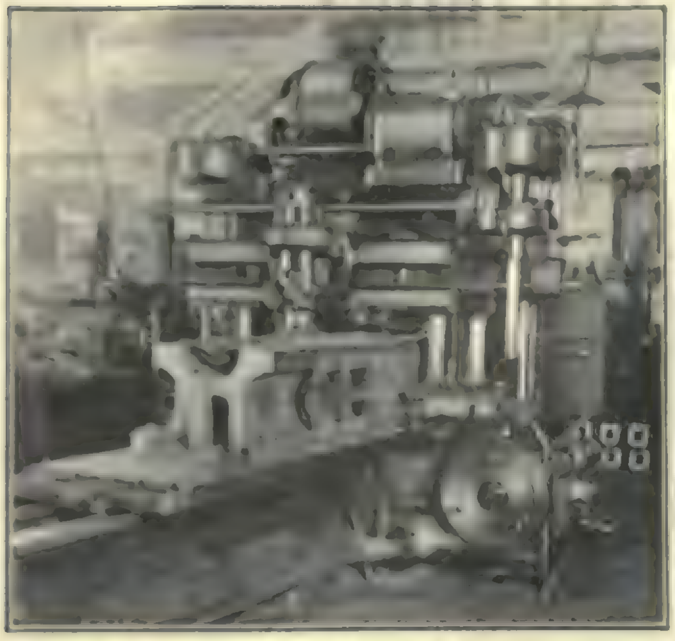


FIG. 2. MILLING UPPER SIDES OF BEDPLATES

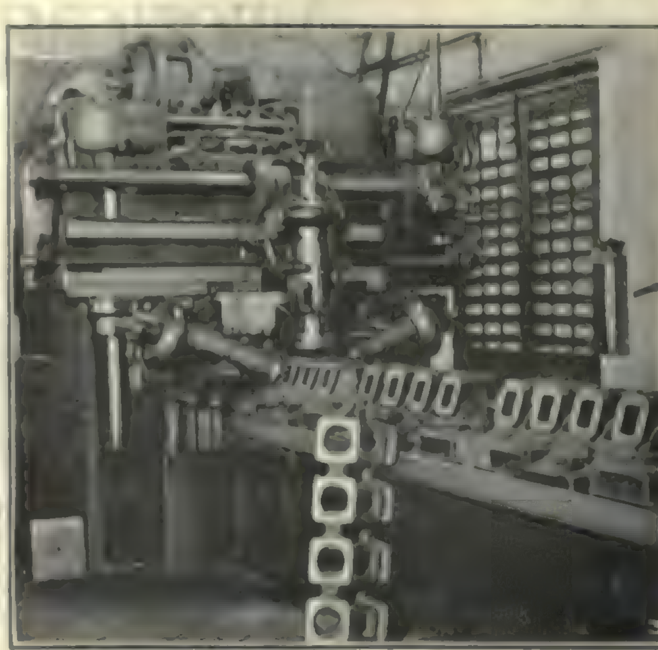


FIG. 3. MILLING UPPER CRANKCASES

thence to the parts and group storeroom, where they were stored in bins near the place where they would be needed on the assembly track.

Since even a larger plant was needed, one of the buildings formerly used for the machine shop was then fitted out to contain all of the departments pertaining to gas-engine manufacture and repair. The layout of this present plant is shown in Fig. 1. The arrangement of the machines should be noted. The path of the work is represented by the lines connecting the machines. The movement is toward the right, where the assembling stand is located. The foundry and forge shop supplying the rough work are, of course, in separate buildings.

In the point of equipment the plant may be considered a little elaborate for the normal amount of production; but it must be remembered that at the time the shop was placed in operation, the country was in the midst of a war the end of which no one could foresee. The plant is fully able to take care of the needs of the navy; in fact, at present few engines are being built, although a great many parts for engines in service are being manufactured.

Some idea of the equipment in the shop can be obtained by reviewing the machining operations performed in manufacturing an engine. The bottom of the bedplate is machined on an Ingersoll two-head milling machine, in the places where it will rest on the shoes in the boat.

The bedplate then goes to an Ingersoll three-head machine where the tops of three plates are milled at one setting. A special fixture was made for holding the bedplates, the arrangement being shown in Fig. 2. The stud holes for the upper crankcase, pumps and thrust bearing, and the through holes for fastening to the shoes are then drilled on a multi-spindle drilling machine. Holes requiring threads are tapped on a drill press, using an Errington tapping chuck. The bedplates are then studded and are ready to be bored for the crank brasses in connection with the upper crankcase.

The upper crankcase has its bottom milled on an Ingersoll arbor milling machine. Afterward, it goes to another Ingersoll three-head adjustable milling machine, where its sides and top are all machined in the same operation, as shown in Fig. 3. The upper crankcase is

FIG. 4. BORING CRANKCASE FOR CYLINDERS

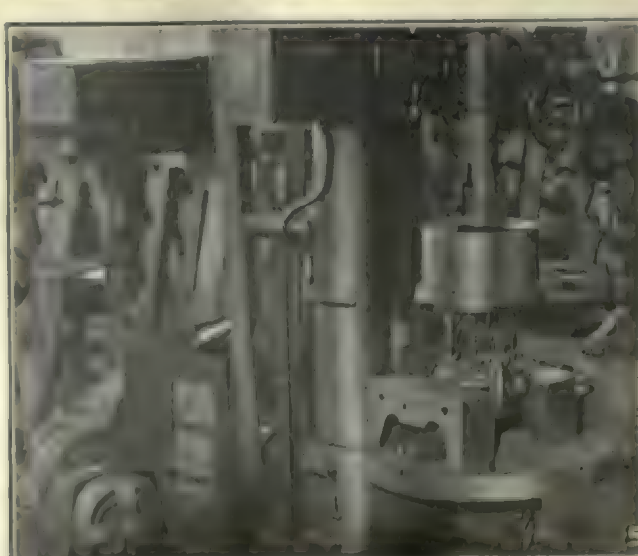


FIG. 5. DRILLING CYLINDER COVER

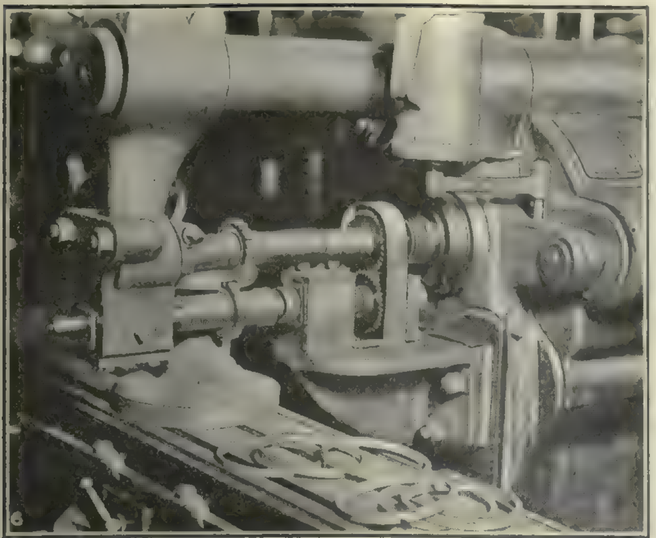


FIG. 6. CUTTING LAP JOINT IN PISTON RING

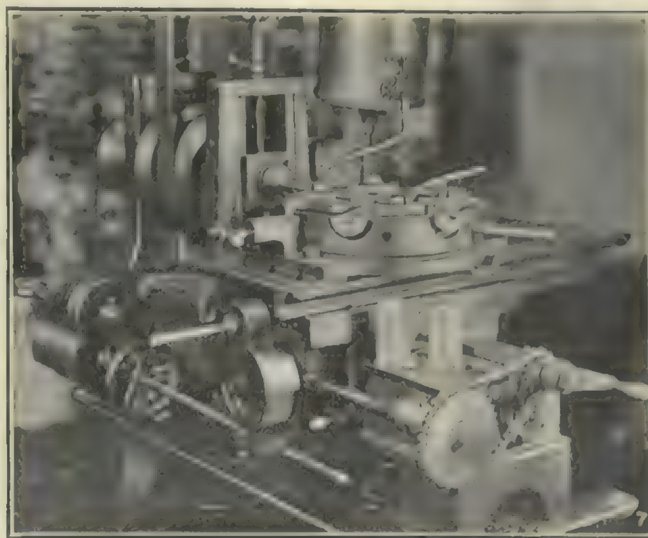


FIG. 7. FACING AND BORING CRANKSHAFT BRASSES

bored on the top for the male part of the cylinder on a Moline four-spindle "hole-hog" machine. This operation is shown in Fig. 4. The pad on the rear end of the crankcase is then machined on a shaper.

The next operation is drilling on a multiple-spindle drilling machine and then tapping, the same as with the bedplate, for studs to hold the cylinder and handhole covers. The crankcase is then placed on the bedplate and fastened to it after a boring bar has been inserted. The crank brasses are bored on a lathe.

Drilling and Tapping

The bottom and male part of the cylinder is machined on a Gisholt turret lathe. The bottom flange of the cylinder is then drilled, using a special four-spindle fixed-center head made at the yard. From here the cylinder goes to another Gisholt lathe, fitted with a special boring bar, where it is bored and faced on the top. The top is then drilled in a manner similar to that employed on the bottom, except that a six-spindle head is used. This head is employed also for drilling the through holes in the cylinder head, which operation is shown in Fig. 5.

The cylinder is milled on two sides on an Ingersoll two-head knee-type milling machine, and on the third side on another Ingersoll two-head machine which is used for other purposes also. The cylinder then goes through the group of drilling machines, where it is drilled and tapped on the sides and top. Multiple-spindle drilling machines and Errington tapping chucks are used for these operations. The cylinder is ground on Heald grinding machines, and then goes to the assembly benches for studding and plugging of core holes. It is now ready for placing on the engine.

Pistons and Rings

The piston casting has the bottom cut off and is counterbored on a Gisholt lathe to fit the automatic turning machine. It is then rough-turned and grooved on a Potter & Johnson automatic lathe. It is finish-turned on an engine lathe; and then sent to another engine lathe where the pinhole is bored and the pin boss is faced by means of special fixtures and tools.

The piston rings are cast in a billet containing twelve rings, that goes directly on a Potter & Johnson automatic lathe of the same type as used for pistons. This machine rough-turns, bores, marks and cuts off the rings, which are then ground on the sides. The rings are cut on a milling machine on both sides at one time; this operation is shown in Fig. 6.

The rings are then put in a pot clamp and squeezed together. A mandrel which holds eight rings is inserted, the rings are clamped in place, the mandrel is put in a grinding machine and the rings ground. The test of

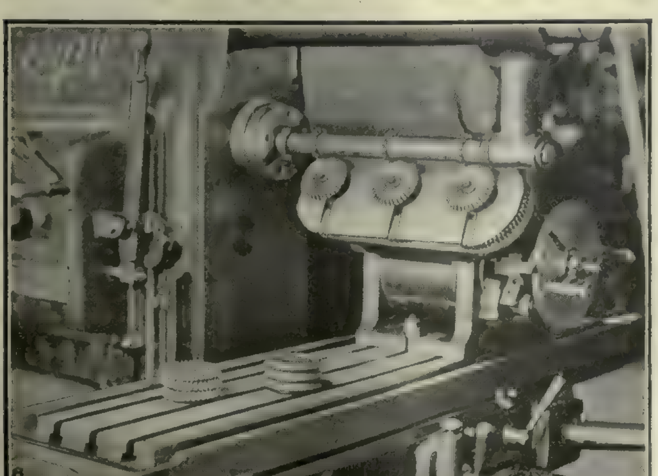


FIG. 8. CUTTING BEVEL GEARS ON A MILLING MACHINE

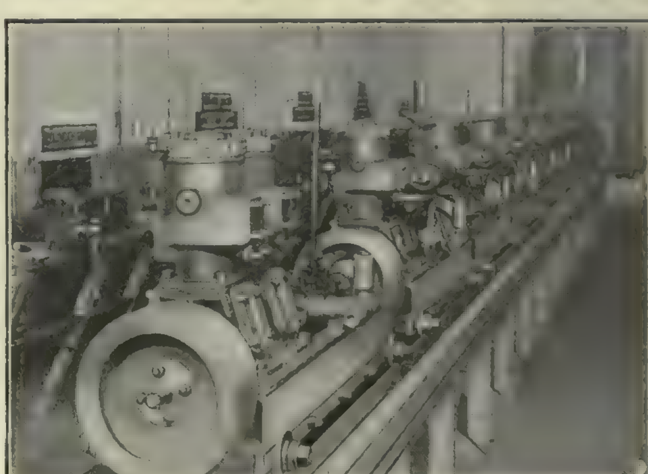


FIG. 9. SECTION OF ASSEMBLY TRACK

the rings is to have a load of 20 lb. supported on the ends of the piece for 24 hours, and then the rings must spring back together so that the ends meet.

The connecting rod is drop forged and the end for the brasses is centered by the die. A ½-in. pilot drill is first run through, and then the large hole is drilled on a heavy-duty Minster drilling machine. The rod is placed in a jig which has both a pin to fit the large end already drilled, and a hardened bushing at the proper position for the pin hole, which is then drilled. The rod is faced for the cap bolts, and the cap cut off in the same operation on a milling machine by the use of a gang of milling cutters, six rods being set up at one time.

The brasses are tinned and then babbitted. The crank brasses are cast on mandrels, and the connecting-rod brasses are poured solid in one piece. The crank brasses are placed in a milling machine where they are bored and faced on one end. The operation, shown in Fig. 7, is practically continuous. The brasses are faced at the other end on a milling machine and then placed on a mandrel and turned. Dowel-pin holes for the bottom brasses are drilled and the oil grooves are cut by hand. In the case of the connecting-rod brasses almost all of the work is done on a lathe, with the exception of the cutting, which is done on a milling machine.

The gears are first bored and then placed on a mandrel and turned, from six to eight being turned at one time. The crankshaft gears are cut on a Gleason gear generator with a special setting device which cuts down the setting time about two-thirds. The lower gear, the upper gear and the magneto gear are all cut on a milling machine three at a time, which operation is shown in Fig. 8. The keyway is then cut in the gears by a keyseater.

Machining the Crankshaft

The crankshaft, since it is of the web type, is forged in a rolling die which makes the forging have the same outlines as the finished shaft. The shaft is rough-turned on an engine lathe and then goes to a Tindel-Morris crankshaft lathe, where the crankpins are all turned at one setting of the shaft. The latter, after being finish-turned, goes to a cylindrical grinding machine where the journals are ground, and then to the crankshaft grinding machine, where the pins are ground. Finally the four bolt holes for the flywheel are drilled on a multiple-spindle drilling machine, the starting pin hole is drilled, and the keyway for the crankshaft gear and pump eccentric are cut.

The engines are assembled on a truck which runs parallel to the storeroom, as shown in Fig. 9. The parts are issued from windows located at the places where they are attached to the engine. There are drawers for the small light parts. These drawers are four high and stand open while assembly is going on, with the lower drawers open further than the top ones so that all are accessible. They are arranged so that they can be pulled back into the storeroom and filled. A heavy screw eye is placed in the storeroom side of each drawer, so that at night the drawers are all pulled back flush and locked by dropping rods through the screw eyes.

An arrangement was gotten up by one of the supervisors whereby the crank brasses are reamed instead of being scraped, at a considerable saving of time. This arrangement consists of a boring bar with detachable fluted cutters, the same cutters being used but with different lengths of bars for different types of engines. The boring bar is supported by two heavy brackets which are bolted to each end of the crankcase at the same place that the cylinder is fastened. The bar is then turned by means of a pneumatic machine. It has been found that this arrangement will give better results than scraping, and will save about three-fourths of the time.

The assembly carriages have detachable bars, so that the same carriage can be used for all types of engines simply by changing the bars.

Shop Terms—the "Old Man"

By Robert Tait

The article entitled "Understanding Shop Terms" by Robert Grimshaw, on page 916, Vol. 56, of *American Machinist*, recalled an amusing (to some of the bystanders at least) incident which happened at one of the large steel mills in Illinois, a number of years ago.

At that time the master mechanic was a very well known character in steel mill circles, with a reputation for being "hard boiled" and with a genius for apparently always being on the job at the wrong time.

One of the bench hands in the machine shop was an old Scotchman with a long, flowing grey beard. He had for a long time been in command of a certain bench just inside one of the doors, where practically all of his time was spent in fitting packing rings or piston rings. He looked with exceeding disfavor on any kind of an order that moved him away from his bench, and was never slow to show his disapproval, no matter from what quarter such an order might come.

One day a nasty breakdown occurred at the rod mill, and as usual "Old Jack," the master mechanic, was right there with his regular line of commands and comments, which, while not having much of any effect on any of the old timers, never had a tendency to soothe the nerves of any new man who had not had time to become acclimated to him. A ratchet drill had been brought on the job and an "old man" was needed. Turning to a green helper, who had been on the job but a few days he roared at him "go-t-shop-get-old-man," and the helper was on his way in a sort of daze. His route took him through the door adjoining the old Scot's bench, and as "old man" meant but one thing to him he immediately and urgently requested the Scot to come along to the rod mill, as Mr. —— had sent for him. For this old boy to get out on a breakdown was contrary to all his ideas as to what constituted a perfect day and on the way to the rod mill his Scotch had risen considerably. As soon as he got within talking distance he glared at the master mechanic and said, "whut ye want me here for Jock"? Jack stared at him for a moment and as the light dawned on him he said, "nuthin, get back to the shop." And the helper was out of a job because he did not quite understand shop terms.

I recall an experience in my early twenties, when I had started to work in a shop in St. Joseph, Mo., and after running a lathe for a couple of days the foreman asked me if I had ever run a "jumper." Inquiry disclosed the fact that I had, but that where I came from they were called "shapers." However, after I had worked on this particular machine for a while I was convinced that it was called a "jumper" advisedly. Later investigations though, showed that shapers were called "jumpers" over considerable territory in those parts.

Machining and Assembling Operations on Pneumatic Tools

The First of a Series of Four Articles—Drilling Air Hammer Parts—Boring, Reaming, Grinding and Lapping Piston Holes

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

THE design and construction of pneumatic tools involves some problems that are solved at the Aurora, Ill., plant of the Independent Pneumatic Tool Co., in ways that are both unique and efficient.

The operation of drilling the port holes in the live air handle, or throttle stem, of an air hammer, is an operation where a number of small holes are drilled to make a big one. Three jigs are used for this purpose, the first being the jig in place at *A* in Fig. 1. This jig slips onto the large end of the throttle stem and is held in place by a setscrew which does not show in the photograph. It is used for drilling the four holes *B*. Then the second jig is substituted and the four holes *C* are drilled, after which the third jig is used, the bushings in this jig being so located that the metal which separates the holes will be drilled away, and the center piece will fall out, leaving a large opening. The rough edges are chipped and filed smooth.

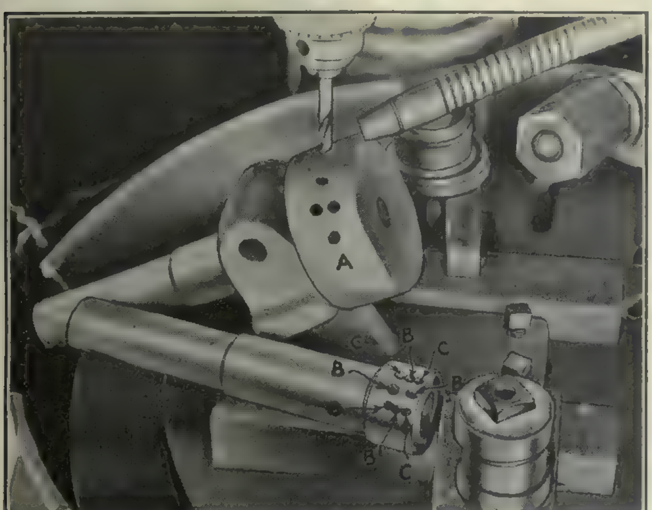


FIG. 1—JIG FOR DRILLING PORT HOLES IN LIVE-AIR HANDLE

The operation shown in Fig. 2 is that of drilling six crossholes, two connecting holes and one trigger pin hole in the handle of an air hammer. The trigger pin hole is shown at *A*. The jig is bored out for the bushing *B*, which is bored and tapered to receive the steel sleeve *C*, a part of the jig *H*. The bushing *B* is held in place by means of a collar on the front end and three lugs at the rear, the lugs being shown at *A*, Fig. 3. The collar and lugs prevent the bushing from working endwise, but allow it to be revolved so that the various drill bushings can be aligned with the drill. The sleeve, together with the hammer barrel, is held in the bushing by a small clamp that slips over the screw *D*, Fig. 2. Positive location for drilling the various holes is obtained by means of a spring plunger in the chamber *E*. This plunger is raised by the lever *F*, and dropped into a slot whenever a bushing is in line with the spindle. This does not apply in the case of the trigger pin hole, however, as that hole is so nearly in line with one set of crossholes that two slots are impossible. Consequently, the plug *G* is used to locate for drilling the trigger pin hole.

The hammer barrel is inserted into the sleeve *C* and located in the correct position in part *H* by means of the pin *I*, which fits into the throttle hole. The jig with a piece in position ready for drilling is shown in Fig. 3.

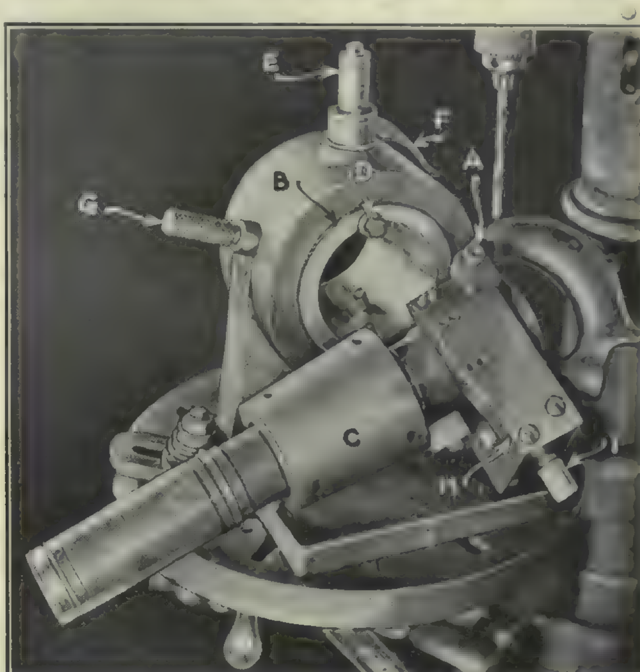


FIG. 2—INDEXING JIG FOR DRILLING AIR HAMMER HANDLE

A hammer barrel set up for drilling six exhaust

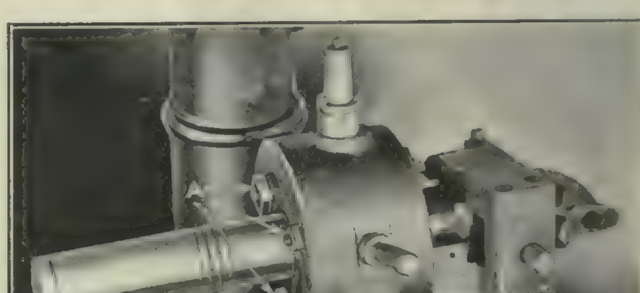
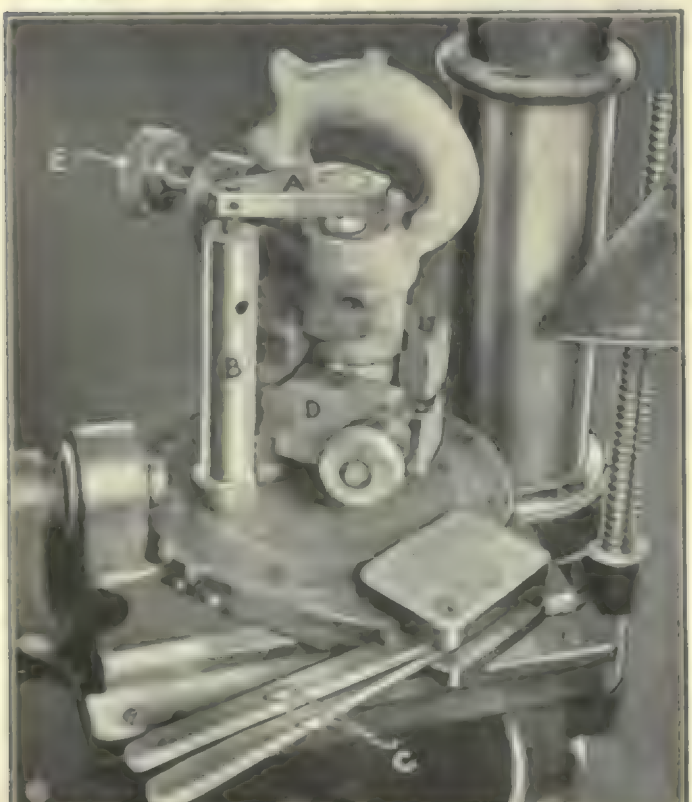


FIG. 3—JIG WITH PIECE IN POSITION FOR DRILLING

FIG. 4—READY TO DRILL CROSSHOLES IN MAIN VALVE. FIG. 5—JIG WITH BRACKET REMOVED, SHOWING METHOD OF LOCATING

holes for the main valve can be seen in Fig. 4. The piece *A*, through which the six holes are drilled, locates on the two pins shown at *A* in Fig. 5, and is held in place by the clamp *B*. The barrel is located on the shaft *C* by a pin on the end engaging in the piston hole. It can only locate in one position, that being the correct one for drilling. The shaft *C* is held in the correct position by means of the pin *D* and locked by the lockbolt *E*. The several holes similar to the hole in which the pin *D* is located, are for the purpose of locating other sizes or types of hammer barrels.

A jig for drilling two holes in the valve head of a heavy riveting hammer is illustrated in Fig. 6. The drill bushings are contained in a sleeve in the jig-plate *A*, the sleeve locating in the valve chamber and a pin in the other end of the plate locating in the end of the vertical shaft *B*. The fixture is made to index so that both holes can be aligned with the drill spindle, the indexing being controlled by the handles *C*. Each handle has a tongue on the end which fits into a slot in the side of the jig, each handle locating for one hole. The change is so slight from one hole to another that the simpler idea of one handle and two slots could not be used as the slots would run into each other. The



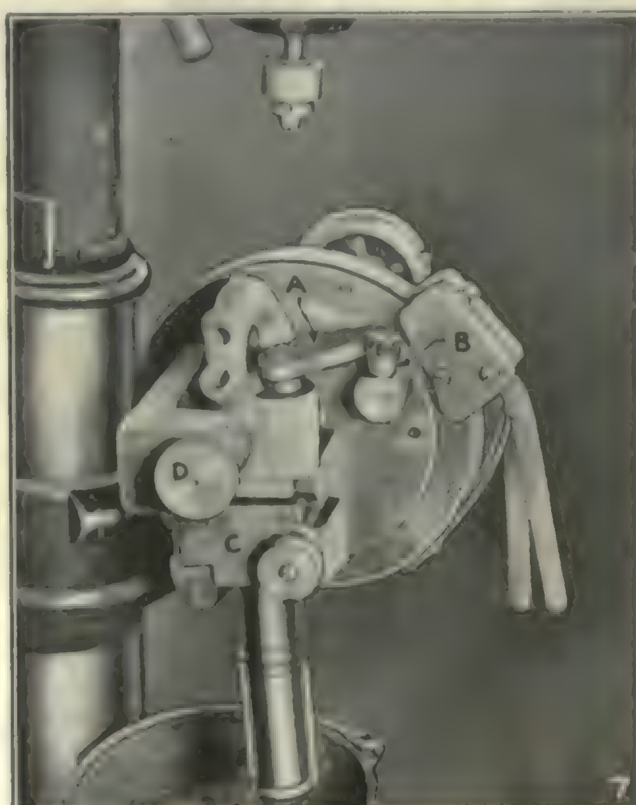


FIG. 6—INDEXING JIG FOR DRILLING VALVE HEAD. FIG. 7—SAME OPERATION IN DIFFERENT POSITION

hammer barrel extends down through a hole in the center of the base of the jig, and the pieces lock in position by the hinge plate *D* and the screw *E* which fits into the throttle hole.

The jig shown in Fig. 7 resembles that used for the previous operation. It is applied in a different position, however, and is used for drilling three holes in the valve chamber of a different type of riveting hammer. The bushings for these holes are contained in the bracket *A*, which is so made that the sleeve containing the bushings slips into the main valve-bushing hole and the end of the bracket fits in the angle formed by the screw *B*. The piece is located in the fixture by the hinge-plate *C* and the screw *D*, which fits into the throttle hole.

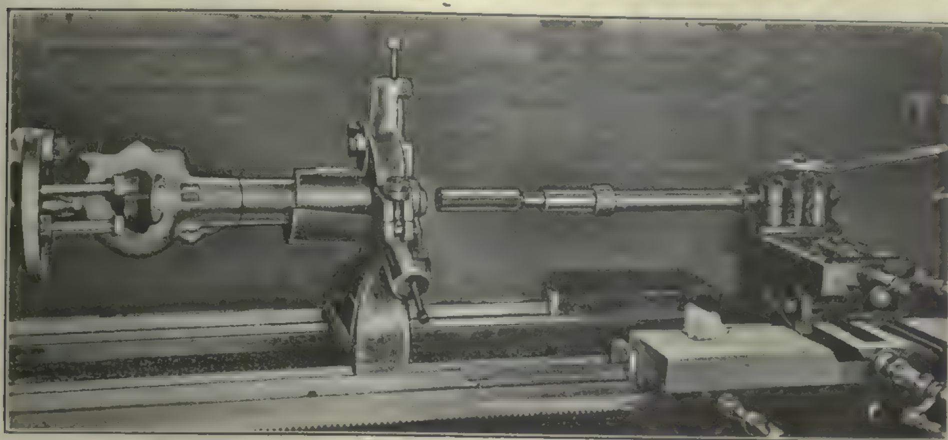


FIG. 8—LATHE SET-UP FOR BORING AND REAMING HAMMER BARREL

Boring and Reaming the Hammer Barrel

The operation of reaming a hammer barrel is shown in Fig. 8. The barrel has previously been rough-drilled on a similar machine, and in this operation both the piston hole and the nozzle hole are bored out and reamed. As can be seen, each tool on the rack behind the machine is fitted with a sleeve, so that the tools can be changed easily and quickly. One turn of the nut instantly and rigidly clamps the tool in the holder which is attached to the toolrest. The piston hole is reamed to 1.0475 in. in this operation.

The next operation after reaming is that of grinding the bore, which can be seen in Fig. 9. The interesting feature of this operation is the length of the hole, which is 15¼ in. The handle of the hammer is held to the faceplate with a strap in the same manner in which it was held in the lathe, and the end of the barrel runs in a steadyrest. The Independent Pneumatic Tool Co., after trying for some time to buy a spindle which would grind the length of this hole, decided that one was not to be purchased and accordingly had such a spindle made to its own specifications. After considerable experiment, a spindle was evolved of sufficient length to grind to the bottom of this hole without vibration or chatter. The wheel is attached to a short metal spindle at the outer end which runs in four ball-bearings, and the shaft which carries the small pulley is also very short and runs in four ball bearings. These two widely separated shafts or spindles are connected with a wooden spindle that gives perfect satisfaction. The connection on either end of the wooden spindle is of the ordinary tongue and slot type. This spindle is 18 in. long and runs at a speed of 12,000 r.p.m., while the hammer is turning at 225 r.p.m. The hole is ground to 1.0595 in. in diameter, leaving 0.002 in. for lapping.

FIG. 9—GRINDING PISTON HOLE IN HAMMER BARREL

The lapping machine, with a piece in position, is shown in Fig. 10. The barrel is held in position by being clamped into the piece *A*, which acts on the principle of a split bushing, the handle *B* operating a screw which pulls the split together. This bushing rests on balls, which allow the barrel to center easily. The balls are held in place by a groove in the lower part *C*. Abrasive is prevented from getting into the ball race by a steel housing, which covers the split bushing. The lower part *C* is made in two parts, held together by a hinge pin at *D*, which makes it possible to change the bushings to accommodate the different sizes of hammers. The handle *E* locks the two parts together around the bushing.

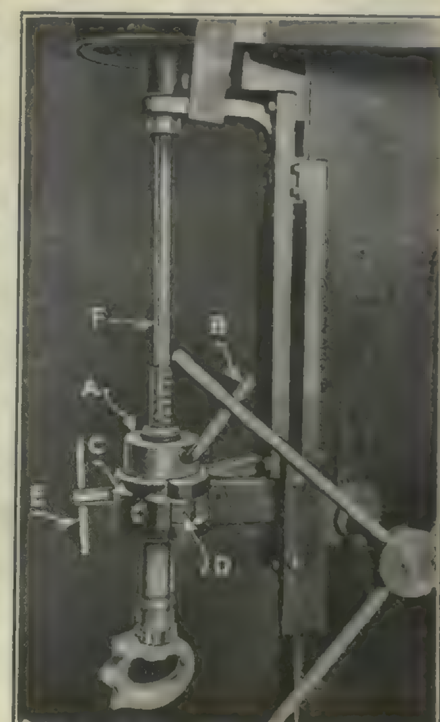


FIG. 10—LAPPING BORES AFTER GRINDING

The laps are of lead, cast onto the rods, one of which can be seen at *F*. A number of grooves are cut in each lap so that the oil and abrasive will be retained, and the lap is then finished to size. New laps are used for finishing, but after approximately thirty holes have been lapped, they become worn enough so that they are only good for the first, or roughing operation. The lapping is done at a speed of 600 r.p.m., approximately.

SPECIAL AUTOMOTIVE

Fig. 1.—Bilton automatic milling machine in the plant of the Hudson Motor Car Co., working on an adjusting eccentric body, a cast-iron piece with eight slots, each [illegible] in. wide and [illegible] in. deep. Each machine turns out 45 per hour.

Fig. 2.—The eccentric adjusting body itself after the slots have been milled. All the holes are first drilled so that the milling cutter breaks through into a hole at each cut. Two holes are left between each notch.

Fig. 3.—Almost a gear cutting job. Another Bilton machine, milling 12 teeth in a steel clutch drive shaft. The teeth are $1\frac{1}{32}$ in. wide. One man runs three machines at times and the average production is 25 per hour.

Fig. 4.—Pratt & Whitney double-spindle automatic milling machine on Chevrolet connecting rods. Material is 0.35 to 0.45 carbon steel. Cut is [illegible] in. deep by [illegible] in. long on each rod. Table feed, 5-10 in. per minute. Production 100 to 120 rods per hour.

Fig. 5.—A four-bolt connecting rod job. Both sides of the cap are milled and the cap is cut off on a Pratt & Whitney double automatic. The fixture is somewhat similar to inset, Fig. 4. Production is proportionately fast.

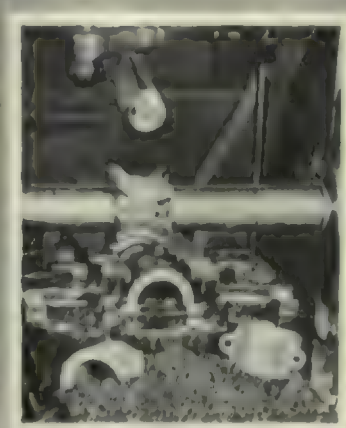
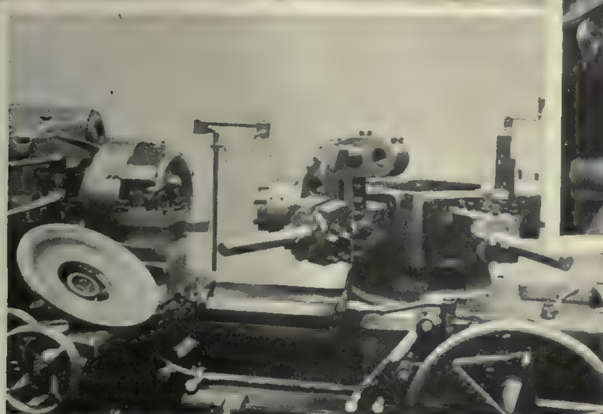


Fig. 6.—Finishing caps on a Pratt & Whitney single-spindle milling machine. Fixture holds five caps. Feed 1.86 in. per minute. Speed 60 feet; depth of cut [illegible] in.; chip per tooth, 0.0026 in. Length of cut [illegible] in. Production 30 caps per hr.

MACHINING METHODS

Fig. 1.—Finishing the concave side of a clutch cover on a Warner & Swasey 3-A universal turret lathe. The outside diameter is $12\frac{11}{16}$ in., the web is $\frac{3}{8}$ in. thick. Because these large, thin steel castings have a tendency to warp, it is necessary to allow about $\frac{1}{4}$ in. of metal for machining.



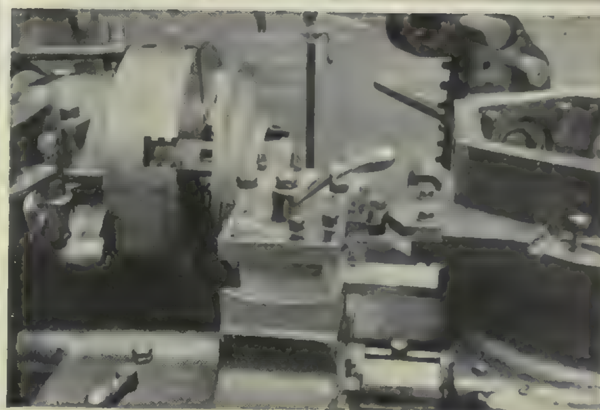


Fig. 2.—Finishing the other or convex side of the same clutch cover plate. The tool and the roller and form which guide it are shown. This method of machining reduced the time per cover from $1\frac{1}{2}$ hr. to 30 min. The machine is a Warner & Swasey 3-A universal turret lathe.

Fig. 3.—One of four operations on cone clutch flywheels. Flywheel flange fit is held to 0.001 in. Production averages 125 flywheels in 9 hr. for two operators and four machines. The machine is a Fay automatic lathe.

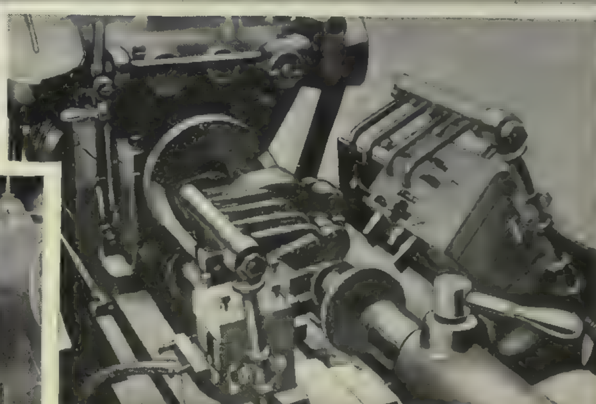


Fig. 4.—Turning ends of crankshafts on Fay automatic lathes. Two machines are used, tooled to turn opposite ends. One man runs them both. This crankshaft has main bearings 2 in. in diameter and a flange 5 in. in diameter at the end. The throw is for a 5-in. stroke. The production runs from 20 to 25 shafts per hour, turned on both ends.

Factors of Safety and Allowable Stress

Meaning of Allowable Stress—Factors of Safety for Live and Dead Loads—Effects of Fatigue, Shock and Uncertainty as to Actual Conditions Existing

By C. D. Albert
Professor of Machine Design, Sibley College, Cornell University

IN THE design of the component parts of a structure or machine, the form and size of each part for proper strength and rigidity may be fixed upon by the designer in any one of three ways:

(a) If an accurate, or reasonably accurate, analysis of the conditions of support and loading is possible, he may proportion the part or member by the application of the rational methods of mechanics.

(b) If rational methods are not possible or convenient, he may proportion the part by the use of semirational or empirical methods which represent successful practice or experimentally determined results.

(c) If both rational and empirical methods are impossible, he must reply upon the insight and judgment acquired as a result of his experience.

It is only in connection with the first method that a figure representing the allowable stress will appear in the calculations. The allowable stress must be sufficiently low to prevent failure and undue distortion under working conditions throughout the contemplated life of the structure or machine.

Allowable Stress: The terms "allowable stress," "maximum allowable stress" and "safe working stress" are synonymous. The allowable stress is the safe limit fixed upon for the maximum induced stress under working conditions. The usual method of obtaining an allowable stress for any given working conditions is to divide the ultimate strength of the material by a suitable factor of safety. The ultimate strength used is that determined by the usual laboratory tests of specimens and is to be regarded as the ultimate static strength of the material. The choice of a suitable factor of safety demands very careful consideration, especially for certain conditions of live loading. Calling the factor we divide into the ultimate static strength to get the allowable stress, the apparent factor of safety, we have:

$$\text{Allowable stress} = \frac{\text{Ultimate static strength}}{\text{Apparent factor of safety}} = \frac{u}{n}$$

Factor of Safety for Dead Loads: A steady, or dead, load may be very definitely defined as any load that induces stresses that do not with time change in magnitude or character.

For a steady, or dead load, the apparent factor of safety may be regarded as made up of two factors, a and e. In order to avoid permanent set or any undue distortion, the maximum induced stress must be kept at or below the elastic limit of the material. Unfortunately the ratio of the ultimate strength to the elastic limit is not the same for different materials, nor is there for all materials a well-defined elastic limit, or limit of proportionality of stress to strain.

It is not possible, therefore, to fix upon a value, or even a few values, for factor a that would cover this ratio for all materials. This difficulty can be largely overcome by basing the allowable stress on the elastic limit, and not on the ultimate strength. However, as we shall base the allowable stress for live loads on the ultimate static strength, we shall treat the apparent factor of safety for dead loads from the same conventional standpoint.

For wrought iron and the carbon steels not heat-treated, a is less than 2; and it is greater than 2 for cast iron which, strictly, has no well-defined elastic limit. If the elastic limit is looked upon as the stress beyond which upon release of the load the material will show no appreciable permanent set, a may be taken as approximately 2 for the materials named.

Besides avoiding permanent set or any undue distortion, we must provide a safe margin to cover uncertainties and unknown contingencies. This introduces the second factor e to cover such considerations as the following:

Doubt in regard to the actual possible load.

Imperfect or approximate analysis of conditions of support and loading.

Initial stresses due to casting or fabrication.

Whether failure would or would not endanger life.

Degree of reliability of the material.

The actual load that may be applied is not always definitely known, nor, where definitely known, is it always possible to make a complete and accurate analysis of the conditions of support and loading. A greater margin of safety should also be allowed where failure would endanger life than where it would not, and for unreliable as against reliable materials.

Aging, corrosion, wear and workmanship are considerations that may affect the sizes or proportions fixed upon, but are not considerations ordinarily allowed for in the factor of safety. Aging, corrosion, and wear are usually provided for by making specific allowances after the proportions for safe strength and rigidity have been fixed. Workmanship, when considered, is allowed for in some such way as in structural work, where about 25 per cent more rivets are required if driven in the field than if driven in the fabricating shop.

Apparent Factor of Safety

If factor e, the real factor of safety, be taken as $1\frac{1}{2}$ to 2 for wrought iron and the carbon steels not heat-treated and 2 to $2\frac{1}{2}$ for cast iron, we have:

	For Dead Loads Apparent Factor of Safety $= n \times e$
Wrought iron and carbon steels not heat-treated	$2\ (1\frac{1}{2} \text{ to } 2) = 3 \text{ to } 4 = n$
Cast iron	$2\ (2 \text{ to } 2\frac{1}{2}) = 4 \text{ to } 5 = n$

These apparent factors are in agreement with the factors ordinarily used for steel and cast iron. Dividing the ultimate static strength by these factors gives reasonable limiting values for the allowable stress for the two classes of materials named. As pointed out previously, factor a may be eliminated and the determination of a reasonable allowable stress simplified by dividing the stress at the elastic limit, or the yield

point stress, by the real factor of safety e fixed upon to cover the uncertainties and unknown contingencies.

It is important to bear in mind that the factor of safety in design is almost without exception a factor used to determine the allowable stress as a safe limit for the maximum induced stress, and to bear in mind also that the allowable stress is generally used in connection with formulas which rest upon the assumption that the induced stress does not exceed the elastic limit. To use a factor of safety of 4 does not mean that a load of 4 times the working load would or would not cause failure.

For a piece of material in direct tension a load of 4 times that necessary to induce a stress of ¼ the ultimate would cause failure. Here the ratio of the failure load to the safe load is the same as the ratio of the ultimate stress to the allowable stress. If, however, we had a beam of the same material whose proportions were based upon an allowable stress of ¼ the ultimate, it would not follow by any means that 4 times the safe flexural load would cause failure or that failure in a practical sense, if not rupture, would not occur for a load of less than 4 times the safe, or design, load.

Example in Design

To illustrate, let it be assumed that a round bar of cast iron resting on supports 18 in. apart is to safely support a load of 250 lb. midway between the supports; factor of safety 4, ultimate tensile strength of material 24,000 lb. per square inch.

$$\text{Allowable stress} = p = \frac{24{,}000}{4} = 6{,}000 \text{ lb. per sq.in.}$$

$$\text{External bending moment} = M = \frac{Pl}{4} = \frac{250 \times 18}{4}$$

$$= 1{,}125 \text{ lb.-in.}$$

$$M = p\frac{I}{e} = p\frac{\pi d^3}{32}$$

$$d = \sqrt[3]{\frac{32\,M}{\pi p}} = \sqrt[3]{\frac{32 \times 1{,}125}{\pi\, 6{,}000}} = 1\tfrac{1}{4} \text{ in.}$$

If the bar is made 1¼ in. in diameter, we can safely say that the maximum induced stress under a working load of 250 pounds would be very closely 6,000 lb. per square inch. Assuming the same law to hold, and substituting the ultimate strength of 24,000 as the maximum induced stress, would give a breaking load of 4 times the safe load, or 1,000 lb. Under actual test, however, it would require a load of about 1,800 lb. to cause rupture; that is, a load of 7.2 instead of 4 times the safe load. This is due to the fact that long before an induced stress of 24,000 lb. per square inch is reached, stress has ceased to be proportional to strain, and due also to the fact that as the stress-strain diagrams for cast iron in tension and compression differ, the neutral axis shifts to a position above the gravity axis.

The formula used above, like all formulas from the mechanics of materials, is based upon the assumption that stress is proportional to strain and that the modulus of elasticity in tension is the same as that in compression, which assumptions are only sensibly true, especially for cast iron, throughout a limited range. Except for cases of direct tension and certain other direct stress conditions, it must, therefore, be concluded that the ratio of the break or failure load to the safe load is not the same as the ratio of the ultimate stress to the allowable stress. In the illustration used these ratios are as 7.2 is to 4.

Occasionally, especially in empirical equations expressing experimentally determined results, we use the factor of safety as the ratio of the failure to the safe load or pressure. The empirical expressions from the experimental work of Stewart and Carman on thin tubes under external pressure are so used. The safe pressure is multiplied by a suitable factor of safety to obtain the collapsing pressure to be used in the proper equation in order to obtain the necessary thickness of tube.

Factor of Safety for Live Loads: A live load may be defined as any load that induces stresses that vary in magnitude or that vary in both magnitude and character.

It is a matter of common knowledge and experience that a piece of material will break or fail under a much smaller repeated load than would be required to break it in one steady application of load. It is also known that a piece of material under a repeated load will endure longer for the same range of variation of stress if the induced stress is of one kind only than if the induced stress changes from one kind to another. Such failure will take place even though the maximum induced stress is well within the elastic limit or yield point.

We now know that fatigue, or gradual failure under repeated variations of stress is due to the breaking down of certain weak or imperfect crystals. As this shear failure of certain local crystals takes place other crystals in their neighborhood are naturally subjected to higher actual stresses than the nominal stress. This action hastens the failure of the neighboring crystals and leads to the gradual fracture, or fatigue of the material. As gradual fracture is due to a breaking down, or to shear slippage, within the crystals, a gradual fracture has a crystalline appearance quite like that of a coarse grained brittle material.

We ordinarily regard steel, other metals, and alloys as structureless, homogenous, and isotropic. So far as their failure under a single application of load is concerned, a great many materials may be so regarded. It is because they are not structureless that their behavior is quite different under repeated loads than under single applications of load.

In 1870 Wöhler published results of a very exhaustive series of experiments on the behavior of materials under repeated variations of stress. Each kind of material was subjected to repeated variations of stress in torsion, bending, and direct stress action at the rate of less than 100 stress-deformation cycles per minute. The following formula, suggested by J. B. Johnson approximately expresses the results of Wöhler's work:

$$\text{Carrying Strength } p_2 = \frac{\frac{u}{2}}{1 - \frac{1}{2}\frac{p_1}{p_2}} = \frac{u}{2 - \frac{p_1}{p_2}} \qquad (1)$$

Where,

u = as before, the ultimate static strength of the material in pounds per square inch.

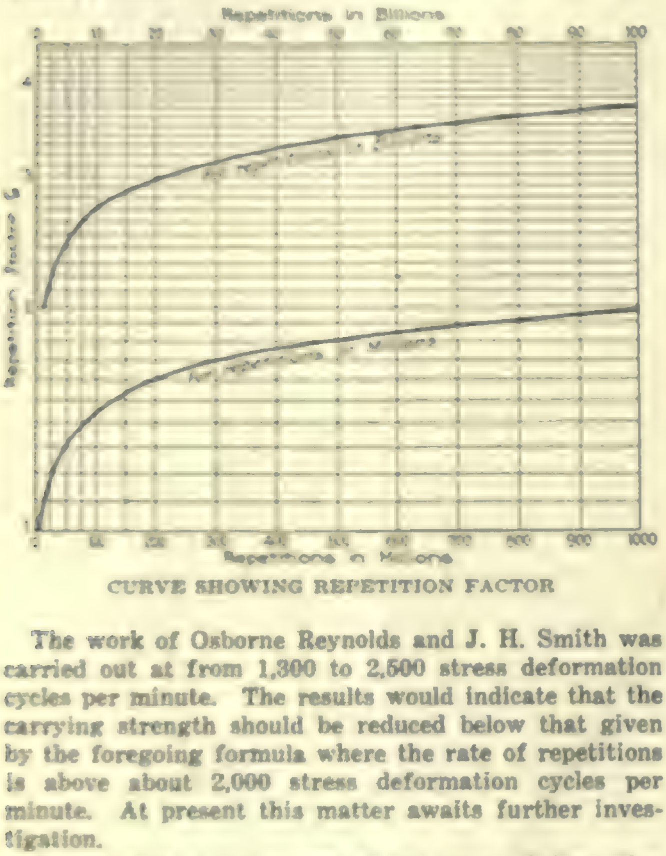
p_2 = carrying strength, or maximum value of the varying stress in the material in pounds per square inch that would cause failure for 4 to 10 million repetitions.

$\frac{p_1}{p_2}$ = ratio of the minimum to the maximum value of the varying induced stress. This ratio is negative if p_1 and p_2 are of opposite kind and therefore of opposite sign.

The ratio of the minimum to the maximum load $\left(\frac{P_1}{P_2}\right)$ is the same as the ratio of the minimum to the maximum stress $\left(\frac{p_1}{p_2}\right)$, where the external forces constituting the load undergo simultaneous and proportionate changes in magnitude with no change in their lines of action, and the loaded member does not rotate or change its position.

Research on Fatigue

Spanbenberg repeated Wöhler's work on the same machines with practically the same results. The later work of Bauschinger and Sir B. Baker was in close agreement with Wöhler's as was also the work conducted by Stanton and Bairstow at 800 stress deformation cycles per minute against less than 100 in Wöhler's work.



CURVE SHOWING REPETITION FACTOR

The work of Osborne Reynolds and J. H. Smith was carried out at from 1,300 to 2,500 stress deformation cycles per minute. The results would indicate that the carrying strength should be reduced below that given by the foregoing formula where the rate of repetitions is above about 2,000 stress deformation cycles per minute. At present this matter awaits further investigation.

As the plot of the energy of the stress deformation loop to the stress range passes through zero, it can not be said that there is a stress range above zero for which a material would stand an infinite number of repetitions. The carrying strength is, therefore, a function of the total number of stress deformation cycles in the contemplated life of the structure or machine. Moore and Seely (*Proceedings American Society for Testing Materials*, 1915) and Kommers (*Engineering News-Record*, Vol. 83, No. 20) have proposed methods of taking this factor into account in connection with the allowable stress.

The form and the surface finish of the piece affect the carrying strength of the material. Stanton and Bairstow rated the strength of the forms tested by them at the British National Physical Laboratory as follows:

Rounded fillets	100
Standard screw threads	70
Sharp curves	50

Sharp corners and abrupt changes in shape should therefore be avoided, as they are conducive to the formation of mico-flaws. For the same reason, the surface finish, especially for small parts, should be free from blemishes, scratches, and tool marks to obtain the greatest endurance under repeated stress.

It is evident from what has been said that the carrying strength of a material, that is, its ultimate strength under repeated stress, depends upon:

(1) The physical properties of the material.
(2) The range of variation of stress.
(3) Whether the varying stress does or does not change in kind.
(4) The rate of repetitions when above about 2,000 per minute.
(5) The total number of repetitions desired before break.
(6) The form and surface finish.

Equation (1) already given takes account of the first three factors and gives approximately correct results for a repetition rate under about 2,000 per minute and for a total number of repetitions of about 7 million. As pointed out above, we do not know at present just how the carrying strength should be reduced for repetition rates above 2,000 per minute. Allowance is usually made for the form and surface finish of the piece in the design and manufacture, and not in the allowable stress.

Account can be taken of the total number of repetitions for the contemplated life of the structure or machine, by dividing the carrying strength from formula (1) for 7 million repetitions by a suitable factor. Moore and Seely (*Proceedings American Society for Testing Materials*, 1916, Vol. 16) have found that a decrease of 9 per cent in the limit stress doubles the number of repetitions required for failure. According to Basquin (*Proceedings American Society for Testing Materials*, 1910, Vol. 10) the limit stress varies with the number of repetitions for rupture as a straight line when the results are plotted on logarithmic paper. As pointed out by J. B. Kommers in his article referred to previously, acceptance of these two statements establishes a simple relation between the ratio r of the number of repetitions and the ratio c of the carrying strengths:

$$0.137 \log r = \log c$$

To assume that the straight line relation between log of stress and log of repetitions holds for any number of repetitions is on the safe side, as experiment tends to show that for very high numbers of repetition the curve tends to bend to the right.

Assuming equation (1) to hold for 7 million repetitions, for which r would be unity, we can compute values of c for various totals of repetitions. For convenience, the results are given in the form of a curve in the accompanying figure.

Effect of Shock

The effect of shock or impact is to increase the induced stresses beyond what they would be in the absence of shock. The duration of the effects of shock or impact may cover the period of each stress-deformation cycle. If the duration of the effects of shock cover only a fraction of each complete stress-deformation cycle the result may, in effect, be the same as increasing the repetition rates. In some cases the liability to shock is only occasional with respect to the regular cycles of stress variation. Such might easily be the case in pumping or hoisting machinery

installations. It is thus possible to have shock effects which occur only occasionally with respect to the cycles of stress variation, or shock effects which are coincident with each cycle of stress variation. In general, the allowance for the former would not be as high as for the latter.

A load W applied instantaneously, but without initial velocity is called a suddenly applied load. If the stresses induced are within the elastic limit, such an application of load is equivalent to a gradually applied load of $2W$. A load W applied instantaneously and with initial velocity is called an impact load. If the stresses induced are within the elastic limit, such an application of load is equivalent to a load of P gradually applied:

$$P = W\left[1 + \sqrt{2\left(\frac{h}{\lambda}\right) + 1}\right],$$

Where,

h = height corresponding to the velocity with which load W is applied.

λ = total distortions of member due to static load W.

In suddenly applied and impact loads, as defined previously, as a guidance in making allowances for shock, it should be kept in mind that in their derivation the yield of the supporting members is neglected. Hence, a factor of 2 would more than cover the case of a strictly suddenly applied load. Shock factors from 1½ to 2 would cover the general run of cases, for we do not, as a rule, in structures and machines accept undue shock conditions. The kinematic scheme and general working conditions in each case should be carefully analyzed, and shock and shock effects reduced wherever possible by modifications in the design, by balancing, by the use of springs and by other expedients.

To determine for a case of live loading a suitable apparent factor of safety and allowable stress, the following procedure may be followed:

I. Determine the carrying strength by formula (1).

II. Divide the carrying strength by a suitable factor c from Fig. 1 to cover the contemplated number of repetitions to break.

III. Divide the carrying strength thus obtained by a suitable shock factor d if the maximum load upon which the design is to be based is not the resultant working load, shock effects included. To introduce a shock factor as a part of the apparent factor of safety is equivalent to assuming that the design load does not include the effects of shock, and that the effects of shock are present in each cycle of stress variation, and that the ratio of the minimum to the maximum stress in formula (1) is not affected. Factors for repeated shock are sometimes based on the revolutions or linear velocity in feet per minute. For the design of gear teeth, we find the shock factors used varying from

$$d = 1 + \frac{V}{1{,}000} \text{ to } d = 1 + \frac{V}{600}.$$

Examination of the allowable stresses given by Seaton for marine engine work yields an approximate shock factor of

$$d = 1 + \left(\frac{r.p.m.}{1{,}000}\right)^2$$

IV. Divide the carrying strength from (II) or (III), as the case may be, by a real factor of safety e to cover the uncertainties and unknown contingencies mentioned previously when considering the factor of safety for dead loads.

If for live loads we use the same real factor of safety e as for the dead loads, we should in no case use an apparent factor of safety for live loads as low as that for dead loads.

Take as an illustration the piston rod of an engine assumed to run at 250 r.p.m. for 10 hours a day for 300 days per year for 25 years; the rod assumed of open-hearth nickel steel having an ultimate strength of 90,000 lb. per square inch.

The rod is subjected to repeated stresses completely reversed each cycle. The total number of stress cycles in the assumed life of the machine is 1,125,000,000.

I. Carrying strength for about 7,000,000 repetitions,

$$p_2 = \frac{u}{b} = \frac{u}{2 - \frac{p_1}{p_2}} = \frac{90{,}000}{2 - (-1)} = 30{,}000$$

II. Carrying strength for 1,125,000,000 repetitions,

$$p_2' = \frac{p_2}{2} = \frac{30{,}000}{2} = 15{,}000$$

III. As liability to undue shock is only occasional, it may be considered as sufficiently covered by the real factor of safety e, or a shock factor

$$d = 1 + \left(\frac{250}{1{,}000}\right)^2 = 1.0625$$

in accordance with the previous III may be introduced, which would give

$$p_2'' = \frac{p_2'}{1.0625} = \frac{15{,}000}{1.0625} = 14{,}120$$

IV. Allowable stress $p = \dfrac{p_2''}{1.5 \text{ to } 2} = \dfrac{14{,}120}{1.5 \text{ to } 2} = 9420$ to 7,060, which is equivalent to an apparent factor n = 9.5 to 13.

Summary: The apparent factor of safety for dead loads was considered above as made up of two factors a and e; the factor a to determine the approximate yield point from the ultimate static strength, and the real factor of safety e to cover uncertainties and unknown contingencies.

The apparent factor of safety for live loads may be considered as made up of either three or four factors

TABLE OF APPARENT FACTORS OF SAFETY n

Material	Dead Load $n = a \times e$ ($a = 2$)	Live Loads $n = (b \times c \times e)$ or $(b \times c \times d \times e)$; $c = 2$ for about one billion repetitions	Repeated 0 to Max. $b = 2$	Repeated and Reversed Min. = Max. $b = 3$
Forgings e = 1½ to 2	3 to 4	Without shock	5½ to 7	8 to 11
		With shock, d = 1.25 to 1.5	7 to 10	10 to 16
Castings e = 2 to 2½	4 to 4	Without shock	7 to 9	10½ to 13
		With shock, d = 1.25 to 1.5	9 to 13	13 to 19
Timber e = 3 to 3½	6 to 7	Without shock	11 to 13	16 to 19
		With shock, d = 1.25 to 1.5	14 to 19	19 to 27

b, c and e, or b, c, d and e; the factor b to obtain the carrying strength for about 7 million repetitions from the ultimate static strength; the factor c to allow for the total repetitions in the contemplated life of the structure or machine; the factor d to allow for shock effects; and the real factor of safety e, as before, to allow for uncertainties and unknown contingencies.

From formula (I), factor b, for a stress variation from zero to some maximum would be 2, and it would be 3 for a stress variation from a minimum to an equal and opposite maximum. For a total of one billion repetitions, factor c is about 2.

Factory Storekeeping and Material Control

The Sixth Article—Storeroom Equipment—Designs for Standard Racks and Interchangeable Bins—Double Binning and Its Advantages—Limiting Minor Equipment

BY HENRY H. FARQUHAR

THE prime requisite as regards the equipment of any storeroom is *flexibility*. It is impossible to foresee all the ups and downs of inventory, the exact space required for different articles, the best arrangement and placing of each item to be stored. Continual rearrangements, particularly in individual racks and bins are desirable or necessary in most storerooms, and not infrequently the whole storeroom must be picked up bodily and moved to another location. The ease with which such changes may be made depends directly upon the character of the racks and bins used.

The ideal storeroom, other things being equal, would be one on wheels. As this is impracticable in most cases, the next best thing is to have only movable, interchangeable storage units just so far as possible. Racks and bins should very seldom be built in or permanently attached in any way to the floor, walls, or ceilings. On the contrary the equipment should include standard racks of appropriate size which may serve as shelves where no bins are required. In such cases the racks may be constructed without backs and so placed as to give shelves double the width of each rack.

Into all standard racks must fit interchangeably individual bins, just as one file drawer may be exchanged with another in a block of uniform, letter-file cabinets. The dimensions of the racks do not matter so long as a suitable and convenient standard be adopted. Similarly, the bins or individual storage compartments which fit into these racks may be of various shapes and dimensions as long as any bin or serviceable combinations of bins may be fitted into any standard rack. The racks illustrated in Fig. 10 have main divisions 24½ in. square by 18½ in. front to back inside dimensions. The bins are dimensioned correspondingly to fit with ample play into these racks in various combinations, and are typical of those commonly used in metal-working storerooms.

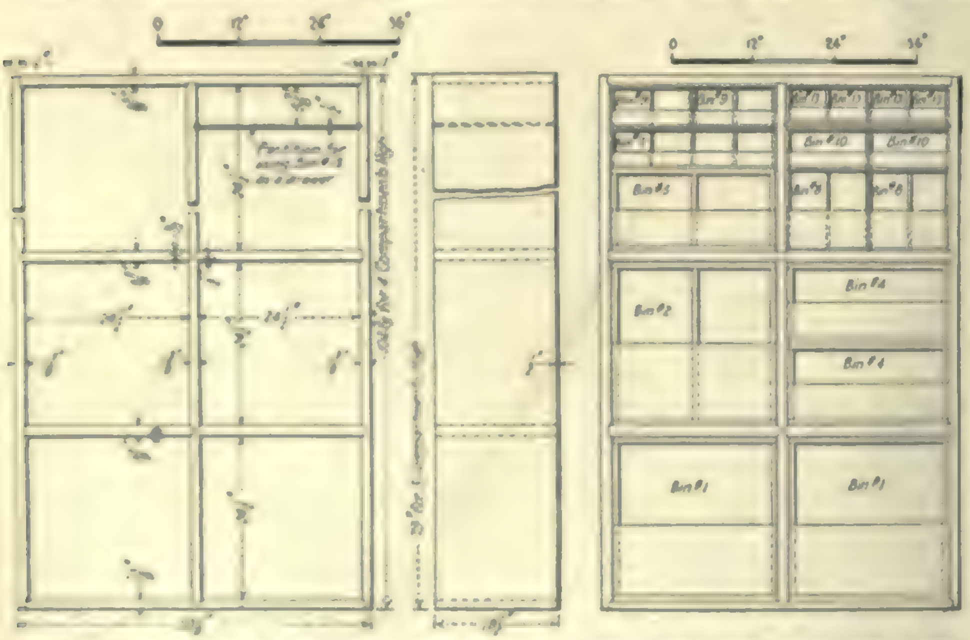


FIG. 10a—STANDARD RACK FOR INTERCHANGEABLE BIN STORAGE. FIG. 10b—TYPICAL ARRANGEMENT OF STANDARD RACK WITH INTERCHANGEABLE BINS FOR DOUBLE BINNING

The exact dimensions are unimportant, however, but I know of one satisfactory arrangement where the main divisions of such racks are 36 in. on all inside dimensions, with bins to correspond. In some instances packing cases may be used for racks, with similarly cheap construction for the bins. Sturdy construction is necessary, however, where heavy articles are stored.

In Fig. 10a is shown a standard wooden rack, three or four stories high by two stories wide, the inside dimensions of each story being 24½ in. wide, 24½ in. high and 18½ in. deep. These racks form the storage space for the whole storeroom for all binned items, or the racks without bins may be used where this arrangement is desirable. Into any story of any such rack may be fitted the individual bins detailed in Figs. 11 and 12. In Fig. 10b is shown a typical arrangement of these bins in the standard rack.

The advantages of such equipment are obvious. Not only may the whole rack with the bins described be picked up and removed to a new location, but as is more often necessary any one of these bins, with or without its contents, may be pulled out and may be replaced by a different arrangement. Thus, double bin No. 5, for example, which now accommodates about 500 ⅜ x 2-in. carriage bolts in each half, may be insufficient when it is decided to raise the limits on this item and to store twice as many as heretofore. In this case either one double bin No. 2 or two single bins of No. 4 design may be used. Usually a slight rearrangement of bins will enable the storekeeper to use one whole compartment of the rack so that all bolts of this size may be kept together in adjacent bins.

In many storerooms, due to the inflexibility of equipment, such rearrangement would be made only with the greatest difficulty, if indeed it would even be attempted. More commonly the increased supply would be dumped into some vacant bin not within speaking distance of the existing supply, thereby increasing the troubles of the storekeeper. Only through interchangeable storage units may all of each different item be kept together.

The installation and proper operation of such equipment have been known to cut down by more than half, the amount of storage space required for a given num-

For the author's forthcoming book.

ber of articles. The reason for this is readily seen. Under most conditions of storage, where the rearrangements are not easily made, the storekeeper plays safe by leaving quantities of vacant space in which additions to the stock may be absorbed. It is the exception where the common variety of built-in bins are found more than half filled, with the result that space utilization is only 50 per cent of what it should be. The waste of headroom is frequently enormous. With racks and bins of the type described, however, the storekeeper may fill each bin completely, knowing that with the contracting and expanding requirements of the business he can readily shift bins to meet current needs, keep all of any

Except where requirements may be very accurately foretold, it is best in the original layout of the racks and bins not to plan on using every bin of every rack. A bin or compartment should be left vacant at regular intervals. This is for the purpose of making rearrangements more easily through the ability to utilize this space in case the amount was miscalculated or in case an increased amount of room for one or more articles becomes necessary. Just what proportion of space should be left depends on the accuracy with which needs may be and have been predetermined, and on the room available for storage. Ordinarily one-half of one compartment of every standard four-story rack is sufficient with

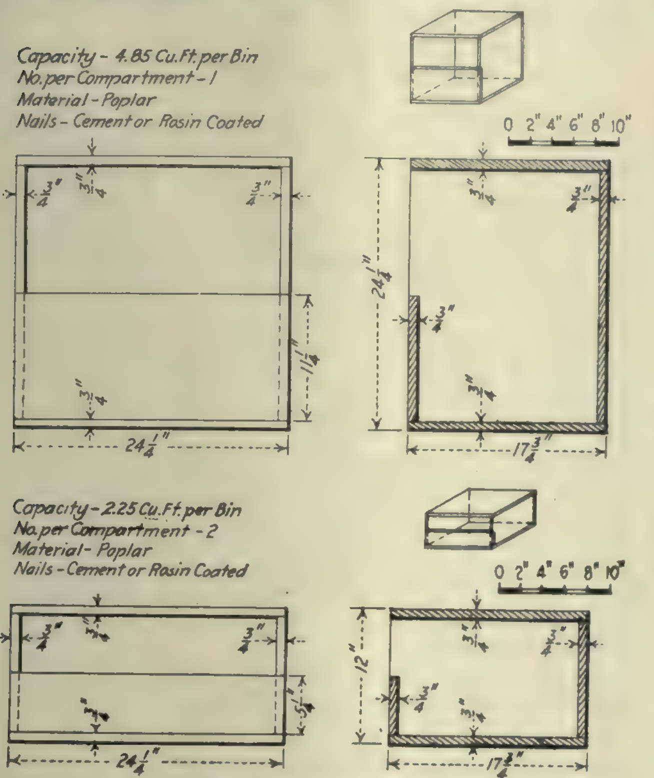


FIG. 11a—BIN NO. 1. FIG. 11b—BIN NO. 2.

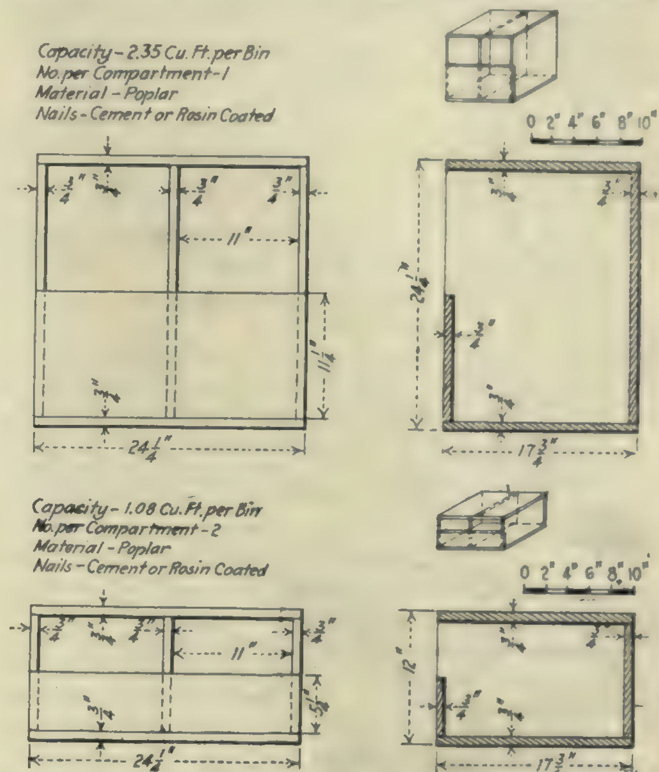


FIG. 11c—BIN NO. 4. FIG. 11d—BIN NO. 5

one item together, largely prevent overflow bins and secure a maximum space utilization.

Occasions arise, however, where the overflow bins should be used rather than undertake the rearrangement necessary to provide for out-of-the-ordinary expansion. When it is known that the increase in the amount to be carried is temporary, the permanent storage space may be completely filled and the temporary excess placed in an overflow bin, which may be simply an extra supply of these standard racks and bins left vacant for the purpose and located at any convenient point. In this case a cross-reference tag on the permanent bin tells the location of the overflow bin for that item, and on the overflow bin the regular bin tag is placed.

No bin tag, but only the cross-reference tag, should be on the permanent bin, and no issues must be made from this bin as long as the other is in use. This method will insure that all issues are made from the excess, overflow stock in order that it will be disposed of first, releasing this space and leaving eventually only the permanent bin to be looked after. An exception to this procedure should be made if the material is subject to depreciation and, in this case, the overflow, which is usually the most recent shipment received, must wait until the older shipments have been used up.

reasonably careful original layout. This is equivalent to a space reserve of 6 per cent—much less than is usually found necessary where flexible equipment is not provided.

Depending upon the type of material to be stored, various other types of racks and bins may be found serviceable. A hopper bin is very useful in some cases, and of course for handling bar stock, castings, barrels and such non-binned items, suitable storage facilities must be provided in addition to the standard racks and bins described.

It may be well at this point to mention the advisability of providing a "morgue" or definite storage place for semi-obsolete materials which it is not desirable to keep with the active items. This may be a special part of the regular storeroom devoted to the purpose, or a separate room may be provided where less attention need be given to systematic arrangement, storage, and handling. The same sort of provision for the temporary storage of strictly departmental and personal articles has been found extremely useful in keeping the departments clean and at the same time providing a definite and known storage place for all such miscellaneous articles.

There is little question that metal racks and bins offer many advantages over wooden equipment, even though

the original cost is somewhat greater. It is hoped that eventually metal equipment embodying the same degree of flexibility and interchangeability as the wooden units described will be placed upon the market.

In choosing the types of racks and bins and in laying out the storeroom very careful consideration should be given to the question of "double binning." This practice consists theoretically in simply dividing each bin into halves by a partition, and thereafter using one half as a receptacle for all incoming lots and making all withdrawals for issue from the other half, reversing the process when the latter half becomes empty.

On each bin is a bin tag, the incoming tag for recording in totals the amounts received from time to time, and the outgoing tag for entering each withdrawal as it occurs and bringing down the balance in this bin. A separate tag may be made out for each shipment received if desired, and in many cases this is the best practice. Should the unusual case occur where the incoming bin becomes filled before the outgoing bin is empty and overflow space is not available, the matter may be handled in a number of ways according to the storekeeper's judgment. For instance, a hand count may be made of what is left in the outgoing bin, the new shipment put in this bin with the old stock on top, and the amount added to this tag, and future issues made from this bin as before. This will result in the new lot being issued before the older material in the incoming bin, which may or may not be serious. If it is serious, the same procedure as described may be followed except that the tags are reversed and issues are made from the previous incoming bin.

FIG. 12—BIN NO. 8

Accurate Inventory Secured

The principle of double binning may be used with a great deal of profit in almost every storeroom and it should be incorporated wherever possible. I say the principle of double binning, for the method described may be followed where the material is not binned at all but piled or stacked on the floor or placed on trucks, or put in racks as is the case with bar stock.

One of the two outstanding results secured through double binning is *accuracy of inventory*, a consummation usually worth all it costs. There is one and only one way to be sure of what our inventory is, and that is to make an actual and careful physical count at the bin. The requirement is set up that whenever an issuing bin for any item becomes empty, or whenever a new shipment is received, a hand count must be made of the amount actually on hand. Whenever a bin tag becomes exhausted either because it is filled with entries or because the zero amount has been reached, it must be sent at once to the balance clerk so that the balance on the proper balance sheet may be checked. Therefore when the issuing bin becomes empty the balance on its bin tag should be zero, thus dictating a physical inventory of the incoming bin.

The result of this count is entered on the regular issuing tag or on the existing incoming tag, which accompanies the bin tag, and the two are sent to the balance clerk for checking. One of the duties of this person is to see that such counts are made regularly and accurately. It will be seen that this procedure results in the taking of inventory every time the issuing bin becomes empty but always for each item when there is least on hand.

Another partial check between the bin contents and the book balance may be secured currently between these physical inventories. When a bin tag becomes exhausted, even though the issuing bin is not yet empty, the amount on hand in the incoming bin (obtained simply from the entries on the incoming tags) may be added to the balance on the outgoing bin tag and the sum entered on the tag before it is sent to the balance clerk. This is simply a paper check which may be used between the actual physical count.

Enforced Turnover of Stock

The second, and in many cases equally important advantage of double binning arises through the enforced *turnover of goods on hand*. With this method of storage it is impossible to let steel parts, for instance, lie undisturbed in the bottom of a bin longer than the time taken in using what the bin holds. I have seen iron washers dumped from the bottom of single bins so completely rusted as to be quite worthless. They had simply remained there while issues were made from the top of the pile, or in other words from the supply most recently purchased. The necessity of thus turning over stock arises with all materials which rust easily or which, like rubber, are subject to deterioration in other ways.

The fortunate thing about double binning or piling is the fact that it ordinarily requires little more space than does single binning. If we start with a single bin holding a maximum of 8,000 bolts of a certain size and we wish to double bin them, we would put a partition in the middle with 4,000 on each side, and start issuing from one of these halves.

So far we have used no more space than originally, but since it is desired to keep new shipments out of the issuing bin, the vacant space which is constantly increasing in this bin is not available for storage, so that if the maximum to be stored at any time exceeds the capacity of the incoming bin (in this case 4,000) additional space becomes necessary. Unless resort to overflow bins be constantly made, this means a larger bin capacity than that required with single bins.

With a well arranged storeroom, however, the additional space thus required for binned items does not ordinarily exceed 25 to 35 per cent. For piled or racked materials where overhead space cannot be so effectively utilized, the percentage would be higher. This additional space in all cases, however, may ordinarily be secured in the average storeroom through attention to a more effective layout and a better space utilization, particularly of overhead room.

Minor Equipment Required

As regards office equipment, scales, ladders, trucks, tote cans and other minor equipment of the storeroom little need be said. It is not that such equipment is unimportant but that there is already a great body of descriptions and illustrations of these things. The investment in them forms a comparatively minor element ordinarily, and their various dealers are ready to help in selecting from the great variety offered, the particular type of equipment which best suits the varying local needs.

It is undeniably convenient to have the latest counting

and weighing machines, automatic conveyors and similar labor-saving equipment on hand when they are needed. But, on the other hand, the cost of the use of these facilities must be compared with the cost of their absence. In very large storerooms there is little question that the very best in such equipment is none too good and is a safe investment. On the other hand, I have found many cases where expensive tiering machines, counting and weighing machines, scales and the like remained covered with dust for very long periods. The cost of having such equipment on hand for the few times it was needed far exceeded what would have been the cost of using the good old strong-arm methods during the exceptional times when the latter became necessary. Just because these various pieces of apparatus are on the market and in use in many storerooms is no guarantee that they would be a profitable investment for our particular conditions.

If we have only two or three men in the storeroom anyway, all of the labor saving devices in the world might not enable us to release one of them or to give much better service. On the other hand, nothing should be sacrificed to accuracy and speed in the receiving, storing, and disbursing of materials, and in keeping the inventory figures correct. If an otherwise over-worked storekeeper is kept busy for an hour hand-counting items which could be accurately machine-counted in five minutes it would be niggardly not to supply him with scales for the purpose.

The layout of the storeroom and the provision of interchangeable standard racks suited to the business, as discussed previously, are matters for very careful consideration. These features of the work run quickly into thousands of dollars and vitally affect the long-time efficiency of operation of the department. Mistakes, furthermore, once made are not easily or cheaply rectified. As regards the minor equipment, the matter is ordinarily not so serious and conservatism is the best policy until the need in any particular case is fully proved.

Provision for Moving Materials

There is a certain minimum of equipment, however, which it would be foolish not to adopt forthwith in any storeroom. In the case of trucks, it is frequently found that not only are insufficient quantities of trucks provided, but that they have been poorly selected for the purpose to which they are to be put, and that they consist of miscellaneous kinds. It is always necessary to provide a minimum of trucks in any given case. To this minimum should be added a sufficient number so that the work of the storeroom is not held up for lack of a truck.

In this connection pains should be taken to see that trucks be properly loaded and expeditiously dispatched where needed and that empty trucks be systematically returned to designated stations. The type of truck best adapted to our particular business should be carefully ascertained, although the tendency to stock up with special trucks not suitable for miscellaneous moving must be guarded against.

The same considerations apply to tote boxes and other containers used for moving material on trucks or by hand. A slight additional investment for a supply of such equipment in addition to what the average storeroom has on hand will save the storekeeper and transportation men much time during the course of a few days.

An ample supply of suitable ladders will repay the investment in them. These should be made with a broad base, wide step, and plenty of room at the top on which to set tote boxes or individual articles. They should be light and provided with substantial casters whereby they may be quickly and readily moved from place to place.

Storing Materials on Wheels

Finally in the list of necessities comes the question of storage "on wheels" for all materials where this method is suitable. I refer to the stowage on elevating truck platforms of items which are ordinarily piled, such as paper, leather, shooks, cloth, box cartons in the flat state, and similar items. With most of such materials much unnecessary handling, both in the storeroom and in the shop, may be avoided by providing a sufficient number of platforms either with or without specially constructed racks on which the materials may be piled instead of on the floor.

In most cases with the exercise of a little ingenuity these platforms may be used to pile material to a considerable height. In some cases, above the practicable platform piling height, a permanent storage rack is erected under which sits the platform with its pile of material. The greatest advantage will be secured in this method of storage if standard lots may be determined upon as the amount to be piled on one platform. In this way no counting is necessary when a withdrawal is made, the elevating truck being simply run under the platform, raised, the load withdrawn, transported to the point of use, deposited, and the truck withdrawn for another load.

Unnecessary Handling

The possibilities for saving handling expense in the shop are very great with such platforms. I have counted no less than seven unnecessary handlings of materials in process through different machines, due to the unloading of the material from the ordinary type of truck to the floor, picking it up and putting it through the various machines, piling it on the floor again, loading it to the truck for transportation to the next machine, and finally unloading it to the floor beside this machine. Much of such handling, moreover, was done by the mechanic who left his machine idle, although there was plenty of work to be processed.

Breadth of Knowledge Needed

By Robert Grimshaw

This being an age of progress we must call on the foreman for that breadth of knowledge which will enable him to lay his most cherished beliefs in regard to his occupation on the table and dissect them calmly and thoroughly, with a view to discovering if his conceptions have not been based on false or insufficient premises.

Theory after theory in mechanics has been ruthlessly dissected and shown to be false, custom after custom laid aside for better ones, sometimes diametrically opposed in their method of working. I will instance only the introduction of high-speed tool steel, the entire success of which is based upon the fact that if it is to do better work than the ordinary or "carbon" steel, it must work at a pressure and speed that will develop a temperature which would be ruinous to the old kind.

The foreman must then discard all prejudices, have an open mind for discussion, be unsensitive to doubt of and attack upon his most warmly cherished opinions and practices. In other words, he must be broad minded.

Duralumin for Gearing

History of Duralumin—Some of the Properties that Make It Desirable for Worm- and Other Gearing—Its Strength and Wearing Qualities

By ROBERT W. DANIELS
Baush Machine Tool Co.

DURALUMIN is an aluminum alloy produced after years of systematic search to fill the demand for a material combining the lightness of aluminum with the strength and toughness associated with ferrous metals. This condition has been met to a remarkable degree, and the resulting physical characteristics make duralumin a most desirable material for certain kinds of gearing. As the commercial manufacture of this material in this country dates back a little more than two years, a short history and general description may be permissible at this point for the better understanding of the subject, although not strictly within the scope of this paper.

Duralumin was first made in Germany and was developed by A. Wilm and associates, during the years 1903 to 1914. The principal and unusual feature of this alloy is that after it has been hot, or hot- and cold-worked, it may be further strengthened and toughened from 40 to 50 per cent by heat-treatment. This heat-treatment is somewhat analogous to that of heat-treating alloy steels and consists of quenching from temperatures below its melting point followed by an aging process. The increased physical properties are not all produced immediately on quenching, but increase during the subsequent aging. In addition to being made in Germany, the manufacture of duralumin was taken up in England by Vickers, Ltd., prior to the late war. During that conflict its use for structural purposes in connection with aviation brought the material before the eyes of the engineering world. Today duralumin is recognized as occupying the same relative position to ordinary aluminum sheet or bar, that heat-treated alloy steel does to ordinary carbon steel.

Duralumin is an aluminum alloy containing copper, manganese and magnesium. Its strength and toughness are comparable with mild steel and are obtained with a specific gravity of 2.81 as against 7.8 for steel. The melting point is approximately 655 deg. C., the recalescence point is 520 deg. C., the annealing temperature is approximately 360 deg. C., and the coefficient of expansion is 0.00003237 per degree of temperature centigrade. The chemical composition of the alloy varies within the following limits: copper 3 to 5 per cent, magnesium 0.3 to 0.6 per cent, magnesium 0.4 to 1 per cent and the balance aluminum, plus impurities. Small quantities of other metals are sometimes added for certain specific reasons, as for instance, chromium may be added to increase the burnishing qualities of the alloy.

As the physical properties that may be obtained from duralumin have not had much publicity, the following U. S. Navy Specification, as drawn up by the Naval Aircraft Factory for duralumin sheet, rod and wire, will be of interest:

A—Use (1) This specification is drawn to cover the requirements of duralumin sheet, rods and wire supplied to the Naval Aircraft Factory.

Paper presented at the Rochester Meeting of the American Gear Manufacturers Association.

B—General (2) General specifications for the inspection of material, issued by the Navy Department, in effect at date of opening of bids, shall form part of this specification.

C—Material (3) Chemical content: This alloy shall show upon analysis the following chemical content: copper, 3.5 to 4.4 per cent; mangnesium, 0.2 to 0.75 per cent; manganese, 0.4 to 1.0 per cent; aluminum (minimum) 92 per cent.

(4) Specimens for analysis or test: Samples for analysis or test shall be taken from the sheet, rod or wire selected as provided by the inspector.

D—Manufacture (5) No scrap shall be used other than that produced in the manufacturer's own plants and of same composition as the material specified.

E—Workmanship and Finish (6) The sheets must be of uniform quality; they must be sound, smooth, clean, flat and free from buckles, seams, slivers, scratches and other defects.

(7) Material in which defects are revealed by manufacturing operations shall be replaced by the manufacturer, notwithstanding the fact that the sheets, rods or wires have previously passed inspection.

F—Physical Properties and Tests (8) Duralumin to be in the heat-treated condition. Physical Properties: Specific gravity, 2.8 to 2.85; yield point in tension, per square inch, 25,000 lb.; tensile strength per square inch, 55,000 lb.; Modulus of elasticity per sq. in., 9,400,000 lb.

(9) Selection of test specimens: At least one specimen for each of the tensile and bend tests shall be taken from a sheet selected to represent each individual melt of the material.

(10) The material shall be furnished in the annealed, quenched or as rolled condition, as specified in the order.

(11) When material is ordered either in "quenched" or "as rolled" condition, specimens for tensile and bend test shall be tested in the quenched condition. When material is ordered in the annealed condition specimens for tensile and bend tests shall be tested both in the physical condition in which the material is received and also in the quenched condition.

(12) Specimens for tensile and bend tests shall be prepared in accordance with the general specifications for inspection of material issued by the Navy Department, excepting that the form of test specimens shall be as shown in a sketch to be obtained upon application to the Naval Aircraft Factory.

(13) Tensile strength: Tensile test specimens cut in any direction from the sheets must have the properties shown in Table I.

(14) Bend Test: Specimens cut in any direction from sheets either annealed or quenched must withstand bending cold through an angle of 180 deg. over a diameter equal to four times the thickness of the sheet, without cracking.

G—Dimensions and Tolerances (15) The sheets shall be shipped in the lengths and widths called for in the order. The following tolerances will be allowed on the thickness of sheets.

It should be noted that in duralumin forgings where the sections are heavy it is advisable to lower the minimum tensile requirements to 50,000 lb. so that a proportional increase in elongation will be secured.

Duralumin is unaffected by mercury, is non-magnetic, withstands atmospheric influences, and offers a remarkable resistance to sea and fresh waters. It is only slightly affected by numerous chemicals, which in the ordinary way so readily corrode other metals and alloys; it does not tarnish in the presence of sulphurated hydrogen.

TABLE I. TENSILE TEST REQUIREMENTS

Physical Condition	Property	Sheets or Strips 0.05 In. or Less Thick		Sheets or Strips Over 0.05 In. Thick	
		Min.	Max.	Min.	Max.
ANNEALED	Ultimate tensile strength, lb. per sq.in..........	25,000	38,000	25,000	38,000
ANNEALED	Elongation per cent in two (2) in....	10		10	
Quenched (see note)	Ultimate tensile strength (min.), lb. per sq.in...	55,000		55,000	
Quenched (See note)	Yield point (min.) lb. per sq.in.....	25,000		25,000	
Quenched (See note)	Elongation per cent in two (2) in............	18		18	

NOTE.—Quenched specimens shall not be tested within four days after completion of heat-treatment.
Annealed specimens shall be tested within 12 hours after treatment.

Duralumin takes a polish equal to nickel-plating and remains bright without cleaning longer than any plated or silvered articles. It is the ideal substitute for aluminum, German silver, brass, copper, nickel-plated and silvered articles, and is the only substitute for steel, where lightness combined with the strength of that metal is required.

Duralumin is the only light alloy that can replace steel in forgings, with a two-thirds saving in weight. Heat-treated duralumin forgings approximate mild steel forgings in strength. Wherever weight is a deciding factor, duralumin is the most satisfactory alloy for most shapes made by hot working or forging. Duralumin forgings are especially desirable for reciprocating or moving parts where inertia, due to their own weight, forms a large part of the total stress.

Duralumin machines and polishes very easily and as it does not rust or corrode, it can be used in many places where weight is not the prime essential.

The manufacture of duralumin is somewhat analogous to that of steel and in brief is as follows: (1) Manufacture of alloy from its aluminum base; (2) casting the ingot; (3) hot rolling or cogging in blooms, billets or slabs; (4) hot or cold working to final shape; (5) heat-treating.

The ingots are poured at as low a temperature as is practicable, that is to say, just enough above the melting point to fill the mold and prevent cold shuts.

The ingots are then either hot rolled or cogged into slabs, blooms or billets, similar to the manner of working steel. This hot working is done at a temperature of from 450 to 480 deg. C. (850 to 900 deg. F.), and care must be used not to perform any work above these temperatures as there is a danger of hot-shortness if the material is rolled or forged at higher temperatures.

It is readily seen that such low temperatures cannot be judged by color, and it is therefore necessary to use accurate pyrometers in heating the alloy, previous to working.

The final rolling or forging may be done hot or cold according to the character of the work being handled or the nature of the shape it is desired to produce.

The hot or cold alloy in its final shape shows greatly improved physical properties over the cast ingot but the full development of its qualities is only obtained by a specific heat-treatment. To obtain this heat-treatment the alloy is heated to a temperature of 500 to 520 deg. C. (932 to 968 deg. F.), for a period of time, depending upon the section of the piece, and immediately quenched. The heating and quenching immediately start to improve the physical qualities, but the maximum results are obtained only by the subsequent aging. During the aging period, which takes from one to five days, the alloy markedly increases in tensile strength, hardness and elongation. Aging is sometimes accelerated by placing the alloy in a hot water bath up to 100 deg. C. (212 deg. F.), or in a hot room.

The above heat-treatment develops the remarkable properties possessed by duralumin and these properties have not been obtained in like degree in any other aluminum alloy.

The various stages of manufacture as related, increase the physical properties of duralumin by distinct steps, and are shown as follows:

The cast ingot shows a tensile strength of from 28,000 to 32,000 lb. per square inch, with an elongation of from 1 to 3 per cent.

The hot- or cold-worked alloy shows a tensile strength of from 40,000 to 50,000 lb. per square inch with an elongation of from 6 to 12 per cent. These last figures are quite variable depending upon the amount of working in the cold state. Upon subsequent heat-treatment and aging, the physical properties of duralumin show a marked increase, namely, 55,000 to 65,000 lb. tensile strength per square inch and an elongation of from 18 to 25 per cent.

When it is required to put a considerable amount of work upon duralumin in its finished state, it is often found necessary to anneal sheets between operations in precisely the same manner as other metals. This annealing should be done at 350 deg. C. (660 deg. F.). If several drawing operations are to be performed it may be necessary to anneal between such operations.

Annealed duralumin can be heat-treated, and the maximum physical properties obtained, no matter what shape or form it may be reduced to. Conversely, heat-treated duralumin may be annealed.

Duralumin may be cold worked after heat-treatment and aging. This operation produces a hard, smooth finish, and materially increases the tensile strength at the expense of elongation. That is, the tensile strength will increase from 6,000 to 10,000 lb. per square inch over the tensile strength of the heat-treated material, but the elongation may drop as low as 3 or 4 per cent.

Annealing and Heat-Treating

In the annealed form it can be drawn, spun, stamped and formed into a great variety of shapes, similar to brass and mild steel. The physical properties in this state average:

Ult. Tensile strength. per square inch	25 to 35,000 lb.
Yield point per square inch	22 to 24,000 lb.
Elongation in 2 in.	12 to 15 per cent
Brinell hardness	57
Scleroscope hardness	11

Duralumin in its heat-treated form may be slightly shaped or formed and may be bent cold to 180 deg. over

a mandrel, four times the thickness of the sheet. Its remarkable tensile strength is here combined with its maximum elongation as follows:

Ult. tensile strength per square inch	55 to 62,000 lb.
Yield point per square inch	30 to 36,000 lb.
Elongation in 2 in.	18 to 25 per cent
Brinell hardness	93 to 100
Scleroscope hardness	23 to 27

Heat-treated duralumin forgings have similar physical properties. Heat-treated and hard-rolled duralumin is used where no bending or forming is required. It is very hard, strong, and springy in this state, and machines or polishes beautifully.

TABLE II. ALLOWABLE TOLERANCES FOR SHEETS NOT WIDER THAN 18 INCHES

Inches Normal Thickness	Tolerances
0.0650 and more	—0.005
0.0350 to 0.0559	—0.003
0.0150 or less ...	—0.001

Its physical properties in this form average:

Ult. tensile strength per square inch	67 to 72,000 lb.
Yield point per square inch	58 to 65,000 lb.
Elongation in 2 in.	3 to 8 per cent
Brinell hardness	130 to 140
Scleroscope hardness	39 to 42

As a Material for Automotive Worm Wheels

From the general description of duralumin it will be readily seen that here is an ideal material for worm wheels provided the bearing or wearing qualities are satisfactory. For a given section the weight is one-third that of the conventional bronze. The tensile strength and relative high elastic limit insure superior tooth strength. The homogeneous structure and uniform hardness of heat-treated duralumin forgings insure entire freedom from hard spots, porosity and spongy areas so common in bronze castings, which entail not only machine loss, but uneven tooth wear in service. The excellent machining qualities insure the manufacturer a saving in his machining costs over bronze.

The wearing qualities of worm wheels for automotive purposes is best determined by actual road service, as bench or laboratory test results do not always correspond. It is instructive, however, to compare results obtained from duralumin with those of other materials under identical conditions. The data from various laboratory tests under the writer's observations on bronze and duralumin worm wheels, may be summarized by saying that tests destructive to duralumin worm wheels were also destructive to those made of bronze. Where duralumin and hardened steel are run together the results are always good. An example of this application is shown by duralumin connecting rods running directly on the wristpins with better life at this point than with the conventional bronze bushed rod of equal bearing area.

Comparative tests of bearings made from duralumin against bearings made of genuine babbitt, show that for shaft speeds exceeding 700 r.p.m. and loads over 200 lb. per square inch, duralumin bearings develop less friction, remain cooler and show practically no loss in weight under most severe conditions. It is needless to say that for lower bearing pressure and slower speeds, babbitt metal is superior. Table III shows the details of this test.

Returning to road tests, a considerable number of duralumin worm wheels are now actually in regular service in trucks ranging from one to 3½ tons capacity. These wheels have been in service from a few weeks to over two years without any failure. As these wheels are all running, complete data is not available, but through the courtesy of Mr. Green, general manager of the Fifth Avenue Coach Co., of New York City, I quote from the report of a preliminary test under date of Aug. 2, as follows:

The greatest possibility of effecting weight saving lies in the employment of aluminum or some of its alloys. With this idea in mind it was decided to test in road service a rear-axle worm wheel fabricated from an aluminum alloy commercially known as duralumin.

To determine by road test the merits of a duralumin worm wheel, especially noting its resistance to wear, relative weights, etc., as compared with the standard bronze unit.

Duralumin is a light aluminum alloy having a specific gravity of 2.82. It can be forged, stamped, drawn or spun. The product is highly resistant to corrosion. It is heat-treated by the producers in a manner which is not made public. They claim the following physical properties:

TABLE III. COMPARATIVE BEARING TEST

Loads in Lb. per Sq.In.	Revs. per Min.	Total Number Rev.	Final Temp. C	Final Temp., F.	Rise in Temp., C.	Rise in Temp., F.	Friction in Lb.		Loss of Weight in Grams
Baush Duralumin (Grade B)									
100	632	37,920	39	102	18	64	21.15		...
200	625	37,500	71	160	70	158	42.30		(1)
300	629	37,740	54	129	32	90	63.45		...
400	623	37,380	62	144	39	102	84.60		(2)
Genuine Babbitt U. S. Bureau of Standards									
100	694	12,230	89	192	53	95	22	0.023	...
200	706	16,510	102	216	58	104	29	0.021	...
300	686	15,150	125	257	100	180	38	0.013	(3)
400	603	5,500	139	282	94	169	79	0.054	(4)

(1) Bearing roughed and ran warm in 10 minutes.
(2) No measurable loss of weight.
(3) Belt slipping.
(4) Bearing seized, smoking.

Tensile strength	55,000 lb. per square inch
Elastic Limit	30,000 lb.
Elongation	18 per cent

Bend cold over 180 deg. on a mandrel four times the thickness of the sheet.

Worm wheel was cut having standard pitch and ratio.

The relative weights are as follows:

Duralumin	15 lb.
Standard Bronze	41.5 lb.
Difference	26.5 lb. (64 per cent)

Three duralumin worm wheels were procured from the Baush Machine Tool Co., and installed in standard worm carriers. Road tests were started on three 2A-type busses. Inspection of these parts was made periodically for the first few weeks' service and again during the next annual overhaul of these busses.

The results obtained with these sample worm wheels are recorded in the following tabulation.

	Bus 302	39	40
Date in	8/27/20	9/15/20	9/11/20
Date removed	6/20/21	In Service	6/17/21
Mileage	26,672	24,143	32,253
Fuel Avg. m.p.g.	6.75	6.52	6.65

It will be noted that a total of 83,068 miles have been covered with these units, all of which at the end of this period show excellent resistance to wear, along the pitch line. In one case the unit removed from bus No. 40 had a gearing failure behind the worm. Sides of this worm are slightly chipped, not sufficient, however, to prevent returning this to service with the others. Inspection of these parts after the above amount of service indicates wearing qualities equal to the standard bronze worm wheel. In view of the advantages to be obtained from the use of this material, it was recommended that several more be obtained for a more exhaustive test.

Before leaving worm gear tests an important condition is revealed by the examination of the lubricating oil. After long tests with bronze wheels where the oil has not been changed, the oil is found to contain particles of bronze in suspension. This condition in some tests is very marked and is of importance not alone as indicating tooth wear but as showing the deterioration of the lubricating value of the oil. Oil heavily charged with metallic particles acts more like an abrasive and less like a lubricant and is an important factor in automotive worm gear wear, as the oil is seldom renewed as often as desirable. When duralumin wheels were used the charging of the oil with metallic particles was practically negligible.

Indications point, as brought out by these tests, to excellent life as well as lightness for duralumin worm wheels, unless the wheels have been roughened by lack of lubrication or too high a tooth pressure which will injure or destroy any worm gearing.

For General Gearing Purposes

The same qualities that make duralumin a desirable material for automotive worm wheels also make this material valuable for plain spur and other gearing. It is suitable for this class of work where the pressures are sufficiently within its elastic limit of 30,000 lb. Where this condition is met, and weight and quietness are desirable, it replaces iron, steel, brass, fiber fabric, etc. Where duralumin can be run with steel rather than against itself, the best results are obtained. An example of this application is found in the timing gear trains of automobile motors where both long life and quietness are essential.

Helical spur gears of duralumin alternated with steel gears have been most successful in service. Detailed test reports are not especially interesting as the gear design varies with every motor, but the fact that upward of 60,000 duralumin camshaft and idler gears are now in use, is conclusive.

That duralumin gears when meshed with steel gears are quiet may seem somewhat paradoxical since when struck, all duralumin forgings are resonant. The explanation is undoubtedly due to the difference in pitch of the sound vibration of steel and duralumin. This, of course, is only true when the mass and section of the duralumin gear is properly proportioned to the steel gear.

It is obviously impossible to more than suggest the practicability of duralumin as a material for gearing, and owing to the short length of time duralumin blanks and forgings have been commercially available, much of the data being compiled are not yet available for publication. It is not too early, however, to say that another alloy has been added to the list of available materials, such as the ferrous metals, the copper alloys, and non-metallic materials, like raw-hide, fiber, etc., from which the gear manufacturers and users may select according to their needs.

The use of duralumin has solved or improved numerous gearing problems and holds much promise for widespread application, at least where lightness and quietness are of importance and where tooth pressures are not too high.

Does Forced Lubrication Score Bearings?

By Frederick Franz

Under the above title on page 919, Vol. 56, of *American Machinist*, Frank C. Hudson gives his observation that it does. He attempts an explanation of gritty oil, which is apparently indorsed in an editorial in the same issue. It is my opinion that the scoring is produced by a different cause.

He states that the splash system rarely scores the shaft. With the better possibilities of oil filtering in forced feed lubrication the splash system should score more frequently than the forced feed, if the scoring is due to the grit, for, other things being equal, the quantity of metal particles worn from the bearing and the freedom of this "grit" to pass between the bearing surfaces is the same.

I note his statement that the scoring is opposite the oil hole. Herein is the explanation. The high pressure of the oil emerging from the oil hole separates the shaft and housing *at that point*, but the reaction of this high pressure is taken at the opposite side of the bearing. On the average, for half a revolution the connecting-rod thrust is also on the opposite side. The sum of the two pressures is sufficient to overcome the lubricating property of the oil opposite the oil hole by rupturing the oil film and causing the scoring.

There are two remedies. One is to decrease the volume of oil forced through the system by decreasing the speed of the pump so that not more oil is fed to the bearing than the bearing will take in "on" side. This decrease in volume will decrease the oil pressure and therefore the initial oil-pressure-load on the bearing. Incidentally, some power will be saved in the pump in addition to the frictional saving.

The other remedy is to drill the oil hole clear through the shaft. The effect will be to equalize the oil pressure on both sides of the shaft. Only the live load will then be borne by the shaft. The best procedure for the engine manufacturer is to use both methods and to determine the proper quantity of oil by running tests.

Wise Is the Man Who Knows His Own Limitations

By Charles W. Lee

Now that the clouds are lifting somewhat, a little story of a former dullness in the machinery line may be permissible.

"Old Uncle Jim," who was a sort of handy man, very slow, and not excessively reliable, was among those laid off. He came around almost every day, hoping to be reinstated, so that he finally became somewhat of a nuisance. At last "the skipper" said to him, "Why Uncle Jim, can't you see that we can't give you what we haven't got? There is no work for you—there is absolutely no work to be done."

"Oh, well then," said Uncle Jim, "I am just the man you want. What little I would do wouldn't amount to anything anyhow, so you'd better take me back!"

Making the Pierce-Arrow Crankcase

The Machining Methods Shown Include Both Truck and Passenger Motors—Details as to Tolerances and Allowance for Oil Film

BY FRED H. COLVIN
Editor, *American Machinist*

THE Pierce-Arrow crankcase for either the passenger or the truck motor has to be very substantial and it is very carefully handled. The inside surface is thoroughly scraped and the cam and crankshaft holes chipped before it goes to the first machining operation. It is also stamped with its serial and factory order number at this point. The upper surface of the crankcase is then milled in the planer-type machine shown in Fig. 1. Here the two small diameter cutters *A* and *B* take the roughing cut, while the large single cutter *C* takes a second cut at the same setting. The roughing cut on both sides allows $\frac{1}{16}$ in. from the center of the camshaft hole for finishing.

The lower surface is milled on a Brown & Sharpe vertical milling machine, as shown in Fig. 2. The method of clamping the crankcase is quite similar in the two fixtures, care being taken to support the casting evenly in each case. The large diameter milling cutters, shown in both Fig. 1 and 2, are of rather interesting construction as can be seen by examining the illustrations. Safety screws play an important rôle in cases of this kind.

The second milling allows 0.006 to 0.008 in. for final milling which follows in due course.

Then comes the boring of the cylinder holes which is accomplished on the drilling machine shown in Fig. 3. This machine is fitted with a special table for moving the crankcase from one hole to the other. It so happens that the crankcase shown in some of the first illustrations belongs to the four-cylinder truck motor, but the operations are similar with both types of cases. The crankcase is positioned so as to bring substantial studs *A* through the holes in the castings, so that they can act as guides for the boring tool *B*. This method of guiding the boring tool insures the holes for each cylinder being correctly located.

After a few minor milling operations, the crankcase goes to the multiple drilling machine shown in Fig. 4, which drills the oil holes in the crankshaft bearing slots, the vertical overflow oil holes, the stud holes for the bearing caps, and other holes as well. Further drilling, reaming and counterboring brings us to boring the valve guide holes in the fixture shown in Fig. 5. This also shows a four-cylinder truck motor. This drilling plate or guide is equipped with handles cast at each end so that it can be readily lifted. Having the main holes drilled, the crankcase goes to a convenient bench and the small drilling fixtures shown in Fig. 6 are put into position. These fixtures guide the portable electric drill for drilling the angular oil holes and show how convenient such fixtures can be made for easy handling.

More drilling and milling is followed by the mounting of the crankshaft bearing caps and shims, these being numbered preparatory to boring. Before boring, however, the crankshaft bearings are straddle-milled while the crankcase is held in a vertical position, as shown in Fig. 7. A suitable gang of milling cutters face the ends of all bearings at one operation, leaving the crankcase ready for boring. Fig. 7 also shows a special cutter.

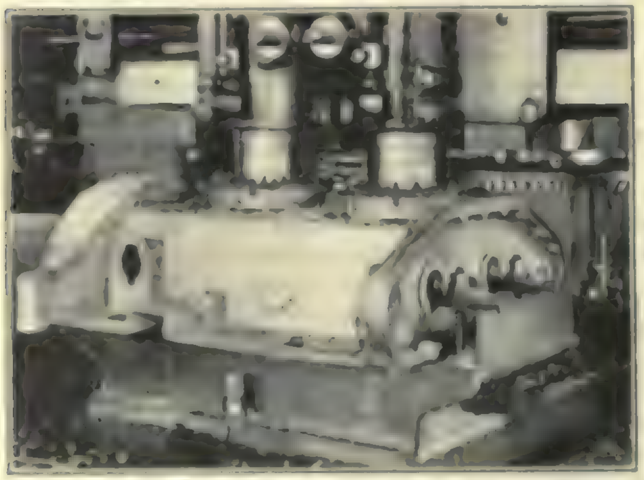


FIG. 1—MILLING THE TOP OF A TRUCK CRANKCASE. FIG. 2—MILLING CRANKCASE BOTTOM

The boring operation includes the crankshaft bearings and both the front and rear camshaft bearings. From 0.008 to 0.01 in. is left in rough-boring the camshaft and crankshaft holes, while the finish-boring allows from 0.003 to 0.005 in. for hand reaming. The boring fixture is shown in Fig. 8, which also gives a good idea of the great care taken to thoroughly lubricate the cutting tools during this operation.

The finish-boring operation is shown in Fig. 9. This view also shows the construction of the bearing caps, which are of aluminum, reinforced with a steel plate on the top. The finish boring is done with single point cutters, the cutters being shown in position for each bearing.

The Pierce-Arrow shop long ago abandoned scraping in bearings and adopted line reaming in its place.

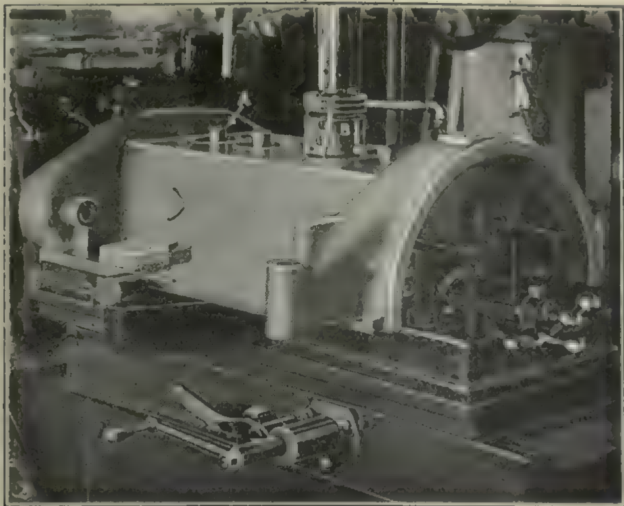


FIG. 3—BORING HOLES FOR TRUCK CYLINDERS.

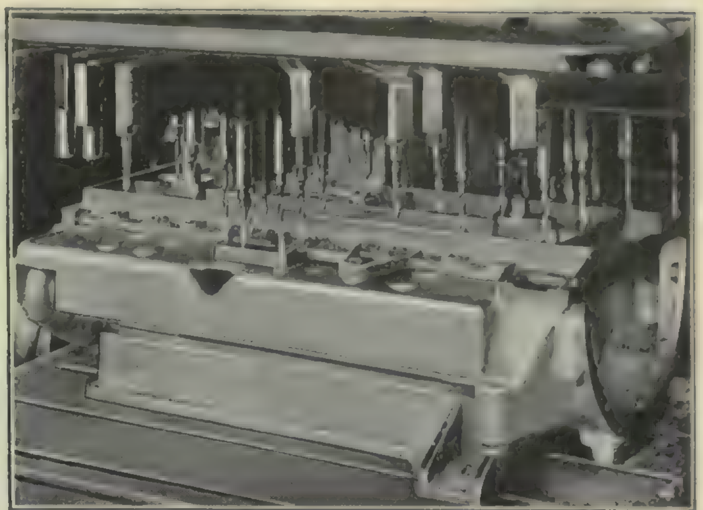


FIG. 4—ONE OF THE DRILLING OPERATIONS

Substantial fixtures of rigid design have been provided, as in Fig. 10, for power reaming. The reaming bar is supported at frequent points as *A*, *B* and *C* to eliminate any sag of the bar and its effect upon proper alignment.

The hand reaming is shown in Fig. 11, which gives a good idea of the substantial bushings and bearings used in the reaming fixtures to carry the bars. One of the shell reamers is also shown beside the bushings. The various bearings are then reamed to suit the crankshaft, which is kept within very close manufacturing tolerances.

Careful Reaming Operations

Great care is used in all the reaming operations, it being required that all camshaft bushings, except the one in the rear be close push fits when in the case. Plug gages are used in checking these holes, and the limit is 0.0002 to 0.0005 in., the tolerance desired being zero. The rear camshaft bushings are a drive fit in the case.

The camshaft must rotate freely in the bushings when it is in position. The main bearing caps must fit so as to slide freely over the studs without shake. The cap must set square on the case, any high spots being removed if necessary. The caps are then mounted on the case with steel reinforcing plates on top and the nuts drawn tight with an even tension, and marked for position on the studs. In this position the main bearings are line reamed. Similar precaution is taken in reaming the cases for the bearing bushings, plug gages being used at each end of the bearing to avoid the possibility of having the holes tapered.

Before fitting the bearings, all burrs are removed as well as all sharp corners on the bearing seat. Fitters are cautioned not to bend the bushings when tapping them into place in the crankcase. To avoid this a wooden block is used, as shown in Fig. 12. By resting this block squarely on both ends of the bearing bushings, they can be tapped into place without distortion. The cap is then mounted and the joint of the bearing tested for oil seal. With the cap mounted on the case and both edges of the bearings tight, there should not be more than 0.0005 in. clearance between the cap and case under any consideration.

Clearance Allowed in Bearings

Great care is taken to secure the proper end clearance in the various bearings. The facing to the exact length is done with the special facing bar shown in Fig. 13, with the bar supported in the center and at the end. This is very carefully done by hand with the inserted-tooth facing cutter *A*. The oil holes in the crankshaft are carefully examined for burrs and in fact

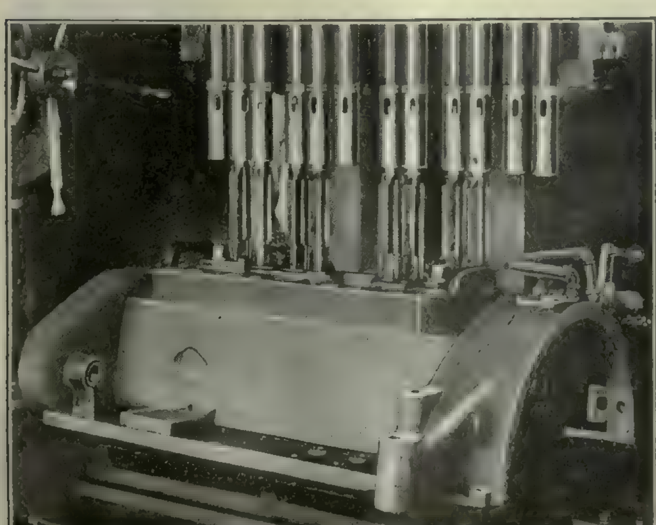


FIG. 5—REAMING THE VALVE GUIDE HOLES.

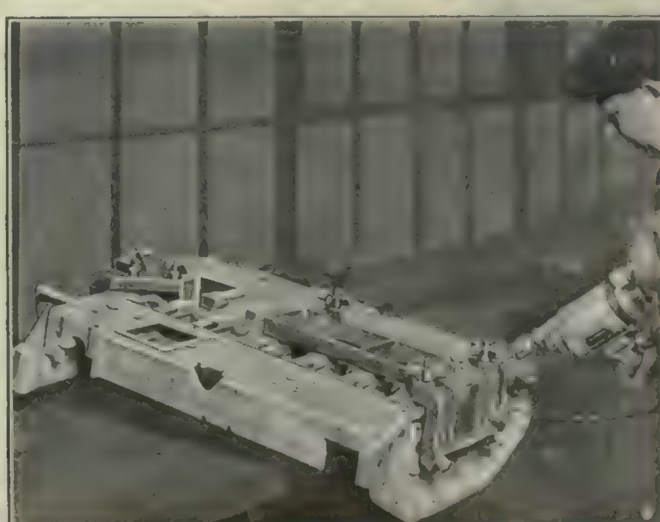
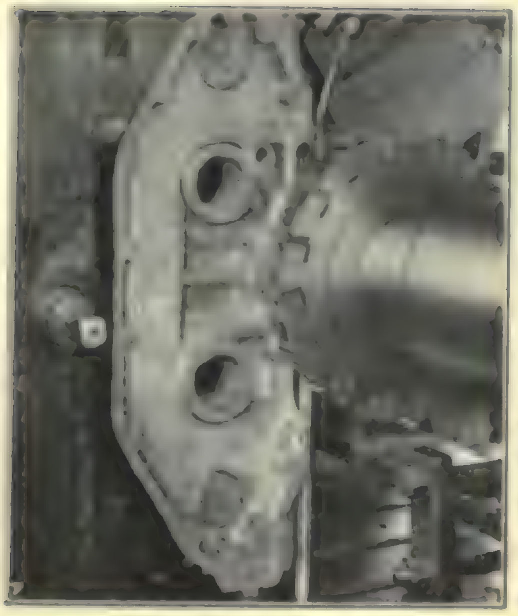


FIG. 6—DRILLING ANGULAR OIL HOLES



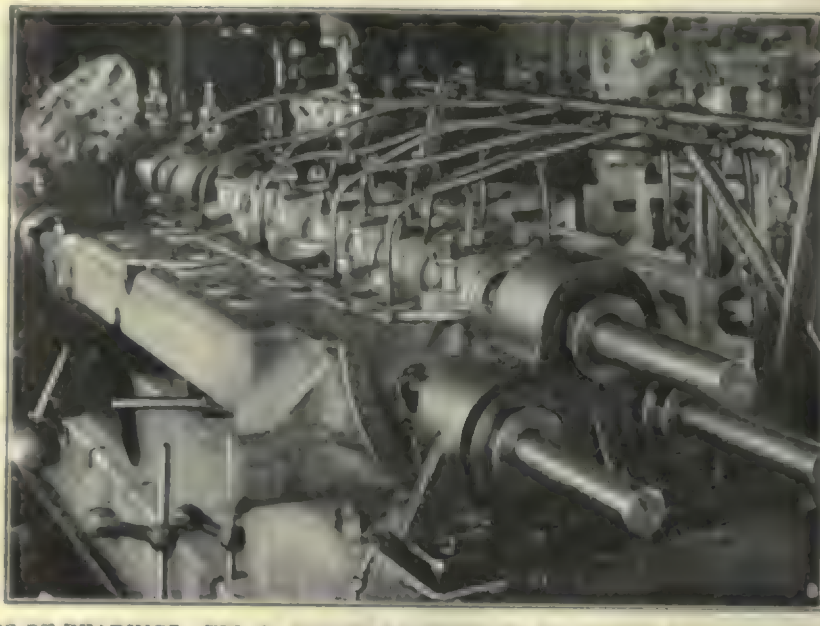


FIG. 7—STRADDLE-MILLING ENDS OF BEARINGS. FIG. 8—ROUGH-BORING THE CRANKCASE

this is quite an operation since it is a very important part of the assembling of a motor.

The clearances are carefully tested to the following standards:

Front end of main bearing	0.003 in.
Rear end of No. 2 bearing	0.005 in.
Rear end of No. 3 bearing	0.007 in.
Rear end of No. 4 bearing	0.010 in.
Rear end of No. 5 and 6 bearings	0.012 in.
Front ends of No. 2, 3, 4, 5 and 6 bearings	0.014 in.
Front end of No. 7 bearing	0.018 in.

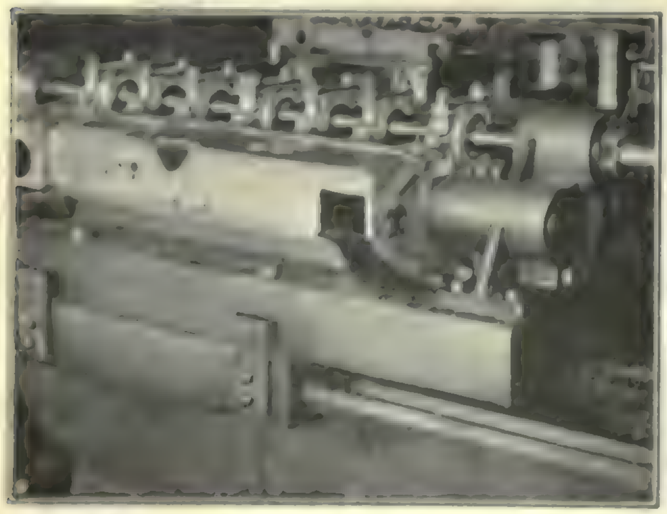
These clearances are carefully checked up by assembling the crankshaft in place, as in Fig. 14, the final testing being done just before the connecting rods are put in place on the assembling stand, Fig. 15. This view shows a feeler being used at the back end of the front bearing.

This form of assembly stand has proved very convenient in handling large motors, as it not only allows the motors to be rotated into any desired position but the whole thing is mounted on good-sized wheels so as to be readily moved to any desired location in the shop. The locking pin for holding it at any point of rotation, is shown at *A*.

All oil holes are carefully flushed out with gasoline, and when the crankshaft is placed in the bearings, the corresponding caps and the nuts are tightened down to the markings previously referred to. In this position the shaft must now revolve freely by hand. In order to check the bearings for the proper clearance, the caps are removed and a feeler 0.001 in. thick is placed on the crankshaft. The caps are then tightened to the markings on the nuts and studs. With this feeler in place, the shaft should rotate stiffly.

A feeler 0.0015 in. is then tried, one bearing at a time, in Nos. 2, 3, 4, 5, 6 and 7 bearings. If the cap tightens down and the shaft turns at all easily with this feeler in place, there is too much space for the oil film in the bearing. The desired clearance is 0.0015 in. in No. 1 bearing and 0.002 in. in all the others. The tolerance is 0.005 inch.

The crankpin bearings are fitted in a similar manner, measuring each crankpin and reaming the bearing to a size which will allow a clearance of 0.002 in. for the oil film. Before reaming the bearings, care is taken to be sure that the nuts are tightened uniformly and the ends of the bolts and tops of the nuts properly marked. Reaming is done very carefully, so as to obtain an even and smooth bearing of uniform size



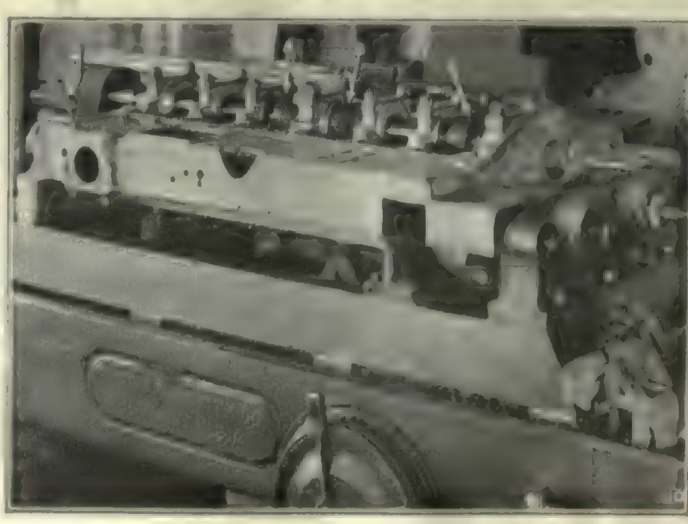
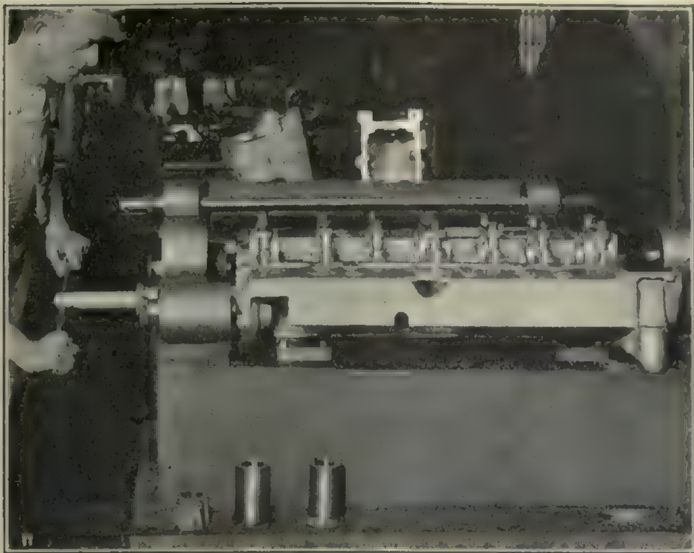


FIG. 9—BORING THE BEARING BUSHINGS WITH SINGLE-POINT TOOLS. FIG. 10—REAMING THE CRANKCASE



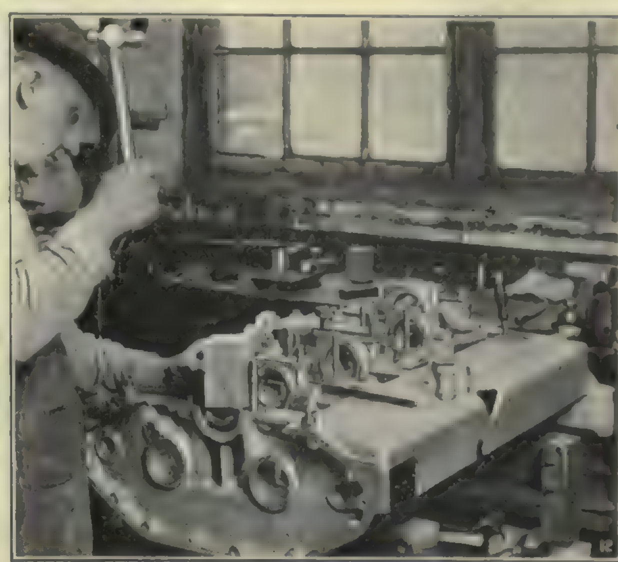


FIG. 11—HAND-REAMING THE BEARINGS. FIG. 12—FITTING THE BEARINGS IN ASSEMBLING MOTOR

at both ends. The bearings are tested at both ends with plugs 0.0015 in. over the crankpin size. The reamers are inspected frequently as to condition and size.

The end or side clearance for the connecting rods is from 0.002 to 0.004 in., 0.003 in. being the clearance desired. The fillets of the bearings, are scraped to fit the radii on the crankpins and this is also done with the main bearing. Hand scraping must not destroy the oil seal where the bearing joints come together.

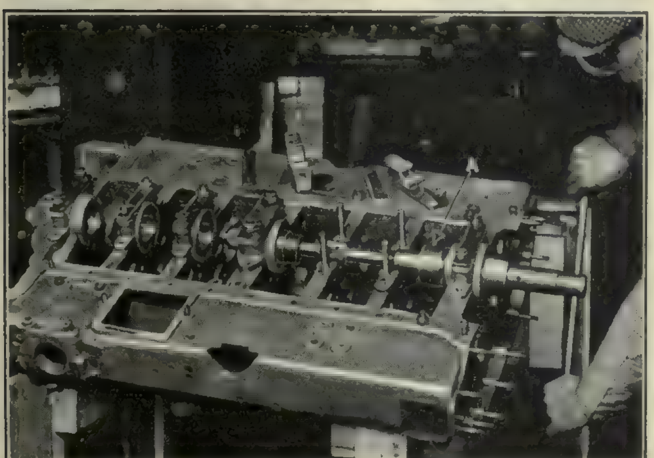
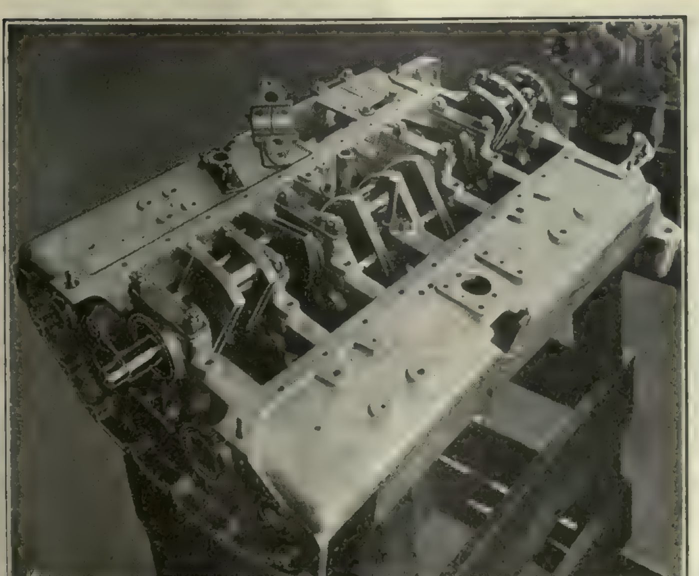


FIG. 13—FACING END OF MAIN BEARING

In mounting the connecting rod on the crankpin great care is taken to draw the nuts down evenly by turning them alternately so as not to distort the bearings. In order to be sure that the cap is correctly seated it is tapped lightly with a small hammer so as to insure an even bearing. The crankshaft is then rotated to try the feel of each bearing. The connecting rod bearings must turn freely on the shaft.

Connecting rods are balanced in sets and one of the last things before assembling is to pass a wire through all oil tubes and oil holes to make sure that there is a free passage.

It is attention to such details as these that makes the difference between cheap cars and cars of high grade. In too many cases perfectly good motor parts are so hurriedly assembled that the performance of the motor is greatly impaired, its life shortened and the user sooner or later deprived of the satisfaction to which he is entitled.



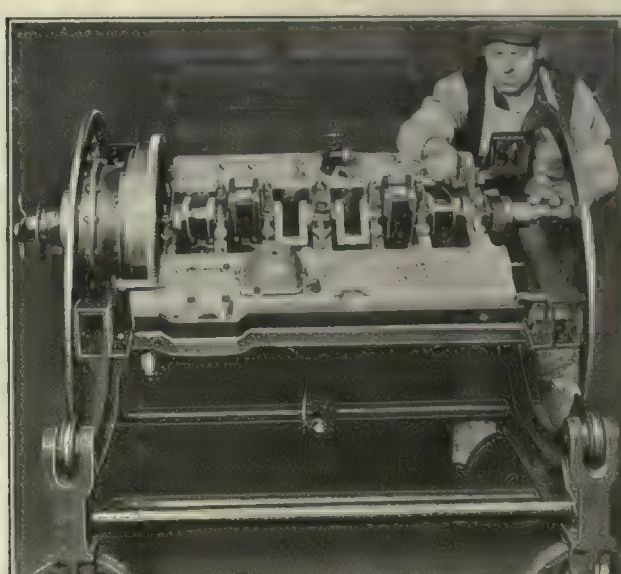


FIG. 14—CRANKSHAFT ASSEMBLED IN CRANKCASE. FIG. 15—TESTING END CLEARANCE IN CRANKSHAFT BEARINGS

Standardizing Tolerances and Allowances in Machine Fits

Suggestions by the A. S. M. E. Sectional Committee on Plain Gages as Compiled from the Practice of Many Well-Known Manufacturers

THE A. S. M. E. sectional committee on plain gages has devoted much time and energy to studying the question of various kinds of fits and allowances and tolerances used by leading builders of various kinds of machinery as a necessary preliminary to the problem of gages themselves. The committee has already adopted the following definitions, and they apply to what follows:

(A) Basic Size: The exact theoretical value from which all variations are made. (Example: The basic size of ⅞ in. is 0.875000 in., or the greatest accuracy obtainable.)

(B) Allowance: A difference in dimensions, the limits of which are prescribed. It is to provide for different kinds or classes of fits. It represents maximum tightness or minimum looseness. (It represents the condition of the largest permissible internal member mating with the smallest permissible external member. The zone represented by the allowance is positive for free fits and negative for force and shrink fits.) (Example: A shaft dimensioned 0.874 in. and a hole dimensioned 0.875 in. represents an allowance of 0.001 in. Using the same hole with a shaft dimensioned 0.876 in. represents an allowance of 0.001 in. also; but, as the shaft is larger than the hole, this allowance becomes a negative quantity.)

(C) Tolerance: A definite difference in the dimensions prescribed in order to permit variations in manufacture. It is equal to the difference between the maximum and minimum sizes specified. In the example under *Allowance*, we have given the ideal condition and the tightest fit permissible; but in manufacturing large numbers of pieces, these sizes could not be produced exactly, so variations must be made that will not prevent their proper functioning but enable them to be produced. These variations must therefore tend toward greater looseness. Therefore, if a manufacturing tolerance of 0.001 in. is required on each member, they would be dimensioned:

Shaft	0.874	+0.000	in.
		—0.001	in.
Hole	0.875	+0.001	in.
		—0.000	in.

We now have a condition in which the greatest looseness is 0.003 in., and the greatest tightness is 0.001 in. We therefore have the following commonly used terms and their equivalents:

Greatest Tightness Least Looseness Tightest Fit Neutral Zone Maximum Metal	Are all common terms which are the same as		Allowance
Least Tightness Greatest Looseness Loosest Fit Minimum Metal	Are all common terms which are the same as	Plus	Tolerance Allowance
Difference between largest and smallest permissible size of either members. Variation in the size allowed.	Now called		Tolerance

The basis for the following recommended allowances and tolerances is classification of fits, quite commonly known to the manufacturing public. Interference between mating parts takes place at the exact basic value of the dimension; hence, an accepted pair of mating standard gages become the "Go Gages" for mating parts which will prevent interference at the basic value of the dimension.

RECOMMENDED ALLOWANCES AND TOLERANCES
Values in Thousandths of an Inch

—Size—		Class I—Loose Fits						Class II-A—Free Fits						Class II-B—Medium Fits						Class II-A—Snug Fits					
						Tightest	Loosest					Tightest	Loosest					Tightest	Loosest					Tightest	Loosest
From	Up to and Including	—Hole— +	—	—Shaft— —	—	Allowance +	Allowance + Tolerances +	—Hole— +	—	—Shaft— —	—	Allowance +	Allowance + Tolerances +	—Hole— +	—	—Shaft— —	—	Allowance +	Allowance + Tolerances +	—Hole— +	—	—Shaft— —	—	Allowance +	Allowance + Tolerances +
0	½	1.5	0	1	2.5	1	4	.75	0	.5	1.25	.5	2	.5	0	.5	1	.5	1.5	.5	0	0	.25	0	.75
½	1	2.5	0	2	4.5	2	7	1	0	1	2	1	3	.75	0	.75	1.5	.75	2.25	.5	0	0	.5	0	1
1	2	3	0	3.5	6.5	3.5	9.5	1.5	0	2	3.5	2	5	1	0	1.5	2.5	1.5	3.5	.5	0	0	.5	0	1
2	3½	3.5	0	5	8.5	5	12	2	0	3	5	3	7	1	0	2	3	2	4	.75	0	0	.5	0	1.25
3½	6	4	0	7	11	7	15	2	0	4	6	4	8	1.5	0	2.5	4	2.5	5.5	1	0	0	.75	0	1.75

Due to the lack of a uniform and acceptable method of measuring the fitting surfaces of external members of a pair of mating parts, it is recommended that plugs, blocks, disks, and rods govern the checking of external members for the reason that usually the same measuring device will check for accuracy both the internal member and the gage for the external member, thus avoiding an interference when both members appear to have the same dimension.

In the following allowances and tolerances, the best practice available was considered, and where differences occurred a compromise was attempted.

It is not deemed feasible at the present writing to lay down allowances and tolerances which will apply to all work. Many so-called standard fits are made in

the industries which are not interchangeable, and an attempt to make them so would be prohibitive, in cost. They do, however, require to be made on a production basis, and it is believed that the tables here given will be found to contain allowances and tolerances which are suitable for most work, even if some individual fitting of parts is desired.

In choosing the class of fit for manufacture, the engineer should keep in mind that cost usually increases proportionately to the accuracy required, and no finer class of fit should be chosen than the functional requirements actually demand. It is axiomatical that the closer the fit the smaller the manufacturing tolerance, and usually the greater the cost. The length of engagement of the fit also plays an important part in the selection of the class of fit for a piece of work. It is obvious that a long engagement will tolerate more looseness than a short one, and due regard should be paid to this feature.

The following classification of fits is recommended.

Class I—Loose Fit

This fit provides for considerable freedom and embraces those fits where accuracy is not essential. Examples: Machined fits of agricultural and mining machinery; controlling apparatus for marine work; textile, rubber, candy, and bread machinery; general machinery of a similar grade; some ordnance material.

Class II-A—Free Fit, Liberal Allowance

For running fits with speeds 600 r.p.m. or over, and journal pressures of 600 lb. per square inch or over. Such as dynamos, motors engines and many machine tool parts, some automotive parts.

RECOMMENDED ALLOWANCES AND TOLERANCES
Values in Thousandths of an Inch

Diam.		Class III-B Wringing Fits				Tightest	Loosest	Class IV-A Tight Fits				Tightest	Loosest	Class IV-B Medium Force Fits				Tightest	Loosest	Class IV-C Heavy Force or Shrink Fits				Tightest	Loosest
From	Up to and Including	Hole		Shaft		Allowance	Allowance + Tolerance	Hole		Shaft		Allowance	Allowance + Tolerances	Hole		Shaft		Allowance	Allowance + Tolerances	Hole		Shaft		Allowance	Allowance + Tolerances
		+	—	+	+	—	+	+	—	+	+	—	+	+	—	+	+	—	+	+	—	+	+	—	—
0	½	.5	0	.25	0	.25	.5	.5	0	.75	.25	.75	.25	.5	0	.75	.25	.75	+.25	.5	0	1	.5	1	0
½	1	.5	0	.5	0	.5	.5	.5	0	.75	.25	.75	.25	.5	0	1	.5	1	0	.5	0	1.25	.75	1.25	.25
1	2	.5	0	.5	0	.5	.5	.5	0	1	.5	1	0	.5	0	1.25	.75	1.25	—.25	.5	0	2	1.5	2	1
2	3½	.75	0	.5	0	.5	.75	.75	0	1.5	.75	1.5	0	.75	0	2.25	1.5	2.25	—.75	.75	0	3.75	3	3.75	2.25
3½	6	1	0	.75	0	.75	1	1	0	2	1	2	0	1	0	3.5	2.5	3.5	—1.5	1	0	6	5	6	4

Negative (or—) Allowance denotes tight fit.
The desired fit between these extremes can be obtained by proper selection at Assembly, that is, the small shafts in the small holes and the large shafts in the large holes.

Class II-B—Medium Fit, Medium Allowance

For running fits under 600 r.p.m., and with less than 600 lb. per square inch in journal pressure, also for sliding fits, the more accurate machine tool and automotive parts.

Class III-A—Snug Fits, Small Allowance

This is the closest fit which can be assembled by hand and necessitates work of considerable precision. It is used where no perceptible shake is permissible and where moving parts are not intended to move freely under a load.

Class III-B—Wringing Fit, No Allowance

This is also known as a "tunking fit" and it is practically metal to metal. Assembly is usually selective and not interchangeable.

Class IV-A—Tight Fits, Slight Negative Allowance

Light pressure required to assemble and are more or less permanently set. They are used for the fixed end of studs for gears, pulleys, rocker arms, etc. Drive fits in thin sections or extremely long fits in other sections. Used in automotive, ordnance, and general machine manufacturing. Also used for shrink fits on very light sections.

FORMULAS
RECOMMENDED ALLOWANCES AND TOLERANCES

Class of Fit		Allowance	Hole Tolerance	Shaft Tolerance
I	Loose	$.0025\sqrt[3]{d^2}$	$.0025\sqrt[3]{d}$	$0025\sqrt[3]{d}$
II-A	Free	$.0014\sqrt[3]{d^2}$	$.0013\sqrt[3]{d}$	$.0013\sqrt[3]{d}$
II-B	Medium	$.0009\sqrt[3]{d^2}$	$.0008\sqrt[3]{d}$	$0008\sqrt[3]{d}$
III-A	Snug	0	$.0006\sqrt[3]{d}$	$.0004\sqrt[3]{d}$
III-B	Wringing	0 (selective assembly)	$.0006\sqrt[3]{d}$	$.0004\sqrt[3]{d}$
IV-A	Tight	$—.00025\,D$ (selective assembly)	$.0006\sqrt[3]{d}$	$.0006\sqrt[3]{d}$
IV-B	Medium force	$—.0005\,d$ (selective assembly)	$.0006\sqrt[3]{d}$	$.0006\sqrt[3]{d}$
IV-C	Heavy force or shrink	$—.001\,d$ (selective assembly)	$.0006\sqrt[3]{d}$	$.0006\sqrt[3]{d}$

d = Diameter of fit in inches.
The Formulas for Allowance Values give the ideal condition of fit.

Class IV-B—Medium Force Fits, Negative Allowance

Considerable pressure required and are considered permanently assembled. Used in fastening locomotive wheels, car wheels, armatures of dynamos and motors, and crank disks to their axles or shafts. Also used for shrink fits on medium sections or long fits.

Class IV-C—Heavy Force and Shrink Fits, Considerable Negative Allowance

Used for fits where metal will stand great stress and where a heavy force fit is impractical. Such as locomotive wheel tires, heavy crank disks of large engines, etc.

The committee will appreciate constructive criticism as to the tolerances and allowances suggested, as it desires that its final report shall be in accord with the best practice so as to be more readily adopted. Suggestions should be sent to E. C. Peck, chairman, general superintendent, Cleveland Twist Drill Co., Cleveland, Ohio. An open meeting will be held in New York on a date to be announced later.

Special Test Block for the Scleroscope

By Albert F. Shore
President, Shore Instrument Company

It is a well-known fact that in the various lines of manufacturing practice, there are developed from time to time new wrinkles which not only make for better economy, but also serve to keep present methods up to date. Sometimes we call these "tricks of the trade," and it is needless to say that without them, complete success would be uncertain.

The application of the hardness test, which has now become practically universal in all kinds of machine building, in a sense is no exception. In scleroscope practice, extended experience has shown that if a variety of metals is tested under the diamond drop hammer, and after a long time the diamond point wears out of shape enough to cause a lower reading, these readings will be low in proportion throughout the scale. By this is meant that, for example, if on the centigrade scale used, the instrument reads 5 per cent low on hardened steel at 100, it would also read 5 per cent low on metal 50 hard, in which instance instead of being short 5 deg. it would be only 2½ deg. and so on down to zero.

If, on the other hand, the scleroscope is continuously used on a metal having a hardness averaging in any fixed part of the scale only, as for example, in heat-treated steel at 75 or 80 hard, it has been found that the diamond point wears differently, or in a manner peculiar to that particular part of the hardness range. For this reason it has been found advantageous to use special checking blocks having a tested hardness the same as the run of pieces cited, as apart from the regular ones which accompany the standard scleroscope testing set. These approximate 30 hard for the soft block and 100 hard for the hard block.

It is here to be understood that when wear occurs on the diamond point peculiar to the above cited run of steels (75 to 80 hard), a drop in the reading resulting from this wear may or may not be of a uniform ratio throughout the whole scale. Hence, in quantity production, not only are these special reference blocks used for the purpose of checking up the scleroscope more directly, but often a collection of samples of exceptional quality or adaptability for special purposes are kept on hand for future references, and also these are sometimes loaned to outside metal or parts manufacturers who are required to fill orders to hardness specifications.

There is a general impression that hardness testing instruments only show comparative values and the suggestions just made, at first sight, would appear to substantiate such impressions. The latest researches embodied in the writer's paper read before the Iron and Steel Institute in England in 1918, show the scleroscope does measure absolute quantitative hardness. Expressed in terms of tons of pressure per square inch the material can resist, or as exerted in miniature by the scleroscope drop hammer to overcome such resistance, admittedly a special scale would have to be inserted, in place of the regular centigrade scale now used, that after fourteen years has become so popular. This scale is a close agreement with the elastic limit strength-hardness comparison scale, regularly included in scleroscope literature, and which is nowadays found within constant reach of draftsmen, designers and metallurgists throughout the world.

In hardness testing it is important at all times to be sure that the instrument is reading up to a recognized standard. In this regard, the systems adopted by Brinell and used for the scleroscope are different. The Brinell uses two constants, a recognized standard diameter of ball, and a recognized standard pressure. The scleroscope has for its two constants a fixed height of drop representing the pressure for its indentor hammer, and reference blocks of tested standard hardness. The Brinell pressures must be changed on the softer metals to avoid flow in them.

The rebound principal used in the scleroscope happily lends itself to testing without special adjustment of pressure throughout the entire hardness range. That is to say, by the use of the universal hammer, which has a diamond striking point, by which the softest lead to the most intensely hard steel is tested, the indicating principal can be used against any scale. For example, the Brinell scale can be used, or a scale representing resistance to penetration in tons per square inch. Inasmuch as the latter two involve odd figures however and which are difficult to comprehend in making comparisons, we come back to the centigrade scale which permits all softer metals to be compared with the round number "100," representing the average for hardened steel.

Do Gear Speeds Vary?

By A. L. DeVinne

Permit me to take exception to a few sentences in an article under the head of "The Grinding of Gear Teeth," on page 779 of *American Machinist*. The writer, after stating very correctly that teeth accurately formed to the true involute curve will operate accurately and relatively quietly on spread-center distance, and that in gear cutting it frequently occurs that one of a pair of gears will be off in form and make noise, says that the action of gears operating with curves placed too high or too low (whatever that is) is to cause the gears to move with a speed varying up and down with each tooth action.

If I understand the matter correctly, he intimates that the relation of the gears (note the plural) will be intermittent or at least irregular—alternately fast and slow. As one of these is a driver, I fail to see how its rotation speed can vary because its teeth hurt it. And, except in the case of pinions with very few teeth, we find from two to three teeth in contact at once—one in full action, one just coming into action and one just going out, all three rolling; and as the teeth on each wheel are fixed with regard to the gear body and each other, I am puzzled to see how the driven gear—much less the driver—can have irregular rotation velocity.

In the next column we have the same things restated: That "after each tooth contact the mating gear is accelerated or retarded abruptly." What is the next tooth ahead doing, all this time? And the next one behind? Both should be in contact and doing some work—either driving or resisting driving—which is what they are there for.

Applying the same principle to herringbone gears, would we not find the edges running at different rotation speeds from the center of face width? In the matter of pressure-angle, have not the actual and the relative number of teeth something to do with the choice?

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Machine Furniture that Saves Setting-up Time

By Frank C. Hudson

Machine furniture, such as blocks, straps, stops, bolts, etc., has more to do with saving time in setting up jobs on planers and boring machines than many seem to realize. The time taken to hunt up odd blocks of wood or metal, to borrow them perhaps from some other machine, or to use pieces that are not suitable and which may slip at the most inopportune moment, all add to that intangible overhead which drives the estimator to despair and too often puts the cost of the job on the wrong side of the ledger.

As a contrast to this method, and perhaps seeming even to go to the other extreme, is the set of boring-

BOLTS, STRAPS, BLOCKS AND STOPS FOR SETTING-UP WORK

machine furniture which the Lucas Machine Tool Co. makes for its own use in its shop in Cleveland. The furniture was designed particularly for handling any kind of work that may come along, as the regular work is, of course, handled in special blocks or fixtures. With such a set of furniture as shown here a mechanic can block up and secure almost any shaped piece in the minimum of time and with no danger of its slipping.

Seven different lengths of bolts are shown at *A*, together with two thicknesses of washers and with nuts chamfered on both sides. The bolts have round heads which are flattened to prevent turning in the T-slots. In front at *B*, are extension bolts and long coupling nuts with pin holes, as well as hexagon sides. These coupling nuts enable almost unlimited extensions to be made for special work.

Two kinds of straps are shown at *C*, each being in three different sizes.

Blocks of various kinds and heights are shown at *D*. The rectangular blocks are made in three sizes and can be built up when necessary, by placing one on top of the other. The stepped blocks are all the same and can be used directly on the table of the machine, or on top of the rectangular blocks as shown.

Two sizes of an entirely different type of block are shown at *E*. This type has a tongue which fits the boring machine table and is of such dimensions as to give different heights when tipped in different positions. The blocks are drilled for bolts in two directions and the holes are countersunk for easy seating of the chamfered nuts. The proportions of these blocks have been carefully considered to give maximum usefulness in setting up work.

Then come the screw stops at *F* which have a wide field of usefulness. They can be bolted in position in any slot by one of the regular bolts which forms a part of this outfit, and are tapped for screws at three different heights in each direction. It is hard to imagine any piece of work that requires a screw stop that could not be handled with this combination.

This will probably seem like a very elaborate outfit to many shop men and some will probably think of the first cost in comparison to a few pieces of scantling and some old bolts which they use. But if the recording angel of time could show them the many hours they have wasted in setting up work because they did not have the right blocking, because bolts were too long or too short, because stops were missing or clamps didn't hold, they would realize how expensive some alleged economies really can be. They too often overlook the fact that the cost of tying up an expensive machine for a half hour frequently means more than a day's wages of the man who runs it.

Power Chart for Silent Chain

By W. W. Gaylord

Having recently to apply motor drives to a number of old machines, and finding the silent chain the most satisfactory method of driving them, the writer has felt the need of a more convenient way of choosing satisfactory sizes of chain and sprockets than is provided by the data given in chain catalogs. Consequently, he has devised the accompanying chart in which all the data necessary to find the sizes of the chain and sprockets are given.

Working an example is the most satisfactory method of showing how the chart is used, so assume that it is required to drive a machine the shaft of which runs at 250 r.p.m., and that it is desired to use a 7.5-hp. motor running at 865 r.p.m. at full-load speed. Assume that Morse chain is to be used with a speed of 1,200 ft. per minute or less, and that a 21-tooth motor sprocket is desired.

Lay a straightedge across the chart from 1,200 on

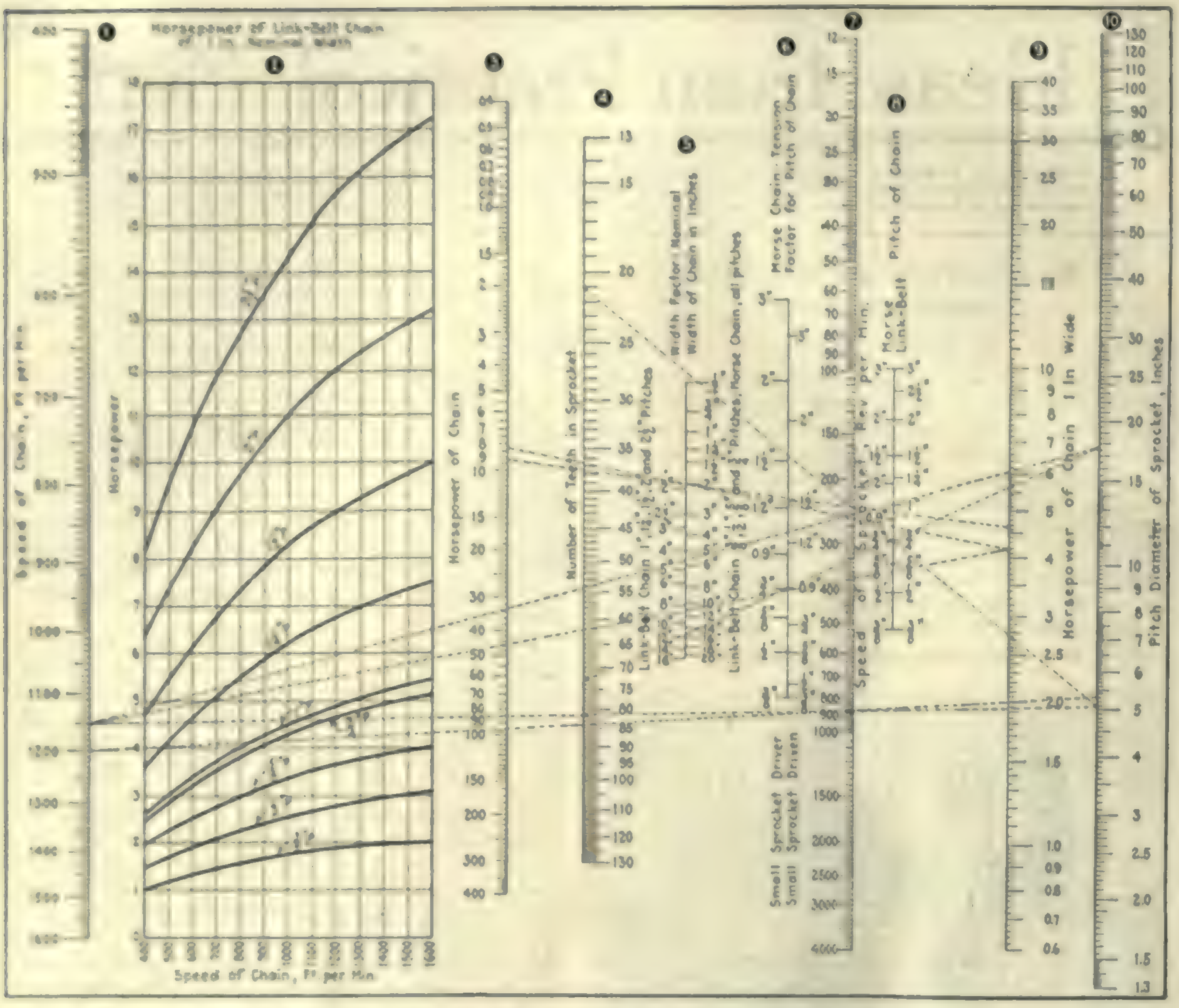


CHART FOR CALCULATING THE POWER DELIVERED BY SILENT CHAIN

the "speed of chain" scale (1), through 865 on the "speed of sprocket" scale (7), and read the "pitch diameter of sprocket" scale (10). This shows that the motor sprocket should be a little over 5 in. in pitch diameter. Then, placing a straightedge at 21 on the "number of teeth" scale (4) and near 5 in. on the pitch diameter scale (10), read the "pitch of chain" scale (8). Note that 21 teeth at ¾-in. pitch will give a pitch diameter of 5.07 in., so that a ¾-in. pitch should be used. Now a line from 5.07 in. on the pitch diameter scale (10) through 865 on the speed of sprocket scale (7), intersects the speed of chain scale (1) at 1,152 ft. per minute, which is the chain speed to use.

Then a line from this point through 250 on the speed of sprocket scale (7) cuts the pitch diameter scale (10) at 17.6 in.; and a line from this intersection through ¾ in. on the pitch of chain scale (8) cuts the number of teeth scale (4) nearest 73, which is the number of teeth required in the driven sprocket.

Now to find the width of chain to deliver 7.5 hp. From 1,152 on the speed of chain scale (1) pass a line through ¾-in. pitch on the "tension factor" scale (6), intersecting the scale (9) of "horsepower for chain 1 in. wide" at 4.18. Then a line from this value through 2 in. on the "width factor" scale (5) cuts the "horsepower of chain" scale (3) at 8.36, which shows that a chain 2 in. wide is ample for this installation.

If it had been desired to use Link-Belt chain instead of Morse, the procedure would have been the same as far as finding the sprocket sizes and chain speed; but the horsepower of a chain 1 in. wide would have been found from the curves (2) at the left of the chart. Reading the value where the speed of chain of 1,152 ft. per minute cuts the power curve for ¾-in. pitch, which gives 4.57 hp., and then proceeding as before, gives 9.14 hp. as the value for 2-in. chain.

The power curves for Link-Belt chain will be found to closely approximate the values given in Link-Belt Data Book No. 125. The reason for the apparent small difference between ¾- and 1-in. pitch is that chains of 1-in. pitch and over have an effective width of about ⅛ in. less than the nominal width, which condition is taken care of in the "width factor" scale.

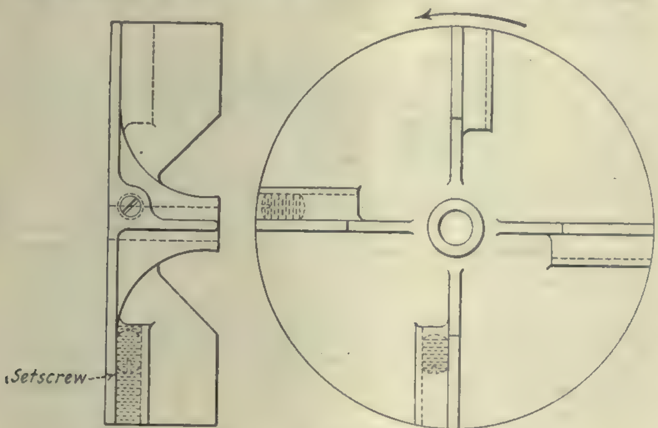
The use of the chart when other factors than those assumed are given or required is so obvious that it needs no further explanation, but the chart has been found helpful in all problems involving the use of silent chain.

Rapid Method of Static Balancing

By John L. Alden

The balancing of small high-speed rotors is generally a slow process. Balance weights must be added, or metal must be drilled or filed away. The writer has had considerable success with a method which does not require removing the piece from the balancing ways. Inasmuch as no drilling, filing, or adding of weights must be done during the balancing operation, the work is accomplished with a minimum of lost time. As described, this scheme covers the use of a counterweight of fixed magnitude with a variable lever arm, in contrast with the usual arrangement employing a variable mass with a more or less fixed arm.

The fan wheel shown in the illustration is a good example of this method. This is a four-bladed cast-iron wheel about 6 in. in diameter. The back of each blade, where it joins the back plate. is enlarged to permit drilling and tapping for a ⅜ in. headless setscrew. When first placing the wheel on the ways, all setscrew holes are empty. As soon as the light



FAN WHEEL BALANCED BY SETSCREWS

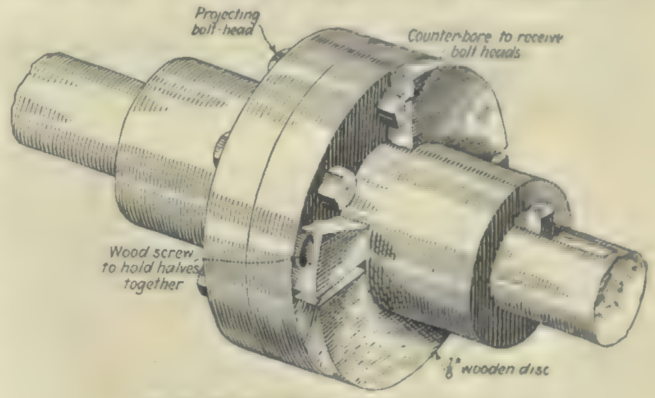
side of the wheel is determined, a setscrew is started in the nearest blade. With only a few threads engaged, the lever arm of the screw is a maximum, and if the wheel is now overbalanced, the excess weight may be counteracted by screwing in the screw, shortening the lever arm. If, when the lever arm is reduced to its smallest amount, the wheel is still overbalanced, a screw in the opposite hole must be employed. Working the screws in and out will quickly bring about balance. Usually but two screws are necessary, although some cases require all four. Where the design will permit, no more than three screws need be used.

The same scheme has been used in balancing large textile flyers, except that the screws were auxiliary balance weights, the larger part of the unbalance being corrected by steel weights into which the screws were tapped. The weights were made a trifle smaller than necessary to secure balance, the difference being made up by the screws which were moved in or out from the center of rotation.

Safeguarding Shaft Couplings

By E. Hoke

To satisfy a factory inspector and at the same time save the expense of purchasing and installing a number of new shaft couplings in place of equipment already in use, was a problem with which I recently found myself confronted. The couplings were of a type familiar to readers of *American Machinist*. They were the kind in which the bolt heads protruded from the sides. To this feature the inspector had objected and removal of the couplings was ordered. A simple, inexpensive safeguard, as shown in the accompanying illustration, was devised as a solution to the problem.



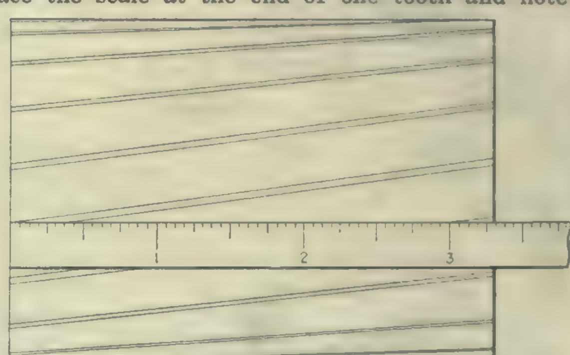
SAFEGUARDING SHAFT COUPLING

Disks of ⅞-in. pine lumber were cut on a bandsaw to a diameter corresponding to the outside diameter of the coupling. Holes were cut in the disks to a diameter corresponding to the outside diameter of the hub of the coupling, after which the disks were cut in half on a circular saw producing a wide kerf. The pieces were then drilled and counterbored, as shown in the illustration, to receive No. 9 x 2-in. round-head wood screws. One disk was laid out on the bolt circle and drilled. Using it as a templet, the remaining disks were drilled and counterbored to a depth sufficient to clear the bolt heads when fitted to the sides of the couplings. A coat of black paint, finally, was given the pieces and all were fitted to the couplings during one noon hour.

Finding the Lead of a Spiral Cutter

By F. H. Sweet

To find the lead of a spiral milling cutter, place the cutter on the marking-off table or surface plate and apply an ordinary scale, as shown in the illustration. Place the scale at the end of one tooth and note the



FINDING THE LEAD OF A SPIRAL CUTTER

distance where the edge of the scale cuts the line of the next tooth. Multiply this distance by the number of teeth and the result will be very close to the lead. The sketch shows a distance of 3 in. from the face of one tooth to the face of the next tooth, measured axially on the cutter. If the cutter has ten teeth, the lead is ten times 3 in. or 30 inches.

Recessing Tool for Screw Machine

By G. G. Spicer

Having an order for a quantity of the small rings shown in section at *A*, I devised the tool shown herewith to make the recess. It was fitted to one of the turret holes of the screw machine upon which the rings were produced and it worked very nicely.

After the ring was bored and reamed the recessing tool was brought to position and advanced into the work until the turret-slide stop indicated the proper

A RECESSING TOOL FOR THE SCREW MACHINE

depth; then by pressing with the hand upon the small knob *B* the cutting end of the tool *C* was pushed outward to form the recess.

The body of the tool is a round piece fitted to the diameter of the reamed hole in the ring and having a suitable slot milled lengthwise to accommodate the rocking cutter, for which a fulcrum was provided by a shouldered screw as shown.

The rear end of the lever-shaped cutting tool was turned and threaded to fit the little knob, and a cell was counterbored into the knob to hold a suitable coil spring. The depth of the recess could thus be regulated by adjusting the knob, which stopped against the body when the determined depth of recess had been reached and, upon being released, the spring would withdraw the cutting end of the tool flush with the body so that the turret could be backed away.

[What became of the chips? Editor.]

Combination Piercing, Shearing and Forming Tools

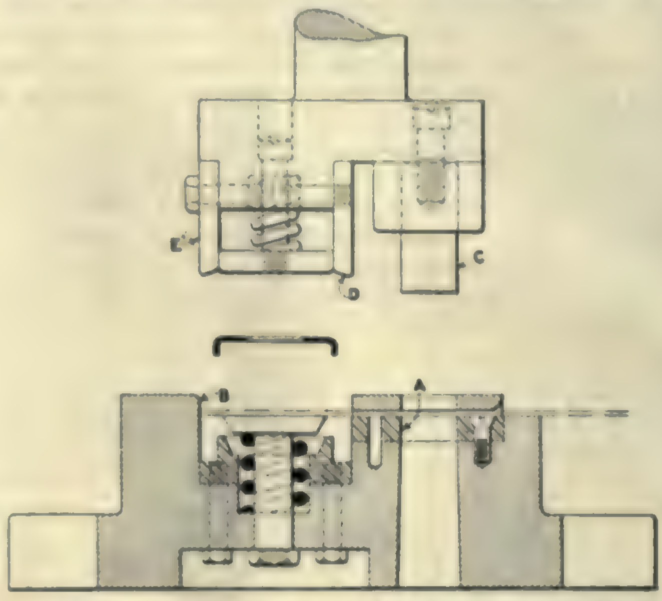
By S. A. McDonald

The accompanying drawing shows a combination piercing, shearing and forming die that is simple in construction and inexpensive to make. The stock upon which it is used is cold-rolled steel 1½ in. wide by $\frac{1}{16}$ in. thick. A round hole is pierced in the center of the piece and, after shearing, the work is carried down by the forming tools and bent as shown in the small sketch.

On the die shoe at *A* is the piercing die and lower shear blade in one piece, set flush with the upper surface of the shoe to which it is secured with screws. A stripper is mounted above it in the usual manner. The forming tools are set in the same shoe at a lower elevation so that as the stock is fed through the piercing die it abuts against the edge of the recess in the shoe at *B*, forming a stop, and lies level with the lower pressure pad.

In the punch holder are the piercing punch *C*, the forming punches *D* and *E*, and the upper pressure pad. The forming punch *D* is of the correct thickness to act in the double capacity of forming punch and upper shear blade.

The operation of the tools may readily be traced from the drawing. As the press ram descends the stock is pierced and the portion that has been pierced on the previous stroke is sheared off. The separated piece is immediately gripped between the upper and lower pressure pads and is carried down to the forming die. As



COMBINATION PIERCING, SHEARING AND FORMING DIE

the punch rises the upper and lower pressure pads strip the work from the forming punch and die respectively and, as the tools are used in an inclinable press, it falls out by gravity.

Swapping Knowledge

By Frank V. Faulhaber

There are many small machine shops where but one toolmaker is employed, and he attends to practically the entire machine work. The mechanic in such a little shop comes across many difficult problems, all of which have to be solved by himself. He cannot ask assistance as can the toolmaker in a large plant where more mechanics are at work.

There is a toolmaker in one such plant who realizes that he can often save himself considerable time when confronted with a new and difficult problem by visiting a neighboring machine shop, also of small proportions and where likewise but one man is at work, to discuss the matter.

There is an agreement between these two toolmakers that whenever a new and perplexing problem arises, as for instance relative to the making of a new die, that the other be consulted, and then the two can go over the problem together. Recently a difficult sub-press die had to be made by one of these toolmakers; there was a knotty problem ahead, so he consulted the second man. Both of these men are sure two heads are better than one; they profit by sharing their knowledge.

There are some mechanics who would hesitate before inquiring of the toolmaker in another shop regarding some difficult problem; but these two men are saving themselves much time by co-operating.

Editorial

A Strike Foredoomed to Failure

BY what process of reasoning the railroad shopmen and their leaders arrived at the conclusion that a strike was justifiable or likely to succeed at the present time is hard to understand. Three issues were voted upon separately: The wage reduction ordered by the Railroad Labor Board effective July 1, the abrogation of certain working rules governing pay for overtime work, and the placing of work with outside contractors.

According to our information as this is written, the last mentioned grievance has been removed by the agreement of the railroads to stop placing work outside. Space does not permit us to discuss the merits of the working rules, elimination of which constitutes the second grievance. The Board has not rescinded them without careful consideration.

As to the reduction in pay, it is interesting to note that under the new rate the average hourly earnings of skilled shop mechanics will be slightly more than seventy cents. Average weekly earnings will be $33.67, or 82 per cent more than the same men received in 1914. Equally skilled mechanics are working for far less in other machine shops and cannot be expected to muster any great show of sympathy for their more fortunate brothers. On the contrary, some of them are likely to be attracted by the wage rates offered by the railroads. In addition, there are still mechanics without any jobs at all to whom seventy cents an hour will look very good indeed.

The early days of the strike have been marked by a commendable lack of violent tactics on the part of the strikers. It is to be hoped that no violence will occur, but should the hotheads get out of control they are sure to find themselves face to face with the armed power of the United States Government. The people of the United States as well as the administration are out of patience with unjustified strikes. President Harding's remarks at Marion on the Fourth of July reflected the views of the great mass of the people and should serve as a warning to any class that seeks its own advantage at the expense of the rest of us.

Civilization and the Automatic Machine

THERE are many people who seem to think that skill, individual effort, ambition and everything else that elevates man above trained monkeys is gradually disappearing, and that it will only be a matter of time when all human effort will be reduced to the task of putting pieces in automatic machines and taking them out again.

Such books as the "Iron Man in Industry" (by Arthur Pound) give the reader the idea that we are fast approaching that dread time. It is perhaps timely to remark that farmers, railroad men, street car men, masons, bricklayers, painters, carpenters, road builders, etc., are still doing things by means of their hands and heads. There are still no automatic housekeeping machines and the professions have not yet reached the automatic stage, though it must be confessed that we would be in favor of automatic lawyers. It is true that few bookkeepers are left enthroned on a high stool and writing long hand in thick ledgers but, after all, there is not yet an automatic bookkeeper.

It is extremely doubtful if one million out of the one hundred and six million people in this country tend automatic machines, and it is highly probable that these people are doing the things they are best fitted to do; that they might have to starve or work beyond their strength if the automatic machine did not come to the rescue.

What the automatic machine has done so far is principally to reduce the amount of elbow grease necessary to carry on the world's work. The self binder relieves the farmer, his wife and daughters of a lot of stooping and disagreeable exercise in the hot sun; spinning machines and sewing machines have emancipated millions of women and even the automatic screw machine has relieved the lathe hand of a lot of dull and dreary repetition work.

The automatic machine has made possible certain things that never would have been done by hand and that would have been the dreariest kind of repetition work if they so had been done—wrapping, bottling and packing, for instance. It has done away with such murderous professions as glass blowing. It has substituted higher for lesser skill, die sinking for hand forging, pattern plate making for hand molding, and finally it has produced numerous things that we need to lead a life of comfort and which would have been beyond our reach without its help.

May the automatic machine prosper and multiply.

Setting a Boundary for Standardization

STANDARDIZATION is a very live issue with engineers at the present time, and deservedly so. It has its limitations, however, and the experienced engineer is the first to recognize them.

A case in point came up at the recent meeting of the Society of Automotive Engineers, undoubtedly the most advanced of our national societies in standards work. A division of the standards committee brought in a recommendation to limit the size of the clear opening of the crankcase drain to a minimum of three-quarters of an inch. One of the most prominent members was promptly on his feet to protest. While admitting the desirability of having at least a three-quarter inch, he pointed out that the recommendation was an attempt to delimit engineering practice and design. If it should be adopted, a precedent would be set which would open the door wide to other design limitations which might be highly undesirable. The recommendation was referred back to the committee.

The incident is unimportant except that it shows a clear grasp by engineers of the relative value of standardization and unhampered designing. Each has its function and nothing is to be gained by confusing one with the other.

Shop Equipment News

Cincinnati Automatic Centerless Cylindrical Grinding Machine

For obtaining a high rate of production on cylindrical work, whether rough ground or requiring the highest precision, the Cincinnati Milling Machine Co., Cincinnati, Ohio, has just brought out an automatic grinding machine of the centerless type. The machine has a capacity for work of $\frac{3}{16}$ to 3 in. in diameter and up to

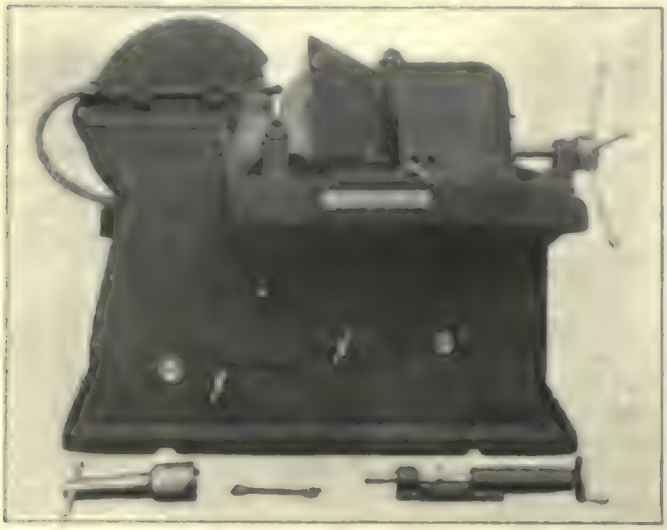


FIG. 1—CINCINNATI AUTOMATIC CENTERLESS GRINDING MACHINE

15 in. in length, and is suitable for finishing all straight cylindrical machine parts within this range of sizes.

The general arrangement of the parts can be seen in Fig. 1. The work is passed transversely between two opposed abrasive wheels. A grinding wheel 20 in. in diameter and having a 3-in. face and 5-in. hole is mounted on a heavy spindle at the left. Opposite to it, a wheel of 12-in. diameter is arranged to control the feed and the rotative speed of the work. Both wheels rotate in the same direction, and the axis of the feed or control wheel is set at an angle with that of the grinding wheel, so as to draw the work through the machine. The manner in which the wheels are mounted is shown by the rear view in Fig. 2.

To support the work, a work rest is mounted between the wheels. The top of this work rest and the grinding wheel spindle are parallel to each other at all times; consequently, the work is always parallel to the axis of the grinding wheel. The control wheel can be swung about a horizontal axis and clamped, so as to obtain the feed required to suit the work. Fig. 3 shows diagrammatically the conditions that obtain when viewing the arrangement at a right-angle to the axis of the spindle.

It should be noted that the feed of the work through the machine is proportional to the sine of the angle to which the control wheel is tilted, and also to the peripheral speed of the control wheel. Thus the value of f, or the feed per revolution of the control wheel is equal to $d \times \pi \times \alpha$. The feed per minute is, of course, f multiplied by the number of revolutions of the control wheel. The peripheral speed of the control wheel is the same as the desired peripheral speed of the work, so that the transverse feed of the work between the wheels is an easily controllable value. For any particular speed of the control wheel, a change in the angle α produces a corresponding change in the transverse feed.

The chief feature to which the maker calls attention in the layout of the machine is the fact that each member is called upon to perform only one function. Thus, actual grinding is done by the abrasive wheel, the work rest merely supports the work, while the control wheel imparts the feed to the work and determines its rotative speed.

The spindle carrying the grinding wheel is made of hardened and ground chrome-nickel steel. The end thrust is taken by a double-row ball thrust bearing. Adjustment can be made while the spindle is running. Due to the fact that the pull of the belt is always downward, half-box bearings are employed. These bearings are made of cast iron lined with the same special bearing metal that is employed in the spindle bearings of Cincinnati milling machines.

The front bearing is $3\frac{1}{2}$ in. in diameter and $6\frac{1}{2}$ in. long. There are adjustable guards above the journals to prevent the spindle from lifting from the bearings in case the belt should break. The grinding-spindle bearings are equipped with special devices for automatically oiling them without the use of a pump and piping. A disk at each bearing throws oil from a

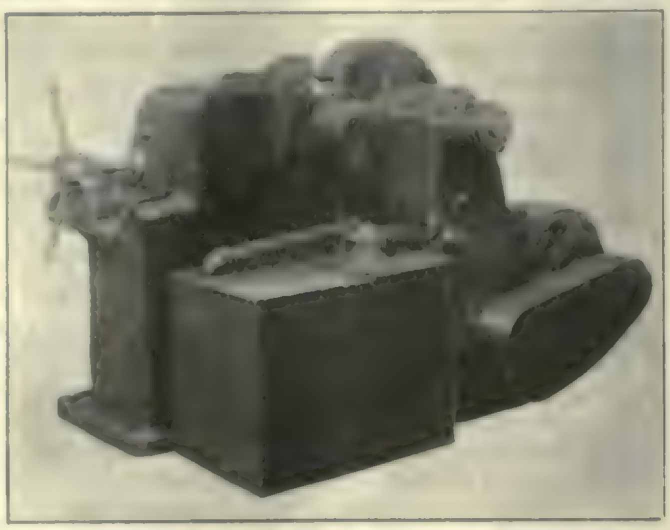


FIG. 2—REAR VIEW OF CINCINNATI CENTERLESS GRINDING MACHINE WITH MOTOR DRIVE

reservoir to a small shelf, from which it runs down to the bearings so that continuous lubrication is obtained. At each bearing a small window is provided through which the flow of oil can be observed.

The control-wheel spindle is mounted in a yoke which

can be tilted about a horizontal axis to obtain the rate of feed desired. Its chrome-nickel steel spindle runs in bearings equipped with sight-feed oilers, the front bearing being adjustable for wear. The primary function of this control wheel is to retard the work and to prevent it from spinning with the grinding wheel. The work rotates at the same peripheral speed as the control wheel. Wear on the control wheel is thus a negligible quantity, as there is very little slippage between the control wheel and the work. After the grinding wheel has been worn down to 12 in. in diameter, it may be employed as a control wheel, particularly if hard elastic or rubber wheels are used.

Two work-rest blades are supplied, one with a flat top for supporting the work for roughing operations, and a so-called knife-edge blade, which is particularly adapted for finishing. This latter form prevents grit and dirt from reaching the support on the rest and thus impairing the finish.

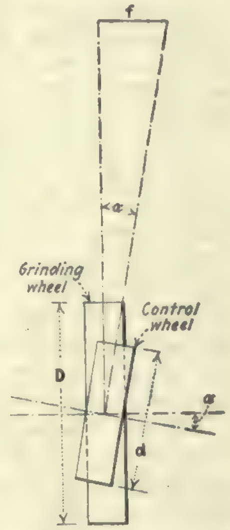


FIG. 3 — DIAGRAMMATIC ARRANGEMENT OF PARTS

The rest is mounted on a slide fitting on the bed so that its distance from the grinding wheel can be adjusted without affecting the parallelism of the rest and the grinding-wheel spindle.

On top of the slide carrying the rest is another slide on which the yoke for the control wheel is mounted. This top slide can be clamped to the lower one, and the lower one can be clamped to the bed, each adjustment being independent of the other. It is thus possible to move either the control wheel alone or both the control wheel and the work rest. The single adjusting screw is operated by means of the spoke wheel when making this adjustment. An unusually large dial is graduated in thousandths of an inch, and very fine adjustment of the position of the control wheel can be obtained while the machine is running so as to properly size the work.

A truing fixture, shown in front of the machine in Fig. 1, can be mounted on top of the work-rest bracket, after removing the slide that holds the rest. It is operated by a handwheel and a fine-pitch screw so as to give smooth movement to the diamond holder. The bar that carries the diamond slides parallel with the axis of the grinding wheel in the same position that will be occupied by the work. The diamond holder is merely reversed in the bar to dress the control wheel. A truly cylindrical periphery is not generated on this wheel, as on the grinding wheel, but a hyperboloid results because of the tilting of the wheel. When the work passes between the wheels, it has a straight-line contact for the full width of each wheel.

A set-up for grinding piston pins is shown in Fig. 4, which illustrates very well the manner of grinding such parts. The pins are delivered to the wheels by a slide, pass between them and drop out onto the delivery chute.

The machine is self-contained, and can be driven either by an individual motor of 10 to 15 hp., or by means of a belt. In Fig. 2 the method of mounting the motor is shown. A silent chain completely protected by a steel guard connects the motor to the main drive shaft in the base of the machine. Due to the weight of the machine and the proper distribution of this weight, mounting the motor on the base does not interfere with the production of work of the highest quality of finish and accuracy.

A 12-in. pulley driven by a 6-in. belt to run at 500 r.p.m. may be mounted on the main drive shaft in the place of the chain sprocket. The countershaft furnished with the belt-driven machine runs at 330 r.p.m. and has 18-in. pulleys driven by 6-in. belts.

The grinding wheel spindle is driven by a belt from the main drive shaft, and a swinging idler pulley mounted on ball bearings keeps the belt taut. A four-step cone connects the main drive shaft to a shaft at the other end of the base. From this position, the control wheel is driven by means of a belt running over idler pulleys. The four speeds provided for this wheel permit of adjustment to suit different diameters of work.

A flood of cutting lubricant is thrown on the work during grinding. The separate 50-gal. steel tank shown in Fig. 2 holds this lubricant. A vertical centrifugal pump driven by belt from the main drive shaft of the machine forces the lubricant through the pipes to the

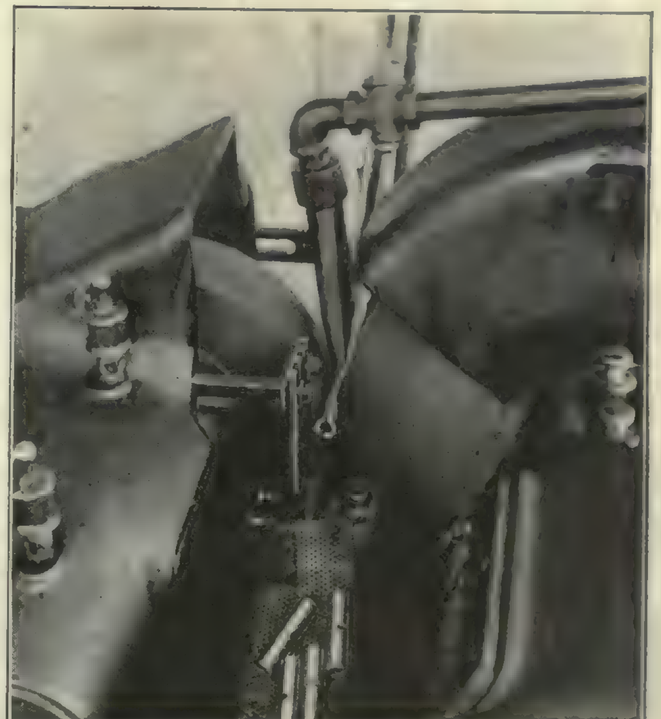


FIG. 4—CINCINNATI GRINDING MACHINE WORKING ON PISTON PINS

wheels, after which it flows back to the tank. No running bearing is exposed to grit or water and no stuffing box is required.

Both wheels are provided with heavy cast guards. All of the rotating shafts are made of steel, hardened and ground and run in bronze bearings lubricated by means of ring oilers. Both of the wheels and all the slides, bearings and belts are completely covered, for the protection of the operator and to prevent grit and water from entering the bearing surfaces.

The net weight of the machine is approximately 4,500 lb. and the shipping weight 4,900 lb. For export, the boxed weight is 5,500 lb. and the contents of the case 189 cubic feet.

Brown & Sharpe No. 646 Thickness Gage

The thickness gage shown in the accompanying illustration has just been put on the market by the Brown & Sharpe Manufacturing Co., Providence, R. I.

The gage contains six blades having respective thickness of 0.0015, 0.002, 0.003, 0.004, 0.006 and 0.015 in.

BROWN & SHARPE No. 646 THICKNESS GAGE

The blades can be used either singly or collectively and will give a variety of measurements up to 0.0315 in. The sizes of the blades have been selected as the ones most frequently used. The blades are accurately ground to the correct thickness.

The gage is especially suited for use by motor mechanics and car owners, as it answers the requirements in many places around a car or truck, as for setting valve tappets, points of distributor heads, spark plugs; fitting pistons and determining the sizes of shims for joints or parts where there is play or looseness.

The gage has an eyelet in one end so that it can either be carried on a ring or hung up.

Norwalk Air Compressor for Small Installations

The Norwalk Iron Works, South Norwalk, Conn., is placing on the market a single-stage air compressor designed especially to meet the requirements of small shops where air under pressure is needed to operate hoists, drills, hammers and similar tools.

NORWALK AIR COMPRESSOR

The machine is compact in design, occupying but little floor space. It is of the center-crank, double-action type with a belt and flywheel on opposite ends of the crankshaft. The cylinder overhangs, and all valves are therefore readily accessible. The cylinder and heads are amply water jacketed. The valves are of the multiple-port plate type, designed to operate at high speeds.

The working parts are entirely enclosed in an oil tight casing and are lubricated by the splash system. A pocket in the upper part of the casing is kept full by the splash and oil flows therefrom by gravity to the main bearings, the upper guide, and the wristpin.

As may be seen in the illustration, the end of the main frame to which the cylinder is bolted is provided with open ports at both sides so that the stuffing box is readily accessible for adjustment and repacking. The piston rod passes from the crosshead through a stuffing box in the end of the main frame, which is otherwise closed, so that lubricating oil cannot be carried by the rod into the compressor cylinder, the gland stuffing being outside of the frame so that it may be easily reached through the ports.

The machine is built in ten sizes, ranging in capacity from 57.6 cu. ft. of free air per minute up to 748 cu. ft. per minute. The cylinder diameter of the smallest size is 6 in., with 6 in. stroke. The largest size has a cylinder diameter of 18 in., with 12 in. stroke.

The main bearings are of generous proportions and designed to withstand belt pull in any direction so that the machine may be driven by an independent motor in any convenient location or from an overhead line shaft.

Willard Forming Toolholder

The Willard Tool Co., Inc., Stratford, Conn., has recently placed on the market the forming toolholder illustrated herewith.

WILLARD FORMING TOOLHOLDER

The holder is adapted for use on lathes, shapers, planers and screw machines and the advantages claimed for it are prevention from chatter, breaking of the cutter and tearing of the work.

Two holes are drilled in the cutter, one for the clamping bolt and the other to fit a dowel pin which not only keeps the cutter from turning but assures its proper location in the holder after removal for grinding.

Cutters of various forms may be kept on hand and inserted in the holder to be used whenever desired. The toolholder is made of a tough grade of steel. The surface against which the cutter rests is parallel with the under side of the shank.

Two sizes of the holders having respective cross-sections of $\frac{1}{2}$ x 1 and $\frac{5}{8}$ x $1\frac{1}{4}$ in. are made to fit ordinary toolposts. The cutter for the smaller size is $\frac{1}{4}$ x 1 x $1\frac{1}{2}$ in., while that for the larger size is $\frac{3}{8}$ x $1\frac{1}{4}$ x 2 inches.

News Section

Railroads Ordering Cars and Locomotives

It has recently been reported that the Chicago & Eastern Illinois has placed order for six Pacific type locomotives with Lima Locomotives. Nashville, Chattanooga & St. Louis has ordered three mountain type from Baldwin. International Harvester is said to have ordered two switching locomotives from Baldwin.

Illinois Central is receiving bids for 500 to 1,000 gondola cars. Western Pacific has placed 2,000 refrigerator cars with American Car & Foundry. Northern Pacific has ordered 250 general service gondola cars from General American Car and 250 gondola cars from Standard Steel Car. Norfolk & Western has divided order for 2,000 hopper cars as follows: American Car and Foundry, 500; Standard Steel Car, 500, and Pressed Steel Car, 1,000.

Illinois Central has placed 20,000 tons of rails with U. S. Steel and Ann Arbor has ordered 1,800 tons of rails from Midvale.

Automobile Companies Form Big Merger

Under the name of the Associated Motor Industries, Inc., an $80,000,000 consolidation of automobile, truck and automotive part manufacturing companies was announced as having been effected in Dayton, Ohio, last week, with Will I. Ohmer of that city as chairman of the board.

The merger includes seven automobile and truck factories, in addition to motor, body, gear, ignition and other parts makers. It is said that a number of other manufacturers of cars are being considered in the consolidation and announcements of these are expected shortly.

Besides the manufacturing plants involved, five assembling plants will be operated, located at Indianapolis, Boston, Louisville, Oakland, Cal., and St. Louis, Mo.

All the plants in the merger are owned outright by the consolidation, the titles being turned over in fee simple to the corporation. Including the assembly units, fourteen plants are involved. The manufacturing plants are:

National Motor Car and Vehicle Corporation, Indianapolis; Covert Gear Co., Lockport, N. Y., transmission and clutch makers; Recording and Computing Machines Co., Dayton, Ohio, ignition, magneto, starter, battery and generator manufacturers; Jackson Motors Corporation, Jackson, Mich.; Kentucky Wagon Manufacturing Co., Louisville, Ky.; Saginaw Sheet Metal Works, Saginaw, Mich.; Traffic Motor Truck Corporation, St. Louis, Mo.; Murray-Tregurtha Corporation, Boston, Mass., manufacturers of gasoline engines, and H. F. Holbrook Co., New York, manufacturers of automobile bodies.

The officers of the corporation, besides Mr. Ohmer, chairman of the board, include: Louis Ruthenburg, Dayton, president; A. A. Gloetzner, Lockport, N. Y.; Robert V. Board, Louisville, Ky.; T. C. Brandle, St. Louis, Mo., and George M. Dickson, Indianapolis, vice-presidents.

Marconi Receives John Fritz Medal

Multiplying the honors bestowed by governments, universities and learned societies here and abroad, the John Fritz gold medal, awarded annually for achievement in applied science, was formally conferred upon Senator Guglielmo Marconi on July 6, at a public ceremony in the Engineering Societies Building, New York City. Prof. Comfort A. Adams, of Harvard University, chairman, and Charles F. Rand, of New York, secretary, of the John Fritz Medal Board, directed the arrangements for the meeting. Previous to the presentation ceremonies, the board gave a dinner in honor of Senator Marconi at the Engineers Club.

Prof. Adams presided and read messages from medallists, distinguished engineers and public men of America and Europe. The speakers, all of whom eulogizing Marconi, dwelt upon different aspects of his life work and its meaning to society. Among the speakers were James R. Sheffield, prominent New York lawyer and for many years counsel to Marconi; Michael I. Pupin, professor of electro mechanics at Columbia University and famous for his inventions in the wireless art; and Elihu Thomson, John Fritz medallist, who presented the medal to Marconi.

Senator Marconi, responding to the address of presentation, voiced the hope that he had been instrumental in advancing concord among the peoples of the earth. He said:

"I have long realized that in America, more than anywhere else, the most cordial and generous encouragement is given to any honest endeavor to apply science to useful and practical purposes.

"It is a great honor for me to be admitted, through your award, to the ranks of the eminent men upon whom the John Fritz medal has been bestowed."

Many distinguished engineers attended the dinner. Invited guests present were: Senator Marconi, Comm. Francesco Quattrone, Italian Minister Plenipotentiary and Commissioner General; Dr. Paolo Rossi, Italian Vice-Consul, New York; James R. Sheffield, counsellor at law; Dr. Edward J. Nally, president, Radio Corporation of America; David Sarnoff, general manager, Radio Corporation of America; John W. Lieb, past president, American Institute of Electrical Engineers; Major-General George O. Squier, chief signal officer, U. S. Army; Alfred W. Kiddle, president, Engineers' Club, New York; Edward D. Adams, vice-chairman, The Engineering Foundation; and J. Vipond Davies, president, United Engineering Society.

Commercial Credit Letters Standardized

Commercial letters of credit, revocable or irrevocable, confirmed or unconfirmed—what are they? Many readers of this paper have heard these expressions with greater or less frequency in the past two or three years. Export departments in nearly all cases have had actual experience with such documents. Shippers of goods abroad in a manner, more or less vague, have learned that these forms contain provisions relating to bills of lading, insurance and other shipping technique.

That there has been much confusion and, in some cases, disagreeable litigation arising out of the lack of knowledge of these documents, no one of experience will deny.

Following the suggestion of the National Foreign Trade Council in 1920 the New York Bankers Commercial Credit Conference began the work of standardizing these forms. The work has now been brought to completion by the American Acceptance Council, with the result that standard forms are now available. These forms, bound in a small pamphlet, may be secured from the American Acceptance Council, 120 Broadway, New York City, for the price of 20 cents per copy. Individual forms for use in commercial transactions are also available and it is hoped to have them in general use by the middle of July.

All persons in any way connected with the financing of overseas shipments will do well to secure a copy of the pamphlet in order to familiarize themselves with the latest practice in connection with commercial credit letters. The provisions dealing with bills of lading, insurance papers, partial shipment, export quotations, and "prompt shipment" are printed on the backs of the forms and should be studied carefully by the personnel of all shipping departments.

Upon the care, skill and accuracy with which all financial arrangements connected with an export shipment are consummated, depends to a great extent, the success with which markets for American products abroad are secured and maintained. No American manufacturer can afford to neglect this part of his business education.

Screw Thread Reports

Reports were submitted to the National Screw Thread Commission, at its meeting on July 7, by the sub-committees dealing with threads on electric fixtures and fittings, with the standardization and unification of screw threads, and with bolt heads, nuts and wrenches. Pending certain detailed additions and changes, the reports will not be made public but it is expected that they will be ready for inspection within a short time. The sub-committees expect to hold their next meeting the second week in August. The next meeting of the commission probably will be held in New York in September.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

"The Improvement Continues" is the heading under which a nation wide report on business was printed in a New York paper last week.

There is no reason to doubt its truth and no need to emphasize it. Most people agree with it. The threatened railroad strike is a fizzle and it is probable that under the spur of the President's warning the coal strike will soon be settled. The settlement will not be ideal, for the unco-ordinated condition of the industry will not be remedied, but the country will at least be supplied with coal though the price may be high.

But with the apprehension of a railroad tie up and a coal famine gone there is really nothing left seriously to obstruct a general revival of trade and the indications are that it has commenced and will continue until bank reserves commence to fall and the supply of bank credit is curtailed. Of this there is no probability in the near future, although the influx of gold appears to have ceased and the reserve ratio of the Federal Reserve System dropped slightly during the week. It now stands at 76.8 per cent as against 77.5 a week ago and 79.1 a fortnight since. Some reduction is, however, seasonal, as the harvest progresses, and these figures are without important significance.

Crisis in Germany

Our domestic conditions are, in fact, so satisfactory that it seems somewhat gratuitous to go abroad looking for trouble. But when business men were in the depths here a year or more ago I did not hesitate to point out the certainty of a recovery and I feel that I should now be neglectful of my duty if I failed to call attention to conditions abroad.

The German bank statement as of June 30 reports an increase since June 23 of 11 billions in the number of paper marks outstanding. The total is now over 169 billions. The price of the mark in New York fell to 19½ cents per 100 last Friday. This is the lowest figure yet touched. On the same day francs sold at 8 cents and lire at under 4½.

The decline which was started by Rathenau's assassination and has continued since is due fundamentally to the fear of a political revolution in Germany that will make it impossible for France to collect the reparations she claims and so wreck the house of paper money that has until now enabled the various European governments to partially conceal their bankruptcy.

But we must not deceive ourselves. With the mark worth less than 1 per cent of its face value in gold it is practically valueless. The Germans will shortly refuse to accept it for their labor or their goods. Economic paralysis will follow. It will probably affect all Europe and the result will be a curtailment in purchasing power that will leave us without a market for a considerable portion of the surplus production that we formerly sold abroad.

This won't all happen in a moment. It may be averted if France should waive her insistence upon conditions that make a loan to Germany impossible, but unless the *impasse* that has been created is soon opened up there will be serious trouble across the Atlantic and we can hardly hope to escape its reflex here. Developments over seas should therefore be closely watched; nor should we neglect to keep an eye upon our political situation at home.

The indications are that next November will provide the radicals with the greatest opportunity they ever have had in the United States. The people are in a mood to say "A plague on both your houses" to the Democrats as well as to the Republicans and it may be that the apostles of some strange political faiths will be elected to high office. After the Civil War the Greenback party was sufficiently strong to induce no less a personage than the greatest philanthropist of his time, Peter Cooper, to accept its nomination for the Presidency, and it is quite possible that in the coming campaign there will be some similar exhibitions of political eccentricity that will for a time make capital cautious and induce a reaction. But these are about the only unfavorable features that are to be discerned. They are as yet visible only to the far sighted and should be heeded only by the super-cautious.

Of course there are and always will be minor troubles for the neurotic to worry about. A regiment in the Brazilian army has mutinied and coffee has declined slightly in consequence. The result of the Mexican election is not known but the Obregon government has accused an American named Beilaski of a new crime called "self abduction" and ordered his arrest if he is found in Mexico. There are some who regard the situation thus created as serious, though to most it seems comic.

Staples in Demand

Sugar is up again on an extraordinary demand from all over the world that argues still higher prices. Wool is rather easier as the tariff tangle becomes more confusing and some Republican newspapers advise that their party should give up trying to pass any tariff bill at all this session.

The demand for small lots of dry goods is continuous but the ups and downs of the cotton market make buyers cautious about buying in quantity. Cotton futures have lost part of the advance which followed the Government report. The boll weevil remains the main support of the market. The steel industry was temporarily quieter over the holidays but great activity is expected when the coal strike is settled. The building boom continues to grow.

Automobiles are still selling about as fast as they can be turned out and the market is said to be bare of used cars. They are like used pins. No one seems to know what becomes of them. There is a wonderful demand for tires but the crude rubber market is no higher. My correspondents in the West say that the low price of wheat is the only thing the farmer now complains of.

The security markets are firm again. Under the lead of the Liberty issues, which are all above par, bonds are firm and railroad stocks are sharply higher on the expectation of greatly increased traffic and earnings this autumn. A Stock Exchange boom led by the railway stocks is quite possible and if it comes the psychological effect will not be limited to the security markets. The transportation industry is America's greatest business and when it is profitable our national prosperity is almost certain.

Keith Company Will Rebuild New Haven Cars

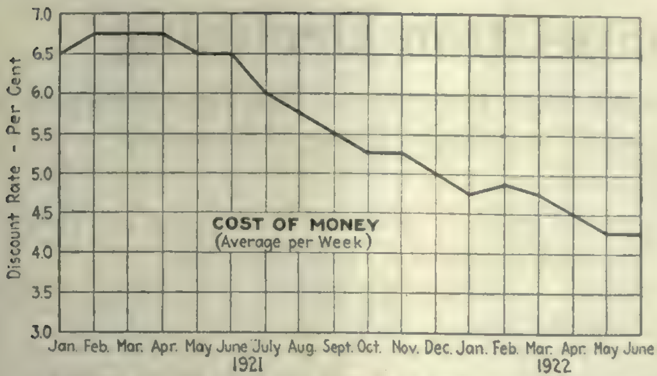
The Keith Car and Manufacturing Co., Sagamore, Mass., it is reported, has secured a contract from the New York, New Haven and Hartford Railroad for the rebuilding of 6,000 bad-order freight cars.

This will help to provide equipment to meet the requirements of traffic. At various times in past years when bad-order cars have increased beyond normal the excess have been sent to the Sagamore plant.

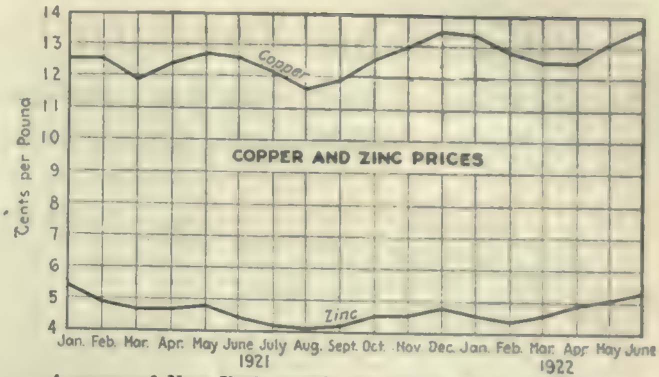
There are a large number of additional cars awaiting repairs, so that this arrangement will not affect the running of the company's shops on a normal basis and the giving of continuous employment to those now in or who may be taken into the employ of the company. It is the programme of the company to give preference to its own shops for this work.

Southern Iron Market Gains Strength

The pig iron market in the Alabama district is holding strong at good prices, with the tendency steadily upward. The present market is $19 to $20, and it is generally believed among the makers that $18 base is a thing of the past. Additional furnaces are starting up each week over the state. Active stacks at present number twenty-one, of which thirteen are making foundry iron and eight are producing basic. Lower freight rates now in effect are expected to help the industry materially as the high rates prevailing up to the present have proved to be the principal retarding factor to the more rapid improvement in iron making.



Average weekly rates for 60 and 90 day commercial paper based on New York quotations.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal.

EMPLOYMENT figures for June show an increase as compared with the month previous, amounting to 3.2 per cent, despite the coal, railroad and textile strikes. Vehicle manufacturing leads with an increase in employment approximating 6.5 per cent. Food and related industries record an increase of 5.5 per cent with iron, steel and their products in third place, recording an increase of 4.04 per cent.

Cotton spindles in operation as compared with the total in place, continue to show a steady increase. In the month of May sixty million yards of cloth were exported as against thirty-nine millions a year ago. For raw cotton and cotton cloth together shipped out of the country a total of $54,249,252 was received as compared with similar exports in May 1921 totaling $35,469,269, an increase of approximately 52 per cent.

American foreign trade for the month of May shows imports totaling $252,617,000 as compared with $204,011,000 in the same month of last year. Exports totaled $301,988,000 as compared with $310,958,000 in the month previous and $322,446,000 in May 1921. The chief import item showing an important increase is that classed as crude manufacturing materials in which there is an increase of $23,000,000. Semi-manufactured articles and articles ready for consumption show important gains as does also the item of crude foodstuffs and these gains cannot be construed otherwise than as indicating an improvement in industrial activities.

Railroad earnings increased for the month of May, 201 railroads in Class 1 showing a net income of $61,980,600 as compared with $50,271,865 for April. The May earnings represent an annual return of 4.36 per cent; April earnings, 3.93 per cent. The earnings for May of last year were $36,943,248. The Southern district is reported as having made the best showing for the month with a net of $11,304,700 representing an annual return of 6.63 per cent, for the month.

The Copper Export Association during the past week announced the retirement of $9,000,000 bonds, indicating satisfactory sales of stocks on hand. Sales of the metal during June are reported to have totaled 140,000,000 pounds and estimates indicate that not more than 200,000,000 pounds of refined copper remain. Electrolytic is quoted at 14 cents on the New York metal exchange for domestic consumption and the Copper Export Association is reported to be selling the metal at 14.15 cents c.i.f. European ports with 14.25 cents predicted within the next ten days.

Money market rates are easier with commercial paper quoted at 4 to 4½ per cent with a good demand for money reported. These quotations compare with rates of 6½ to 6¾ per cent prevailing a year ago.

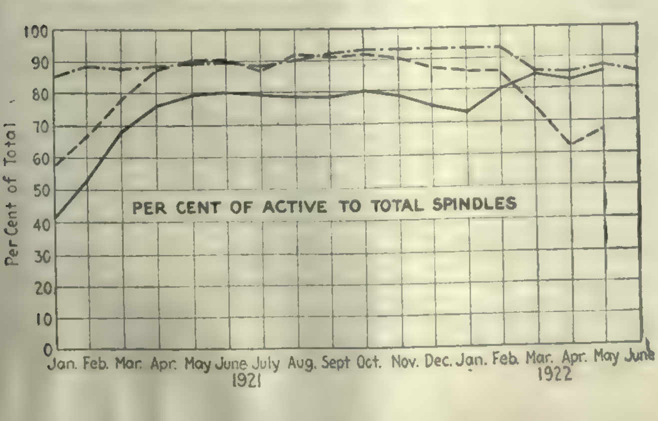
Foreign exchange rates show declines as compared with a week previous, due chiefly to the crisis, apparently at hand in Germany. Marks dropped over 3 points to $0.0017½, a new low record. Francs, particularly, fell off in sympathy, breaking 16 points to 7.79. Sterling was the exception declining ⅝c. to $4.44.

Car loadings for the week ending June 24th as reported by the American Railway Association show an increase of 17,084 cars as compared with the week previous. As compared with the same week of 1920, there is a decrease of 33,647 cars. Loadings of coal show an increase of 4,824 cars the figures for the cars loaded standing at 96,960. In contrast to 1920 the coal traffic for the week of June 24 showed a decrease of 98,539 cars.

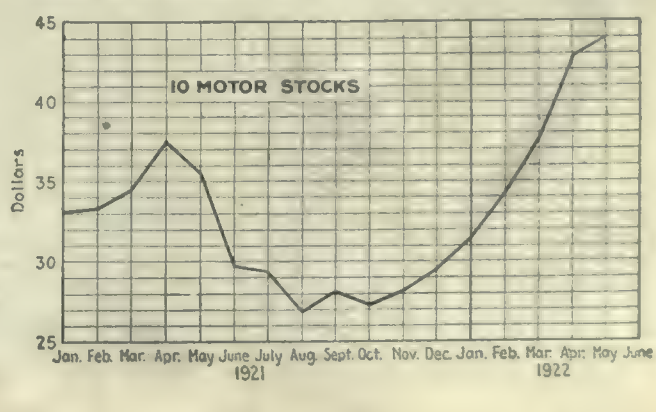
Comparative Prices of Shop Supplies
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.025	$0.0236	$0.0283
Cold finished shafting	per lb	0.0335	0.032	0.0435
Brass rods	per lb	0.155	0.1533	0.159
Solder (½ and ½)	per lb	0.21	0.213	0.203
Cotton waste	per lb	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	4.00	4.06
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	....
Lard cutting oil	per gal	0.575	0.608	....
Machine oil	per gal	0.36	0.40	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in	off list	55% @60%	60%@ 60–10%	50%@ 60–10%

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



German Foreign Competition Declining

Factors Which Make German Tools and Machinery More Expensive—Will Only Quote on a Sliding Scale System—British Labor Costs Four Times Those of Germany

BY A BRITISH CORRESPONDENT

We have so often been told that Germany's power to compete on the foreign markets is waning, and the story has so often been found to be premature that most business people have become rather sceptical as to its truth. But recently events have occurred that entitle it to consideration. We know, for instance, that Germany has found greater difficulties this year in her purchase abroad of materials than she found in 1921. The latest trade statistics show a considerable excess in the value of exports, while her purchases of iron ore, copper and many other metals have declined. The troubles of the German engineering firms have been increasing, due to the rise in wages, cost of fuel, raw materials and transport.

German Costs Increasing

We know too that although there is little if any unemployment in the country, yet her factories have not always of late been working to their fullest capacity. At both the Leipzig and Frankfort Fairs it was noticed that prices of certain classes of goods approximated to the world's level, while several firms would not quote fixed prices at all nor book orders too far ahead. We know that after accepting contracts they have been unable to execute them at the prices quoted. And now we are told that in spite of further depreciation in the value of the mark German export prices are approaching, and in some instances, have attained the world's level.

Another point worth remembering in this connection is that as Germany's cost of production tends to rise so British and probably American costs show a decrease. For instance those countries which were recently selling us pig iron and various other metals are now buying similar products from us; while the reductions which are taking place in wages in British engineering trades will have the further effect of equalizing conditions between the two countries.

Although Germany is now less favorably placed as regards her supply of raw materials for her engineering trades, yet her position in the latter industry has not been seriously affected. As regards production costs in the engineering and electrical trades, while there is every indication of a general increase, the courses of exchange will be the determining factor in respect to margin between home and export prices. Since the armistice German firms have catered more especially for the foreign trade because of the much greater profit accruing. But a change is now coming about. Export orders are beginning to fall off, foreign competition checking the upward trend of prices. In the engineering trade orders can now be placed with a shorter time for delivery. The difference between prices in the home and foreign markets is steadily lessening, and it may be expected that this difference will grow less. Not only are there signs of a general drop in prices abroad, but wages, raw materials and transport charges in Germany all tend to rise very considerably. This not only reduces the margin but also makes it very difficult for German firms to enter into long-dated contracts on fixed prices.

At present German exporting houses in the engineering trade quote on short delivery contracts a fixed price subject to surcharges corresponding to increases in costs of production from date of order. Long period contracts cannot be quoted at fixed rates as the risks consequent upon rising prices for labor and raw materials cannot even be approximately ascertained. Many German engineering firms will now quote only on a sliding scale. Manufacturers of electrical heating and cooking appliances have increased prices by 50 per cent, and the general electrical industry by 15 per cent. Prices of white castings have been increased 50 per cent, while the Iron-foundries Association has raised prices by 33 per cent.

It is significant that German makers of railroad rolling stock are finding it difficult to secure orders. A short time ago the Siamese Government called for tenders for trucks, the result being that the lowest quotations were from Belgian firms, most of the English, French, German and American firms quoting at about the same level, the highest price of all being made by a German house.

It is reported that many of the German engineering firms are spending the large cash reserves they have accumulated in renewing their plant and in bringing their works fully up to date. They think that the best way to safeguard themselves against loss by depreciation of the mark is to invest their capital in shop equipment and raw materials. At the end of the war most of the big munitions factories were dismantled, a great number of machine tools being thrown on the market. It was very naturally expected by makers that this would depress the market for such products; but quite the reverse was the case. The trade continued to be as active as before, as engineering firms preferred to pay a higher price to obtain a new machine with up-to-date equipment than save a little money by purchasing a second-hand article.

Makers Quoting Sliding Prices

It is stated that the change from fixed to sliding prices has encouraged some makers of machine tools to revert again to serial production, and this in turn has led to sales at fixed prices from stock. It is said also that there is a tendency to confine production, especially of small and medium machines, solely to standardized types. Buyers contend that makers should devote a part of their shops to small alterations to standard machines in order to meet the special requirements of customers.

German manufacturers when quoting sliding prices protect themselves against loss by a clause something to the following effect. "The price under our present tender to vary according to the directions issued monthly by the Association of German Machine Tool Manufacturers." The following are examples of increases authorized by the Association. In December, 1921, 34 per cent; January, 1922, 6 per cent; February, 14 per cent; March 16.5 per cent; April, 22 per cent; amounting in all to an increase of some 130 per cent since 1921. The defect in this arrangement from the buyer's point of view is that he is powerless in the matter. It is stated that negotiations are proceeding with a view to raising the inland selling prices in consequence of the recent rises in cost of production, but it is understood that this arrangement will not apply to the foreign trade for obvious competitive reasons. This is further evidence that German export prices in this respect are nearing world prices.

Labor Rates Compared

Now that tranquility has been restored in the British engineering trade, manufacturers are hoping to be able to compete on more even terms with German firms. But we have a very long way to go before we can accomplish this in consequence of the huge difference in the cost of German and British labor as it is today. The following are the rates of wages for the chief European countries per hour reduced to a common denominator in Swiss currency:

Austria	.51 francs
Germany	.54 francs
Italy	.59 francs
Belgium	1.10 francs
France	1.12 francs
Switzerland	1.75 francs
England	2.10 francs

This shows that the labor cost of production in England is four times greater than it is in Germany. In consequence of the ca'canny policy of restricting output, the production for each unit of wages is far less with us than one-fourth of that of the competing Belgian or French. How can British labor expect to compete and still receive four times the wages of Germany and Austria, and twice as much as French and Belgium and work for shorter hours? I may mention in passing that our shortened working week is estimated to cost us 200 million pounds a year, of which of course the engineering trade contributes its full quota of loss. If the shorter working week is to stay then we must reduce the cost of British products by that sum annually.

Although we have got rid of German and Belgian competition in pig iron and steel, continental shipbuilders and repairers are still able to offer lower prices and better deliveries than those in this country, due largely to the better and more regular work done by the operatives and particularly the lack of restrictions on overtime and night shift operations. These are just the points over which the recent great strike in the English engineering trade has raged, on the vital question as to whether the men or the masters were to control production in the workshops. The masters won because at heart the

men did not want the responsibility of control put on their shoulders and the vicious system of double shop stewards has received a fatal blow. Ever since the war employers in this industry have been under the harrow of a militant trade unionism, or in plain English an iron tyranny. They revolted, and fortunately for the furture of British engineering, they have won. So severe has competition been that lately a British firm tendered at a price which would have left it no profits and only half its establishment charges. This was done really to keep the staff together, but it was found afterward that a Dutch firm had sent in a tender lower by 25 per cent!

GOOD AVERAGE FOR ALL

Yet in spite of all these adverse circumstances the main body of our engineering firms have held their own very well during the last two years of trial. Taking the balance sheets of 14 representative firms manufacturing machinery for a wide range of different purposes we get the following results: In five instances out of the 14 selected, the profits for 1921 were actually higher than those of 1920, this fact being partly accounted for by the reduced liability of taxation. The total companies had a paid up capital in 1920 of 11 million pounds, and in 1921 of slightly over 11½ million pounds. The The average return as regards net profits on capital invested was therefore 12 per cent in 1920 and 8.2 per cent in 1921.

Belgian Market for Machine Tools

A report from acting commercial attaché Samuel H. Cross, Brussels, has this to say about the machine tool market in Belgium:

In spite of improved industrial conditions and the removal of the immediate threat of German competition, the market for American machine tools in Belgium is unfavorable by the presence of considerable stocks of American machinery, probably aggregating 15,000,000 francs in value, which will no doubt require another year for liquidation, even at the sacrifice prices at which they are being sold off.

Appreciation of American equipment, even at higher prices, is indicated, however, by the fact that, at the recent commercial fair, one of the best-known Belgian manufacturers sold no lathes whatever, while several purchasers were found by representatives of American manufacturers. Some sales of universal millers, as well as sales of broaching and balancing machines ordered from the United States rather than being taken from local stocks, indicate also that American prices are reaching a point where they are interesting the native user, though Belgian dealers in machine tools, after taking considerable losses, can not be expected to stock machinery again for some time to come.

Two factors must be distinguished in regard to German competition with American tools. At the present time, in view of constantly increasing labor costs in Germany and the discriminatory tariff against German products, the German manufacturer can not produce machine tools and deliver them in Belgium at prices very much below American quotations. On the other hand, German machinery dealers, who accumulated considerable machinery stocks before production costs in Germany had greatly risen, can still undersell American tools so long as these stocks hold out.

Except on light tools, such as small millers (some of which are direct copies of American machines), it can hardly be said that Belgian manufacturers present very serious competition with American tools on any basis except price. Recently, for instance, the local representatives of a well-known American manufacturer secured an order for a 48-in. boring mill, at a price 6,000 francs above that quoted by the principal Belgian producer. Prices being practically equal, it is probable that the preference would be in favor of American tools, as their accuracy and production capacity is well known. Without some slight price modification, it is generally difficult, however, to compete with the better products of a Belgian firm like the Progrès Industriel.

MACHINERY OUTLOOK BRIGHT

Some sales of Czecho-Slovak tools are also noted. The firm of Podhajsky in Prague, for example, turns out a bolt cutter similar to a favorably known American machine, and is reported to have sold 250 in France during the past year.

The outlook for machine tool sales in Belgium is, on the whole, more hopeful during the spring. Better results can probably be obtained in this market by quoting local representatives special prices and by supporting them to the extent of supplying moderate stocks on consignment, as the losses of the average firm have been too great to permit any purchases for stock. Orders of machinery for restoration purposes have naturally been concluded. Some shop construction is reported, however, in the vicinity of Brussels, and a certain amount of buying for replacements and development is being done by producers of light mechanics. It is likely, therefore, that moderate price concessions would somewhat extend sales of American shop equipment in this district.

Efforts have recently been made to place agencies for small American electric-driven woodworking machinery in Belgium. In view of the cheapness of hand labor and the small size and means of most Belgian woodworking shops, it is believed that the market for this equipment is very limited in scope, and would hardly compensate the outlay in publicity necessary to place these products before the average prospect.

Increase Cost of Ships

In passing the bill already passed by the House to scrap vessels under the naval limitation treaty, the Senate voted to increase the cost of construction of the battleships "Colorado" and "West Virginia" from $15,000,000 as originally provided to $17,000,000, as these vessels are to be retained in the Navy. The cost of scout cruisers four to ten was also increased from $7,500,000 to $8,250,000. These increases are due to changes in construction, increase in armament in the scout cruisers and improvements of machinery and appliances in all ships.

Business Items

The Imperial Steel and Wire Co., Collingwood, Ont., at its annual meeting elected the following officers: president, Col. J. A. Currie; vice president, Donald McKay; manager, secretary, and treasurer, Geo. A. Royal.

The Rose Machine and Spring Co., Canton, Ohio, through its president, D. H. Rose, announces the purchase of the entire machinery and equipment of the Advance Dairy Machine Co. The enlarged company will move from its present location, in the near future, to the building now occupied by the Canton Holmes Co., 12th Street and Spring Ave., Canton.

The Fayro Machine and Engineering Co., Johnstown, Pa., has taken over the boiler making business established a number of years ago by Reinhold Betterman. The company, at the present time, is erecting a plant in Sheridan but until it is completed the Betterman shop will be used with Mr. Betterman in charge as superintendent of the boiler and tank shop. The officers of the company are F. F. Faunce, president; J. C. Ayres, vice-president and treasurer; and Hon. John M. Rose, secretary.

The W. R. Martin Co., Louisville, Ky., it is announced, recently has doubled the capacity of its plant and will install equipment for a complete forge shop to be operated in connection with their present machine shop.

The Hoole Tool and Supply Co., [illegible] Hackensack St., Newark, N. J., has filed a voluntary petition of bankruptcy in the Federal Court, in that city.

The Hodes-Zinc Manufacturing Co., Fremont, Ohio, has leased a building in Erie, Pa., it is reported, where a branch factory and warehouse will be opened for the manufacture of auto accessories.

The General Electric Co., during the past week, exercised their option on the Bridgeport factories of the war-time Remington Arms Co., by the purchase of the properties at a price reported to be in excess of $3,500,000. The General Electric Co. came to Bridgeport two years ago, occupying the Remington plant, and held a five years' option to purchase. The plant consists of thirteen five-story buildings about 80 by 240 feet each, with a connecting corridor to each unit, making the 13 units, in reality, one gigantic building. Other buildings in the purchase constitute a large foundry building, office building, several smaller structures, and a large power plant also.

The Durant Motors Co., through its president, W. C. Durant, is reported to be in negotiation for the purchase of the plants of the Locomobile Company of America, Bridgeport, Conn., now in the hands of receivers, Col. Elmer H. Havens, president of the company, and Edmund S. Wolfe, both of Bridgeport. The report has been confirmed at the offices of the company, but no additional details are available at this time.

The Winchester Company, New Haven, Conn., and the Simmons Hardware Companies, Waldon, N. Y., it has been announced, have effected a combination. The combination will be operated under a common management

and hereafter will be managed jointly. The combined interests will be operated through a holding company to be known as the Winchester-Simmons Co., the stock of which is owned by the present individual interests. The Winchester Co. will be the manufacturing organization and the associated Simmons Hardware Cos. will be the distributing body. The latter company has warehouses in various sections of the country, as has also the Winchester Co. The Winchester Co. has factories in New Haven; Springfield, Mass.; and Beaver Falls, Pa., while the Simmons Co. has plants in Walden, N. Y., Philadelphia and St. Louis.

The Alabama Concrete Pipe and Manufacturing Co., Birmingham, Ala., a company recently formed for the production of concrete drain and sewer pipe, began operations late last month in the plant formerly occupied by the Southern Bridge Co. The officers of the company are J. C. Griffin, president; W. C. Austin, secretary and treasurer, and L. M. Mahaffy, vice president.

The Alabama By-Products Corporation is increasing the capacity of its Birmingham plant by the erection of 25 additional Koppers ovens.

Wilson Welder and Metals Co., 132 King St., New York City, announce the appointment, recently, of the King-Knight Co., Underwood Building, San Francisco, as their exclusive representatives in Central and Northern California.

Horace T. Potts and Co., Philadelphia, Pa., announce the commencement of construction work on new warehouses, office building, garage, machine shop, power house and watchman's residence. The new building will cover about 10 acres of ground and the total expenditure will be in excess of $500,000.

The Phillips and Buttorff Manufacturing Co., Nashville, Tenn., announces the manufacture of a new product at its foundry plant in the shape of a warm air furnace. H. M. Sawrie, of Nashville, is the engineer in charge of the new department.

The Gulf States Steel Co., Gadsden, Ala., has placed in operation the twenty in. bar machine which has been idle since 1920. The thirteen in. mill at the same time went on a double turn, and it is also announced that the company will blow in its fourth open hearth steel furnace in the near future.

The Atlantic Coast Line Railroad Co.'s shops at Montgomery, Ala., were destroyed by fire, June 29, with a loss estimated at about $200,000. Considerable valuable machinery was lost in the blaze.

The Nashville Bridge Co., Nashville, has installed recently what is said to be the largest enamel sign in the south. The sign, constructed of porcelain enamel and sheet metal, is 152 feet long by six feet wide. Approximately 2,000 pounds of sheet metal was used in its manufacture, and 25 gallons of enamel.

The Manicha Storage Battery Locomotive Co., St. Louis, Mo., has arranged for an increase in capital from $300,000 to $400,000.

The Reynolds Wire Co., Dixon, Ill., has arranged for a reduction in capital from $1,000,000 to $[illegible].

The Lohbaugh & Jordan Tool and Machine Co., Elkhart, Ind., has filed notice of company dissolution under state laws.

The Norwalk Iron Works Co., Norwalk, Conn., has filed notice of increase in capital from $10,500,000 to $11,500,000, for proposed expansion.

The Howe Scales Co., for southern territory is being constructed at 9 to 11 Stewart avenue, Atlanta. The building will provide about 12,000 square feet of floor space and cost about $25,000.

The Gill Mfg. Co., 8300 South Chicago Avenue, Chicago, Ill., has filed notice of increase in capital from $1,000,000 to $1,500,000.

The Winchester Repeating Arms Co., is constructing in Oakland City, a suburb of Atlanta, a two-story, fire-proof warehouse, containing approximately 30,000 sq.ft. at a cost of approximately $60,000. It is to serve as a southern depository for the company's products.

Personals

FREDERICK M. SPENCER, until recently, production superintendent of the Landers, Frary and Clark Co. plant at Meriden, Conn., has been appointed assistant superintendent of factory "H" of the International Silver Co., in that city.

CLINTON E. WOODS, Bridgeport, Conn., largest stockholder of the Woods Industrial Engineering Co., Bridgeport, Conn., which firm has been in the hands of a receiver, has bought up the company, having supplied sufficient funds to pay off all creditors in full.

THOMAS FULLER, at present manager of the supply division of the Atlanta office, Westinghouse Electric and Manufacturing Co., has been appointed manager of the power division also to fill the vacancy created by the resignation of Paul H. Smith.

OTIS HUDSON has recently been appointed production superintendent of the Meriden plant of the Landers, Frary and Clark Co., hardware and cutlery manufacturers, New Britain, Conn.

C. F. FORD, for the past several years connected with the Chicago Pulley and Shafting Co., has recently joined the engineering sales force of W. A. Jones Foundry & Machine Co., Chicago, Ill. Mr. Ford will make his headquarters in Minneapolis, as manager of the company's branch in that city.

G. A. RAY, of the Taylor and Fenn Co., Hartford, Conn., was elected to the board of managers of the Connecticut Foundrymen's Association, at the recent annual meeting held at the Stratfield Hotel, Bridgeport, Conn.

R. S. GILDART, formerly director for the American Malleable Castings Association, has just been appointed advertising manager of the General Fireproofing Co., Youngstown, Ohio.

IRVING A. BERNDT and DWIGHT T. FARNHAM, formerly vice presidents and members of the firm of C. E. Knoeppel and Co., Inc., announce the establishment of consulting engineering offices in the Equitable Trust Building, 347 Madison Ave., New York City.

P. J. CONNER, formerly traveling representative for the International Machin Tool Co., Indianapolis, Ind., is now engaged with the Haynes Stellite Co., with headquarters in New York City.

CHARLES T. MAIN announces the opening of engineering offices in the Massachusetts Trust Building, 200 Devonshire Street, Boston, Mass., where he will do consulting, designing and development work for industrial plants of all kinds.

SAMUEL ARONSON, formerly a member of the editorial staff of the *American Machinist* and for the past five years president and secretary respectively of the Presto Phono Parts Corporation and the Presto Machine Works, Brooklyn, N. Y., has also been elected vice-president and a director of the newly formed Products Distributing Corporation, New York City, recently organized for the purpose of selling and distributing the products of companies favorably passed upon, examined or managed by M. H. Avram and Company, management and industrial engineers.

CHARLES B. KENDALL, for the past eighteen years connected with the Hart Manufacturing Co., Hartford, Conn., has recently been appointed general purchasing agent of the company.

PHILIP NORTON, formerly superintendent of the Turner Machine Co., Danbury, Conn., has joined the organization of the Fellows Gear Shaper Co., Springfield, Vt.

T. L. SCHRANTZ, formerly manager of the supply division of the Buffalo office, Westinghouse Electric and Manufacturing Co., has been appointed branch manager of the Syracuse office.

CHARLES W. STROUP, for a number of years manager of the Norwalk plant of the Crucible Steel Co. of America, has resigned to accept a similar position with the Indiana Rolling Mill Co., New Castle, Ind.

PAUL H. SMITH, manager of the power division of the Atlanta office, Westinghouse Electric and Manufacturing Co., has resigned to accept a position with the Brooklyn Edison Co., Brooklyn, N. Y.

S. GLEN VINSON, secretary and general manager, Ideal Electric Manufacturing Co., Mansfield, Ohio, is making a tour through Japan, China, India and the Philippines, studying business conditions. He is expected to return home about October 1.

CARL G. SCHLUEDERBERG, assistant to the manager of the supply department, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., will hereafter devote all his time to the foreign supply and merchandising business.

R. D. SHIELDS, for several years past Chief Engineer of the Ohio Machine Tool Co., Kenton, Ohio, has just been appointed Assistant General Manager of that company.

GEORGE W. ROOSA has been made acting manager of the supply division, Westinghouse Electric and Manufacturing Co., Syracuse, N. Y.

ROY GEDELL has recently been appointed mechanical superintendent of the Meriden plant of the Landers, Frary and Clark Co., New Britain, Conn.

CLARENCE E. BILTON, president and treasurer of the Bilton Machine Tool Co., Bridgeport, Conn., was re-elected vice-president of the Connecticut

Foundrymen's Association, at the recent annual meeting held at the Hotel Stratfield, Bridgeport.

STANLEY H. BULLARD has been reelected president of the State Chamber of Commerce of Connecticut.

PHILIP H. SEE, of Amherst, Mass., has recently been appointed assistant general manager of the Parks & Woolson Machine Co., manufacturer of textile machinery, Springfield, Vermont.

F. G. HICKLING is now manager of the railway division of the Pittsburgh district office, Westinghouse Electric and Manufacturing Co.

A. BUOL, for many years general superintendent of the New Britain Machine Co., New Britain, Conn., recently has severed his connection and is preparing to open a tool and machine shop on Arch Street, New Britain, where he will build tools, jigs and fixtures as well as special and experimental machinery. The business will be conducted under Mr. Buol's name and will be directly under his personal supervision. He expects to be ready about August 15.

NORMAN STEWART is branch manager of the Minneapolis office, Westinghouse Electric and Manufacturing Co.

SAMUEL T. FREAS of Henry Disston & Sons, Philadelphia, Pa., has been awarded the Edward Longstreth Medal by the Franklin Institute for his invention and thirty years' work of development of the inserted tooth circular metal cutting saw.

Book Reviews

Sharing Profits with Employees. By James A. Bowie, M. A. Cloth; two hundred eighteen 6 x 9-in. pages. Published by Isaac Pitman & Sons, 2 West 45th St., New York, N. Y. Price, $4.

This is a critical study of profit-sharing methods in the light of present conditions. The book is divided into four parts, dealing with profits, profit-sharing, co-partnership, and other methods of sharing profits. The question is viewed impartially from the standpoint of both employers and employees and the cases of both are very fairly stated.

The author starts off with labor's point of view and tells of the injustice of a system which permitted the profiteering of employers during the war. Yet from the employer's side of the question, he recognizes the necessity for preserving the incentives to the employers to undertake the risks involved in investing their money in business enterprises.

Of government control, the author holds the opinion that: "During the war control was certainly necessary, but the Government makes a great mistake if it thinks that it can continue to control industry, without the grave danger of suffocating it." Of the employment question he suggests: "As industry fluctuates today the greatest safeguard against unemployment would be the co-relation of demand and wages."

While the author deals impartially with the subject of profits he says that before labor settles the matter, it must be educated up to its part in profit-sharing. He sums up the case against labor very well: "The most abstract thinker in Britain today is the working man. He condemns on scanty evidence, thinks without knowledge, readily subscribes to the most visionary schemes of reconstruction, abstracts facts from their context and draws erroneous deductions, believes in the necessity of destruction and revolution without any clear idea of the structure he proposes to destroy or of the substitute he hopes to provide. The working man must be taught to think concretely on economic matters." Further on, he says: "But the workers must climb into their new status, not usurp it. And to this end social and economic education should be advanced among the rank and file . . . and in ownership through copartnership and capital-sharing, finally graduating as complete partners in industry." He goes on to say: "If labor is to be given the fullest incentive to produce, it must be allowed some of that freedom which is claimed as the crowning merit of private enterprise."

Part II begins with a general consideration of profit-sharing and shows the diverse aims of the profit-sharing schemes so far undertaken. The present day tendency is to invite the co-operation of employees in formulating the scheme, and normally, the method adopted divides among employees one-half of the extra profits over the reserve limit. The dissatisfaction felt with the profit-sharing schemes so far has been due to the fact that most of them consisted in cash profit-sharing and do not refer to copartnership. The shares failed to exert an appreciable influence on the conduct of the worker.

Part III takes up co-partnership. The author says of this scheme:

"If the mere wage-earning attitude to production can be supplemented by the shareholding attitude, at once a pernicious distinction will be removed and a new bond of industrial good will created. . . . Copartnery . . . seeks to reinforce the wage-earning interest by the shareholding interest."

After giving some examples of the schemes in use in England, the author tells of labor's antagonistic attitude toward copartnery which it claims upholds the capital system and destroys the solidity of labor. In the chapter on the conditions of the success of co-partnery, the author states: "Real co-partnery implies a sharing in the good and bad fortunes of the business, but certain risks the workman should not be asked to bear. . . The worker's control should be exercised through the ordinary voting rights of shareholders and secondly through a co-partnership committee."

In the last part dealing with other methods of sharing profits, the author gives as his opinion of a bonus on collective output: "Whatever effect such a bonus may have on efficiency it certainly fails to effect improvement in the worker's status."

The author states that sliding scales may result possibly in uniting employer and employee against the consumer. At present, he says, the only control a worker has involves the anti-social attitude of restricted production. He advocates co-partnership in order that: "Employees may be given a share in capital or be helped to acquire it."

Of trade unionism, the author holds this opinion: "One of the great obstacles in the way of progress will certainly be the vested interests enthroned in trade unionism."

In conclusion the author predicts: "The workers will become capital-owning copartners with possibilities of becoming through their abilities, democratically recognized, co-managers and co-directors of industry."

Annual Report of the Smithsonian Institution, 1920. Washington, D. C. Six hundred ninety 6 x 9-in. pages, cloth board covers, illustrated.

This book describes the activities and conditions of the institution for the year ending June 30, 1920. Its contents include chapters on the establishment of the institution, researches and explorations, National Museum, International catalog of scientific literature, and many scientific papers. There is an appendix containing eight reports on such subjects as the "Bureau of American Ethnology," "National Zoological Park," etc.

The general appendix comprises a selection of miscellaneous memoirs of interest to collaborators and correspondents of the institution, teachers, and others engaged in the promotion of knowledge.

Trade Catalogs

Pneumatic Measuring Instruments. Trost Brothers, 26 Little Park St., Coventry, England. A circular describing the rotameter, an instrument for measuring the air consumption of pneumatic tools.

Scientific Instruments. Davis Instrument Manufacturing Co., Inc., Baltimore, Md. A circular describing various styles of anemometers and other mining scientific instruments made by this company.

Expansion Reamers. Samuel Hocking & Son, Lancaster, Pa. A circular descriptive of and setting forth the various sizes of the double relief steady-ring expansion reamers manufactured by this company.

Hot and Cold Plate Presses. Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio. Two bulletins on hydraulic hot and cold plate presses for molding bakelite, condensite and other compositions. The bulletins have been prepared especially to meet the demands of radio manufacturers for presses of this character.

Vises. The Charles Parker Co., Meriden, Conn. Catalog No. 57, just issued, containing descriptive cuts of the complete line of vises manufactured by this company. Data on sizes, weights and construction details is also given in the catalog.

Forming Tool Holders. Willard Tool Co., Inc., Stratford, Conn. A circular describing the Willard forming tool holder for use in lathe, shaper, planer and screw machine work.

Air Compressors. The Norwalk Iron Works Co., South Norwalk, Conn. Bulletin No. 8 containing data, specifications and descriptive cuts relative to the various sizes of horizontal, single-stage air compressors made by this company.

Time and Motion Study Watches. Stein and Ellbogen Co., 31 North State Street, Chicago, Ill. A booklet containing descriptions of the various styles of special watches produced by this company for time and motion study purposes.

Lighting Systems. Sampson Axcess System, Inc., Lynn, Mass. A twenty-page catalog containing numerous instructive cuts and descriptions, illustrative of the Sampson lighting equipment and method of application in machine shops on individual machines. The system is designed to furnish a light for the machine operator, placed to illuminate the work in the machine, without being in his way.

Pamphlets Received

Precision Gage Blocks. Bureau of Standards Scientific Paper No. 436, entitled "Interference Methods for Standardizing and Testing Precision Gage Blocks," by C. S. Peters and H. S. Boyd, associate physicists of the bureau. For sale by Superintendent of Documents, Washington, D. C. Price 10 cents.

Metallographic Etching Reagents. Bureau of Standards scientific paper No. 435, entitled "Metallographic Etching Reagents for Copper Alloys, Nickel and the Alpha Alloys of Nickel," by Henry S. Rawdon, physicist, and Marjorie S. Lorentz, assistant physicist of the bureau. For sale by Superintendent of Documents, Washington, D. C. Price 15 cents.

Properties of Steel. Bureau of Standards scientific paper, entitled "Thermal Expansion of a Few Steels," by Wilmer Souder, physicist, and Peter Hidnert, associate physicist of the bureau. For sale by Superintendent of Documents, Washington, D. C. Price 5 cents.

Rust Prevention. American Chemical Paint Co., New York City. Bulletin No. 11 describing a method of preventing rust, especially on soldered work which is to be painted.

Eliminating Waste in Blasting. A fifty-page booklet written by N. S. Greensfelder and published by the Hercules Powder Co. The booklet is abundantly illustrated and contains numerous instructive diagrams. The best practice in planning the work, drilling, kinds of explosives and methods of firing is clearly set forth. The booklet is printed for free distribution and may be obtained from any office of the Hercules Powder Co.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4,600 Prospect Ave., Cleveland, is secretary.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances—Quotations of $1.60 per 100 lb., Pittsburgh, on steel shapes, plates and bars disappearing from market. Considerable business being done at $1.70@$1.80. Steel sheets show slightly higher range of quotations, at mill. Tin up ½c. per lb., New York warehouses; copper market firmer, slight improvement in sales; zinc also firmer, owing to strength of sheet and pipe market. Babbitt metal, best grade, up ½c. per lb., New York. Linseed oil advance continues; paint trade active. New York quotes raw oil at 93c. as against 90c. per gal., 5 bbl. lots.

Declines—Chinese antimony down ½c. per lb., New York warehouses; lead market quiet. Dealers' purchasing prices of old copper down ½c.@½c. per lb.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.00
Northern Basic	26.52
Southern Ohio No. 2	26.02
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.16
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	27.82
Virginia No. 2	29.24
Basic	25.50
Grey Forge	25.50
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10.0	8.0	3.0
New York	9@10	6.0	3.0
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]@2.[illegible]	3.63	3.[illegible]	3.63
No. 12	2.[illegible]@2.[illegible]	3.68	3.30	3.68
No. 14	2.[illegible]@2.[illegible]	3.73	3.35	3.73
No. 16	2.7[illegible]@2.[illegible]	3.83	3.45	3.83
Black				
Nos. 17 and 21	3.0[illegible]@3.10	4.15	3.80	4.30
Nos. 22 and 24	3.[illegible]@3.1[illegible]	4.20	3.[illegible]	4.30
Nos. 25 and 26	3.10@3.20	4.25	3.90	4.35
No. 28	3.1[illegible]@3.25	4.[illegible]	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11	3.15@3.25	4.35	3.85	4.45
Nos. 12 and 14	3.25@3.40	4.45	3.95	4.55
Nos. 17 and 21	3.55@3.70	4.75	4.25	4.85
Nos. 22 and 24	3.70@3.85	4.90	4.55	5.00
No. 26	3.85@4.00	5.05	4.70	5.15
No. 28	4.15@4.30	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	3.63	2.81	3.48
Cold rolled strip steel	6.25	8.25	6.15
Floor plates	4.80	4.66	5.08
Cold finished shafting or screw	3.35	3.30	3.40
Cold finished flats, squares	3.85	3.80	3.90
Structural shapes (base)	2.68	2.51	2.68
Soft steel bars (base)	2.58	2.41	2.58
Soft steel bar shapes (base)	2.[illegible]	2.41	2.58
Soft steel bands (base)	3.23	3.06	3.23
Tank plates (base)	2.68	2.68	2.38
Bar iron (2.20 at mill)	2.58	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{16}$	8.00		12@13
¼	6.50		11@12
$\frac{5}{16}$ to ½	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	31.75
Lead (up to carlots), St. Louis, 5.50; New York	6.12½
Zinc (up to carlots), St. Louis, 5.30; New York	6.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	20.50	21.00	23.00
Copper wire (carlots)	16.00	17.00	16.25
Copper rods (ton lots)	19.00	22.00	19.50
Copper tubing (100-lb. lots)	23.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	18.00	18.75
Brass tubing (100-lb. lots)	20.50	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Brass wire (carlots)	17.25	17.75	.....
Zinc sheets (casks)	8.25	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	21.00	22.00	20.00
Babbitt metal (fair grade)	24.25	41.50	36.00
Babbitt metal (commercial)	11.00	16.00	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.75	11.50
Copper, heavy, and wire	11.75	11.25	10.50
Copper, light, and bottoms	9.75	9.50	9.75
Lead, heavy	4.75	4.75	4.75
Lead, tea	4.25	3.50	3.75
Brass, heavy	7.00	6.00	7.00
Brass, light	6.00	5.00	6.00
No. 1 yellow brass turnings	6.50	6.00	6.50
Zinc	3.00	3.00	3.00

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.07½@\$0.10	\$0.12	\$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13½x13½	....	per M. 50.00	per lb. .10
Wiping cloths, 13½x20½	....	per M. 55.00	per lb. .13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.07	.96
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville		per net ton	\$8.00
Coke, prompt foundry, Connellsville		per net ton	\$8.50

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	65–10%	60%
1¼ and 1¼x3 in. up to 12 in.	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	.....	\$1.00 off
Button head bolts, with hex. nuts	25%	\$3.90 net	.....
Hex. head and hex. nut bolts	30%	....	65-5%
Lag screws, coach screws	50%	....	60-5%
Square and hex. head cap screws	70–10%	75%	70-10%
Carriage bolts, up to 1 in. 30 in.	40%	60%	50-5%
Bolt ends, with hot pressed nuts	50%	....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70–10%	80%
Case-hardened nuts	60%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$4.50	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$4.00	\$3.25	\$3.10
Cone heads, ditto (net)	4.10	3.35	3.20
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	.....	\$3.35 base
Copper rivets	55–5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.28@0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$3.85	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Cal., Los Angeles—Bd. of Educ., Security Bldg.—machine tools, etc., for proposed high school on Boyle Heights.

Ga., Columbus—Huston Mfg. Co., 30th St., [illegible], Purch. Agt.—one rivet spinning machine for setting [illegible] in. rivets and 3 [illegible] presses.

Ill., Chicago—P. [illegible] 1410 Clybourman St.—vertical milling machine.

Ill., Chicago—Peterson Shop, 207 East [illegible] St.—one 20 in. and one 24 in. heavy duty or standard Gould & Eberhardt shaper, gear box drive.

Ind., Hammond—Hammond Machine and Forge Wks.—heavy duty engine lathe, 43 or 48 in. swing, 12 to 14 ft. centers.

Kan., Wichita—W. Brunker, 519 South Wichita Ave.—power lathe, drill press, lathe cylinder grinder, emery stand and belting.

Kan., Wichita—S. C. Coble, 410 North Main St.—power lathe (large).

Kan., Wichita—J. Emerick, 438 North Main St.—power drill press, lathe, emery stand, belting, pulleys, shafting, hangers, bearings, cylinder grinders.

Kan., Wichita—Nash Cycle Co., 122 South Washington St., H. H. Nash, Purch. Agt.—drill, lathe and emery wheel.

Kan., Wichita—Pierce Auto Co., South Topeka Ave., W. Shanklin, Purch. Agt.—one drill press and power lathe.

Kan., Wichita—B. Staunton, 232 South Water St.—one power lathe, drill press, belting, emery stand, cylinder grinder and straightener.

Mich., Detroit—Daly Machine Co., 116 Post St.—machine shop equipment.

Mich., Detroit—The Wilton Tool Mfg. Co., [illegible] Grand River Ave.—machinery and equipment for proposed factory at Sharon, Pa.

Minn., Strathcona—The Northern Metal Wks., Inc. (manufacturer of steel roller cases for auto curtains), C. H. Nordby, [illegible]—sheet steel stamping dies and other equipment.

Mo., Kansas City—G. Wendell, 3417 East 6th St.—14 in. power lathe, standard gear (new or used).

Mo., Martin City—H. E. Clay—power lathe, drill press, trip hammer, and hand tools for garage.

N. Y., Buffalo—R. I. Aldrich, 607 Fargo Ave.—machinery, equipment, and small tools for garage at 14 West Bennett St.

N. Y., Buffalo—E. P. Leitz, 463 Connecticut St.—small electric driven lathe and other tools and equipment for auto repair shop on East Genesee St.

N. Y., New York—Star Photo Co., 242 Lafayette Ave.—steel die press.

N. Y., Rochester—T. Doud, 32 Lake View Park—small tools, machinery and other equipment for new garage on May and Stewart Sts.

O., Bucyrus—[illegible] Mfg. Co.—metal working machines, grinders, drill press, [illegible] and shafting.

O., Columbus—[illegible] Auto Sales Co., 199 North [illegible] St.—machinery for enlarged service station, including drill press, grinder, boring mill, milling machine, etc.

Pa., Johnstown—The Walling Co., 518 Washington St.—tools, machinery and other equipment for automobile repair shop.

Pa., Mahanoy City—D. [illegible]—machinery, tools and equipment for proposed garage in [illegible].

Pa., Phila.—J. H. [illegible] Co., 1639 [illegible] St.—equipment for machine shop.

Va., Richmond—Chesapeake & Ohio R.R., [illegible], Purch. [illegible]—machinery and equipment for proposed [illegible] shop, power house and addition to engine house at [illegible] Creek, W. Va.

Va., Richmond—Union Machine Shop, R. E. Savage, Purch. Agt.—quick change lathe (large), also Union grinder (new or used).

Wis., Kenosha—G. L. Ross, Public Service Bldg.—machinery and equipment for auto repair shop.

Wis., Marshfield—P. Hagen, Route 1—machinery for auto repair shop, also air compressor, gas storage tank, etc.

Wis., Milwaukee—Bahde Mfg. Co., 2631 Vine St.—lathes, drill presses, grinders, dies, electric motors, etc., for proposed factory tool room.

Wis., Milwaukee—Harley-Davidson Motor Co., 3732 Chestnut St., W. Davidson, Purch. Agt.—one No. 34 automatic chucking machine (New Britain).

Wis., Milwaukee—Ideal Sheet Metal & Heating Co., 725 Pearl St.—sheet metal working machinery.

Machinery Wanted

Ark., Sulphur Springs—The Speaker, W. N. Stranahan, Purch. Agt.—newspaper press.

Cal., Marysville—Associated Oil Co.—machinery and equipment for proposed addition to refinery.

Cal., Richmond—San Pablo Pottery Co.—additional machinery and equipment for proposed plant enlargement.

Cal., San Francisco—Shell Oil Co., 242 Sansome St.—pumping machinery and equipment for proposed distributing station at Yuba City.

Conn., Bridgeport—Karm Terminal Co., 447 North Washington Ave.—coal pocket equipment and coal conveying machinery.

Fla., Eustis—Acme Sand Co., Inc., L. Wylly, Genl. Mgr.—machinery pumping equipment, etc., soon to be installed.

Fla., Lynn Haven—The Citizen—hand press and complete printing equipment.

Fla., Miami—A. W. Webb, 2nd Ave., N. E.—machinery and equipment for cannery.

Fla., Orlando—W. F. Blackman and associates—machinery and equipment for proposed ice and cold storage plant.

Ga., Atlanta—Atlanta Army Stores, Inc., 1 Grant St.—foundry machinery and equipment for the manufacture of window sash weights.

Ga., Valdosta—R. L. Harris—machinery for the manufacture of chairs.

Ill., Carlyle — Union Banner — printing equipment.

Ill., Chicago—L. Bloom (broker), 128 North Wells St.—complete job printing plants.

Ill., Chicago—E. Hooson, 6245 South St. Louis Ave., (machine shop)—plating dynamos, 250 to 500 amperes; also polishing machinery.

Ill., Chicago—Landfield & Bloom, 123 North Wells St.—job printing presses (used).

Ind., Indianapolis—Acme Wks., Inc., 420 South Harding St., iron casting manufacturers, P. Lambertous, Pres.—machinery and equipment for addition, to wood and metal pattern shop.

Ind., Indianapolis—R. H. Hassler, Inc., 1235 Naomi St.—special machinery and equipment for proposed factory for the manufacture of automobile shock absorbers.

Ind., Vincennes—Self Lay Block & Machine Co., manufacturers of concrete block machinery—additional machine tool equipment for proposed addition to plant.

Kan., Wichita — Good Will Builders, Broadview Hotel Bldg., E. B. Kennedy, Purch. Agt.—job printing press, belting, shafting, pulleys, hangers.

Kan., Wichita—Gruen & Hoshaw Packing Co.—refrigeration machinery, belting, hangers, shafting, pulleys, bearings, etc., for stock yards.

Kan., Wichita—Hockaday Auto Supply Co., 406 East Douglas Ave.—air pressure tank.

Kan., Wichita—North End News, 215 East 13th St. (R. R. Weber, owner)—job printing press (power).

Ky., Winchester—Pilot Knob Sand & Gravel Co., G. B. Williams, Pres.—machinery and equipment for mining sand and gravel, (500 acres).

Md., Texas—Maryland Calcite Co., c/o R. J. Lovell, Dir.—machinery and equipment for mining and preparing calcite.

Mass., Ware—Ironside Fdry. Co., Inc.—equipment and machinery for foundry now being remodeled.

Mich., Detroit—Shepard Art Metal Co., 2821 East Grand Blvd.—equipment for the manufacture of automobile hardware.

Mich., Highland Park (Detroit P. O.)—The Ford Motor Co.—conveying equipment for proposed assembly plant in New Orleans, La.

Mich., Kalamazoo—The Vegetable Parchment Co.—machinery and equipment for proposed 120 ton paper plant.

Mich., St. Charles—F. A. Bement, Prop. of St. Charles Union, (newspaper)—No. 3 or No. 5 linotype.

Minn., St. Paul—Washington Fdry. Co., St. Paul, Eagle and Washington Sts., H. H. Orme, Pres.—air compressor, blowers, sand blast machine, electric motors and other foundry equipment.

Miss., Natchez—Natchez Ice Co.—machinery for proposed ice, cold storage and refrigeration plants.

Mo., St. Louis—Broderick & Bascom Rope Co., 805 North Main St.—equipment for machine shop and blacksmith shop, also machinery and equipment for engine room, and proposed wire rope factory and warehouse.

N. J., Newark—Leiman Bros., 175 Christie St.—sanding machine.

N. Y., Batavia—G. V. Frank & Bros., 11 Main St.—machinery and equipment for the manufacture of candy.

N. Y., Buffalo—Pratt & Lambert, 79 Tonawanda St.—machinery and equipment for proposed addition to varnish factory.

N. Y., Buffalo—E. F. Schroeder, 405 East Ferry St.—machinery and equipment for proposed candy manufacturing shop, including small gas furnace.

N. Y., Buffalo—J. Voll, 38 Bennett St.—tire repairing and vulcanizing equipment for new shop.

N. Y., Buffalo—W. Willis, 1121 East Ferry St.—equipment for battery service station including charging outfit, etc., also 1,000 gal. storage tank and gasoline pump, and other miscellaneous equipment for gas and service statino.

N. Y., Charlotte (Rochester P. O.)—G. Ward—one large size saw and table.

N. Y., Ellenville—Coffield Radio Equipment Corp.—machinery and milling supplies for the manufacture of radio and electrical supplies and instruments.

N. Y., Jamestown—Ideal-Peerless Laundry Co., 26 Forest Ave.—equipment for proposed laundry addition.

N. Y., Jamestown—J. E. Jackson, 46-48 Market St.—gas tank, pump and other small tools and equipment for gasoline and service station.

N. Y., Jamestown—Philo-Burt Co., 5 West 4th St., manufacturer of spinal appliances, etc.—addition machinery and equipment for proposed improved plant on East 6th St.

N. Y., Medina—H. J. Heinz Co.—machinery and equipment for brining plant to be installed in packing house of Pekin Cooperative Assn., at Sanborn, N. Y.

N. Y., New York—New York Mchy. Co., 200 5th Ave., A. Loewy, Purch. Agt.—several baling machines.

N. Y., Retsof—Retsoff Mining Co., T. Courthope, Engr. of company—machinery and equipment for refinery and salt mining plant.

N. Y., Rochester—S. Goldberg, 204 Hudson Ave.—machinery for proposed addition to mattress factory.

N. Y., Rochester—Ilex Optical Co., 726 Portland Ave.—machinery and equipment for addition to camera shutter plant.

N. C., Oxford—Oxford Public Ledger—presses, machinery, etc., for proposed plant.

N. C., Rocky Mount—Munn & Griffon Co.—machinery and equipment for new cold storage and refrigeration plant.

O., Cleveland—C. M. Fulkerson, 3904 Superior Ave., N.E.—machinery for concentration of iron ore by special process.

O., Marion—Marion Curtain Rod Co., G. H. Spragg, Pres.—$5,000 worth of machinery for plant.

O., Wellston—Wellston Telegram—one 30 in. lever and paper cutter with interlocking back gauge.

O., Youngstown — Youngstown Mazda Lamp Co., 617 Williams St.—equipment and machinery for proposed factory addition.

Okla., Poteau—Poteau Mfg. Co. (manufacturer of chairs, porch swings, folding chairs, etc.)—complete machinery and equipment (used).

Okla., Tulsa—Osage Battery Co.—machinery and equipment for proposed battery factory.

Okla., Valiant—Amer. Rock Asphalt Co.—machinery for mining asphalt.

Pa., Ambler—Bd. Educ.—equipment for vocational department of proposed high school.

Pa., Erie—Bd. Educ.—machinery and equipment for vocational department of proposed high school on West Side.

Pa., New Brighton—R. B. McDanel Co.—equipment for smoke houses, including 2 new coolers, etc.

Pa., Phila.—G. D. Ellis & Sons, 309 North 3rd St.—additional machinery for the manufacture of tin ware.

Pa., Phila.—A. Locke, 4945 Mulberry St.—automatic hosiery machines, (full fashion).

Pa., Pottstown—Century Knitting Co., Inc.—machinery and equipment for bleaching plant, now under construction.

Pa., Reading—Central Abattoir Co., Chestnut St.—machinery for new packing plant.

Pa., Warren—Hand Printing Co.—automatic presses and equipment for modern printing plant, on Lexington ave.

Pa., Wrightsville—Susquehanna Casting Co.—equipment for foundry to be established at New Oxford, Pa.

Pa., York—McGann Mfg. Co.—one 10 ton electric crane with 50 ft. span.

S. C., Newberry—C. P. McDaniel, Secy. of the Chamber of Commerce—machinery and equipment for proposed tanning factory.

Tenn., Chattanooga—Dixie Spinning Co., J. L. Lupton, Pres.—machinery and equipment for proposed cotton and yarn mill.

Va., Newport News—Appacosta Shoe Mfg. Co., c/o Chamber of Commerce, Schmelz Bldg.—full line of machinery for the manufacture of shoes.

Va., Richmond—Fish Guano Co. (manufacturer of fish fertilizer)—engine, boiler, grinders, separators and belting.

Va., Richmond—Grigsby Constr. Co., 120 South 8th St.—electric welder and air testing machine.

Wash., Seattle—Pacific Specialty Co., 1407 Dearborn St., A. C. Townsend, Secy.—machinery and equipment for proposed soap factory.

W. Va., Fairmount—Fairmount Mining Mchy. Co.—power bending brake, capacity ⅜ in. material 12 ft. long.

W. Va., Huntington—Main Island Creek Coal Co., A. J. Dalton, Pres.—lumber mill and mining machinery.

Wis., Appelton—G. R. & S. Motor Co., 738 Washington St.—equipment and machinery for proposed garage and auto repair shop.

Wis., Beaver Dam—Middle West Mfg. Co.—iron-working machinery for the manufacture of stanchions etc., for barns.

Wis., Chippewa Falls—A. F. Ender—linotype and job press, newspaper press, type, belting, hangers, shafting and pulleys.

Wis., Chippewa Falls—Olsen Shoe Mfg. Co. — shoe-working machine, (electric power).

Wis., La Crosse—Trane Co., 2nd St. and Cameron Ave.—machinery for the manufacture of heating specialties and electric motors.

Wis., Madison—Kennedy Dairy Co., 618 University Ave.—ice making and refrigerating machinery for ice manufacturing plant.

Wis., Manitowoc—Aluminum Goods Mfg. Co.—one 20 ton electric traveling crane for proposed plant.

Wis., Marshfield — Blum Bros. Co., manufacturer of butter tubs—box-board matcher, 30 in. double planer with motor connected and sectional feed rolls and chip breakers, 3 jointers, 1 heading turner.

Wis., Milwaukee—Cohen Iron & Metal Co., 629 Canal St.—acetylene cutting machine for scrap iron.

Wis., Milwaukee—Meredith Bros. Co., 1043 Kinnickinnic Ave.—additional woodworking machinery, including saws and probably a planer.

Wis., Milwaukee—A. Ramhorst, 1113 Maiden Lane—machinery with electric motor, for the manufacture of candy.

Wis., Milwaukee—The Standard Victoria Steam Laundry, 69 Ogden Ave.—additional laundry machinery and belting.

Wis., Neillsville—E. W. Scheel—dairy and refrigerating machinery.

Wis., Oshkosh—Winnebago County, J. Binning, Commissioner. — machinery and equipment for garage and repair shop.

Wis., Phillips—Kneeland—McClurg Lumber Co., P. S. McClurg, Pres.—woodworking machinery for sawmill.

Wis., Stevens Point—The Pfiffner Lumber Co., 229 Franklin St.—band re-saw, sander, and smaller machinery.

Wis., Two Rivers—Bd. Educ., J. Doleysh, Secy.—machinery and equipment for manual training department, also gas machine.

Wis., Waunakee—Gripx Mfg. Co.—special machinery for the manufacture of patterns, punch press stamping, etc.

Wis., Wauwatosa—Economy Block Co., 7th St. and East North Ave.—power driven machinery for the manufacture of cement block, including tampers, etc.

Wyo., Rock River—R. A. Young—newspaper press and job press.

Ont., Toronto—Farmers Dairy Co., Walmer Rd.—dairy equipment for pasturizing, etc.

Ont., Toronto—Pure Gasoline Co., 13 King St. W.—equipment for proposed gasoline stations at Kitchener and Niagara Falls.

Metal Working Shops

Cal., Berkeley—City of Berkeley (Berkeley School Dist.) has awarded the contract for the construction of a 1 story shop building at Burbank School. Estimated cost $15,225. Noted June 29, 1922.

Cal., San Francisco— L. R. Lurie, Mills Bldg., will build a 1 story, 10 x 49 x 165 ft. machine shop on Folsom St. near 6th St. Estimated cost $17,600. To be leased to Hubbard Machine Co., 615 Howard St., manufacturer of pumping machinery.

Conn., Bantam—Fletcher-Thompson, Inc., Engrs. and Archts., 542 Fairfield Ave., Bridgeport, is receiving bids for the construction of a 2 story, 50 x 104 ft. factory addition, for Bantam Ball Bearing Co., here. Estimated cost $50,000.

Conn., Bristol—E. Ingraham Co., Inc., 392 North Main St., has awarded the contract for the construction of a 1 story, 40 x 195 ft. addition to its clock and watch factory. Estimated cost $20,000 to $25,000.

Ill., Chicago—E. Edelmann & Co., 2638 North Crawford Ave., has awarded the contract for the construction of a 2 story, 150 x 250 ft. factory on Logan Blvd. and Holly Ave., for the manufacture of auto accessories. Estimated cost $250,000. Noted June 29, 1922.

Ind., Indianapolis—R. H. Hassler, Inc., 1335 Naomi St., has awarded the contract for the construction of a 2 story, 37 x 120 ft. factory for the manufacture of automobile shock absorbers. Estimated cost $40,000. Architect not announced.

La., New Orleans—The Ford Motor Co., Highland Park, Mich., had plans prepared for the construction of a 1 and 2 story automobile assembly plant on North Peters St., here. Estimated cost $100,000. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt.

Md., Frostburg—Frostburg Sewer Pipe Co., Inc., plans to build a large plant in the northern section of the city. Estimated cost $200,000. Engineer not announced.

Mass., Somerville—B. F. Smith Co., Inc., plans to build a 1 story, 50 x 70 ft. machine shop at its artesian well factory on Cross St. Estimated cost $15,000. Private plans.

Mich., Detroit—A. Kahn, Archt., 1,000 Marquette Bldg., will receive bids until July 20, for the construction of a 4 story, 95 x 259 ft. automobile factory addition on Clark and Jefferson Aves., for the Studebaker Corp., Brush and Piquette Aves.

Minn., St. Paul—Washington Fdry. Co., St. Paul, Eagle and Washington Sts., has awarded the contract for the construction of a 2 story, 22 x 100 ft. and a 1 story, 71 x 166 ft. foundry. H. H. Orme, Pres.

N. J., Belleville—Thompson Machine Co. has awarded the contract for the construction of a 2 story factory for the manufacture of bakery machinery. Estimated cost $150,000. Noted June 8, 1922.

N. Y., Buffalo—The Great Lakes Dredge & Dock Co., Morgan Bldg., plans to build a repair shop at the foot of Katherine St. Estimated cost $5,000. Architect not announced.

N. Y., New York—S. M. De Padquale, c/o S. J. Kessler, Archt., 529 Cortlandt St., will build a garage on Webster Ave. Estimated cost $125,000.

N. Y., New York—Webster Building Co., c/o S. J. Kessler, Archt., 529 Cortlandt St., will build a 3 story garage on 172nd St. and Sheridan Ave. Estimated cost $175,000.

O., Akron—M. O'Neil, of the General Tire & Rubber Co., had plans prepared for the construction of a 2 story, 96 x 163 ft. garage and service station on West Market St. Estimated cost $75,000. Walker & Weeks, 1900 Euclid Ave., Cleveland, Archts.

O., Bellaire—C. L. Dorer Fdry. Co. has awarded the contract for the construction of a 1 story, 36 x 60 ft. foundry addition. Private plans.

O., Cleveland—E. McGeorge, Archt., 1900 Euclid Ave., is receiving bids and will open same about July 15, for the construction of a 2 story, 96 x 180 ft. factory and warehouse on East 61st St. north of Euclid Ave., for the Cleveland Folding Machine Co., 5200 Euclid Ave. E. H. Jones, Secy. Estimated cost $100,000.

O., Dover—Reeves Mfg. Co., manufacturer of galvanized sheets, etc., has awarded the contract for the construction of a 1 story, 60 x 180 ft. factory and warehouse. Estimated cost $100,000.

O., Niles—Youngstown Steel Car Co., Niles, plans to build a large addition to its car factory. Estimated cost $60,000. Architect not announced.

Pa., Charleroi—Fox Grocery Co. plans to build a 1 story, 44 x 100 ft. garage and repair shop on McKean Ave. Estimated cost $40,000. Architect not selected.

Pa., Charleroi — G. Woodward has awarded the contract for the construction of a 3 story, 88 x 100 ft. garage addition. Estimated cost $40,000. Noted June 15, 1922.

Pa., Meadville—Champion Tool Co., Pine St., is receiving bids for the construction of a 1 and 2 story, 100 x 200 ft. and 60 x 60 ft. machine and forge shops. Private plans.

Pa., New Brighton—Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, has awarded the contract for the construction of a 1 story, 47 x 135 ft. foundry addition, here. Estimated cost $50,000.

Pa., Pittsburgh—National Metal Products Co., North Side, plans to build a 3 story, 80 x 120 ft. or a 120 x 120 ft. weatherstrip factory, on Erie and West Diamond St. Estimated cost $100,000. Architect not selected.

Pa., Pottsville—D. Guinan, Mahonoy City, plans to build a 4 story, 60 x 120 ft. garage and repair shop on Harrison and Centre Sts., here. Engineer not announced.

Pa., Trafford City—Westinghouse Electric & Mfg. Co., East Pittsburgh, has awarded the contract for the construction of a 1 story, 50 x 135 ft. tin shop, here. Estimated cost $40,000. Noted June 29, 1922.

W. Va., Peach Creek—Chesapeage & Ohio R. R., 9th and Main Sts., Richmond, Va., has awarded the contract for the construction of a 1 story machine shop, round house and power house, here. Estimated cost, $250,000.

W. Va., Wheeling—E. B. Franzhiem, Archt., 1425 Chapline St., is receiving bids for the construction of a 3 story, 40 x 60 ft. garage and motor sales building on 15th and Eoff Sts., for Hopkins Motor Co., 15th St. Estimated cost $45,000.

W. Va., Wheeling—Warren Auto Trading Co. will build a 3 story, 60 x 125 ft. garage and repair shop. Estimated cost $50,000. Private plans.

Wis., [illegible]—G. R. & S. Motor Co., [illegible] St., is [illegible] for the construction of a 1 and 2 story, 30 x 100 ft. garage and repair shop. Estimated cost [illegible]. Private plans.

Wis., [illegible]—Trane Co., 2nd St. and Cameron Ave., manufacturer of heating [illegible], has awarded the contract for the construction of a 1 story, 60 x 90 ft. factory addition. Estimated cost [illegible].

Wis., Milwaukee—Rablo Mfg. Co., 3621 [illegible] St., is receiving bids for the construction of a 1 story, 30 x 150 ft. factory on Chambers and 30th Sts., for the development and manufacture of patented mechanical articles. Estimated cost $30,000. Leiser & Holst, 105 Wells St., Archts.

Wis., Oshkosh—Winnebago County, has [illegible] funds and plans to build a 1 [illegible] garage and repair shop. Estimated cost $40,000. J. Binning, Com[illegible].

Wis., Waunakee—Grip Mfg. Co., plans to build a 2 story, 75 x 90 ft. factory for the manufacture of [illegible]. Estimated cost [illegible]. Architect not selected.

Ont., Montrose—The Canadian Axolite Co. has awarded the contract for the construction of a 2 story, 50 x 100 ft. addition to its machine shop. Estimated cost $50,-000. Private plans.

General Manufacturing

Cal., Fresno—United Warehouse Co., H. and [illegible] Sts., will build a factory-warehouse on O St. near Monterey, to be leased to [illegible]-Low Co., 903 North Main St., Los Angeles, for the manufacture of car-[illegible]. Estimated cost $14,[illegible].

Cal., Oakland—Central [illegible] Creamery Co., [illegible] St., has awarded the contract for the construction of a 3 story creamery on West [illegible] Ave. and South 55th St. Estimated cost $62,000.

Cal., Pittsburgh—The California Bean Growers' Assn., [illegible] Battery St., San Francisco, is receiving bids for the construction of a 1 story, 50 x 250 ft. warehouse, and a 5 story [illegible] x 40 ft. mill, here. Estimated cost $80,000. MacDonald Eng. Co., 149 California St., San Francisco, Engrs.

Cal., San Bruno—P. Grassi Co., 135 Tehama St., will build a 1 story factory on [illegible] near Waterloo St., for the manufacture of marble and terrazzo steps, [illegible]. Estimated cost $2[illegible]. Willard & [illegible], [illegible] Bldg., San Francisco, Archts.

Cal., San Francisco—Collins-Hencke Co., 25 Beale St., has had plans prepared, and will soon receive bids, for the construction of a 1 story [illegible] factory on [illegible] St., between 2nd and 3rd Sts. Estimated cost $100,000. N. W. Sexton, Chronicle Bldg., Archt.

Cal., [illegible]—Fresno Tire & Rubber Co., [illegible] Bldg., has awarded the contract for the construction of a factory on Block St. Estimated cost $136,000. Private plans.

Cal., Taft City—Shell Oil Co., 342 Sansome St., San Francisco, has awarded the contract for the construction of a distributing station, including pumping machinery and tanks.

Conn., Hartford—Coca Cola Bottling Co., 375 Allyn St., has awarded the contract for the construction of a 1 story, 65 x [illegible] ft. bottling plant, on Walnut and [illegible] Sts. Estimated cost $19,000.

Conn., Rockville—[illegible] Bros. & Co., [illegible] Main St., has awarded the contract for the construction of a 5 story, 16 x [illegible] ft. addition to its silk mill. Estimated cost $[illegible].

Ill., Chicago—R. Griesser, Archt., 64 West [illegible] St., is receiving bids for the construction of a [illegible] story, [illegible] ft. bakery for [illegible] Bakery Co., Inc., [illegible] Ave. Estimated cost $160,000.

Ill., Forest Park (Oak Park P. O.)—J. D. [illegible] Dairy Co., 3014 West Polk St., Chicago, has awarded the contract for the construction of a 2 story, 145 x 175 ft. dairy on Harrison St., here. Estimated cost $150,000.

Minn., Minneapolis—[illegible] Ice Cream Co., 2nd and [illegible] Ave., S. E., is having plans prepared for the construction of a 2 story, [illegible] x 117 ft. and a 3 story, 117 x 1[illegible]7 ft. addition. Estimated cost $[illegible]. C. A. [illegible], [illegible] Bldg., Archt.

N. Y., Buffalo—Peckham Vocational School, 221 Peckham St., plans to build a 1 story, 32 x 36 ft. and 30 x 96 ft. addition. Estimated cost to exceed $5,000. Architect not announced.

N. Y., Buffalo—Pratt & Lambert, 79 Tonawanda St., plans to build a large addition to its varnish factory. Estimated cost $40,000. Architect not announced.

N. Y., Elmira—Elmira Water, Light & R. R. Co., plans to build a gas manufacturing plant; daily capacity 1,500,000 cu.ft. F. H. Hill, Vice Pres.

N. Y., Jamestown—Ideal-Peerless Laundry Co., 26 Forest Ave., plans to build a large addition to its laundry. Estimated cost $15,000. Private plans.

N. Y., Rochester—Ilex Optical Co., 726 Portland Ave., plans to build a 3 story 85 x [illegible] ft. addition to its camera shutter plant. Estimated cost $200,000. Architect not announced.

N. C., Asheville—Gulf Refining Co., Liberty and Water Sts., Pittsburgh, Pa., is having plans prepared and will soon receive bids for the construction of 3 filling stations, here, estimated cost between $20,-000 and $25,000, and also for several concrete storage tanks. S. C. Cooper, Asheville, Archt. and Engr.

N. C., Lexington—The Erlanger Cotton Mills Co. has awarded the contract for the construction of a 1 story 69 x 229 ft. cloth room and cloth storage building.

N. C., Oxford—Oxford Public Ledger is having plans prepared for the construction of a 2 story, 75 x 100 ft. plant. Estimated cost $20,000. M. Minor, Oxford, Archt.

N. C., Winston-Salem—J. Reich is receiving engineers plans and will receive bids this summer for the construction of a 2 story, 60 x 70 ft. paint manufacturing plant, recently destroyed by fire. Estimated cost $20,000-$25,000.

O., Cleveland—The Standard Envelope Co., 1011 Oregon Ave., will soon award the contract for the construction of a 1 story, 155 x 200 ft. factory, on East 30th St. and Chester Ave. Estimated cost $150,-000. J. H. Altman, Pres. Christian Schwarzenberg & Gaede, 1900 Euclid Ave., Archts. Noted June 1, 1922.

O., Columbus—Department of Public Welfare, 9th and Oak Sts., has awarded the contract for the construction of a laundry and bakeshop on West Broad St. Estimated cost $33,000 and $20,700 respectively. Noted June 22.

O., Dayton—The Bd. Educ. will receive bids until July 13 for the construction of Roosevelt High School, 3 story. Will contain shops, laboratories, etc. Estimated cost about $250,000. C. J. Schmidt, 122 La Belle St., Clk. Schenk & Williams, Mutual Home Bldg., Archts. Noted April 27, 1922.

O., Lima—Toloson Tent and Awning Co. plans to build a factory. Estimated cost $75,000. Architect not announced.

O., Youngstown—Youngstown Mazda Lamp Co., 617 Williams St., plans to build a 4 story, 97 x 120 ft. addition to its factory. Estimated cost $125,000. Engineer not announced.

Okla., Tulsa—Osage Battery Co. plans to build a large factory for the manufacture of storage batteries. Engineer and architect not announced.

Pa., Altoona—The Confederated Home Abattoir Corp., 123 Willow Ave., has awarded the contract for the construction of a 3 story, 80 x 140 ft. meat packing plant on Eldorado Rd. Noted Feb. 9.

Pa., Butler—Rieck-McJunkin Dairy Co., Forbes St., is having plans prepared for remodeling its 2 and 3 story ice cream plant and dairy. Estimated cost $50,000. A. Daniels, c/o owner, Archt.

Pa., Cambridge Springs—Blystone Mfg. Co. plans to build a 1 and 2 story 90 x 400 ft. and 40 x 96 ft. factory, for the manufacture of concrete mixers. Private plans.

Pa., Franklin—Atlantic Refining Co., plans to rebuild a large portion of its refinery destroyed by fire. Estimated cost $100,000. Engineer not announced.

Pa., Hays—Harbison-Walker Refractories, Farmers Bank Bldg., Pittsburgh, manufacturer of fire bricks, has awarded the contract for the construction of a 4 story, 40 x 120 ft. shop and mold storage building, here. Estimated cost $[illegible],000.

Pa., New Brighton—R. B. McDanel Co., plans to build a 2 story 42 x 68 ft. packing house addition to its plant. Architect not announced.

Pa., New Kensington—Premier Baking Co. has awarded the contract for the construction of a 3 story, 80 x 90 ft. bakery. Estimated cost $100,000. Noted June 29, 1922.

Pa., Phila.—J. F. Nolan & Sons, Church Lane, has awarded the contract for the construction of a 2 story, 38 x 80 ft. and 50 x 85 ft. dye house, on Magnolia and Armstrong Sts. Estimated cost $18,000.

Pa., Phila.—I. West, 139 North 2nd St., has awarded the contract for the construction of a 4 story, 19 x 47 ft. furniture factory. Estimated cost $16,000.

R. I., Pawtucket—Hope Webbing Co., 1005 Main St., has awarded the contract for the construction of a 6 story, 85 x 190 ft. mill addition. Estimated cost $200,000.

Tenn., Chattanooga—Dixie Spinning Co. plans to build a cotton and yarn mill, 10,000 spindle capacity. Estimated cost $500,000. J. L. Lupton, Pres. Architect not announced.

Tex., Refugio—Refugio Glass Wks., Inc., Natl. Bank of Commerce Bldg., San Antonio, plans to build a glass bottle factory here, capacity 50,000 bottles per day. Estimated cost $75,000. Private plans.

Vt., Rutland—Rutland Sash and Door Co., plans to build a 2 story door and sash mill. Estimated cost $50,000. Private plans.

Va., Danville—Dan River Cotton Mills, has awarded the contract for the construction of a 4 story, 148 x 300 ft. bleachery and finishing cotton plant. Estimated cost $450,000.

Va., Richmond—News-Leader Publishing Co., 9 North 8th St., is receiving bids for the construction of a 4 story, 90 x 140 ft. newspaper plant on 4th St. near Grace St. Estimated cost $300,000. Baskerville & Lambert, Travelers Bldg., Archts.

Wis., Madison—Kennedy Dairy Co., 618 University Ave., plans to build a 1 story, 50 x 75 ft. ice manufacturing plant on Washington St. Estimated cost $40,000. Architect not selected.

Wis., Milwaukee—Lesser & Schutte, Archts., 82 Wisconsin St., are receiving bids for the construction of a 2 story, 40 x 114 ft. laundry addition, for the Standard Victoria Steam Laundry, 69 Ogden Ave.

Wis., Phillips—Kneeland-McClurg Lumber Co. plans to build a 60 x 120 ft. saw mill, to replace the one which was destroyed by fire. Estimated cost $200,000. P. S. McClurg, Pres. Architect not selected.

Wis., Stevens Point—The Pfiffner Lumber Co., 229 Franklin St., is receiving bids for the construction of a 2 story, 60 x 100 ft. planing mill. Estimated cost $100,000. F. Spaienker, Stevens Point, Archt.

B. C., New Westminster—New Westminster Paper Mills Ltd., plans to build a factory for the manufacture of tissue paper on the Indian Reserve, near here. Estimated cost $100,000. A. Onkels, Dir. Engineer not announced.

Cuba, Guantanamo—Bureau of Yards and Docks, Navy Dept., Washington, D. C., plans to build a distilling plant, here. Spec. No. 4683.

N. S., Halifax—Premier Paper & Power Co., 91 Hollis St., plans to build a large paper mill 35 miles from here. Estimated cost $1,500,000. P. H. Moore, Manaing Dir. G. F. Hardy, 309 Bway, New York City, Engr.

N. S., North Sydney—Cape Breton Cold Storage Co., plans to build a cold storage plant and packing house. Estimated cost $200,000. Address J. Clarke, c/o owner. Private plans. Architect not announced.

Ont., Brampton—Sturgis Baby Carriage Co., 60 Sumach St., Toronto, is having plans prepared for the construction of a 2 story, 50 x 100 ft. factory and a 2 story, 20 x 30 ft. boiler house, here. Estimated cost $100,000. R. W. Hall, 707 Yonge St., Toronto, Archt.

Ont., Ottawa—Stadium of Ottawa, Ltd., 108 Sparks St., is having plans prepared for the construction of a stadium, stores and artificial ice plant, on King Edward Ave. Estimated cost $300,000. Millson & Burgess, Home Bank Bldg., Sparks St., Archt.

Ont., Stamford—The Canadian Carborundum Co., Montrose, has awarded the contract for the construction of a 2 story, 50 x 100 ft. addition to its plant here.

Ont., Stamford—Culp Paper Co., Rochester, N. Y., has purchased a site on Winery Rd., here, and plans to build a paper plant soon. Estimated cost will exceed $40,000.

Ont., Toronto — Toronto Wet Wash Laundry Co., 11 Dundas St., is having plans prepared for the construction of a 2 story, 40 x 60 ft. laundry. Estimated cost $45,000. Harkness, Loudon & Hertzberg, Confederation Life Bldg., Archts.

American Machinist

Volume 57 NEW YORK, JULY 20, 1922 Number 3

A Factory That Fits the Job

Laying Out a Manufacturing Plant with Future Developments in Mind—Selecting Machinery, Transportation Equipment and Fixtures on an Economic Basis

By G. I. RHODES

INDUSTRIAL construction in 1920 proved to be so costly that many new factories are now "white elephants" on the hands of their owners. A notable exception is the plant of the Syracuse Washing Machine Corporation. Built during that trying year of 1920, its burden is eliminated by its economies. It is pre-eminently "A Factory that Fits the Job."

The Syracuse Washing Machine Corporation in 1919 occupied rented factory space which was rapidly becoming inadequate to meet the demand for washing machines. Rented facilities had been increased from time to time and in the fall of that year it became evident that some radical step must be taken.

The product of this concern has been designed and developed with a view to low cost of manufacture combined with quality equal to or better than the best of its competitors. It was accordingly felt that this product would be profitable when the later inevitable competitive period of the washing machine business should be reached and that this situation warranted permanent factory investment.

A Well Developed Plan

It was accordingly decided in December, 1919, to build a new factory and general requirements or specifications were outlined as follows:

The new plant should be located in Syracuse with direct shipping facilities on more than one railroad, with reasonable accessibility to labor and with ample space for future growth not only of the business of manufacturing washing machines and other similar products but for later subsidiary or auxiliary industries.

The building should be of fireproof, permanent construction without unnecessary frills, well lighted both night and day and have 180,000 sq.ft. of space of which 30,000 sq.ft. should be available for office facilities. It should be a permanent part of a much larger factory and be adapted to considerable rearrangement with the growth of business and gradual transfer of certain activities to later building extensions.

Equipment should be installed to manufacture several times the daily capacity of the old factory with proper space equipment where necessary. There should be installed no "special purpose" equipment of limited use for other products, and expensive machine tools should pay for themselves within three years of normal use as compared with simpler and less expensive equipment. All jigs and fixtures should be designed to pay for themselves in six months as compared with devices already in use.

With these general specifications as a guide, arrangements were entered into with Ford, Bacon & Davis, acting in co-operation with company officials, to assist in determining the site, to design and construct the building, to specify, lay out and install ready for operation, all manufacturing equipment, and to supervise the selection, design and purchase of all jigs, tools and fixtures. In connection with the latter work, the Manufacturers' Consulting Engineers, of Syracuse, co-operated with Ford, Bacon & Davis.

The entire city of Syracuse was studied for location, and finally, some twenty-five acres of land were purchased near the Erie Barge Canal Terminal, the Rome, Watertown & Ogdensburg Division of the New York Central Railroad, and the Delaware, Lackawanna & Western Railroad, thus providing three direct methods for the receipt of materials and the shipment of finished products, and space enough for any possible future development. The location is within one-half mile of the business center of Syracuse and is the focus of transportation facilities in Syracuse both present and future. Plans are under way to make this territory, known as the "salt lands," the future industrial district of Syracuse, involving the construction of a loop railroad tying together the main line railroads and the barge canal with a freight station directly across the street from the site.

The location chosen is adjacent to those districts of Syracuse from which labor is largely drawn and accordingly there was no housing problem. The location of the site with respect to Syracuse and with respect to the proposed loop railroad and the barge canal are shown in Fig. 1.

Buildings to Meet All Conditions

It had been observed that in the manufacture of domestic appliances, a reasonably definite relationship existed between the amount of space required for the assembly and shipment of a given number of machines per day and the space utilized for the production of parts, storage of raw materials, finished parts, etc. The single-story building seemed to offer the greatest merit for the volume of production immediately to be planned for, and a building of the size chosen would fit in very satisfactorily with a connected multi-story building which could later be used for general manufacturing purposes, the single-story building then being utilized for the assembly and shipment of machines.

The relationship between the single- and multiple-story building, together with street and track levels is shown by Fig. 1, which indicates a complete development of one block of the site purchased.

In the complete development it was planned to have all incoming freight arrive on the upper tracks adjacent to the multi-story building and have all shipments made

FIG. 1—PRESENT AND PROPOSED DEVELOPMENT OF SITE

from the lower level tracks along the single-story building. It seemed probable that the output of the ultimate building would call for receipts and shipments aggregating approximately 200 cars per day and accordingly this segregation seemed absolutely necessary with a further simplification of internal transportation problems. With the initial construction of only the single-story portion of the building, the volume of receipts and shipments could very easily be handled on the low level tracks.

The single-story building was accordingly designed 300 x 420 ft. with a two-story building 300 x 90 ft. at the southerly end. The single-story building is of concrete and steel construction with saw-tooth roof and steel sash throughout; the two-story portion is of similar construction with a saw-tooth roof over the second-story office for better lighting facilities. Gypsum was chosen as a roof material on account of its lightness and its heat insulating qualities which offered large savings in the cost of heating plant and of coal. Five-ply tar and gravel roofing was installed as offering the best protection for a gypsum roof. The frame and walls of the building are supported on concrete piles but the ground floor is laid directly on filled land. It was planned to utilize the two-story building as an office and general storehouse and the single-story building for manufacturing and assembly purposes combined with stores of finished parts. Insurance regulations required separation of the two-story building from the one-story building by firewall and the division of the single-story building into two substantially equal parts by a wall of hollow tile or a construction of equivalent safety.

With the limitations as imposed by location of fire walls, careful study of the floor layout was made with a view to arranging storage, manufacturing, assembling, crating and shipping facilities in such a manner as to reduce to the absolute minimum the amount of internal transportation. In fact, transportation and the handling of materials was one of the prime considerations in the layout of the factory buildings.

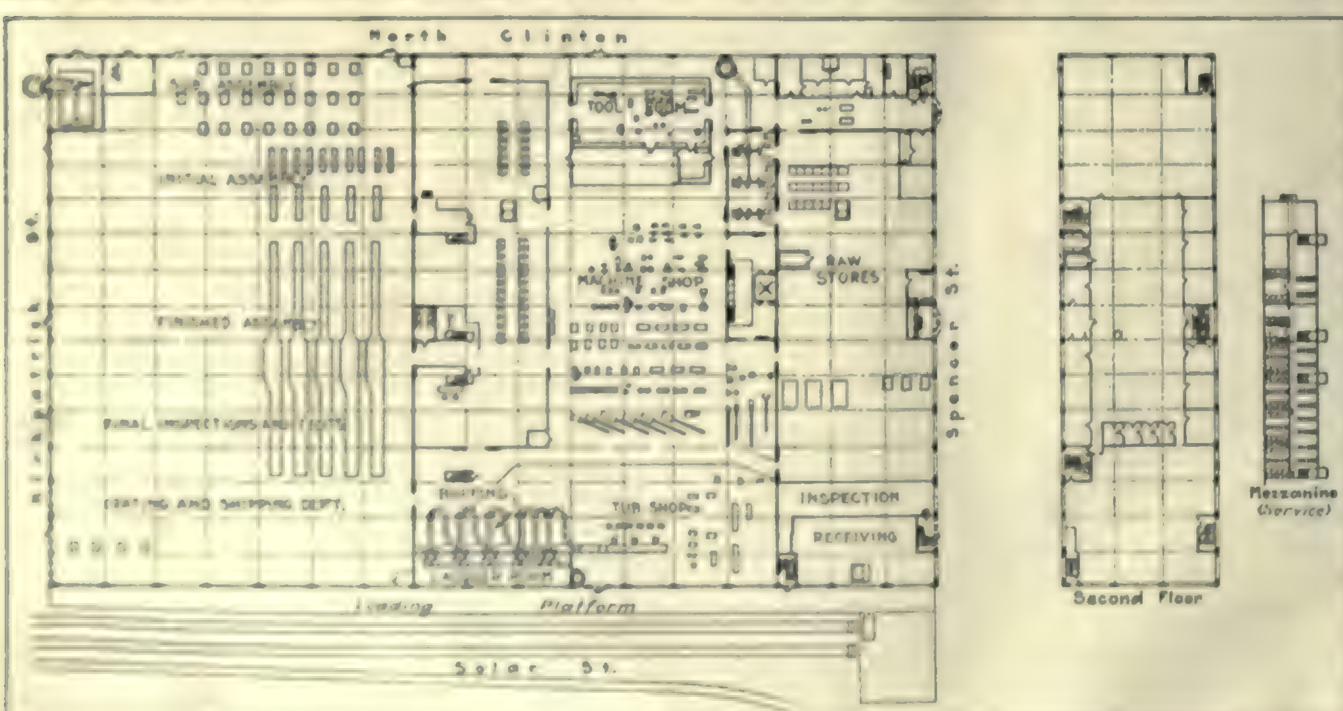


FIG. 2—THE FACTORY LAYOUT

FIG. 3—MACHINE SHOP; OBSERVE DOUBLE AISLE ARRANGEMENT TO FACILITATE TRUCKING

FIG. 4—TUB SHOP SHOWING ORDERLY HANDLING OF PARTS IN PROCESS

FIG. 5—ASSEMBLING DEPARTMENT; NOTE EXCELLENT LIGHTING CONDITIONS

FIG. 6—BUILDING SHIPPING CRATES ON A QUANTITY BASIS

FIG. 7—SHIPPING DEPARTMENT SHOWING COMPLETED MACHINES BEING CRATED

FIG. 8—RACKS AND BINS IN THE STOREROOM FOR FINISHED PARTS

The arrangement finally chosen is indicated by Fig. 2. The shipping and receiving platform which is ultimately to be covered by a canopy is parallel to two tracks. In general, material is received at the end of the siding where provision is also made for motor truck delivery of raw materials. These materials are inspected, weighed and passed into the storerooms, locations for the different classes of material being chosen adjacent to the operating department in which they are to be used. Practically all castings pass through the grinding room and are japanned before machining operations. Very few castings are later returned to the japanning room for further treatment. These castings then pass through the machine shop and are delivered to finished stores or to the assembly department as may be desired. All bars pass to the left through the machine shop and are either operated upon by punches and saws or by bar automatics. Some of these parts require other machine operations but a large portion of them pass directly to the finished storeroom or to the assembly department. The sheets pass to the left through the tub shop and tubs art delivered to the buffing department and thence by gravity conveyor into the lacquering room from which they are conveyed to the assembly. Throughout the entire arrangement, there is little necessity for doubling back of tractory transportation.

Inter-department Transportation

Types of factory transportation were carefully considered for the ultimate capacity of the single-story building, although it was not planned to make the installation of the ultimate equipment until business conditions brought the output of the plant to a volume materially larger than the output of the old plant. Storage battery tractors seemed to offer the best solution of the general factory transportation problem and accordingly all aisles, together with the shipping platform, were made sufficiently wide to allow two trains of tractors and trailers to pass each other at any point. In the case of tubs and covers, the bulk was too large for reasonable transportation by such means, and it was accordingly planned eventually to install an overhead tub conveyor. The tubs when fabricated in the tub shop would be hung on the conveyor and delivered to magazines located above the buffing jacks. After buffing, the tubs would be placed upon magazine gravity conveyors and delivered to the lacquering room. After lacquering the tubs would be hung from the conveyor which would carry them through a continuous drying oven and deliver them to overhead magazines located along the various assembly trains. It was planned in the complete plant, to use continuous assembly systems for sub-assemblies and the final assemblies of the machines but the working out of such systems was deferred until the production of the factory should warrant.

The washing machine as constructed in the old factory was thoroughly examined with a view to making such changes as would be desirable for production in larger quantities and a detail study was made of every individual operation entering into fabrication and assembly of the finished machine. The machine tool market was studied with a view to securing the best equipment in the quickest possible time and the machine tool manufacturers were given an opportunity to demonstrate the possibilities of their machines in the line of reducing costs. The capacities and operations of the various machines were carefully checked in detail and their applicability to best possible jigs and fixtures was carefully studied. Since delivery of all tools was required before July 1, 1921, limitations were placed upon the choice of machine tools, which made it impossible to secure all economies that were desired. The operation of every individual tool was carefully studied in its relation to the production expected from the equipment to be installed and no tool was purchased unless it would pay for itself within three years, as compared with methods of fabrication employed in the old factory. Automatic bar machines, gear cutters, etc., were installed, but in large measure the equipment was non-automatic and jigs and fixtures were provided for the various operations, with a view to eliminating to the greatest possible extent, all lost motion or waiting time on the part of the operator and all non-productive time on the part of the machine. Where the number of production parts warranted, multiple jigs were provided, of which the operator would be loading one section while the tool was working on the other half. Some of the jigs showed savings sufficient to pay for their entire cost in three months as compared with methods used in the old factory.

As a result of the operation of this new factory at considerably less than its capacity due to the depressed market for washing machines, it has been demonstrated that the actual savings in labor alone, should the new factory be operated at outputs no greater than the capacity of the old plant, would be more than sufficient to pay the full carrying charges of the entire new factory. The Syracuse Washing Machine Corporation is therefore provided with several times its old manufacturing capacity without additional annual cost.

Spiral or Helical?—Discussion

By Gus Haessler

The recent editorial on page 719, Vol. 56, of *American Machinist*, entitled "Spiral or Helical?" and emphasizing the need of the precise use of terms as applied in the machinery field, is a step in the right direction. Not only do handbooks, treatises and advertisers persist in using these terms interchangeably, but writers of the current literature from whom we might expect better deeds continue to do so. They even go further by coining other erroneous ones in spite of the fact that "Halsey's Handbook" proclaims in large type that helical gears are commonly miscalled spiral gears.

Gear teeth may be either straight or helical—then why should we not term them so? Why introduce a multiplicity of terms into the nomenclature that serve no well defined purpose other than to cause doubt? The path of those seeking accurate information along mechanical lines may be made smoother by doing away, as far as possible, with the use of synonyms in technical literature and substituting terms of restricted meaning.

Dictionaries may treat the terms helical and spiral in the abstract as having something in common, or as synonymous. On the other hand, in dealing with two different concrete objects there is need of specific terms, which to avoid error must be correctly applied. Progressive writers should prove that they are, by following the leadership of those endeavoring to distribute the greatest amount of information with the least possible resistance.

Automotive Service Methods and Equipment

XIV. Boring Fixture for Crankcase Bearings—Boring Connecting Rods in the Lathe—A Simple Cylinder Lap—Brazing a Cracked Manifold

By HOWARD CAMPBELL
Western Editor, *American Machinist*

THE descriptions and illustrations included in this article were obtained during a trip through the service department of the Sinclair Refining Co., at Chicago, Illinois.

The operation shown in Fig. 1 is that of boring the main bearings on a truck crankcase. The apparatus consists of the boring bar, together with the gears, drive pulley and belt, and three castings containing sets of jaws similar to those in a steadyrest. One of these castings can be seen at *A* in Fig. 2. The crankcase is placed in position on a stand consisting of the two sections *A* and *B*, Fig. 1, and the "steadyrests" are bolted to the case, the middle one as near to the center bearing as possible, and one just inside of each end bearing. Two bushings, each of which is a sliding fit on the boring bar and just large enough on the outside diameter to fit into the rough bearings, are slipped into place in the end bearings, and the bar is inserted. Then the steadyrest jaws are adjusted to the bar and the bushings are slipped out of the bearings again. The toolbits are now set with the aid of a micrometer, the gears are slipped into place, and the belt is put on.

FIG. 1—BORING CRANKCASE MAIN BEARINGS

The feeding mechanism can be seen in Fig. 2. The pulley, which is driven by belt from a motor, turns the pinion *B*, which is meshed with the gear *C*. Gear *C* is on the same shaft with pinion *D*, and this in turn drives the gear *E*, which turns the boring bar *F*. This bar is threaded for about 6 in. at the front end, as shown, as are also the jaws in the part *G*. Thus as the bar is revolved, it is also fed forward an amount equal to the lead of the thread. As the shaft is of steel and the jaws are made of bronze, the mechanism works very well. The piece *G* is hinged so that the two halves can be spread apart in order to locate the bar for boring. Toolbits are located in the bar at each bearing so that all three bearings are bored at the same time.

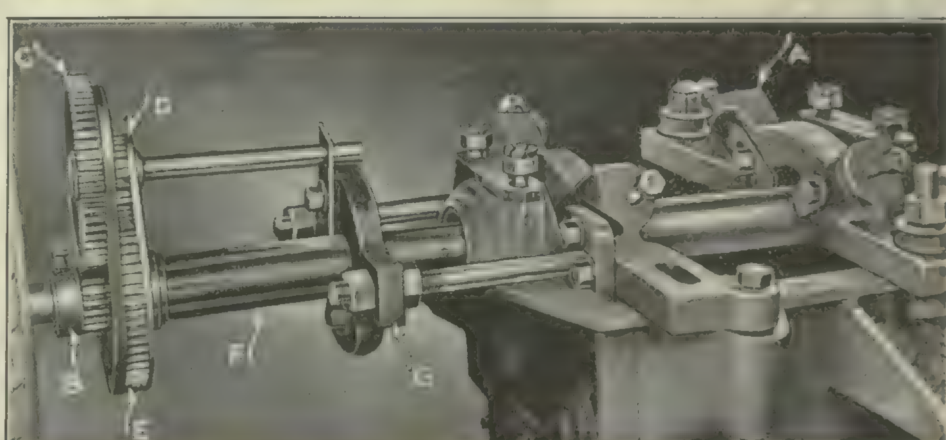


FIG. 2—MECHANISM OF BORING FIXTURE SHOWING METHODS OF DRIVING AND FEEDING BORING BAR

The Crankcase Stand

The stand on which the crankcase is located for boring is made of two sections of 8-in. pipe, threaded at one end and screwed into flanges which are bolted to the floor, as shown in Fig. 3. The piece *A* is a block of wood that has been turned to a sliding fit in the pipe, except for about 1¼ in., which being turned to the same diameter as the outside diameter of the pipe, serves as a flange or support for the block. A hole is bored through the block to receive the shaft *B*, which is about 6 in. longer than the block, and the collar *C* is slipped over the shaft to support it at the desired height. A slotted forging is welded or forged to the upper end of the shaft, to which the crankcase is bolted. Wooden handles are driven into opposite sides of the block so that the blocks can be turned and the space between the shafts varied with the design of the crankcase.

A unique type of crankshaft turning tool is shown in Fig. 4. This is a commercial article, made by Peters, Inc., Philadelphia, Pa. The operator shown in the illustration is holding the tool steady while the shaft revolves, but the real feature of this tool is that it can be used to turn the pins on a crankshaft without the use of a machine tool. In fact, the shaft need not be removed from the motor, in emergency cases.

The tool consists of an adjustable screw plate containing eight cutters, the whole thing being inclosed in an aluminum housing approximately 1¼ in. wide and 9 in. in diameter. The housing is made in two parts which are hinged together so that the tool can be opened and placed in position around the crankshaft pin. Then the screw plate is set so that the cutters rest on the crankpin, which is done by turning the screw plate with a

FIG. 3—STAND FOR HOLDING CRANKCASE

the fixture may be aligned quickly, two dowel holes are drilled in the cross-slide and corresponding pins are inserted in the bottom of the fixture. The small end of the rod, which is uppermost, is held in position by means of a wristpin which is inserted part way into the wristpin hole and partly into a collet chuck which is drawn into the piece *A* by the action of the nut *B*. The tightening of this nut also clamps the piece firmly in the slot. The slot is provided so that the various lengths of rods can be accommodated. The collar *C* is step-counterbored to accommodate the large ends of the various rods. The large end of the rod is held firmly in the fixture by the plate *D*, which is drawn against the piece by means of two screws with knurled nuts, as shown at E. The boring tool consists of a stub arbor carrying a toolbit, which is held in place by the usual headless setscrew. The stub arbor is turned to the same taper as the taper in the spindle.

No Scraping on Connecting Rods

No scraping is done on the connecting rods; they are bored exactly to size and the only hand operation is that of relieving the sides. The operator shown in

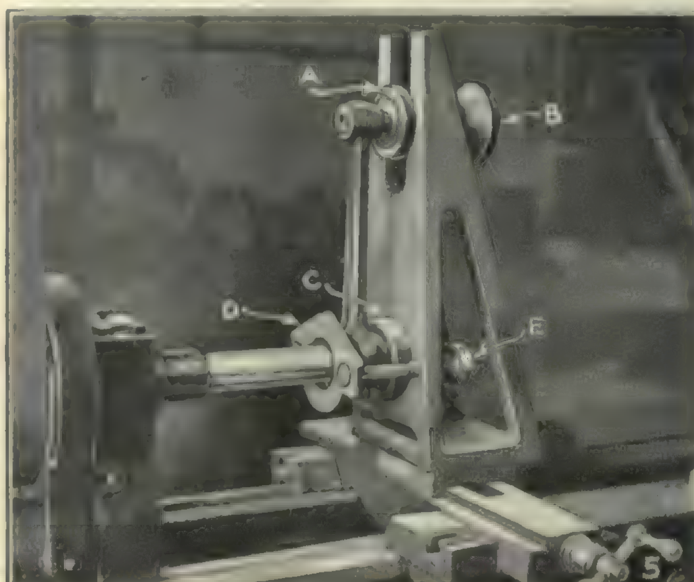


FIG. 4—TURNING CRANKSHAFT WRISTPINS. FIG. 5—BORING LARGE END OF CONNECTING ROD

spanner wrench. The turning of this plate moves all the cutters to or from the center universally. When the cutters are set, the tool is revolved by hand, the cutters gradually being closed in until the high spots are taken off or the desired size is obtained. After the tools have once been set, all pins can be turned to the same diameter, if desired.

After the crankshaft has been turned to the "clean-up" size, the fixture shown in Fig. 5 is set up on the lathe and the connecting-rod bearings are bored out. The compound rest is removed from the cross-slide and the fixture is bolted in place. In order that

FIG. 6—RELIEVING CONNECTING ROD BEFORE ASSEMBLING; ROD HELD IN SPECIAL FIXTURE

Fig. 6 is performing this operation on one of the rod caps. The manner of holding the crankshaft for this operation is very simple. Two holes are drilled in a small section of angle steel, the holes being of the same size and the same distance apart as the holes in the flange end of the crankshaft. Then the steel section is bolted to the work bench in the position shown in the illustration, where it is left permanently. The shaft that is to be worked on is bolted to the angle and the other end of the shaft is rested in a notch in the end of a small board.

The operator shown in Fig. 7 is lapping out a cylinder with a home-made lap made out of an old piston. The piston, which can be seen in Fig. 8, is bored through the head so that the handle can be inserted. Then the piston is slotted the length of one side so that it can be expanded, and both wristpin holes are solidly plugged. One of these plugs is now drilled out to 1 in. diameter and threaded 14 threads to the inch. A headless screw is inserted in the threaded plug and screwed against the solid plug in the opposite side of the piston. A slight turn will expand the piston, which makes it possible to use it in many places instead of a solid piston.

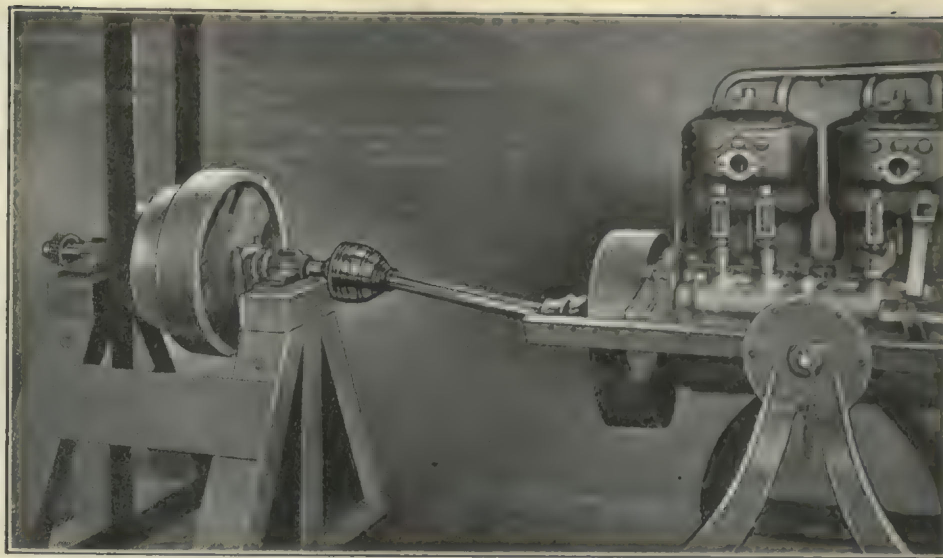


FIG. 10—"HOME-MADE" RUNNING-IN STAND

FIG. 9—BRAZING A CRACKED MANIFOLD

FIG. 7—LAPPING A CYLINDER BORE

FIG. 8—PISTON USED FOR LAPPING

The value of the gas torch in motor repair work is becoming more evident every day. Previous articles in this series described the use of the torch for brazing scores in cylinders, for filling worn clevis pin holes with bronze so that new bearings could be drilled and reamed in the solid metal, and for cutting off frames. Another illustration of the use of the torch is given in Fig. 9, where an operator is shown brazing a crack in a Packard truck manifold. According to the operator, a better job is obtained by brazing than by welding, because not only does the piece have to be preheated before welding, but a weld is much more liable to crack again than if the crack is brazed full of metal. For brazing no pre-heating is necessary. The metal used is a brass rod, $\frac{1}{8}$ in. in diameter for small cracks, but up to $\frac{5}{16}$ in. in diameter for larger ones. When ready to proceed with the operation, the operator dips the end of the rod into the flux, which aids in the amalgamation of the brass with the iron.

After a motor has been overhauled it is given a running-in test on the stand shown in Fig. 10. The stand is built of heavy timbers, and the three-step pulley, shaft and bearings are commercial materials that can be purchased from any supply house. An old universal joint is used to connect the motor with the pulley, and power is supplied from the line shaft. While it is usually safe to assume that an overhauled motor will run satisfactorily there is nothing like knowing positively that it has been turned over long enough to get the oil flowing through the bearings, and to know it is all right.

Methods of Machine Tool Design

Beginning Part Five on Gear Drives—Arrangements of Drive and Feed Gears on Lathes, Milling Machines, Boring Mills and Drilling Machines—Efficiencies

BY A. L. DELEEUW
Consulting Editor, *American Machinist*

ONLY the smaller and simpler kinds of machine tools have a belt drive pure and simple. Practically all larger machines and even a large percentage of the smaller ones have some gears in the driving system. When we say that a machine is "belt driven" we refer to the source of power of that machine in order to distinguish it from a motor or engine drive.

Not only are gears used in the drives of most machine tools, but they are used also in feed mechanism and quite often in the system of control. We have, then, three systems of gear drives to consider—those used for the drive, those used for feed and those for control.

Whether gears are used for feeds or for speeds, we must consider carefully the elements of power to be transmitted and the speeds to be obtained. The amount of power of machine tools varies widely and is principally dependent on the size of cut we wish to take. We say "principally" dependent, because the nature of the tool also has a large effect on the amount of power required. For instance, it requires more power to remove a given amount of metal by a milling machine than by a planer. Similarly, it requires more power to remove a given amount of metal by drilling than by turning.

The exact calculation of the amount of power required for a given machine tool can never be carried out with any high degree of accuracy. The condition of the tool, the shape of the chip, the characteristics of the metal to be cut, etc., vary so largely that it would never be safe to guarantee a machine tool to be able to take a cut of given dimensions. It is this fact which has led to much misrepresentation and misunderstanding as to the capacity of a machine tool. However, there is no reason why a standardized cut cannot be established as a unit of measure for the determination of the capacity of a given type of machine tool.

Let us take as an example a planer, and let us say that the standardized cut would be taken with a tool of given shape and angles and in a slab of steel of given analysis, strength and hardness. Such tools and such slabs of steel could be furnished just as gages are furnished at the present time, and some disinterested institution—such as, for instance, the Bureau of Standards—could check up the qualities of the standard tool and the standard material. Having these two items, standard tool and standard material, it would then be possible to state that a machine has a capacity of a cut of so-and-so much at a speed of so-many feet per minute. If this were done, there would be very little chance for misrepresentation or misunderstanding.

To drop our dream and come back to realities again, we have to follow an entirely different line of procedure at the present time. Not being able to say how many cubic inches of metal can be removed and consequently being unable to say what the maximum pressure on the tool point will be, we must guess at the drive, and after having guessed, we must then construct our machine so that every element shall be strong enough to resist whatever strains this amount of power may impose on the machine.

Generally speaking, part of the power supplied to the machine is used for the drive and part for the feed. Notable exceptions to this rule are the machines of the planer type; planers, shapers, slotters, gear shapers, etc. In these machines the feed takes place when the tool is out of the cut so that all of the power supplied is available for either the drive or the feed.

In order to proportion the mechanism of a machine tool it will be necessary to determine what portion of the total power supply is needed for the feed. Besides, it will be necessary to determine beforehand at what point in the mechanism feed and drive part company. To illustrate what is meant by this latter problem, let us consider a lathe. In practically all cases the feed of a lathe is taken off the rear end of the spindle, so

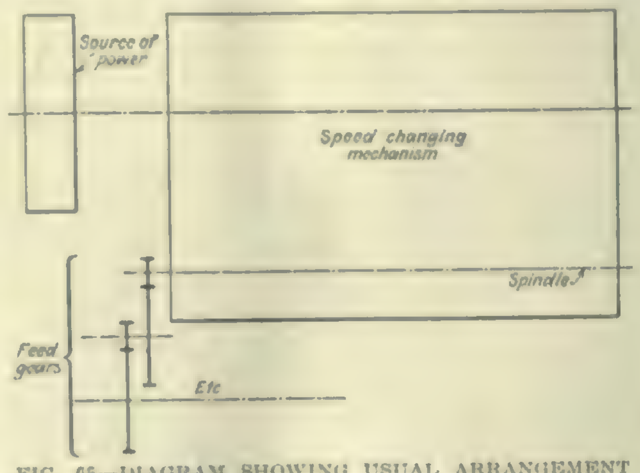


FIG. 65—DIAGRAM SHOWING USUAL ARRANGEMENT OF LATHE DRIVE AND FEED GEARS

that all gears, shafts, etc., between the driving source (motor or single pulley or cone pulley) and the rear end of the spindle must be proportioned so that they can take care of both drive and feed, while all similar parts coming after the rear end of the spindle need to take care of the feed only. This case is represented by Fig. 65.

On the other hand, a milling machine so arranged that the feeds are given in inches per minute presents a different problem. Here the feed is taken off a constant speed shaft, and all gears between this point and the spindle must take care of the drive and the drive only, while all gears on the other branch must be proportioned for the feed only. This case is illustrated by Fig. 66.

A third case, though essentially similar to the first one, is illustrated by Fig. 67. In this case, the feed is given in fractions of an inch per revolution. The machine represented here is supposed to be a large boring mill. In such a machine the speed changing mechanism is early in the train of gears and after

For the author's forthcoming book.

this there is a further reduction of speed. The reason why such a construction is followed is rather obvious. In a case of this kind the feed is taken off the first shaft of which the speed bears a constant relation to the speed of the spindle. In the case represented by Fig. 65, all gears of the drive had to be of sufficient size to transmit all of the power for drive and for feed; but in the third case, the last gears of the system needed only sufficient strength for the drive, as the feed

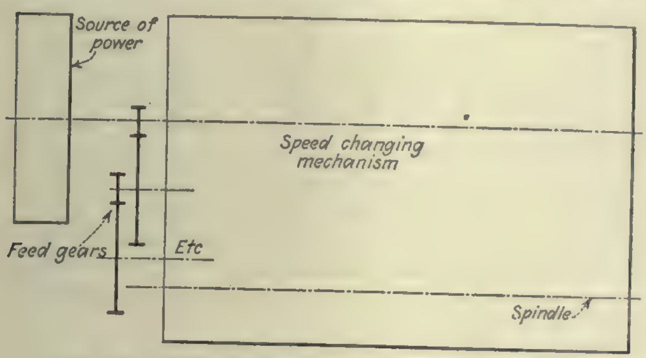


FIG. 66—DIAGRAM SHOWING ARRANGEMENT OF MILLING MACHINE GEARING

had already been branched off before this point was reached.

It is often difficult to state what portion of the total power is required for the feed only. On the other hand, as we must proportion gears, shafts, etc., for the greatest load which they may have to bear, we need to be interested only in the amount of this greatest load. This load is imposed when we take the heaviest roughing cuts in the case of lathes and similar machines. It has been found by practical experimentation that, for heavy cuts and using a round nosed tool (which is the tool used for such cuts in the majority of cases), the amount of pressure of the chip on the tool is about equal to the amount of side pressure required to make the tool feed into the work; so that, if we know what cuts we can take and what the pressures are which are caused by such cuts, we will have the necessary data for the proportioning of the feed parts.

Though such data are not known with a high degree of accuracy, yet we know enough to determine the maximum feed pressures with a fair degree of safety.

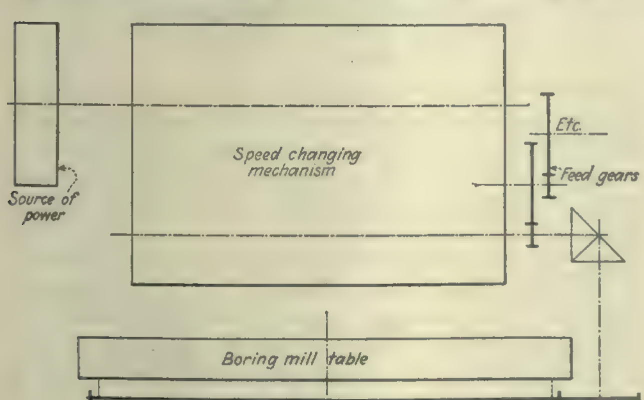


FIG. 67—DIAGRAM SHOWING ARRANGEMENT OF BORING MILL GEARS

If, for instance, a certain lathe must be constructed to take a cut in mild steel $\frac{1}{2}$ in. deep and with $\frac{1}{4}$-in. feed, then we know that the pressure of the tool will be in the neighborhood of $\frac{1}{2} \times \frac{1}{4} \times 240{,}000 = 30{,}000$ lb., and this would be the amount of feed pressure we may expect with a round-nosed tool.

If the mechanism for drive and feed were 100 per cent efficient, then the total amount of power which must be set apart for the feed would be very small. Assuming that the cutting speed is 45 ft. per minute and that we are turning up a 6-in. shaft which makes approximately 30 r.p.m., so that the feed would be $30 \times \frac{1}{4} = 7\frac{1}{2}$ in. per minute, then we would find that the drive (running at 45 ft. = 540 in. per minute) requires 72 times as much power as the feed which runs at $7\frac{1}{2}$ in. only. Under such ideal conditions the feed would take less than $1\frac{1}{2}$ per cent of the total power of the machine.

Efficiency of Lathe Feed Mechanism

However, the efficiency of practically any feed mechanism is very low. In the first place, a great number of gears and shafts are, as a rule, required to transmit the power from the starting point to the point where it is applied to carriage or toolholder. In the second place, in the majority of cases, there is a screw employed somewhere in the mechanism, and generally at the final point of the feed train, and such a transmission of power by screw has a very low efficiency. As a consequence, it would not do to base the proportions of the various parts of the feed mechanism on the theoretical amount of power required for the feed. Rather must it be based on the pressure against the tool point. In other words, proportioning the elements of the feed train, we must start at the tool point and work backward. We must not forget that there are other resistances to overcome besides the resistances of the metal against the edge of the tool. Toolholders, carriages, etc., are tightly gibbed to their supporting members. This is absolutely necessary in machine tool construction so as to avoid all unnecessary looseness and resulting vibration and inaccuracy. The power required to move such a tightly gibbed member may be quite an appreciable percentage of that required to feed into the metal. Finally, the point of application of the feed mechanism to a toolholder or carriage is very often out of center, thus tending to twist the toolholder, or, as it is commonly called, to "cock" it against its ways, and this may, under unfavorable conditions, cause a great deal of extra resistance.

It will be seen, then, that even with such a simple and well-known machine as a lathe, it is not quite possible to estimate with any degree of certainty what percentage of the total power must be used for the feed, and it therefore becomes necessary to make ample allowance over and above the best possible estimate which can be made.

In the case of a milling machine, we again have the condition that the pressure of the cut is approximately the same as the pressure required for the feed. If the teeth of the cutter were always working in a horizontal plane, then the feed pressure would be the same as the cutting pressure. This condition is modified by the fact that the tooth of the milling cutter describes an arc and that therefore the pressure of the cutter against the work, measured in a horizonal direction, changes from point to point. Besides, the chip does not have the same thickness at various points. As the cutter tooth starts to work it takes a chip of infinitesimal thickness, but this thickness gradually increases and with it the required feed pressure. The feed mechanism of a milling machine, therefore, is not subject to an even

load but changes continually from a minimum to a maximum. This amount of variation is less when more than one tooth is in the work, and is still further reduced if a spiral or helical cutter is used.

Actual experiments have shown that the efficiency of the feed mechanism of existing milling machines, though widely varying, is always very low. The highest efficiency obtained in a series of tests was 20 per cent, the lowest efficiency less than 2 per cent. In another series of tests, and with older types of milling machines, it was found that with a cut requiring a total of 10 hp., as much as 3½ hp., and in one case even 4 hp. was required for the feed. It is possible, however, to construct the feed mechanism in such a way that a maximum of 20 per cent of the total power supplied will take care of the feed for the heaviest cuts which may be taken. With lighter cuts a larger percentage may be used for the feed, but, as the total power required under these conditions is less than with the heavier cuts, those less favorable proportions do not need to be considered.

Extremely Heavy Feed Pressures Applied Hydraulically

Feed pressures have been used in actual practice up to 300,000 lb. To the writer's knowledge no machine tools have been constructed employing strictly mechanical means, such as gears and shafts and screws, for the application of these extreme feed pressures. Where such pressures were required, hydraulic feeds were applied. On the other hand, feed pressures as high as 200,000 lb. have actually been transmitted by means of long feed screws.

In the case of boring mills of large size, heavy cuts may be taken requiring heavy feed pressures. In addition, the construction of a boring mill makes it necessary to use long shafts and many gears for the purpose of reducing and controlling feeds and for the purpose of going around the many angles and corners that lie between the toolholder and the point where the feed branches off from the main drive. As a result, the amount of power required for the feed of a boring mill is greater than that required for the ordinary lathe.

As a broad proposition it may be said that the amount of power which should be set aside for the feed of a lathe, a boring mill or a milling machine, is proportional to the size of cut taken; or better still, proportional to the amount of metal removed per minute. This rule does not apply to drilling machines. In such machines the feed pressure is only partly dependent on the size of the cut, and very largely dependent on the nature of the tool used.

Considerations Affecting Drilling-Machine Feeds

A 1-in. twist drill removes an amount of metal of which the cross-section has an area of about ¾ sq.in. This same area would be removed if a 1-in. hole were counterbored to 1½ in., but the feed pressure required for this latter operation would be very much less than that required for the drilling of the 1-in. hole. This is due to the fact that not all of the metal is removed by the action of cutting when a twist drill is used. The central web must penetrate into the metal by sheer compression or crushing. If we picture the action of a twist drill as if it consisted of two separate actions —in the first place, that of penetrating into the metal an amount equal to the feed per revolution; in the second place, the removal of this metal by turning the drill—we will see that the metal lying under the central web must be pushed away in order to permit this penetration. There is a popular conception of this action to the effect that the central web crushes the metal into fine particles which are removed with the other chips. This picture is not correct. The metal is not crushed into fine particles, but is pushed sideways into the surrounding metal, and part of that surrounding metal is lifted up. The action is the same as that of a center punch when making a punch mark. A crater is formed of which the rim is composed of the metal which has been displaced by the punch point. The action of the central web may be compared to that of an operation of embossing. We can readily reason out for ourselves that it would not be possible for the central web to crush the material into a fine dust. If this were the case, we might make a punch shaped like the central web, force it into the metal, remove it, blow out the dust that was formed, force the punch somewhat further, and so on until we finally had made a hole of the required depth.

The feed pressure required for the penetration of a twist drill into a piece of work consists then of two items: (1) The pressure required to make the cutting lips feed into the work; (2) the pressure required to cause the central web to displace the metal underneath.

The first item depends on the size of the drill, the amount of the feed, the hardness of the material to be drilled, and the sharpness of the tool. In other words, it follows much the same laws as the feed pressure required in other cutting operations. The second item, the pressure required to make the central web penetrate into the metal or crush the metal, also depends on the nature of the metal to be crushed, and besides, on the area of the central web and the angle to which it is ground. A flat angle will have a tendency to press the metal downward rather than sideways. A pointed cone will press the metal sideways and allow it to get out of the way without excessive pressure. This is the reason why a pointed drill is used where the breaking through of the drill might cause serious trouble. The amount of pressure required for this punching action of the central web is, at the present, not known. It is, however, well known that it is a very large percentage of the total pressure required.

Prefers Forced Lubrication

By Frank W. Wearin

Both forced feed and splash lubrication are good systems, but the first is the better as it supplies a steady stream of oil to each bearing. With the splash system the oil gets dirty very quickly, and should be changed regularly as it is difficult to provide a filtering system that would be suitable.

The forced feed system is by far superior, but, as the editor remarks, there should be a proper system of filtration that will clean the oil before it enters the pump on each cycle. The oil should be changed regularly though it is not necessary to do so as frequently as with the splash system. With clean oil the bearings will very rarely score, and never on account of the oil, if it is of good quality.

My experience has been on steam turbines and machine tools. The oil reservoir is invariably too small on the latter. Of course there are limitations to size, but the larger the reservoir the slower the filtration and the purer the oil.

The Machining of Camshafts

Use of Multiple Tools in Turning Camshafts—Master Cams and Cam Grinding Methods—Uniform Centers a Necessity—A Flush Pin Gage

By FRED H. COLVIN
Editor, *American Machinist*

THE machining of camshafts for automobile motors is generally done by rough-turning the bearings and straight portions between the cams, the rest of the work being done by grinding. In some few places the cams are first milled with small cutters to approximately the desired shape and in one or two instances special machines have been designed for turning the cams ready to be finished by grinding. The general practice, however, is to grind the cams from the forgings without previous machining of any kind.

The individual cam of the earlier designed motors has given way to the cam forged integrally with the camshaft and machined as previously indicated.

In plants where a large production is necessary, multiple tooling is resorted to in order to economically machine numerous straight portions between the cams. In some cases these multiple tools are arranged in a special

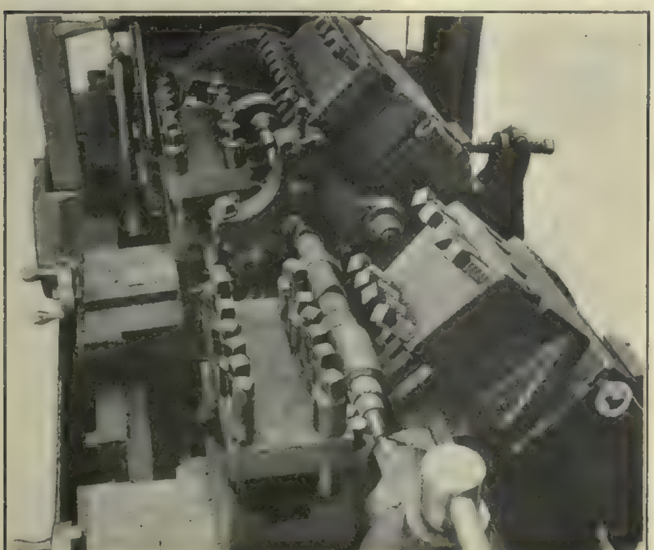


FIG. 1—FIRST TURNING OPERATION

toolblock on a standard engine lathe, but large production usually requires special machines such as the Fay automatic or the Lo-Swing. The tooling arrangement on the Fay lathe can be seen in Figs. 1, 2, 3 and 4. Figs. 1 and 3 show the lathes themselves with the work in place, while Figs. 2 and 4 are the tool diagrams which show clearly the number of tools employed and explain how the camshaft can be so quickly machined. Referring to Fig. 2 it will be seen that the tools in group *A* face down between the cams and the bearings, while those at *B* automatically feed into the work, traverse it in the direction of the arrow shown and automatically feed out of the work. The tools in group *C* feed in and cut the four shoulders shown, while those in block *D* turn the small diameters at the end of the shaft. The remainder of the camshaft is turned at a second operation, which is shown in Figs. 3 and 4 and requires no explanation.

In this particular shop the first operation is to mill the ends of the camshaft to lengths, as shown in Fig. 5, locating it by means of the gage at *A* so as to have the cams and bearings come in their proper position. The camshaft is centered as shown in Fig. 6, utilizing a quick acting clamp and having the workrests firmly against the stop so as to insure uniform center depth. The correctness of the centering has a marked effect on the production as a shallow center in one end and a deep one in the

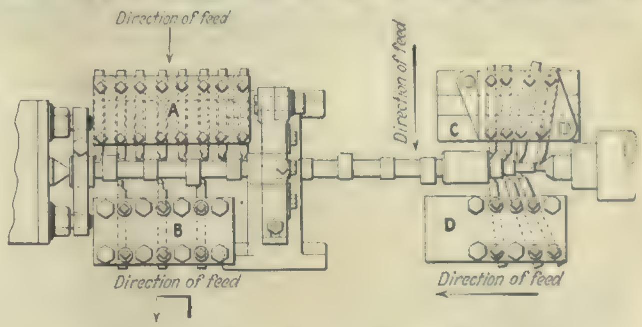


FIG. 2—THE TOOL LAYOUT USED

other shifts the camshaft endwise and affects the turning operation. In order to insure this uniformity the minimum and maximum gage shown in Fig. 7 is used.

The three large-diameter bearings are next rough-turned or ground to within 0.003 to 0.005 in. to furnish driving and back resting surfaces for future operations. Then comes the turning which has already been shown, leaving the camshaft ready for heat-treating, oil grooving and the finish-grinding of both the bearings and the cams themselves. It is interesting to note that in the turning operation there are eighteen tools at work simultaneously.

The other method of machining referred to is illustrated in Figs. 8 and 9, which show another design of camshaft. The sequence of operation is approximately the same and the arrangement of the tools can be very

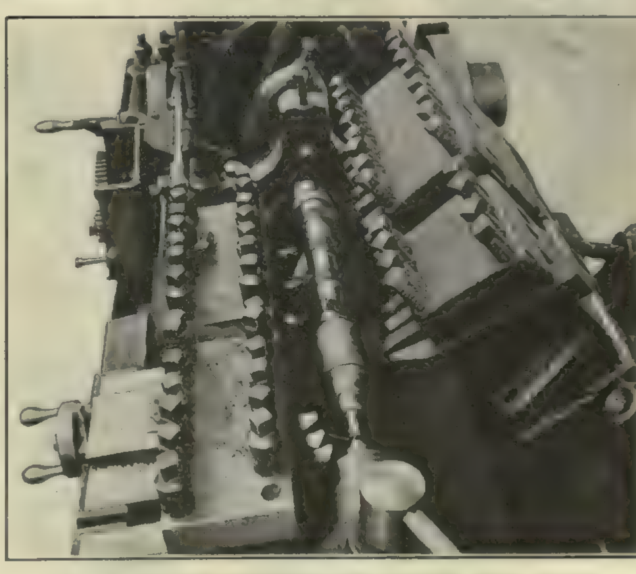


FIG. 3—TURNING THE OTHER END

easily studied from these two illustrations. These illustrations show a camshaft for a six-cylinder motor and consequently the use of a greater number of tools is possible.

After the turning operations, no matter how they are

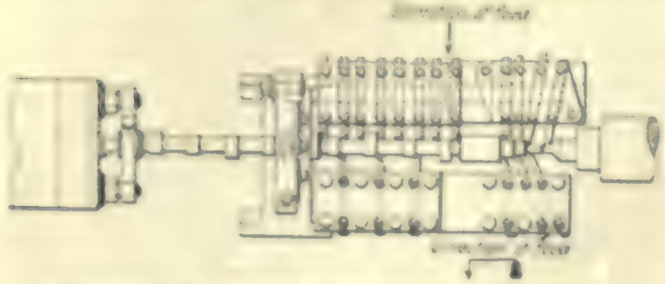


FIG. 4—TOOL LAYOUT FOR SECOND OPERATION

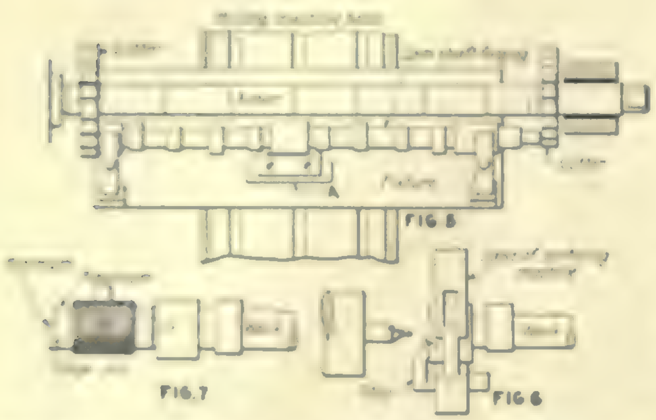


FIG. 5—CUTTING OFF SHAFT ENDS. FIG. 6—CENTERING THE SHAFT. FIG. 7—GAGING THE CENTER

performed, camshafts are ready for heat-treating or carburizing, or both, as the case may be.

As the cams themselves are usually ground from the rough forging, it is necessary to remove considerable material at a fairly rapid rate, and at the same time to preserve accuracy so as not to leave too much material for the finishing wheel. Probably no other common grinding operation calls for such fine workmanship and accuracy as the grinding of cams. It is a case where the art of grinding must be known and practiced continually in order to give satisfactory results.

The makers of wheels and grinding machines usually recommend the 24-R. Alundum wheel, or its equivalent, for roughing. The general practice of automobile shops,

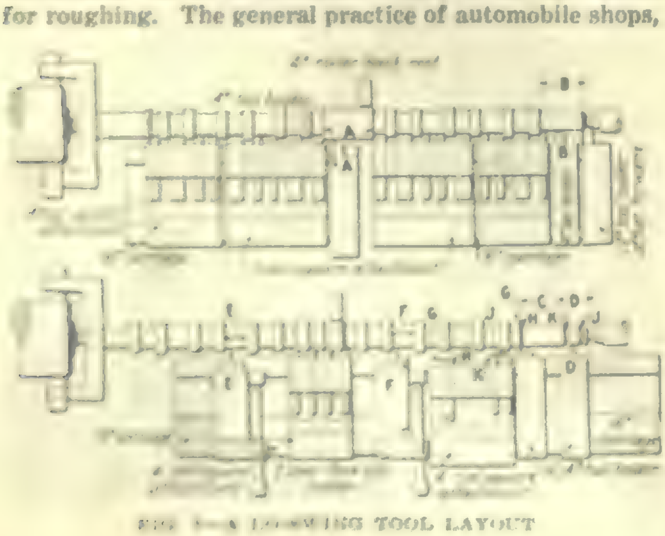


FIG. 8—A LO-SWING TOOL LAYOUT

however, is to use a considerably harder wheel as a means of securing a higher output per machine. This seems to prove satisfactory and it is usually very difficult for the demonstrator to secure any change in this practice.

Finish grinding of cams is usually divided into two operations, the first, removing the scale due to case-hardening or heat-treatment. The wheels used are usually of the J or K grade, either No. 46 or a No. 24 combination. While some shops make two entirely separate operations of the finish grinding, in most cases the camshaft is not removed from the grinding machine but the wheel is dressed and the finishing touch taken.

In the plant of the Hudson Motor Car Company, for instance, a 24-R. or a 24-S. wheel is used for rough-grinding. This removes from 0.25 to 0.275 in. from the rough forging. In the finish-grinding, wheels of No. 24 combintion K and No. 46, J or K are used, the latter being standard in the above plant. In the rough-grinding, the production is from 60 to 70 camshafts in 8½ hours, and in finishing from 55 to 60 camshafts in the same time.

In the same plant, production of the Essex camshaft (which, of course, is for a four-cylinder motor) is from 75 to 80 camshafts in the rough-grinding, and about the same number in the finishing operation. This production has, we understand, been materially increased by the application of vertical wheel-slide stops.

In large plants wheels No. 30-R. are used for rough-grinding and No. 24 combination K for finishing. The production is from eleven to twelve shafts per hour for

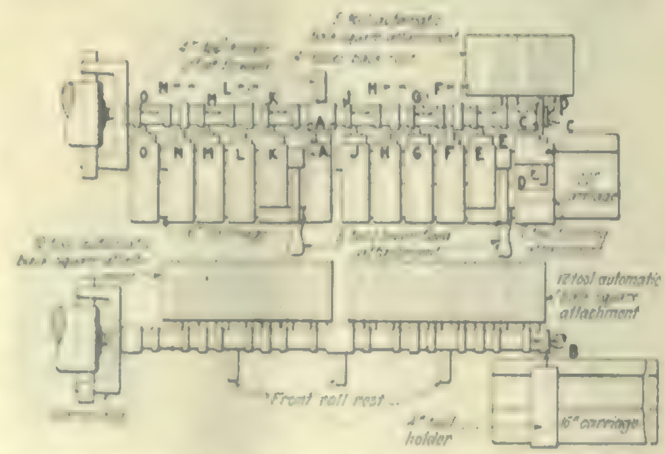
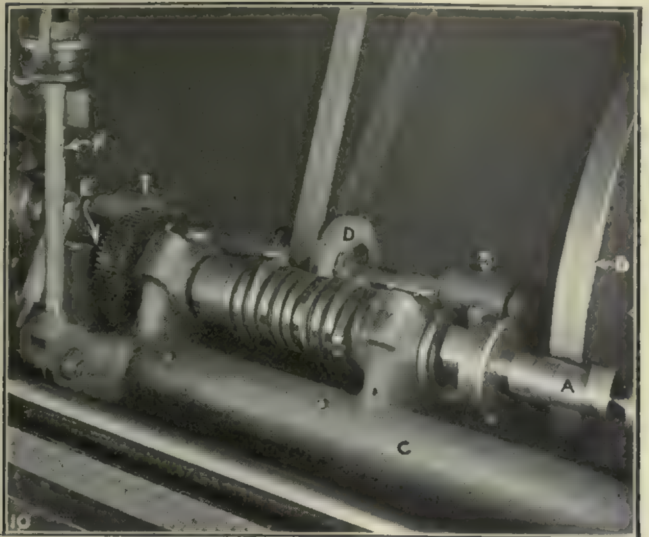


FIG. 9—ANOTHER EXAMPLE OF LO-SWING TOOLING

rough-grinding and about eleven per hour for the finish-grinding. The finish-grinding is in two operations, removing 0.08 in. The operator takes his first cut over 100 camshafts, trues his wheel and goes over them a second time, producing 100 finished camshafts in nine hours. A wheel speed of 6,500 circumferential feet per minute is advocated although there is a tendency in some quarters to reduce this appreciably, sometimes as much as 1,000 ft. per minute. When it comes to the best work speed, there is a wide range of opinion, and it is here that the operator can utilize his experience to the best advantage in order to secure the desired finish without reducing the output. For roughing, the work speed is not so important and the camshaft can be run moderately fast, say from 40 to 60 r.p.m.

For finishing, however, a considerably lower work speed should be used, from 16 to 20 r.p.m. being found satisfactory in most cases. The best speed, however, must be



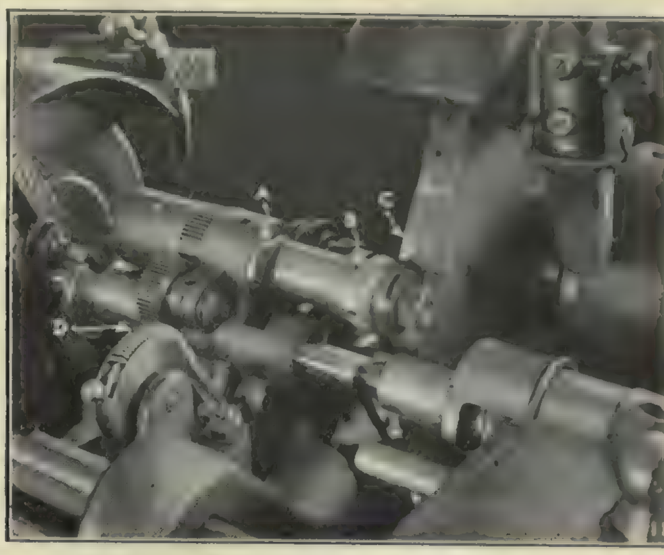


FIG. 10—GRINDING MASTER CAMS. FIG. 11—GRINDING A SINGLE MASTER CAM

determined in each individual case by actual experience, as much depends on the shape of the cams, especially of the lift portion. The finish required and the wheel used also have a marked effect. In one particular instance, it became necessary to reduce the speed to 5 r.p.m. in order to eliminate the chatter. In order to thoroughly lubricate the work and carry away the heat, a large supply of grinding solution or compound should flow directly on the work at the point of wheel contact at all times during the grinding operation, helping to keep the work at uniform temperature and tending to insure thorough lubrication and accurate grinding. This is important if an accurate camshaft is required, as excessive heating distorts the shaft and often causes checks in the cam faces. Any good commercial compound or soda water and lard oil can be used.

In finishing camshafts, it is very important to keep the wheel true and it should be dressed very frequently. Unless this is done, it is impossible to secure satisfactory results.

It is also necessary to pay careful attention to the steadyrests and to be sure they are securely fastened in place. The work shoes must have a good bearing surface on the camshaft in order to hold it as they should. It is also advisable to be very sure that the camshaft attachment is firmly fastened to the table, and that the attachment has been wiped very clean before putting in place.

The centers in camshafts should be as large as is consistent with the size of the shaft and as perfect as possible. The centers should be kept clean and well oiled; but do not put oil on the master cams or on the roll surface, as dust collects rapidly and may result in inaccurate work.

Attachments for grinding master cams are shown in Figs. 10 and 11. Fig. 10 shows all the master cams mounted on the single shaft, while in Fig. 11 a single cam is being ground at *A*. The master cams are shown at *A*, Fig. 10, making contact with the large disk *B* by which the cradle *C* carrying the cam to be ground is moved to and from the grinding wheel *D*. The gearing by which the cams are driven is plainly shown at *E*. The rod *F* leads to a counterweight which always keeps the master cam in contact with the large disk.

A somewhat different arrangement is shown in Fig. 11 where the cam being ground is shown at *A*, the master cam at *B*, the large disk at *C*. Instead of an overhead counterweight, the cradle is controlled by the spring *D*, keeping the master cam always in contact with the large disk.

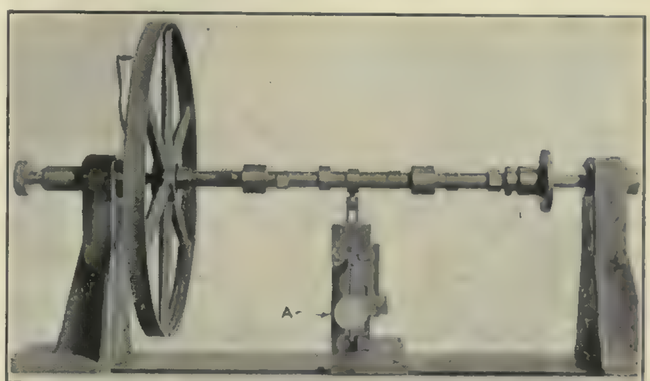


FIG. 12—TESTING A FINISHED SHAFT

A device for testing the cams is shown in Fig. 12 where the graduated wheel shown indicates the degrees at which certain movements of the cams take place and the dial indicator A, shows the exact throw of the cam being tested at each point of its contour.

Idleness Is Contagious

By Robert Grimshaw

Watchmakers say—with what degree of truth, I do not know—that if a number of clocks stand on a shelf, some tending to run too fast and some too slow, the fast clocks will slow down and the slow ones will speed up to a noticeable degree.

I do know this: A slow workman will lessen the speed of a fast one beside him, while his own speed will increase. But on the principle that disease is more catching than health, the slow worker's influence for harm will be greater than the fast one's influence for good. The workman is not conscious of the influence.

There are often instances where a fast or a normal worker, put next to a slow one, will purposely reduce his own speed, so as not to "give away his neighbor."

All this shows the desirability of a record of output by which standards, especially minimum standards, may be established.

Grinding Wheel Breakage and Its Causes

What Produces the Stresses Resulting in Wheel Breakage—Effect of Over-speeding—Heating the Wheel Face and Spindle Bearings

BY HAROLD E. JENKS
Instructor in Mathematics U. S. Naval Academy

THE subject of grinding wheel breakage is one which forcibly and frequently brings itself to the attention of the wheel user and the wheel manufacturer, and is of great importance to both. Whenever a grinding wheel, however well it may be protected, breaks in operation, there is always the possibility that flying fragments of the wheel may cause the loss of life or serious injury of persons nearby, particularly of the operator of the wheel. Financial loss is always involved, due to the loss of the wheel itself, loss of time in mounting another one, and to the possible breakage of parts of the grinding machine. If a man is killed or injured by the breakage, further financial loss has to be borne by his employer.

The manufacturer of the broken wheel is perhaps less affected than is the consumer, but his interest in preventing breakage is a very real one. The reputation of his wheels is to a certain extent impaired by every breakage that occurs. If breakages take place too frequently he will lose customers, unless it can be shown that the grinding wheels are not at fault, which is often hard to prove. Reputable manufacturers realize this and do all in their power to minimize breakage.

Grinding wheels are tested in various ways before they are allowed to leave the factory, to make certain that they are sound and can be safely run at the speeds for which they are recommended. Some manufacturers ask for the return of broken wheels, and maintain a board of experienced men to examine them and determine, if possible, the cause of breakage. If it can be shown that the wheel itself was at fault, the manufacturer is expected to replace it at his own expense. In cases where breakages constantly and persistently occur with some particular consumer, men are sometimes sent by the manufacturer to observe the wheels in action under operating conditions, and to report on probable causes of breakage and possible methods of preventing it.

From the foregoing introductory remarks the desirability of reducing grinding wheel breakage to a minimum becomes evident. The purpose of this article is to show as clearly as may be possible the underlying causes of breakage, and to give whatever other information may be necessary in order that an intelligent attempt may be made toward its prevention in any given case.

PRIMARY BREAKAGE CAUSES

Breakage of a grinding wheel while in operation may be due to any one of the following primary causes, or to a combination of two or more of them:

(1) Centrifugal force due to rotation of the wheel.
(2) Direct pressure exerted by the work upon the wheel.
(3) Heating of the wheel.
(4) Heating of the wheel spindle.
(5) Pressure on the side of the wheel.
(6) Improper mounting.
(7) Impact on the side or face of the wheel.
(8) Cracks or flaws in the interior of the wheel.
(9) Variation in density of wheel material.
(10) Lack of balance.
(11) Initial stresses in the wheel.

Evidently these causes are not entirely independent; for example, heating of the wheel is a result of direct pressure by the work; but the type of stress produced by direct pressure is entirely different from that due to heating, hence separate enumeration and treatment of these two causes of breakage are necessary. In general, it is thought that the above list has been condensed as much as possible to still allow a clear discussion of the subject.

By stress, as used here, is meant the force acting between the particles of wheel material per unit of area, ordinarily expressed in pounds per square inch. Wheel material is much weaker under tensile than under compressive stress; that is, a much smaller force will break it if tending to pull its particles apart than if tending to push them together. For this reason, stresses are here specified as tensile or compressive, it being understood that compressive stresses are not usually important as sources of breakage of grinding wheels. It is possible to obtain mathematical proof of many statements made below regarding the amount and position of the various stresses in wheels, but this is beyond the scope of the present article and is therefore omitted.

It is very important to note that while not one of the stresses existing in a wheel may be excessive, the combination or resultant of two or more of them may be sufficient to cause breakage. This fact will be frequently referred to in the following paragraphs.

DIAMETRAL CRACKS FROM TANGENTIAL STRESSES

Centrifugal force due to rotation of the wheel.—In any body which rotates about an axis, stresses are induced at every point due to centrifugal force, which for the purpose of this article may be defined as the force tending to make the body fly apart. In a grinding wheel these stresses are of two kinds: a radial stress acting in the direction of the radius of the wheel, and a tangential stress acting in a direction perpendicular to the radius, as illustrated in Fig. 1. Both these stresses are tensile, and their amounts vary as the square of the speed of the wheel, which means that if the speed is doubled, the stresses are quadrupled.

The radial stress is zero at the circumference of the wheel and at the hole, and reaches its maximum value at a point distant $\sqrt{Rr}$ from the hole, measured along the radius, R and r being the radii of the wheel and hole, respectively. In comparison with the tangential stress the radial stress is unimportant.

The tangential stress is much greater than the radial, and reaches its greatest value at the circumference of the hole. For a given speed and diameter of wheel, this maximum tangential stress increases slightly as the diameter of the hole is made larger, and in cylinder wheels becomes about 20 per cent greater than in disk

wheels with holes of ordinary size. This is a very important stress, since it always exists when the wheel is in motion, and because of the location of its maximum at the circumference of the hole, where it readily combines with other maximum stresses to produce a resultant stress large enough to cause breakage.

A wheel breaking from the effect of centrifugal force alone cracks approximately across a diameter, the crack starting at the hole and extending in opposite directions outward to the face, as shown in Fig. 2. This is of course the initial break, after which the wheel may or may not split into a larger number of pieces of irregular shape and varying size. It is not impossible that initial diametral cracks may in some cases start at several places simultaneously, as theoretically there would be an infinite number of these cracks, providing the wheel were of absolutely uniform strength throughout. Practically, due to variation in the wheel material, there must nearly always be one diametral plane that is weaker than any other, and the first crack will naturally start across this plane.

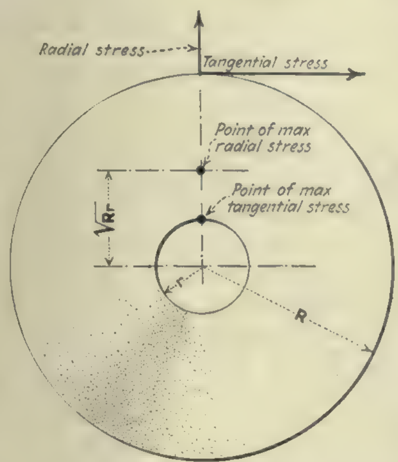


FIG. 1—STRESSES FROM CENTRIFUGAL FORCE

Reliable grinding wheel manufacturers test all wheels before they leave the factory by running them at a speed approximately twice that for which they are designed and recommended, thus obtaining a factor of safety of about four. It would then appear that breakages due to speed alone must be few in number. Such is indeed the case, yet they do occasionally occur from such causes as shifting thoughtlessly from large to small pulleys, placing wheels of large diameter on spindles running at speeds intended for smaller diameters, or substituting for a wheel running at the correct speed one of different grain and grade designed for lower wheel speed. In other words, most breakages due to speed are really due to over-speeding, either through carelessness or ignorance on the part of the operator.

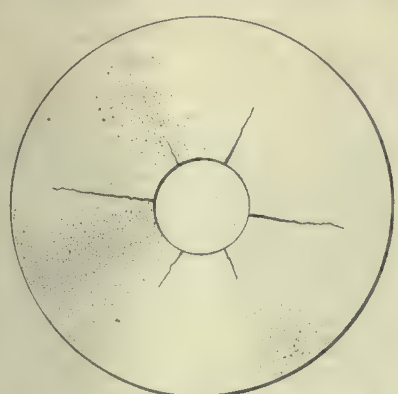


FIG. 2—STARTING OF CRACKS DUE TO CENTRIFUGAL FORCE

The writer well remembers his first and only speed breakage. He had mounted a 14-in. wheel on a cylindrical grinding machine that he had never before used, and knowing nothing about the machine or its combinations of pulleys, he asked one of the men in the shop if the wheel would stand "all the speed the motor could give it." The reply was in the affirmative, but before the speed was two-thirds that which could have been obtained the wheel exploded with great violence, breaking off part of the protecting hood, but fortunately doing no other damage. Needless to remark, the writer has made sure of his spindle speeds since that time, and as stated above, he has never had another breakage from centrifugal force alone. In fact, most breakages of this type could have been as easily prevented as this one.

Direct pressure exerted by the work upon the wheel.—By direct pressure is meant pressure on the face of a wheel in operation directed toward its center as illustrated in Fig. 3. Stresses produced by this pressure are of two kinds, radial stress and bending stress.

The radial stress is the same as would be produced by an equal pressure if the wheel were not revolving, and is principally compressive. It is usually small, and is unimportant as a cause of breakage.

Contact between the work and the face of the revolving wheel produces a frictional force, the amount of which is proportional to the direct pressure and which is in a direction tangent to the wheel face. This force causes bending stresses along any diametral section of the wheel, which are tensile on one side of the center and compressive on the other. These stresses reach their maximum value at the face of the wheel, but are usually comparatively small and unimportant.

Heating of the wheel.—Every student of grinding knows from experience that much heat is developed at the point of contact of wheel and work, and that in cases where grinding is done dry, the wheel may become very hot. Comparatively few, however, realize the importance from the standpoint of possible breakage, of the stresses due to this heating. As a matter of fact the stresses produced by the unequal expansion of different parts of the wheel may reach a large value so that many breakages are no doubt due to this cause.

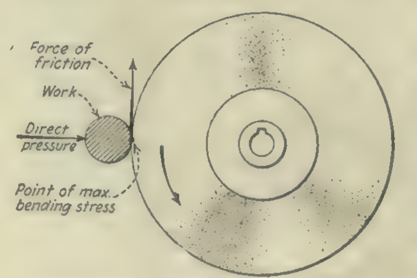


FIG. 3—DIRECT PRESSURE STRESSES

These stresses are similar in character to those produced by centrifugal force and are as in that case, of two kinds—radial and tangential. They may vary greatly in amount according to variations in temperature of different parts of the wheel, an exact determination of their amount in any given case being difficult if not impossible.

The greatest tensile stress occurs at the circumference of the hole and hence combines at that point with the maximum tensile stress due to the centrifugal force, shown in Fig. 1. This is an important statement, as both these stresses may be large and their resultant may easily cause breakage.

A few years ago the writer assisted in making some tests of the effect of heat alone upon grinding wheels. An electric heating coil was arranged to cover the entire surface of the face of the wheel to be tested. and heat was gradually applied. The wheel was not in motion, so that the effect could be due only to heat.

At a temperature of the circumference averaging from 70 to 115 deg. C., the wheels tested cracked along a diametral plane, some with sufficient force to entirely separate the two halves of the wheel. With the heat thus applied, from 40 to 70 minutes elapsed before breakage occurred. It should be borne in mind that the stress due to centrifugal force was not present in these tests, so that it is reasonable to conclude that under similar heating conditions a wheel of the same type in operation would break at a still lower temperature and probably in a shorter time. Actual heat breakages in operation are in very close agreement with this conclusion.

As stated above, the typical heat break is a diametral crack, the same as in the case of breakage due to centrifugal force. It is evident that a fracture resulting from a combination of heat and speed stresses would be of the same type.

Heating of the wheel spindle.—Tight or insufficiently lubricated bearings on a grinding machine may cause heating of the wheel spindle. In case the wheel bushing fits the spindle tightly, the expansion of the latter may cause tensile stresses of considerable magnitude in the wheel. This is clearly the case of a thick cylinder under internal pressure. The stresses produced are similar in character to both those due to centrifugal force and those due to heating of the wheel. They are of two kinds, radial and tangential, as in those cases, and the maximum tangential tensile stress occurs at the circumference of the hole. Hence the maximum stresses would combine at that point and breakage might occur from the resultant stress. The typical break due to heating of the wheel spindle would be a diametral crack, as in the case of breakage due to centrifugal force.

(To be continued.)

Keeping the Mill A-Going

By A. L. DeVinne

There are, of course, manufacturing and other businesses where the initial outlay that makes part of the overhead expense is so slight that any slackness of work, any lowering of the efficiency percent of any worker, would cause but little damage beyond the immediate sphere of action of the worker in question. In fact, about the only loss would be that of the inefficient worker himself.

Where, however, as in some lines, the initial outlay is great, and rent, insurance, taxes, repairs and salaries constitute the greater part of the cost of production or service, "the mill must be kept going" in the figurative sense, if great loss is to be avoided. Here, the foreman may be the prime factor that determines whether or not either material or human wheels stand idle, or rotate intermittently or unprofitably. In too few establishments is the amount of overhead percent revealed to the workers—even to the foreman, or if known, justified in the workers' eyes. If the amount—or better yet the percentage—were a matter of common knowledge, there would be a greater chance for the employees to see the necessity for exerting themselves to keep down this element in the cost per product unit. The average workman, however, in charging the employer with making enormous profits, figures the cost of the job as material plus labor cost, and of course, having this idea may be excused if in his ignorance he thinks the employer is getting rich at his expense.

Apprenticeship in the Metal Trades—A Report Full of Helpful Suggestions

The committee on industrial education of the National Metal Trades Association, consisting of Harold C. Smith, William M. Taylor, John C. Spence and Philip C. Molter, has done an excellent piece of work in getting out its report on apprenticeship in the metal trades. The foreword points out that, while semi-skilled men can usually be had, there is nearly always a dearth of the skilled, all-around mechanics on which so much of the future of the industry depends. These skilled men are not only necessary in the shop but are the natural supply of future foremen, superintendents, and possibly managers. The pressing need of a supply of such men is responsible for the publication of this report.

The suggestions for apprenticeship contracts for the training of boys in both shop and school, and the relations which are to be maintained are commended as being thoroughly practical, recognizing the frailties of plain, human boys and not expecting them to be angels in embryo. The training is based on a four-year apprentice training with due allowance for college or other experience. It is recommended that no piece work or premiums be given during apprenticeship in order to eliminate the incentive to stay on a given job longer than necessary.

One particularly good suggestion deals with the shifting of apprentices from shop to shop in order to give them the desired training. Small shops can thus take apprentices as well as large ones, can give the boys its part of his training and then pass him on to another shop in the town. In this way every small shop gets its quota of boys in various stages of training and stands an equal chance of having all-around mechanics at the end of the training period.

While training and not wages is the first object of apprenticeship, the committee realizes that finance cannot be overlooked. It is recommended that the rate be sufficiently high to attract the highest type of boy. They suggest that the wage be increased every six months beginning at one-third the journeyman's rate and reaching 85 per cent for the last six months of service. The committee also advises against requiring a deposit from the apprentice and also against prosecution of any boy who breaks the contract. It does not feel that the first is desirable or that an unwilling apprentice can be of much value.

Six types of apprenticeship are suggested, each designed to fit different shop conditions, and covering both large and small shops. The committee also suggests a definite division of different kinds of work to suit shops of various kinds and sizes. These suggestions should be of great value to everyone contemplating introducing an apprentice system, while those who already have one in operation can use it as a check on their own methods.

One of the interesting and encouraging features of the course is that it includes both economics and civics, two subjects of vital importance to the individual, to the employer and to the welfare of the country at large. This is along the right line, as the more mechanics know of the economics of production and distribution, the fewer illogical and erroneous ideas will pervade industry. Both the National Metal Trades Association and the committee that prepared this report, are to be congratulated on the publication of such a progressive plan. It should be carefully considered by every manufacturer in the metal industry.

Machining and Assembling Operations on Pneumatic Tools

The Second of Four Articles—Turning and Drilling Crankshafts for Air Motors—Machining Valves—Fixture for Rolling Segment Stock

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

THE method of centering the small crankshafts that are used in the Thor air motors manufactured by the Independent Pneumatic Tool Co., Aurora, Ill., is shown in Fig. 11. The two shafts *A* have been straddle-milled flat at the inner ends and then grooved vertically so as to form jaws. Each jaw has a steel pin, 1 in. in diameter, projecting from the back side so as to ride in the slot *B* and in the slots *C* in the plate *D*, Fig. 12. The end of each pin is encircled with a hardened bushing to take the wear. It can easily be seen that when the handle *E* is raised the jaws will spread apart, due to the fact that the slots *C* are cut on an angle. And when the handle *E* is lowered the jaws will close, holding the shaft in position for centering. The lower end of the shaft locates in a hole in a stationary block.

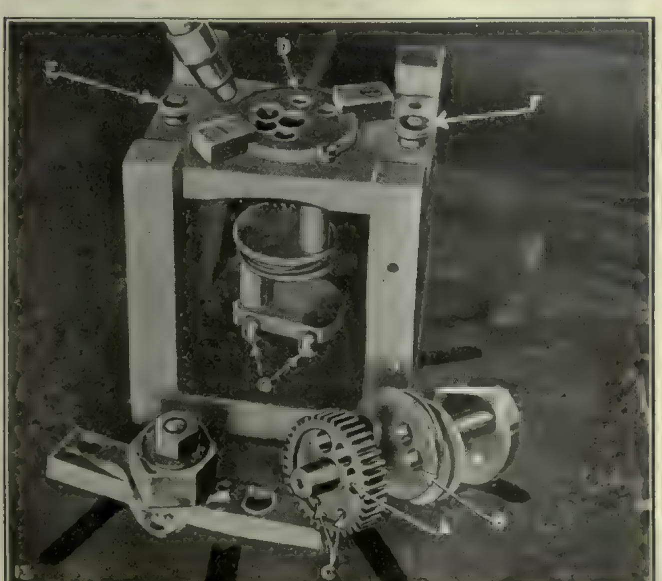
The drilling of the counterweight rivet holes and holes for lightening the crankshaft for a "close quarter" drill is illustrated in Fig. 13. The three holes *A* and the two holes *B* are for the purpose of lightening the crankshaft, and these are also located on the heavy side of the shaft so as to assist in balancing. Holes *C* are for the counterweight rivets. The under side of the bushing plate *D* is counterbored about $\frac{1}{16}$ in. to receive the gear end of the crankshaft, which is located in the jig by loosening the knurled screws *E* and *F* enough so that the entire top plate can be raised the necessary amount. The flat side of the lower end of the shaft is aligned with the pin *G* which insures the holes being drilled in the correct position.

The operation of milling the cheeks and roughing the pins of a crankshaft for a "close quarter" drill is illustrated in Fig. 14. The machine is a Becker vertical milling machine. Two heads are clamped on the crank for this operation, one on each end. Each head has a hole in it which slips over the end of the crankshaft, and a center hole to receive the centers of the fixture *A*. Each head is attached to the shaft by means of a setscrew, as shown at *B*. Neither the setscrew in the lower head nor the lower center can be seen in the illustration. Each head also contains a slot which locates in the lower face or lower part of the fixture, as shown at

FIG. 11—CENTERING AIR DRILL CRANKSHAFTS. FIG. 12—VIEW SHOWING OPERATION OF FIXTURE

C. The upper end of the shaft locates on a screw center which is withdrawn when the piece is to be changed or removed.

When pieces or cutters are to be changed, the piece



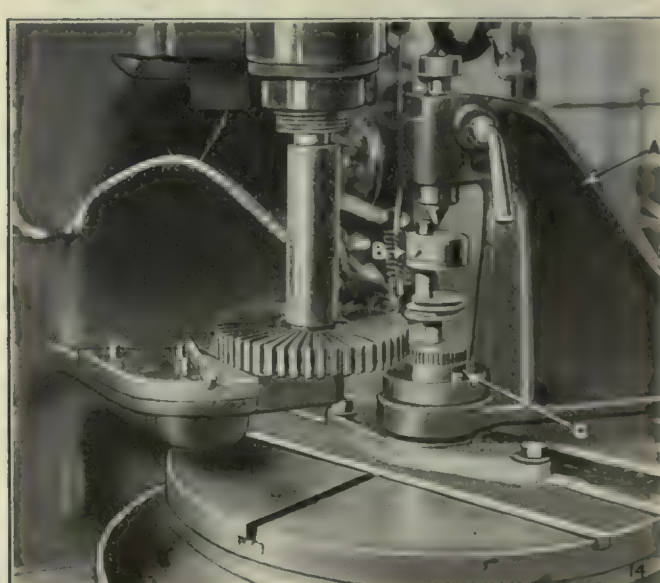


FIG. 13—DRILLING COUNTERWEIGHT RIVET AND "LIGHTENING" HOLES. FIG. 14—FACING CHEEKS AND ROUGHING OUT CRANKPINS

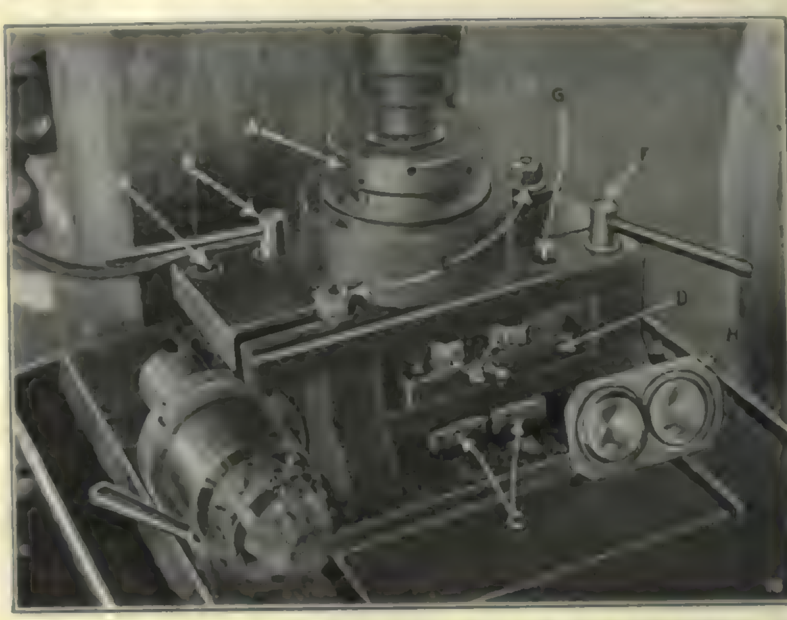


FIG. 15—MILLING THE PISTON CLEARANCE. FIG. 16—JIG FOR BORING JOURNAL BEARING CASE COVERS

is fed away from the spindle, using the longitudinal feed. When ready to mill a new piece, the table is fed in to a stop, then the table is rotated as far as possible, giving the cutters an opportunity to mill nearly around the circle. When one crank has been roughed out, the piece is inverted and the operation is repeated.

The operation of milling the piston clearance on a different type of crankshaft is shown in Fig. 15. The lower end of the shaft is held in a collet chuck which is attached to a plate and bolted to the table of the ma-

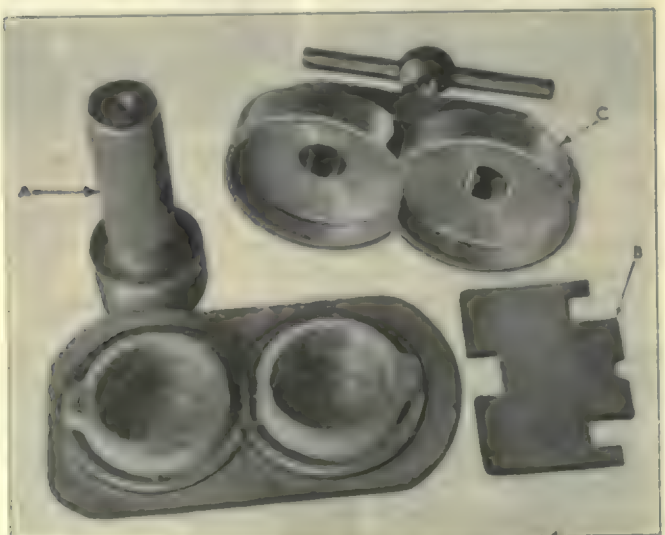


FIG. 17—INSPECTION GAGES FOR BEARING CASE COVERS

chine. The chuck is located off center in the direction of the spindle, and the piece is fed past the cutter by rotating the table.

The set up shown in Fig. 16 is for boring and recessing the crank journal roller bearing case cover for a No. 8 air drill. A cover is shown at *H*, and an extra cutter can be seen lying on the table of the machine.

The stop collars *A* determine the depth of the bore. The piece is put into the fixture through the left end, locating in a groove and against a stop at the right end. Tightening the bolts *B* clamps the piece between the strap *C* and the piece *D*. Two cutters are used in this operation, the roughing cutter being shown in the

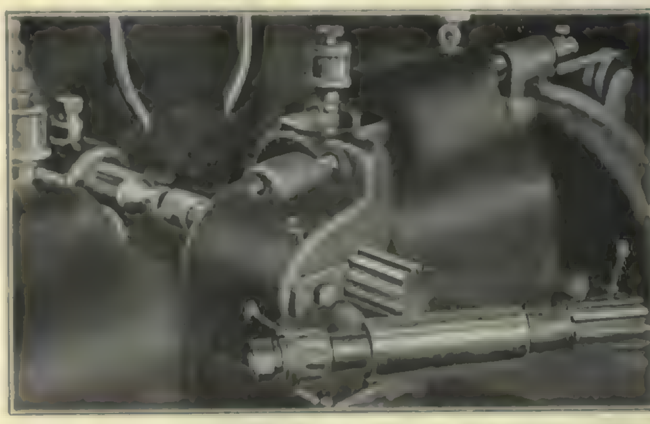


FIG. 18—MILLING SLOTS IN ROLLER RETAINER

spindle of the machine and the finishing cutter being shown lying on the table at the left. Both holes are roughed out before being finished. After one hole has been bored, the nuts *E* are loosened, the pins *F* withdrawn, and the entire fixture is moved over until the pins *F* will slip into the holes *G* at the top of the fixture. Then the nuts *E* are tightened and the boring operation repeated.

The tools for inspecting the work done in the opera-

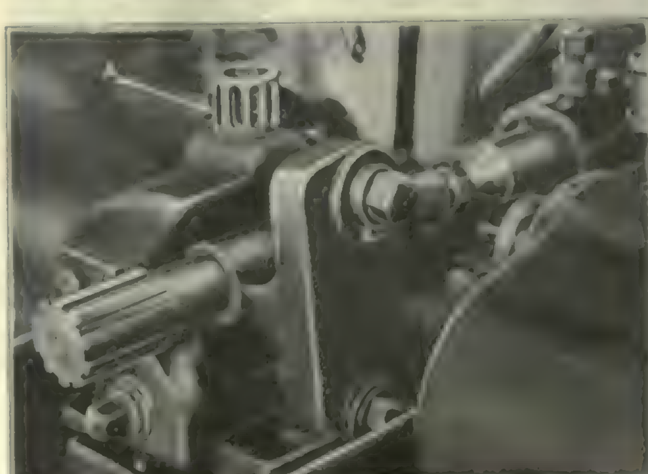


FIG. 19—VIEW OF MACHINE FROM OPPOSITE SIDE

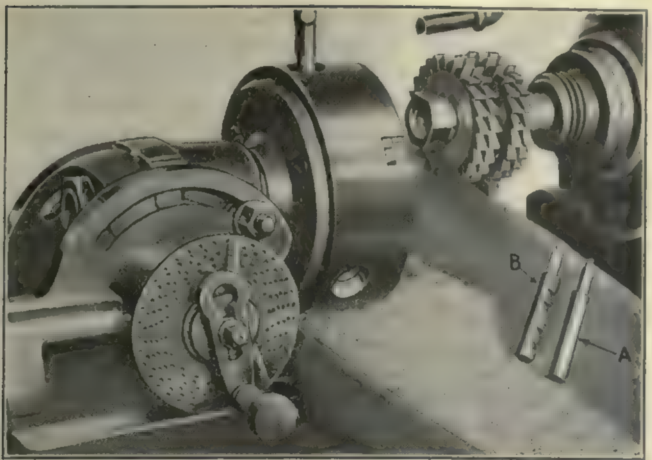


FIG. 20—SET-UP FOR VALVE MILLING OPERATION

tion just described are shown in Fig. 17. The plug *A* must be a push fit in the bore. The gage *B* is for testing the distance from the face of the cover to the bottom of the bearing hole. The use of the gage *C* insures that the two holes are in correct relation to each other and that the O.D. is correct.

Milling Slots in Roller Retainers

The equipment used in milling the roller slots in the roller retainer for the air drill is illustrated in Fig. 18 and 19. The retainers, one of which can be seen at *A* in both figures, are pressed onto the end of the crankshaft after the rollers are in place, forming a very efficient roller bearing. The arbor that is used for this operation is turned to as large a diameter as practicable at the center, in order to afford as much surface as possible for the clamping action of this fixture. The end of the arbor is splined as can be seen at *B*, Fig. 18, and the hardened plate *C* is made with a tongue which fits into one of the grooves as the arbor is clamped in position. The grooved end of the arbor is used as an index plate for spacing the slots in the retainer, the tongue on plate *B* acting as the index pin.

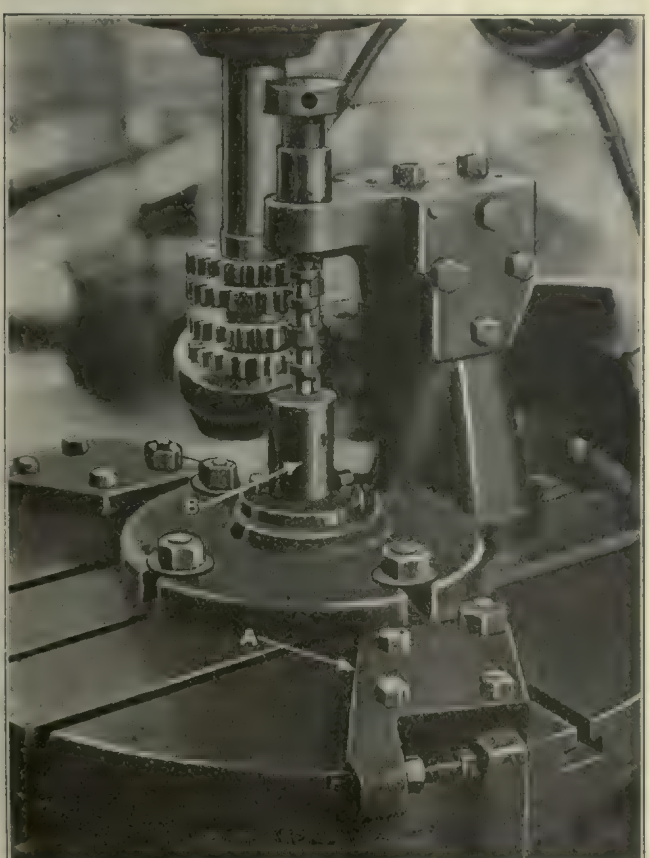


FIG. 21—MILLING VALVES ON A VERTICAL MILLING MACHINE

The machine on which this operation is performed is a Pratt & Whitney duplex milling machine, arranged so that two cutters are operating simultaneously on opposite sides of the piece. Both cutters feed in very slowly while the table is traveling back and forth the length of the slots. After the slots have been milled through, the cutters withdraw, the whole action being

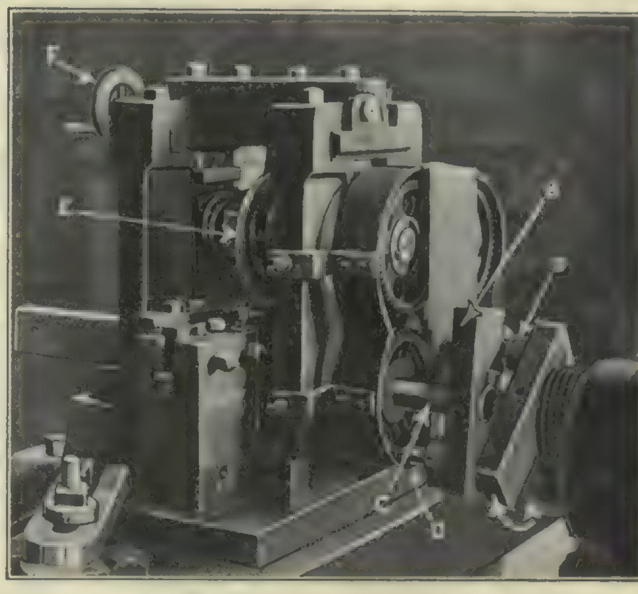


FIG. 22—ROLLING COMMUTATOR SEGMENTS

automatic. One operator runs three of these machines simultaneously.

The illustration, Fig. 20, shows a milling machine set up with four cutters which are used for milling the valve blank *A* into the form with four grooves shown at *B*. The valve is held at one end in the chuck and the other end is held on a center which does not show in the illustration. The table is fed longitudinally into the cut until the required depth is reached, then the chuck is rotated by means of the dividing head so that the grooves surround the base with the exception of a small rib on one side, then the table is withdrawn.

The use of a Becker vertical milling machine for a similar operation is shown in Fig. 21. Instead of milling straight across the piece, however, the grooves are milled practically three-fourths of the way around the piece, this action being accomplished by rotating the table of the machine. The limits of the cut are determined by two stops, one of which can be seen at *A*. A slot in the lower end of the valve locates on a key in the bottom of the hole in the round piece *B* and the upper end is held in place by a center of the screw type. The piece *B* turns the valve as the table is rotated.

Rolling Commutator-Segment Bars

The attachment shown in Fig. 22 was designed for a unique operation—that of rolling out round copper bars to flat, knife-blade shape. The bars are orginally 0.230 in. in diameter, and after rolling they are 0.425 in. wide, 0.070 in. thick at one side and 0.014 in. at

the other. This is equal to a taper of 7 deg. 30 min. These bars are made into commutator segments for the motors that are used in the electric drill. The attachment is blocked up on the bed of a lathe so that it can be driven from the spindle as shown. The driver is the block *A*, which is attached to a stub arbor and drives the block *B* on the end of the stub shaft *C* by means of the two pins *D*. A short section of rubber tubing is slipped over each of these pins to take the shock.

The shaft *C* drives one gear and this in turn drives the other three gears in train, which is necessary in order that the upper one of the two hardened steel rollers may be raised and lowered as the different diameters of stock are used. It is obvious that if only two gears were used, the rollers would always have to work at the same distance between centers in order to keep the teeth of the gears in mesh. The shaft of the upper roller runs in bearings contained in two blocks which are raised and lowered by means of the worm gear operated by the handle *F*. The faces of the rollers, one of which can be seen at *E*, are ground to give the correct taper to the copper as it is fed through the machine.

Recollections of an Old-Time Mechanic

By John J. Grant

My next attempt was a pair of roller skates, made because my father forbade me to skate on ice. I had good success with them and was supposed to have been the original inventor of roller skates until someone several years after, in an article in the American Machinist, proved that there had been a priority of invention dating back to about the year 1600.

I had done considerable work on clocks and made a complete grandfather's clock, movement, dial and case, and had it running before I was thirteen years old. I would give many dollars to have that clock and my first steam engine at present; but when I went to learn my trade, or rather when I had been at it long enough to know more than the superintendent, I took them apart to refinish them, with the usual results in such cases—they were never assembled again.

The next thing I tackled was marine engineering. I made a boat about twelve feet long and put paddle wheels in it, but one night the rain descended and the floods came; it broke loose from its mooring and went over the dam, and that was the end of my ambition to become a second Robert Fulton.

The turning point in my life was when an oil merchant, Mr. Reisner, came into the factory and saw my steam engine running, taking steam from the heating pipes. This gentleman told my father that I would certainly make a second Corliss and that I must get started at once to learn my trade. He lived in Providence and was well acquainted with Corliss. In a short time I received an invitation to visit him at his home. I was then nearing the advanced age of fourteen years and it was a great day for me when I started, with a hundred instructions from the whole family of how to conduct myself, including one from my dear old mother, not to whittle around the house without cleaning up afterwards. I set forth for Providence, my first trip away from home. If ever a boy had as good a time as I did on that visit, I have never heard of it.

I was taken down to the Corliss shop and introduced to the men in the high places, as the coming mechanic of the age, which I think my benefactor really believed. I was immediately accepted as an apprentice and indentures were drawn up and signed for me for a seven year apprenticeship, four years in the machine shop and three years in the drafting room. I went home to have my hopes dashed to pieces by the refusal of my father to sign the papers. He said he had served seven years apprenticeship and that I should never do it. He wrote to Mr. Reisner to that effect and in a short time I received word that he had secured for me a place at Brown & Sharpe's for a three years' term.

Brown & Sharpe's Old Shop

How well I remember the day I went with my father to Brown & Sharpe's shop at 115 South Main St., Providence, where I met Mr. Sharpe, who questioned me and also read the riot act to me; and Mr. Brown who took me under his wing and said, "You look like a good boy." Well boys, you who have served your apprenticeship in the old shop and know what it was to scrub the sink so that it would satisfy Mr. Sharpe, and have had Mr. Brown stand by you and encourage you when you made a slip or a bad job, know what it was to be brought up in a shop where boys were instructed; it would be far better if there were more of those shops in the present day.

Of course, the kind of work that was done at that time in Brown & Sharpe's was not the kind that made the all around mechanic, but it laid the foundation for it. The country job shop was the place where you could take a post graduate course that would fit you to repair a sewing machine in the morning and in the afternoon put a soft patch on a boiler, lying on your back in a hot firebox. But at Brown & Sharpe's you got it pretty thoroughly drilled into you that quality and not quantity of work was the first requisite in a good mechanic.

I would like to know if any of the boys of that time remember the sound of the bell that used to call us down to the front shop to get a lecture from Mr. Sharpe for some infraction of the shop rules; and then perhaps to meet Mr. Brown on the stairs when going back and have him try to talk severely to us about the shop being a school for the boys; and then because he thought he had hurt our feelings, hand each one a three or four-inch scale that he would explain was a little damaged—I could never see the damaged place.

Well both of them have gone and certainly have left their "footprints on the sands of time" and a name that stands high for all that is good in mechanics. That was a great combination—a disciplinarian and an easy boss—but the mechanics that they turned out are favorably known all over the world.

The Foreman as Liaison Officer

By C. E. Jensen

Those who have been "over there" know the importance—in fact the necessity—of the *liaison* or connecting link between different armies or divisions, or even brigades, the means of acquainting each, by word of mouth, with the plans and movements of the others who are expected either to co-operate actively or to remain ready for this or that contingency.

The foreman is the liaison officer between departments or production centers. Through his conferences and messages, efficient co-operation is secured.

Gears and Pinions for Electric Railway and Mine Service

The following suggestions for gear material, manufacture and finish are of special interest. They are recommended practice by the American Gear Manufacturers' Association for casehardened forged steel gears and quenched and hardened gears.

Manufacture

Material: All blanks for gears shall be made from openhearth steel which has been thoroughly worked to secure a homogeneous dense material, free from all injurious defects.

Chemical Properties and Tests (Casehardened Forged Steel Gears Only)

Chemical Properties: The steel shall conform to the following requirements as to chemical composition:

Carbon	0.20%	— not less than 0.12% nor more than 0.28%	
Manganese	0.50%	— not less than 0.40% nor more than 0.60%	
Phosphorus		not over 0.05%	applies also to material for quenched and tempered carbon steel gears.
Sulphur		not over 0.05%	

Check Analysis: A check analysis may be made by the purchaser or his representative from one or more gear blanks from each lot of 100 or fraction thereof ordered and this analysis shall conform to the requirements specified above. Sample for check analysis to be taken at the pitch line so that the blank will not be destroyed.

Physical Properties and Tests (Casehardened Forged Steel Gears Only)

Hardness: The hardness as shown by the scleroscope shall not be less than eighty, taken at the center of the top of the tooth after treatment.

Treatment: All gears, after the teeth are cut, shall be carbonized to a depth approximately one-sixth of the thickness of the teeth on the pitch line.

Finish—All Gears

Dimensions: The outside diameter *A*, Fig. 1, over the teeth as machined must not vary from that specified by more than plus zero (0) in. or minus 1/32 inch.

The face *B* of the gears must not vary from the specified width by more than plus 1/32 in, or minus 1/32 inch.

The minimum thickness of the rim *C* under the teeth shall be as follows, measured 1/8 in. from the edge of the rim:

Pitch	Thickness of Rim
3	5/8 in.
2½	7/16 in.
2	½ in.

Web: The web *D* of all gears shall have four 3½-in. holes on 7½ in. radius spaced with a tolerance of 1/8 in. in center of webbed section, whenever the space will permit.

Bore: The diameter of finished bore *E* shall not vary from that specified by more than plus 0.001 in. or minus 0.0015 inch.

The diameter of rough bore E_E shall not vary more than 1/16 in. over or 1/8 in. under that specified.

The ends of finished bores shall be chamfered, *F*, 1/16 in. on motor side to avoid injury to shaft when mounting.

Bore shall be measured with a pin gage or inside micrometer.

Hub: The face *G* of hub *H*, next to lining, to have a smooth bearing finish and run true with bore.

The variation from the specified dimensions of hub *H* and hub extension *L* shall not exceed the following:

Length of hub *H* overall, plus zero (0) in. to minus 0.02 inch.

Length of hub extension *L*, plus 1/32 in. to minus 1/32 inch.

Diameter of hub extension *J*, plus zero (0) in. to minus 0.03 inch.

Teeth: The thickness *K* of teeth at the pitch line must be to specified dimensions as a maximum or to

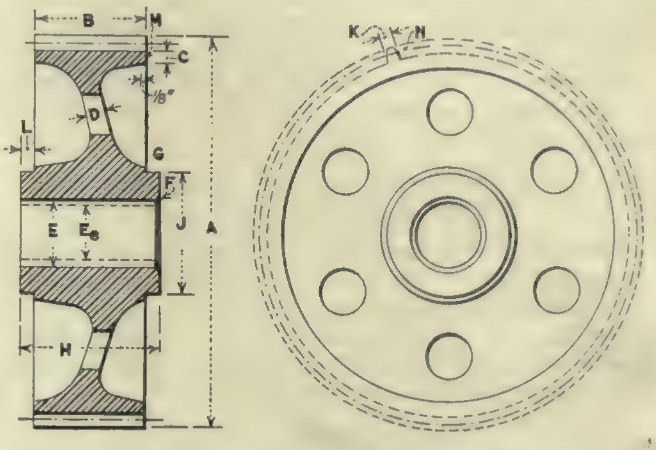


FIG. 1. DIMENSION CHART OF GEAR

specified dimensions minus 0.010 in. as a minimum.

The teeth shall be of the Brown & Sharpe standard 14½-deg. involute form unless otherwise specified.

Marking

Marking: All gears shall be plainly stamped on motor side of rim *N* as follows:

Grade.

Month, year, serial number of manufacturer, consecutive for each month.

Name, initials or trade mark of manufacturer.

Inspection and Rejection

Inspection: All gears shall be tested for smooth running. The teeth must be equally spaced so that the gear will run smoothly in both directions with a master pinion.

Records of all chemical analysis and physical tests shall be kept by the manufacturer and shall be available to the purchaser for a period of one year.

Rejection: The purchaser reserves the right to reject any portion of or all of the material which does not conform to the above specifications in every particular.

CASEHARDENED FORGED STEEL PINIONS AND QUENCHED AND TEMPERED FORGED CARBON STEEL PINIONS

Manufacture

Material: All blanks for pinions shall be made from

openhearth steel which has been thoroughly worked to secure a homogeneous dense material, free from all injurious defects.

Chemical Properties and Tests (Casehardened Forged Steel Pinions Only)

Chemical Properties: The steel shall conform to the following requirements as to chemical composition:

Carbon	0.20%	— not less than 0.12% nor more than 0.28%
Manganese	0.50%	— not less than 0.40% nor more than 0.60%
Phosphorus	not over 0.05%	applies also to material for quenched and tempered carbon steel pinions.
Sulphur	not over 0.05%	

Check Analysis: A check analysis may be made by the purchaser or his representative from one or more pinion blanks from each lot of 100 or fraction thereof ordered and this analysis shall conform to the requirements specified above. The sample for check analysis to be taken at the pitch line so that the blank will not be destroyed.

Physical Properties and Tests (Casehardened Forged Steel Pinions Only)

Hardness: The hardness as shown by the scleroscope shall not be less than eighty, taken at the center of the top of the tooth after treatment.

Treatment: All pinions, after the teeth are cut, shall be carbonized to a depth approximately ⅛ of the thickness of the tooth on the pitch line.

Dimensions—All Pinions

Diameter: The outside diameter *A*, Fig. 2, of the pinion shall not vary from that specified by more than

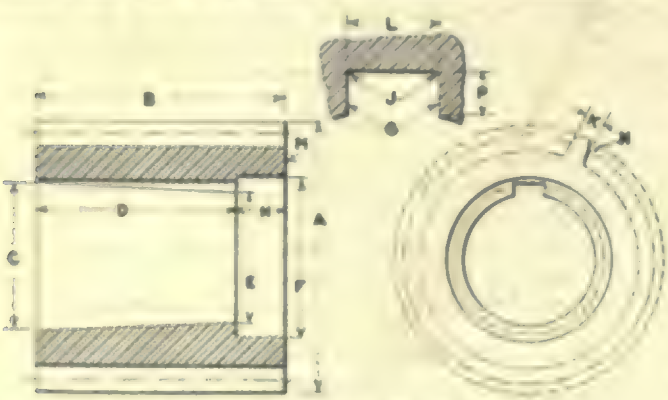


FIG. 2. DIMENSION CHART OF PINION

plus zero (0) in. or minus $\frac{1}{32}$ in. measured at the center of the face.

Face: The face *B* of the pinion must not vary from the specified width by more than plus or minus $\frac{1}{32}$ inch.

Bore: All bores *C-E* must be finished after treatment. The diameter of the bore must be such that the standard plug gage will not project less than $\frac{1}{32}$ in. or more than $\frac{1}{16}$ in. measured at the large end of bore *C* and have bearing the full length of *D* of bore *C-E*.

Counterbore: The depth *H* of the counterbore must not vary from that specified by more than plus zero (0) in. or minus $\frac{1}{32}$ inch.

The diameter *F* of the counterbore must not vary from that specified by more than plus $\frac{1}{32}$ in. or minus zero (0) inch.

Keyway: The sides *G* of the keyway must be cut parallel with the center line of pinion.

The width *L* of the keyway must not vary from that specified by more than plus 0.003 in. or minus zero (0) inch.

The depth *P* of the keyway must not vary from that specified by more than plus $\frac{1}{64}$ in. or minus zero (0) inch.

The fillet *J* at the bottom of the keyway shall have $\frac{1}{16}$ in. radius. With this specification $\frac{1}{16}$ in. clearance shall be provided between bottom of keyway and pinion key.

Teeth: The thickness *K* of teeth at the pitch line must be to specified dimensions as a maximum or to specified dimensions minus 0.010 in. as a minimum.

The teeth shall be of Brown & Sharpe standard 14½-deg. involute form unless otherwise specified.

Marking

Marking: All pinions shall be plainly stamped, preferably on the outer end *M* with steel letters approximately ¼ in. as follows:

Grade.

Month, year, manufacturer's serial number (to be consecutive for each month).

Name initials or trade mark of manufacturer.

Workmanship and Finish

Finish: All pinions shall be tested for smooth running. The teeth must be equally spaced so that they will run smoothly in both directions with a master gear.

All pinions shall be gaged with a standard taper plug gage, which shall be the same size as the nominal size of the bore at the large end.

Inspection and Rejection

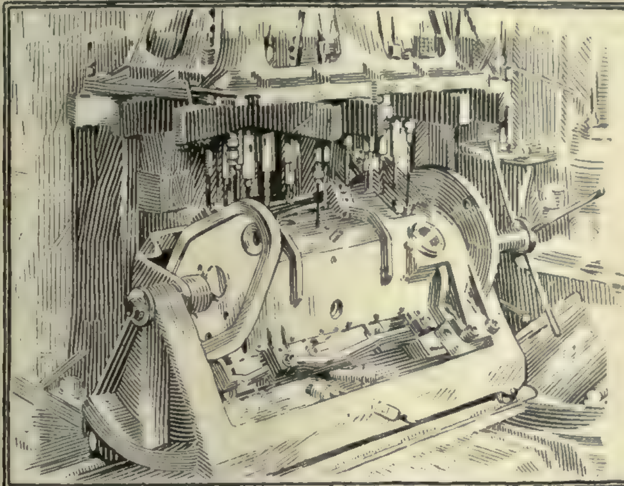
Inspection: All pinions shall be free from any seams, cracks or other defects that would in any way affect their service.

Rejection: The purchaser reserves the right to reject any portion of or all of the material, which does not conform to the above specifications in every particular.

Growth of Pennsylvania Employment Bureau

Some idea of the growth of state employment bureaus or offices may be had from the very interesting report of the Bureau of Employment of the Pennsylvania Department of Labor and Industry for the year 1921. This bureau has headquarters in Harrisburg and branch offices in Philadelphia, Pittsburgh, Scranton, Altoona, Pottsville, Lancaster, Williamsport, Kane, Erie, Johnstown, McKeesport, Meadville, Dubois, Wilkesbarre and New Kensington. It co-operates with other bureaus such as those of Mediation and Arbitration, Rehabilitation, Inspection, Occupational and Therapy, as well as with Federal agencies along similar lines. Each office has sections for men, women and juveniles, the latter department being conducted in co-operation with the public schools.

It is interesting to note that, in spite of industrial conditions, some of the offices placed more people in 1921 than in any previous year. The only conclusion is that employers have learned to rely more on the employment offices, as there were certainly fewer people employed in 1921 than in 1919 and 1920. This is borne out by a total of nearly 92,000 applications for workers from employers.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Tooling for Vertical Turret Lathes and Boring Mills Concluded — Machining Spherical and Formed Surfaces — Methods of Laying Out and Developing the Design of the Tools

MANY of the principles brought out in the article which treated of the design of attachments for horizontal turret lathes, are equally applicable to use on vertical turret lathes and boring mills. The construction of the machine, however, is somewhat different so that the application of attachments varies considerably, although the general principles may be much the same. In addition, the cutting action is usually more severe and the attachments must be built in a more substantial manner than those used on horizontal turret lathes.

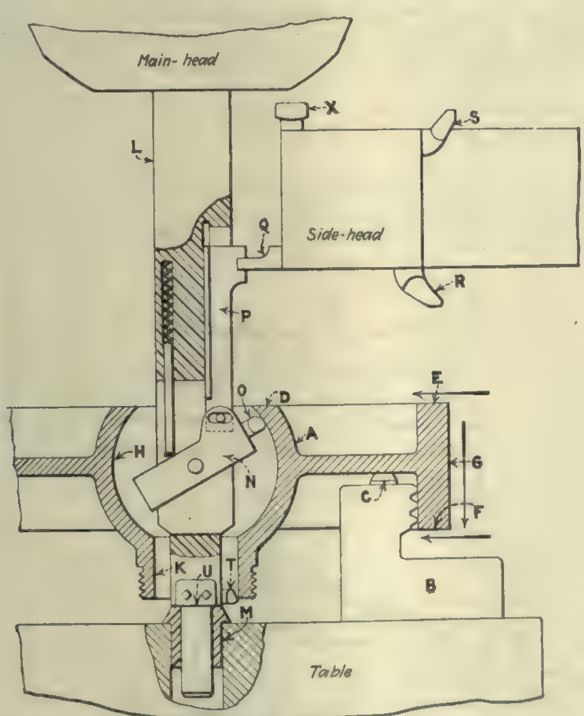


FIG. 402. SPHERICAL BORING ATTACHMENT

In Fig. 402 is shown a piece of work *A* which is held by the inside rough surface in a set of special chuck jaws *B*. The web of the casting rests on hardened buttons *C* in the chuck jaws. The work which is to be done consists of facing the surfaces *D* and *E*, turning the outside diameter *G* and undercutting the flange *F*. In addition to this machining, both the spherical hole *H* and the straight hole *K* are to be bored.

A heavy bar L is held in one of the turret faces and piloted at the lower end in a bushing *M* in the center of the table. The bar is slotted to receive a swivel block *N*, which carries a tool *O* for generating the spherical surface. Connected to the swivel block is a sliding member *P* traveling vertically in a slot in the side of the bar and operated by the finger Q in the sidehead. The feed is obtained by using the down feed of the sidehead. The cylindrical hole *K* is bored by a tool *T* in the lower end of the boring bar. This tool is so placed that it completes its work shortly before the shoulder *U* strikes against the top of the bushing. In using this tool the sidehead is disconnected and the turret feed used, the latter being thrown out of engagement at the completion of the cylindrical boring cut.

The surfaces *D* and *E* are faced by standard tools in the regular toolholders of the turret. The rough- and finish-turning of the outside diameter *G* is done by the sidehead, using the tools *R* and *S*, respectively. The undercutting of the flange *F* is also done by the sidehead, using the tool *X* for the purpose. The peculiar part of this equipment is the combination of a straight and spherical tool in the same bar, as this condition is seldom found. The tools *T* and *O* are both arranged so that they can be moved for roughing and finishing and other tools substituted rapidly.

Generating a Spherical Surface

In Fig. 403 is shown a piece of work *A* which is to be turned at *B*, faced at *C* and *D*, undercut at *E*, turned at *F*, grooved at *G* and turned spherically at *H*. The hole *K* is also to be bored and reamed. All of these operations are to be done in one setting of the work, and as a consequence a considerable amount of special tool equipment is necessary. The jaws *L* grip the inside of the work in such a way that

---

For the authors' forthcoming book. All rights reserved.

the tools in the sidehead used for undercutting will not interfere with the jaws. The table is provided with a central bushing which is used as a guide for the boring bars.

We are particularly interested in the turning of the spherical surface H, and the equipment for this purpose consists of a heavy casting N which is bolted to the face of the turret. On this casting a dovetailed slide O is mounted so that it is free to move longitudinally. The lower portion of this slide is built out so that it supports the tool P, which is used for turning the spherical surface. Both roughing and finishing tools are made so that they fit the slide in the holder, so that one can be used after the other in the turning operation. The sidehead contains a form plate Q of the proper curvature, so that when the roll R is in

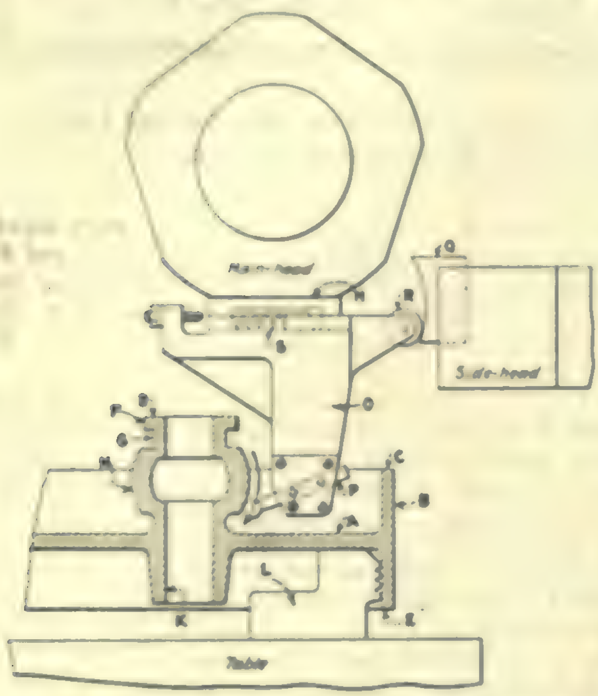


FIG. 402. SPHERICAL TURNING ATTACHMENT FOR VERTICAL TURRET LATHE

contact with the curved surface the correct radius will be generated at H. A heavy coil spring S keeps the roller in contact with the form, and the down feed of the turret provides the power necessary.

Other tools are used in both turret and sidehead for performing the boring, facing, turning and grooving operations. The work shown here is rather unusual in shape, and because of the fact that the spherical surface is in such a position that it cannot easily be reached by the sidehead tools, the design and application of a spherical turning device requires considerable ingenuity. In operation it was found that a fine feed was necessary in order to produce the desired finish.

Concave and Convex Surfaces

If a vertical boring mill of the two-head type is used for manufacturing work, the generation of a curved surface causes considerably more trouble than if the work is done on a vertical turret lathe. Fig. 404 shows a piece of work A which is held in chuck jaws B in such a way that the curved surface C can be machined to the desired form, the plane surface D faced, and the outside diameter turned. It is desirable to perform all of these operations in the same setting and without loss of time. The work is set up in the jaws so that the under side of the flange rests on hardened buttons which are high enough so that the turning tool for the outside diameter will not strike the chuck jaws.

Two special brackets E and F are applied to the

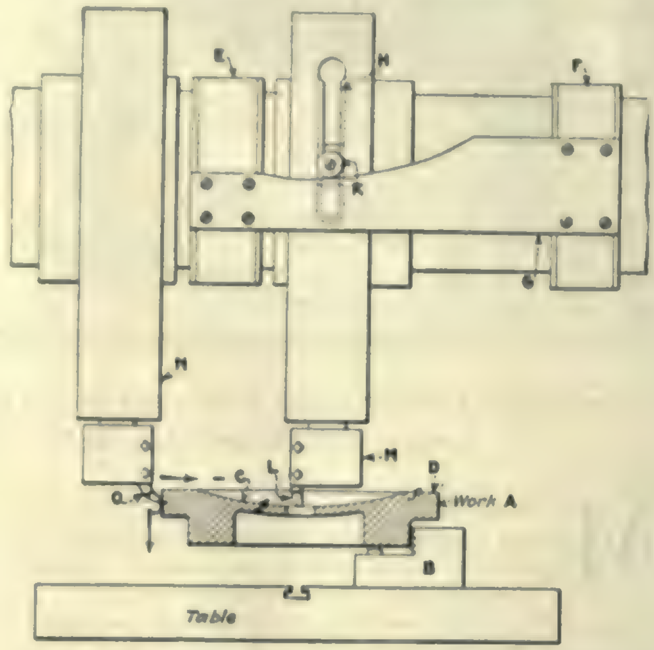


FIG. 403. SPHERICAL TURNING ATTACHMENT FOR VERTICAL TURRET LATHE

rails of the machine and on these brackets a form plate G is fastened. The toolslide is slotted at H in a vertical direction, in order to permit the use of a block which carries a roller K. The block can be adjusted ver-

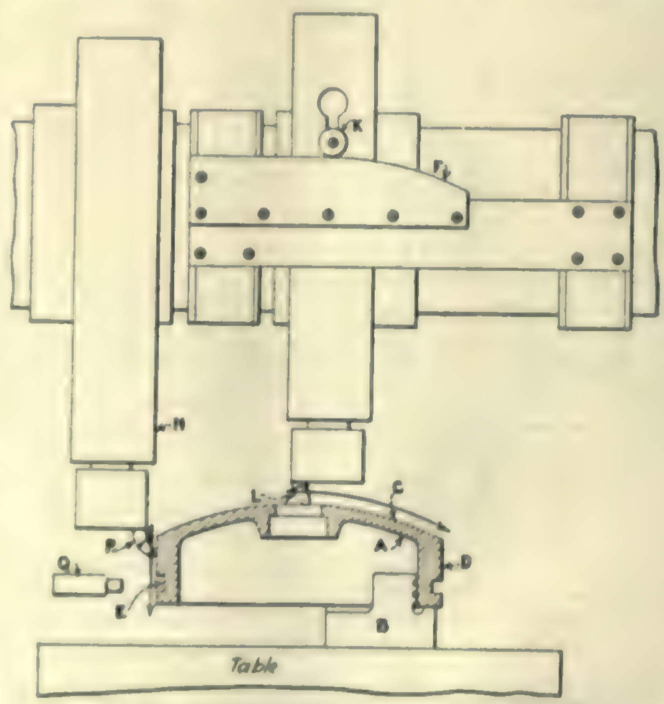


FIG. 405. GENERATING A CONVEX SURFACE

tically in order to compensate for variations in the tool setting. In operation the tool L, held in a standard holder M, is controlled in its movement by the position

of the roll *K* with respect to the form. When the feed is engaged the tool travels in the direction indicated by the arrow, thus generating the concave surface.

While this tool is in operation, the left-hand toolslide *N* faces the surface *D* and turns the outside

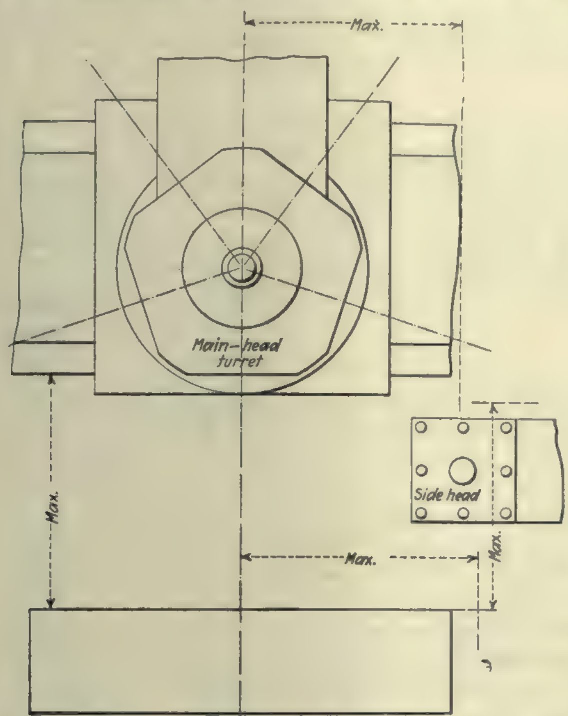


FIG. 406. DIAGRAM FOR TOOL LAYOUTS ON VERTICAL TURRET LATHE

diameter, the tool *O* being used for the purpose. This is a very simple arrangement, but it must be made substantially and carefully fitted to the machine. It also necessitates the removal of the right-hand toolslide in order to cut the slot in which the roller *K* is held.

The same attachment used for machining a convex surface is shown in Fig. 405, the only difference being in the shape of the form plate. The work *A* is held by the inside in a set of special jaws *B*. The work which is to be done is facing the convex surface *C*, turning the outside diameter *D* and cutting the groove *E*. A form plate *F* is applied to the same brackets that have been shown in the previous illustration, and the roll *K* is adjusted to suit the conditions. The tool *L* is constrained to travel in the direction determined by the shape of the plate. While this operation is being done, the left-hand toolslide *N* is used to turn the outside diameter *D* with tool *P*. After the turning has been completed, the grooving tool *Q* is set in position and the groove *E* finished.

The various examples which have been given here are sufficient to illustrate the adaptability of vertical turret lathes and vertical boring mills to the machining of spherical surfaces. In addition to the devices illustrated, some of the ideas which have been mentioned under horizontal turret lathe work may in some cases be subject to a certain amount of revision and applied to vertical boring mill work. There are so many cases which require special treatment, that it is not considered advisable to take up here anything more than the simpler methods. Special attachments can, of course, be designed to suit particular cases. One point of importance is that, wherever possible, the attachments should be arranged so that the use of both heads will not be interfered with.

Layouts for Vertical Boring Mills

In laying out tools for machining work on the vertical boring mill and vertical turret lathe, the standard tools which can be purchased with the machine are so adaptable that the tool layouts are considerably simplified. As there are only five sides to the turret there is less likelihood of interference, and the method of setting up the work and applying the tools allows the operator considerable latitude. In making tool layouts for the machines mentioned, a simple diagram like that shown in Fig. 406 will be found of great help. This diagram should be made in ink on tracing cloth, and should contain about as much information as seems to be essential for making a correct layout. The table diameter and the maximum movements of turret and sidehead should be clearly shown. With this diagram as a guide, when it becomes necessary to make a layout the tools and toolholders can be easily placed in position, and the various operations indicated in such a way that they will be easily understood.

The first and second settings of a large cast-iron spider which is machined on a vertical turret lathe are shown in Figs. 407 and 408. All of the tools used for the operations are of a standard nature, and it is considered advisable to show these two settings in order

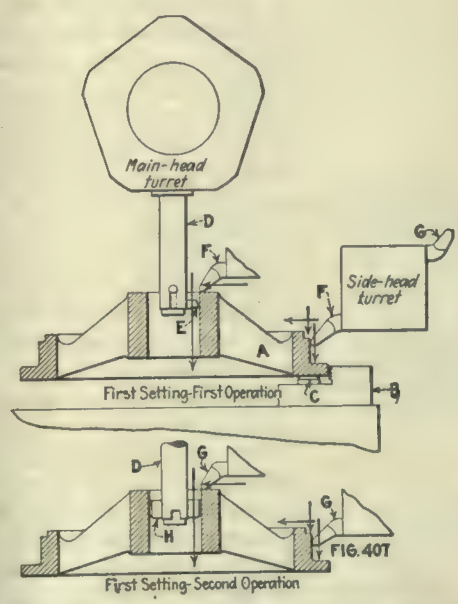


FIG. 407. TOOL LAYOUT USING STANDARD EQUIPMENT

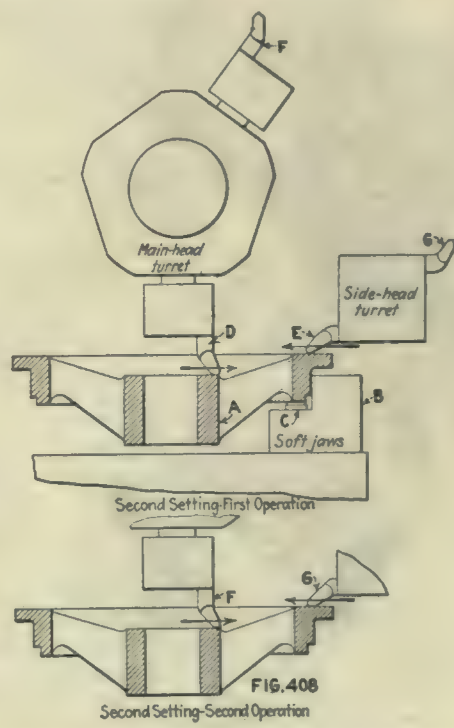


FIG. 408. SECOND SETTING LAYOUT WITH STANDARD TOOLS

to illustrate the adaptability of the machine to work of this character. The work A is held in standard jaws by the outside diameter and it rests upon hardened buttons C. The main head carries a standard type of boring bar D, in which tools E are used for rough- and finish-boring. The sidehead contains a tool F, which is used to face the hub and turn and face the other surfaces indicated by the arrows.

The sidehead and main head are working simultaneously. After the rough- and finish-boring operations have been done, the floating reamer blade H is placed in position in the bar D and the reaming cut taken, while the tool G in the sidehead is used to finish the same surfaces which were roughed in the first operation.

The second setting is shown in Fig. 408. The work is held by the outside in soft jaws B, which are bored out on the machine to fit the outside surface finished in a previous operation. The work is supported on hardened buttons C in the chuck jaws. The tool D in a standard holder in the main-head turret is used for roughing off the surface of the hub, a longitudinal feed causing the tool to travel in the direction indicated by

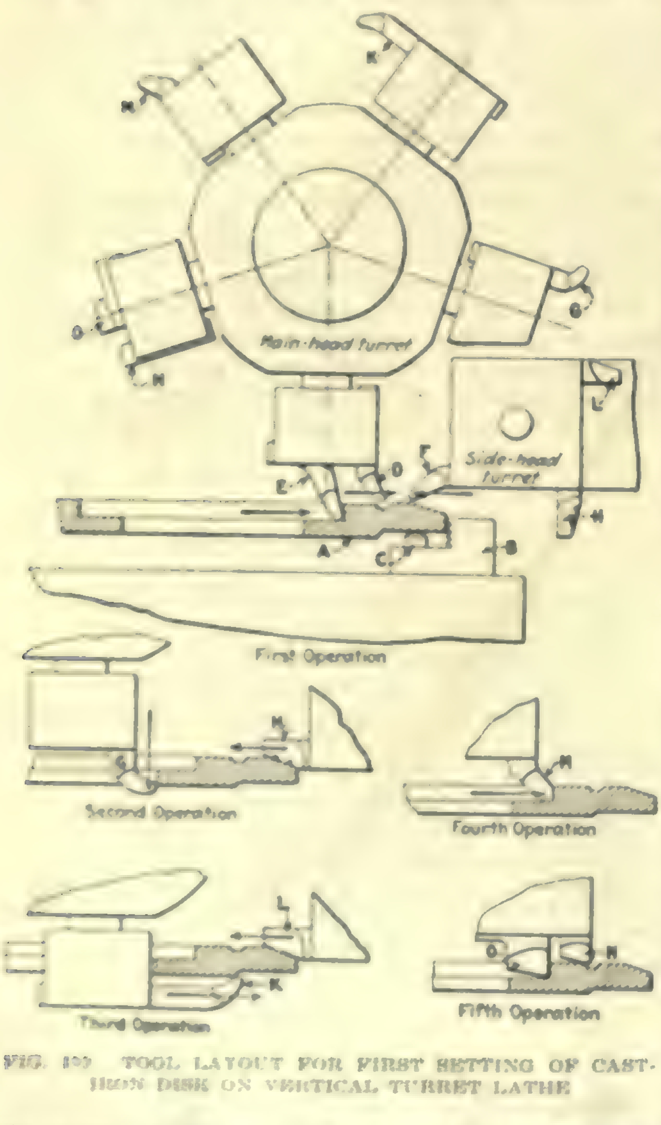


FIG. 409. TOOL LAYOUT FOR FIRST SETTING OF CAST-IRON DISK ON VERTICAL TURRET LATHE

the arrow. At the same time the tool E in the sidehead turret faces the flange, as shown by the arrow.

For the second operation, the tool F in the main-head turret and tool G in the sidehead turret are used for finishing the same surfaces. This completes the work, and it will be seen that practically all of the tooling is of a standard nature. It can further be noted that both the main-head and sidehead tools are

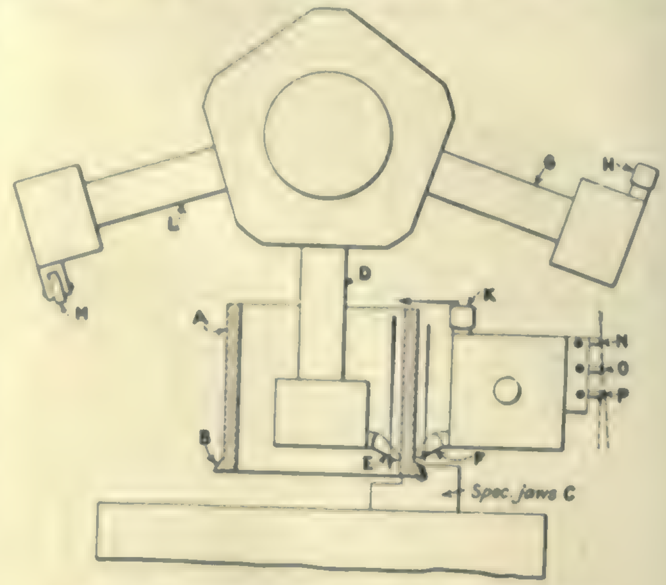


FIG. 410. TOOL LAYOUT FOR PISTON-RING POT

working simultaneously and practically all of the time, which makes the production rapid.

We have several times mentioned the importance of keeping as many tools in operation at the same time as possible, in order to obtain maximum efficiency. This matter is exemplified on vertical turret lathe work, and the greatest care should be taken to make sure that the sidehead and main-head turrets are working continuously, so far as the nature of the work will permit. At the same time, it is often not necessary to go to great expense in regard to the tool set ups, but it does require that the engineer who makes the layout should be thoroughly familiar with the machines and their movements if maximum production is to be obtained.

Holding a Large Piece

In Fig. 409 is shown a piece of work A which has a diameter of 26 in. and which is to be machined on the various surfaces indicated in the illustration. The work is held by the outside in chuck jaws B and supported on hardened buttons C. The tool equipment used is very simple, and for a great part of the diameter both the sidehead and main-head turrets are working simultaneously. In the first operation a standard toolholder carries tools D and E, which are used for rough-facing the surfaces indicated by the arrows. The turret is fed in a horizontal direction to produce this result. The tool F held in the sidehead turret is at the same time fed inward in order to rough-face the surface shown.

In the second operation, the tool G is used for rough-boring the large hole, and the tool H in the sidehead turret is brought forward to rough-face the angular surface. The tool used here is nickeled, in order to break up the chip and make the cutting action easier. In the third operation, the tool K is of exceptional length, but it is held in a standard toolholder as indicated. The main-head turret is fed down to a predetermined distance and the tool K is used to undercut the surface shown. Only one roughing cut is taken on

this surface. While this undercut is going on, the tool L in the sidehead turret is used for finishing the angular surface.

In the fourth operation the tool M finishes the shouldered portion of the work, leaving a small amount for a final sizing cut. The final finishing operation is done in the fifth operation by the tools N and O, these being so set that they will retain the shoulder distance, which is important.

The second setting of this piece is not shown, but it is very simple, and some of the same tools can be used that are shown in this illustration. The work is turned over and located on the finished shoulder on a special fixture of simple design. The outside diameter is then turned by the sidehead and the facing cuts done by the main head. No extra tools are necessary for this operation.

Layout for Piston-Ring Pot

The work shown at A in Fig. 410 is a cast-iron ring pot of special form from which large packing rings are made and cut off. The tool required for such a piece of work is comparatively simple, yet the operation is somewhat different from any which have been previously described. In the first place, the lower portion of the casting B is made somewhat heavier than the remainder of the pot, and it is beveled as shown so that it can be firmly held in the special jaws C, which are cut to a corresponding angle. As this work is of 12-in. diameter and as the walls of the casting are rather thin, care is necessary in the cutting to make sure that excessive vibration is not set up by the tools. In order to prevent this vibration a special toolholder D is used in the main head, and it carries a boring tool E which works directly opposite a turning tool F in the sidehead. This method of machining tends to reduce vibration and greatly facilitates the cutting action.

The finishing of the outside and inside diameters is accomplished in the same manner by means of the holder G and tool H in the main-head turret, working in opposition to a finishing tool K in the sidehead. After these two operations have been completed, the holder L is indexed into position and the roll M brought into contact with the inside of the ring pot.

The three tools N, O and P in the sidehead are now used for cutting off the ring, and the support furnished by the roll M is of value in order to prevent chatter. The parting tools mentioned are set progressively, so that P is slightly ahead of O and O is ahead of N. By this means the rings are cut off one at a time and the operator stops the machine and removes each ring as fast as it is made. It is possible to use more parting tools if desired, but it has been found that greater satisfaction is obtained by using two or three tools than by attempting to cut all the rings at one time. It is obvious that the roll M must be moved downward into a suitable position for giving support, according to the position of the sidehead tools.

We have attempted to cover in a concise and graphic manner the field of manufacture to which the vertical turret lathe is adapted, but the tool engineer will appreciate the fact that many of the matters which have been dealt with in horizontal turret-lathe tooling are applicable to the methods for the vertical turret lathe. For this reason it has been our endeavor to simplify the examples given as far as possible, in order to avoid any repetition of principles which have been previously treated.

Does Forced Lubrication Score Bearings?

By Theodore H. Miller
Works Manager, DeLaval Separator Co.

I have read with a great deal of interest the article on page 919, Vol. 56, of *American Machinist*, entitled "Does Forced Lubrication Score Bearings?" Mr. Hudson has evidently hit upon a kind of apparatus where direct comparison between the splash and forced lubrication can easily be made.

The scoring of the crankshaft, which he brings out, was new to me; not so, however, the very great difficulty which is being experienced with the oil used in the gear cases on large steam turbine installations and in crankcases of Diesel and other heavy oil engines. For these services, it was found out sometime ago that a means of purifying the oil constantly is not only a very great saving in oil, but very materially reduces repairs and most important of all, tends to insure continuity of operation. As an example of this importance, one of the very large public service corporations not far from New York had one of its largest steam-turbine driven units out of commission for three days, when it was very badly needed, on account of dirty oil. This was the final wedge which resulted in the installation of a centrifugal oil purifier to clean the oil. Not only has that machine continued to operate with the aid of the centrifugal purifier, but all of the other many units of that corporation are also fitted with them.

A destroyer making a round trip to Europe during the war and since, has been able to about pay for the installation of a centrifugal machine through the oil saved alone, to say nothing of the reduced wear on the power plant. It was formerly the practice to use the oil as long as it was thought safe, then to pump it overboard and fill up with fresh oil. The centrifugal purification system by-passes a portion of the oil in use through the purifier all the time, thus keeping it at all times in prime, usable shape. These machines are now installed, or in process of being installed on all the vessels of the Navy and most of the merchant marine.

Cutting oils used in manufacturing establishments are purified to such an extent as to keep them in almost new condition and very greatly prolong the life of the cutting tools. Perhaps the editor had all of these things in mind when writing the very timely editorial which appears on page 939 in the same issue.

The Foreman as "Non-Com"

By A. W. Brown

The "buck private" has learned, or should have learned, both to obey and how to obey, so that when promotion comes, he knows why obedience is not merely good policy but absolutely essential, and can better command, and better explain, why obedience is necessary and why certain orders are issued.

As "non-com" he has not forgotten his "rookie" days; nor does he forget that the ex-rookie, now "non-com," may aspire with due confidence to exchanging his chevrons for the bars of a "shave-tail." He has mingled on equal terms with all sorts and conditions of men and knows the inner workings of their minds. He remembers, perhaps, injustices that he would be wise to avoid and bears in mind advice and examples that have stimulated him and his colleagues to increased and well-directed effort. He can avoid, or at least strive to avoid, his predecessors errors.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

How the Disk Is Machined

By Milton Wright

On page 959, Vol. 54, of *American Machinist*, P. Arter asked the question "How would you machine this disk?", and at intervals throughout the succeeding volume there appeared various contributions offering advice and suggestions as to methods and tools for performing the job.

The job cited was the machining all over (except the periphery) of disks of cast brass 22$\frac{7}{8}$ in. outside diameter and of different thicknesses, ranging from $\frac{3}{8}$ in. to 0.070 in. Six 5$\frac{11}{16}$-in. holes equally spaced about the center at a radial distance of 8 in., were to be bored and threaded to a diameter of 5$\frac{1}{2}$ in., having a 24 pitch V-thread.

A hub on one side of the disk was 9$\frac{1}{2}$ in. in diameter with a total thickness, including the web of the disk, of $\frac{3}{4}$ inch.

There were various holes to be drilled and slots to be cut in each disk, but these were minor details and a subject only for ordinary jig designing; the real problem was to face the disks on both sides so as to leave them flat and parallel, and to hold them for subsequent drilling and threading of the dial holes without again distorting them. This latter operation also called for some consideration, as the bushings which were later to be screwed into the threaded holes must stand square with the face of the disk and present smooth faces flush with the web on both sides. On the thinner disks there could be but little more than one turn of thread in the hole.

FIG. 1—THE FACEPLATE UPON WHICH THE LATHE WORK IS DONE

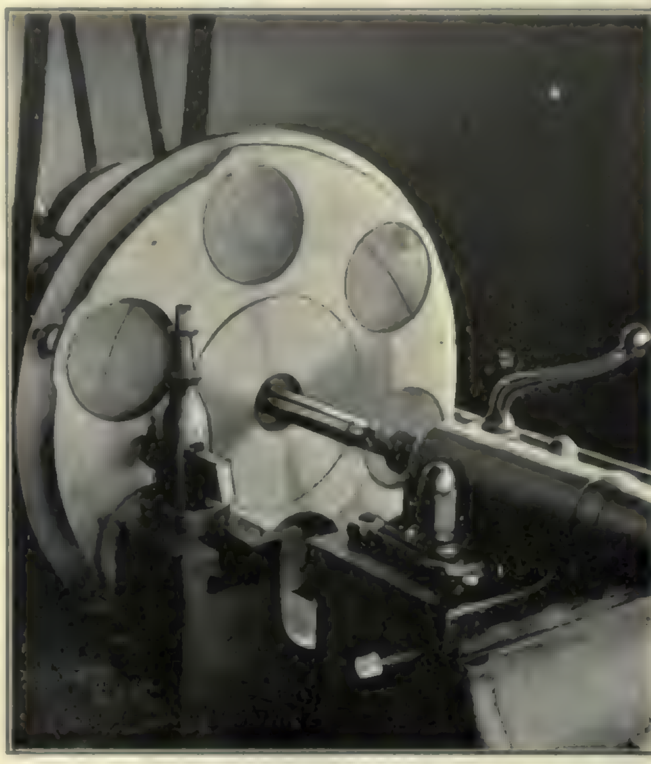


FIG. 2—THE DISK MOUNTED IN THE LATHE FOR FACING

This job has been and is still a standard manufacturing operation in the shops of the Persons-Arter Machine Co., of Worcester, Mass., where the present writer had the privilege of seeing and photographing it.

In Fig. 1 may be seen the special faceplate upon which all the lathe work is done. This is a parallel disk of cast iron permanently bolted to the regular faceplate of the lathe and fitted with a number of freely moving plungers, each plunger having behind it a coil spring and each being fitted with a collar that may be tightened upon it by means of a setscrew.

Method of Holding the Work

Two of the projections that may be seen in the picture are permanent bushings set into the faceplate, and a third similar bushing is concealed from view by the toolblock. These three bushings are faced off after assembling and together form a three point bearing against which the disk to be machined is held by means of standard hexagon head machine screws passing through from the back of the plate.

The first machine work upon the disk casting is to drill and tap the holes for the holding screws. As these holes must not only come in the right place to match the screws but must also be very exactly spaced so that the three screws will enter freely from either side, the drilling and tapping is done in a jig.

With the setscrews in all the collars loosened the disk is then fastened to the faceplate as in Fig. 2 by means of the screws, the spring plungers moving back as the pressure comes upon them but remaining always in firm contact with the disk regardless of any irregularity in the casting. When the holding screws are all tight the lathe is turned over to see that everything is all right and then the collars are tightened upon the plungers.

As each collar lies against the surface of the plate the disk is now suported against deflection due to tool pressure at a sufficient number of points to insure that a cut taken over the outer surface will leave it flat, except for the slight warping due to the removal of the scale. In this position the entire exposed surface is machined, including the hub.

The disk is then turned over and again fastened with the newly machined surface toward the plate, the setscrews in the collars being loosened so that the plungers will bear upon the work only by the pressure of their springs. Having secured the disk to the plate, the setscrews are again tightened to present a rigid backing to the work.

In this way the bearing against which the work rests is always made firm and unyielding so that, were it not for the natural distortion of the casting due to the removal of scale, but one cut over each side would be needed to make it flat and parallel. Because of the distortion, however, two cuts, and sometimes on the thinner disks three or more cuts, over each side are required to produce the desired condition.

The arbor shown in the foregoing pictures does not seem to be a necessary part of the set-up, but as a matter of fact it is quite an important one, for without it the lathe spindle would have a slight amount of end movement that would result in a wavy or "chattered" surface. With the arbor between centers all end movement of the spindle is taken out toward the thrust bearing and a smooth surface is obtained on the work. This dodge is an old one and well known to all lathesmen who have much facing to do.

Boring and threading the six dial holes is done under a radial drill press and in Fig. 3 is shown the equipment necessary. The jig plate *A*, bolted to the top of the drill press table, has at its center a shouldered stud over which the center hole in the disk (bored while the casting is still in the lathe) fits. At the correct radial distance from this stud a hole through the plate accommodates a slip bushing which is held in place by a setscrew.

Two bushings are provided, one having a plain hole and the other threaded internally with a 24-pitch thread to correspond to the thread to be cut in the disk. Likewise two boring bars are provided, one with a plain pilot to fit the plain bushing and the other with a threaded pilot to fit the threaded bushing.

The disk shown in Fig. 3 is a finished piece of work laid upon the jig for the purpose of photographing. It will be noted that there is at one side of each of the six dial holes a steel finger lying in a radial slot extending from one side of the dial hole toward the center of the disk. At the time when the work would in regular course of procedure come to this operation, the fingers would not be in place but the slots would be there, having been milled in an indexing fixture in a previous operation.

As the brass disk lies in position upon the jig it rests at its center upon the shoulder of the stud and is further supported at one side, under the hole to be machined, by a ring of cast iron having an internal diameter somewhat larger than the hole in the work. Having located the hole to be threaded by its respective radial slot, a similar ring is now laid on the disk surrounding the hole and is clamped in place by bolts and straps as shown.

With the plain bushing in the jig plate and the bar with the boring cutter in place in the spindle of the machine, the method of boring is obvious. Substituting the bar with the threaded pilot, which bar carries a chaser instead of a boring tool, and setting the threaded bushing in place of the plain one the operation of threading becomes quite as simple. In Fig. 3 it is the threading tools that are shown. From the position occupied by them in the picture it is necessary only to run the spindle down until the bushing is seated in the jig plate, tighten the setscrew, and start the machine.

FIG. 3—THE SET-UP FOR BORING AND THREADING THE DIAL HOLES

The threaded bushing *B* is first screwed two or three turns onto the pilot of the bar. When the spindle is brought down to seat the bushing the chaser *C* is almost at the starting point of the thread. All feeds and operating levers are thrown out and the spindle is free to follow the guidance of the pilot in the threaded bushing. A half dozen turns of the spindle and the work is done.

The chaser does not have to be "unscrewed" from the work. It cuts at one end only and when its work is done the holding straps are released and the disk turned slightly to one side to clear the longer end of the chaser.

Quick-Acting Monkey Wrench

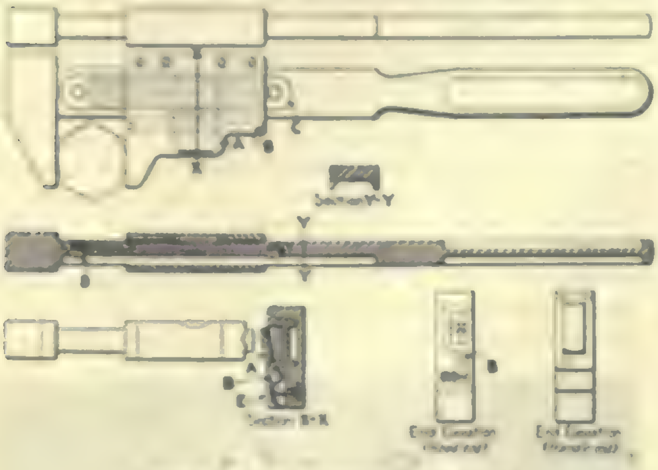
By Raymond Beckman

The sketch herewith shows a wrench that was designed and made by the writer for use in our own shop. It was so well liked by everyone who used it, and has proved such a success that I felt it my duty to present it to readers of *American Machinist* in return for the many splendid ideas that I have gotten from that magazine.

The advantages of this wrench are that it is quick-

acting in adjustment, positive, extra strong for its weight, stays put and fits the nut perfectly.

The body is similar to that of the conventional monkey wrench. At A is a spring-actuated pawl mounted on the movable jaw and pivoted on pin B which is a



QUICK-ACTING MONKEY WRENCH

press fit in the jaw. A hardened tool steel rack C is let down into the body and held in place by screws at D. The rack teeth are sixteen to the inch for the reason that every nut progresses in size across the flats in steps of $\frac{1}{16}$ in. or multiples thereof. This makes the wrench fit every nut with a full bearing across the flats and not on the corners of the nut. To adjust the movable jaw push down on pawl with thumb at E, disengaging the pawl from the rack and the jaw can be pushed up or down.

While the cost of making this wrench was rather high in the small quantity made, the work was done during the recent business depression.

Tools for Blanking and Piercing Watch Wheels

By I. Bernard Black

In modern die construction the old cylinder sub-press is fast being replaced by the pillar type of sub-press. There has been considerable discussion as to the relative merits of the two types and many old-time diemakers are not favorably disposed toward the pillar housing, claiming that it is not as accurate as the cylinder sub-press; but the writer has had much experience in designing dies to be used in pillar sub-press housings and finds them to work better, to be more accurate, and cheaper to make, due to the fact that no relining of the housing is ever necessary and it can be used over and over again as often as new tools are designed for similar jobs.

In the illustration, Fig. 1, is shown a set of tools designed to produce the watch wheel shown in Fig. 2. The material of which this wheel is made is Bessemer steel 0.026 in. thick, and the wheels are blanked complete with teeth and centerhole from 10-ft. lengths of stock $\frac{3}{4}$ in. wide. In designing this die the pillar type of construction was chosen as being more universal than a sub-press.

The operation of the die is as follows: On the downward stroke of the ram the die A forces down the stripper B, allowing the punch C to enter the die, blanking the periphery of the wheel. At the moment of blanking, the shedder D is pushed back and the punch E, being rigidly re-enforced by a hardened steel stop-plate, pierces the center hole, the piercing passing out through the hole in the blanking punch C which also constitutes the piercing die.

At the end of the stroke the blank is pushed entirely clear of the stock and is lodged in the die A, but as the ram recedes, the powerful spring that backs up the shedder pushes the blank back into the stock from whence it was cut so that when the stock issues from the die it is to all appearances as solid as when it went in, except for the small center hole.

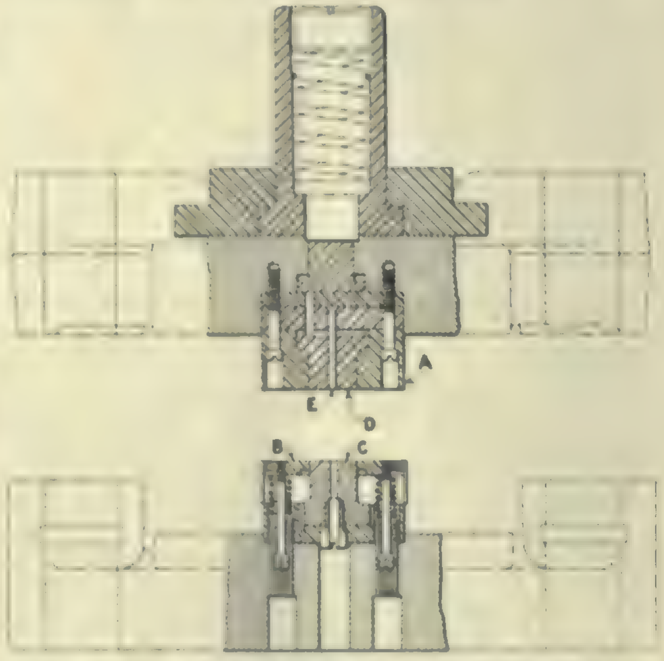


FIG. 1. PILLAR PRESS TOOLS FOR BLANKING A WATCH WHEEL

In Fig. 3 is shown a plan of the tools. It will be noticed that two stops are used. In order to get accurate work and at the same time make the tools foolproof, the stop F is used when feeding the stock by hand until a sufficient number of blanks have been cut for the stock to have reached the automatic stop G, when the roll feed is thrown in.

On the second stroke of the press the stock is pulled over the stop-pin H in the stop-bar F, and after the fourth stroke, at which time the stock has reached the automatic stop G, stop F is pulled back and locked.

The automatic stop, shown in Fig. 4, is of the

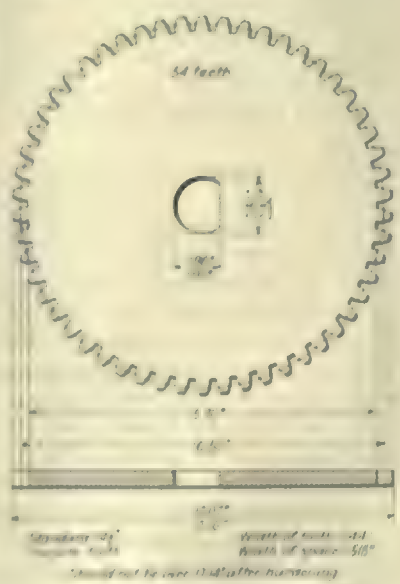


FIG. 2. THE WHEEL TO BE BLANKED

trigger type with a projecting end to be operated by the adjustable striking screw in the die plate. As the die descends this screw strikes the end of the trigger, lifting the opposite end of the stop out of the way of the stock.

It has been mentioned that the blank is replaced in the stock so neatly that the outline of the cut is hardly

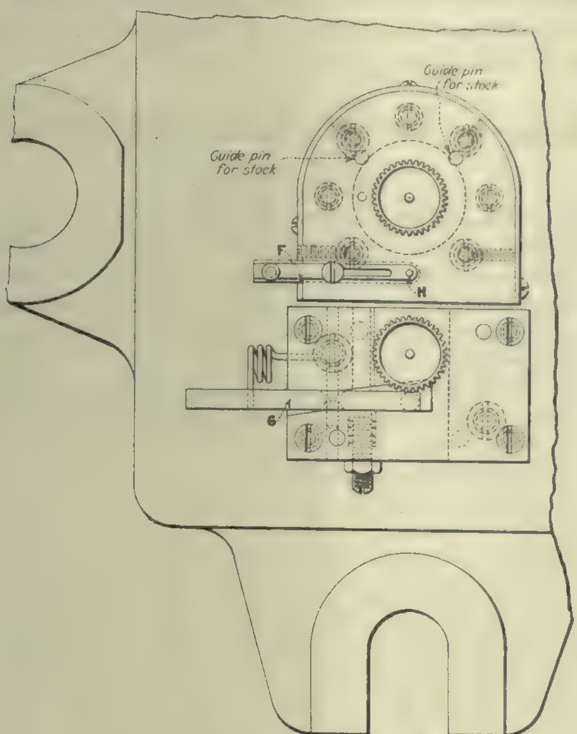


FIG. 3. ELEVATION OF TOOLS

discernible. To remove it from the stock, a second punch and die, known as the "knockout" is located at the required distance from the blanking die. The knockout punch is, however, made 5 mm. smaller than the blanking punch, and the die a corresponding amount larger than the blanking die.

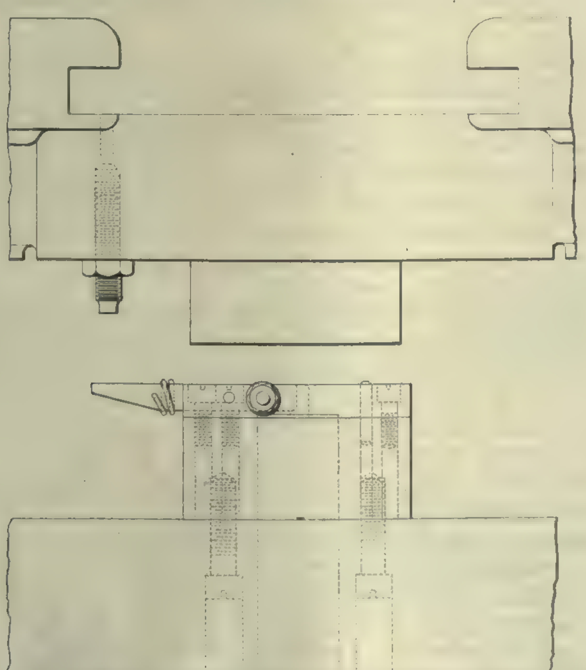


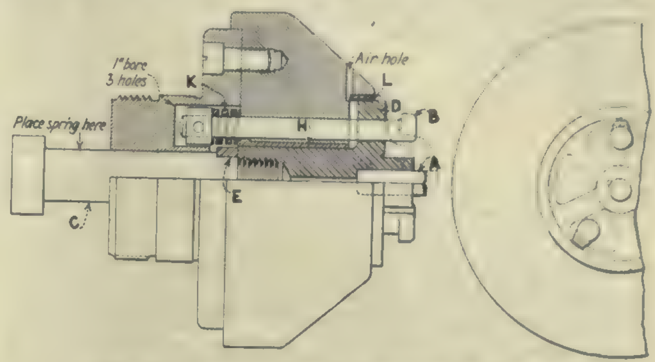
FIG. 4. THE AUTOMATIC STOP

A Special Screw-Machine Chuck

BY EDWARD H. TINGLEY

The special screw-machine chuck shown in the illustration has been successfully used to simplify the chucking of circular work, and accomplishes the same result as any reversing mechanism for a collet closing plunger. It can also be applied to any work that has to be clamped against a pad or faceplate on a hand screw-machine and which requires that work be located on a stud. It is simple and quick in operation and results in accurate work.

The operation of the fixture is as follows: Place the casting to be machined on stud *A* and with the



SPECIAL CHUCK FOR A SCREW MACHINE

fingers turn the hook bolts *B* a quarter turn. Pull the collet-closing plunger to push spindle *C* forward carrying with it parts *D*, *A* and *E*. The forward motion is continued until collar *E* stops against the head of bushing *H* thus clamping the work between the hook bolts and the face of *D*, under tension of the spring *K*. The collar *E*, stopping against the bushing *H* locates the work in the same position each time. Bushings *L* and *H* act as guides for pad *D*. An air hole is bored back of pad *D* to allow air to escape as it moves back and forth.

Slotting Tool Steel Cylinders Without a Cutting Tool

BY I. B. RICH

There is perhaps nothing in the line of mechanical work which gives more opportunity for personal skill than the use of flame or electric welding apparatus. Here the difference between a good job and a poor one. assuming of course that the apparatus is O. K., depends almost entirely on the individuality of the operator.

One of the latest developments is that of accurate cutting, the usual cutting operations hardly coming under this heading. An excellent example of this is to be seen in the plant of the Western Tool and Manufacturing Co., Springfield, Ohio, as shown herewith.

An Oxweld torch is fastened to the overarm of an old milling machine so that the tip or nozzle points vertically downward as in Fig. 1. The cylinder to be cut forms the barrel or sleeve of the expanding mandrel and is mounted in a holder so as to index the sleeve to line up with the holes previously drilled. The milling machine table provides the feed, which is hand operated.

The proper flame, and here the skill of the operator comes into play, cuts a slot $\frac{1}{16}$ in. wide and as straight as the table guides the work. The slots are clean, straight, radial and of uniform width. And the cutting

speed is about three times that of milling without the trouble and expense of cutter breakage. The sleeve is shown in Fig. 2.

The slots vary in length up to 8 or 10 in. and the metal is from [illegible] to [illegible] in. in thickness. The steel is about

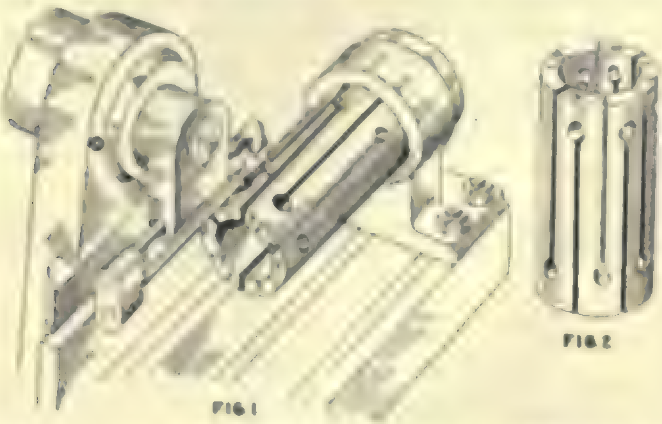


FIG. 1. CUTTING NARROW SLOTS WITH A FLAME. FIG. 2. THE SLEEVE IN WHICH SLOTS ARE CUT

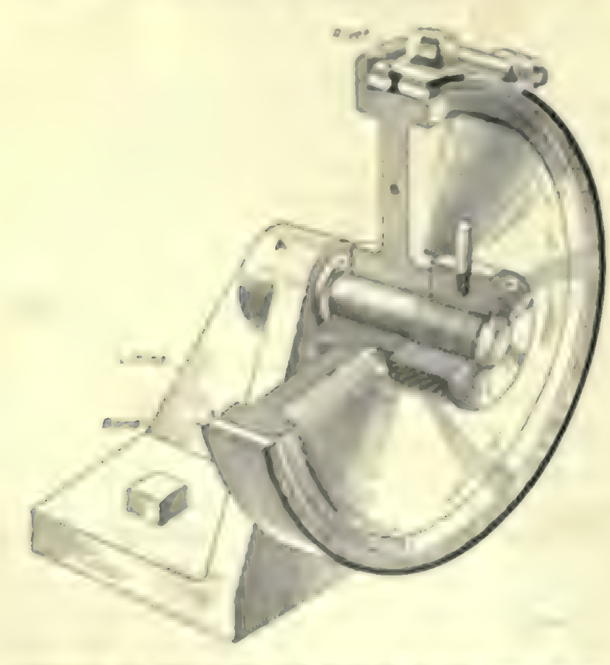
70 point carbon and is afterward hardened and drawn to a spring temper. An adaptation of this should prove of great value in roughing out cutting and blanking dies instead of drilling the outline as is the usual method. This would leave a cleaner job and be much faster. It requires a skilled operator but this is simply a challenge to those who desire to get ahead in the work.

Device to Hold Brake Bands for Relining

By O. S. Ghiglia

Some time ago I had occasion to re-line the brake bands of my Ford car and, having difficulty in holding the work and riveting at the same time, I built the fixture illustrated and described herewith. With this device the work of riveting on the brake lining is relieved of many of its tedious and disagreeable features.

Into the upper part of the face of a suitable angle



DEVICE TO HOLD BRAKE BANDS WHEN RELINING

plate *A*, I screwed a shouldered stud having a thread on each end, and to the central part of this stud I fitted a drum of cast iron *B* of proper size to hold the work. A nut *C* with a pin handle, screwed on the outer end of the stud, enables me to clamp the drum in any position, and thus have the particular rivet upon which I am working at all times on top where it is easy to get at.

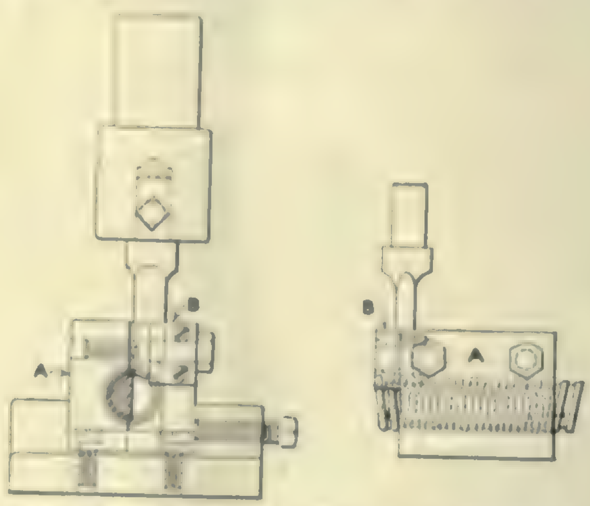
The device may be bolted on the edge of the bench, to the studding of the garage, or to any convenient projection that offers.

Die for Cutting Short Lengths of Coil Spring

By H. M. Fay

The illustration shows a die that was designed to cut short lengths from previously coiled wire springs. In this case only two turns were required in the cut spring but it is obvious that the device could be adapted to cut other lengths by providing a suitable stop for determining the length.

The block *A* is made in halves and held together by suitable screws. After assembling it is bored and



TOOLS FOR CUTTING COILED WIRE SPRINGS

threaded to fit the coil with a round section thread of a depth equal to a little more than half the wire diameter and of a pitch to match that of the spring. An arbor, similarly threaded to correspond with the internal diameter of the spring, is tightly clamped in the block in such a position that when assembled there is a helical groove or passage clear through the combined piece, through which the spring may be "screwed" in the operation of feeding.

A small plate *B* attached by screws to the block, forms a stop against which the end of the wire is fed, and also acts as a guide or backing for the punch. At the end of the threaded arbor that comes under the punch one half of its diameter is cut away so that it becomes the die against which the cut is made.

The outer end of the arbor is allowed to protrude some distance beyond the block, and thus enables the operator to start a coil easily by simply screwing it onto the half thread. As the shortened coil passes into the block and out of sight of the operator, a new coil is screwed on and serves to push the shorter one through the die, cutting off as it is fed along, so there is no loss of material except perhaps a part of a turn of each coil.

Editorial

Training and Rewarding the All-Round Mechanic

DURING the slack period from which we are fortunately emerging, there seemed little need of thinking of apprenticeship or of training men. But almost the first increase in demand shows that highly skilled men are scarce and even the semi-skilled none too plentiful. Realizing the constant need of trained men, the apprenticeship committee of the National Metal Trades Association, after devoting much time and thought to the subject, has issued a most instructive report on apprenticeship, primarily for its members, but obtainable by others as well.

The report recognizes that while many shop operations can be performed by comparatively unskilled men, or men with little training, the all-round mechanic is, and always will be necessary in production. The problem of how to train such men from promising boys with more or less educational foundation is taken up earnestly, practically and with much breadth of vision.

There is also another side to the problem of the all-round mechanic—that of so utilizing his knowledge and experience as to enable him to be paid in proportion to his value. In too many cases we find a man with a thorough fundamental knowledge of machine work, a man who can be depended on in an emergency, earning less money than a specially rapid machine operator with very little training.

It is not an easy matter to handle such a problem. The specialist operator produces a given number of pieces per day and we have tangible evidence of his value. The all-round mechanic might not be able to produce as many pieces even if we wanted to put him at the job. His value lies in a different phase of manufacturing and unfortunately one that is less tangible. But unless this value can be realized and paid for, what inducement is there for a boy to spend four years in acquiring the necessary training?

Promises of future advancement, of foremanships and other possible paths to larger incomes, lose their attractiveness if long deferred. In these days of high rents and living costs, the young man of domestic tendencies is obliged to consider immediate as well as future returns. And in order to secure the best class of boys, who will make the most desirable and dependable all-round mechanics, it is more than ever necessary to consider what the trade holds out for him in the near future. If we consider such men necessary and desirable, we may have to count on other qualifications as well as ability to produce.

Dependability and interest in the work and welfare of the company have a real value, even though it cannot be designated easily in dollars and cents. We perhaps need some new standards of value for such service, standards that will enable us to measure more than the actual work performed, in cases where previous training and experience make a man available for unusual or especially valuable work at a moment's notice. We need the all-round man; let us find some way of rewarding him so as to attract the best men to such work.

Co-operation Between Colleges and Industry

THE question of the engineering school's relation to industry has come to the front once more, this time in a resolution by the National Industrial Conference Board for the consideration of present engineering education in colleges and universities and for suggested improvements relating thereto. The conference emphasized the fact that the nation's development depends largely on the character and efficiency of the engineers turned out by the various schools, as industry requires technical experts and engineering managers in all its many branches. To secure the best type of graduate engineers requires the development of thoroughly competent men as instructors in engineering schools.

It has long been held by many that there must be close co-operation between engineering schools and industry of all kinds. With this in view it is believed that adequate methods must be developed so that each may help the other in securing better trained graduate engineers. This involves, however, many things which do not appear on the surface, such as better remuneration for teachers in engineering colleges and more encouragement to graduates after they leave college.

Perhaps the best real co-operation between colleges and industry is that worked out by Dr. Schneider in Cincinnati. It is not only good for the boys but it gives the manufacturers a good idea of the value of college training, which many of them lack. They have an opportunity to see how such training helps in making the kind of men they need.

The colleges must have instructors who keep in touch with industry and who do not let graduates go out with false ideas of their importance. Industries on the other hand must co-operate with colleges by telling them the qualifications they require, they must aid the colleges to give practical instruction by furnishing data from their own plants, and they must offer suitable inducements to young engineers of the right sort. They must not forget that the young men have invested several thousand dollars in an education which can be of value to the industry and that this must be capitalized.

Nor is this all. There is an increasing feeling on the part of engineers that they have not received and are not now receiving their share of the earnings from the industries which they make possible, or manage. There are too many cases of absentee directorship, which dictates policies that make it impossible to secure the best results. Banker control of industries has rarely proved satisfactory even to the bankers, and for some reason or other, the banker seems to have the faculty of picking the wrong man to manage a mechanical plant, as shown many times during the war.

If the industry of the country is to receive the greatest value from the engineers which are turned out by the colleges, there must be a better understanding between the financial and the engineering interests than now exists. Colleges must be alive to the newer phases of these relationships and must teach more economics and management to engineering students.

Shop Equipment News

Mitchell Ball Bearing Polishing and Buffing Lathes

The Mitchell Engineering Co., Springfield, Ohio, has recently brought out a line of polishing and buffing lathes equipped with ball bearings.

The No. 5 machine, illustrated herewith, has two independent spindles, while the No. 6 machine has a single spindle arranged for carrying wheels at both ends.

In the case of the No. 5 machine, either spindle can be started or stopped independently of the other. Either or both spindles, together with the bearings can be removed by releasing the bearing-housing clamps and can be replaced without danger of disturbing the alignment as the bearing housings are ball and socket type.

Both machines can be driven either from overhead or underneath and, in addition, the No. 5 machine can be furnished with motor drive, the motor being placed in the base and belted to the spindles. The independent starting and stopping of the spindles is taken care of by a belt-tightening device operated by a hand lever.

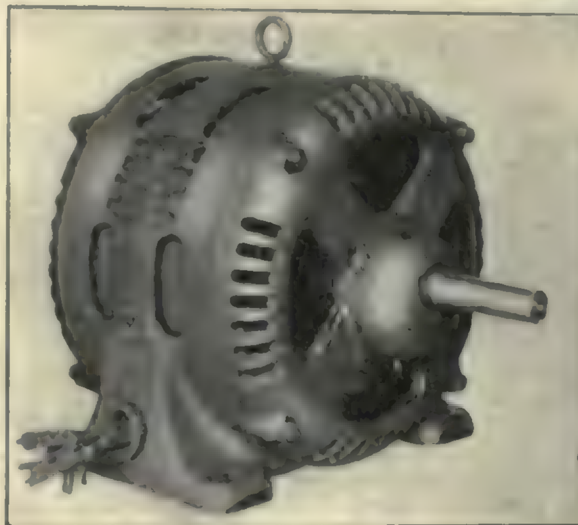
MITCHELL NO. 5 POLISHING AND BUFFING LATHE

Specifications of No. 5 machine: Length of each spindle, 32 in. Overall length of both spindles, 66 in. Diameter of spindles in bearings, 2 in. Height from floor to center of spindles, 38 in. Size of base at floor, 26 x 42 in. Net weight, 950 lb. Crated for domestic shipment 1,100 pounds.

Specifications of No. 6 machine: Overall length of spindle, 48 in. Diameter of spindle in bearings, 2 in. Height from floor to center of spindle, 38 in. Size of base at floor, 20 x 26 in. Net weight 600 lb. Crated for domestic shipment 675 pounds.

Watson A.C. Multi-Speed Motors

The Mechanical Appliance Co., Milwaukee, Wisconsin, has recently placed on the market a line of a.c. multi-speed motors, one of which is shown in the accompanying illustration.



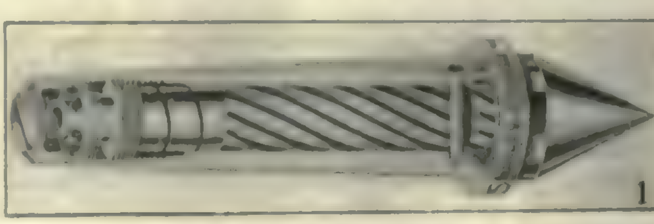
WATSON A.C. MULTI-SPEED MOTOR

The motors have speed ranges of 600, 720, 900 and 1,200 r.p.m. on 60-cycle circuits. Motors will be furnished for constant horsepower, constant torque or any required combination of both in two, three or four speeds, selected from 600, 720, 990, 1,200 and 1,800 r.p.m. either for circuits of 60 cycles or other frequencies and of either two or three phase.

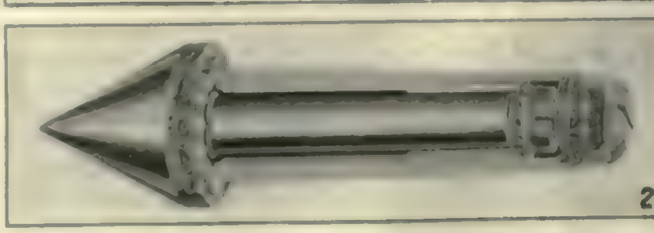
A control apparatus can be supplied which the maker claims has been thoroughly worked out and is suitable for both automatic and remote control.

Snellex Automatic Centers

The Snellex Manufacturing Co., Rochester, N. Y., has recently placed on the market the anti-expansion center for use in lathe and grinding machine headstocks as shown in Fig. 1. The shank of the center proper is milled with a series of helical oil grooves and has longitudinal motion within the tapered case. This motion is opposed by a very stiff adjustable spring, the purpose of which is to allow the center to recede within



1



2

FIG. 1—SNELLEX ANTI-EXPANSION CENTER. FIG. 2—SNELLEX ANTI-FRICTION CENTER

the case to a limited extent when great pressure, such as the expansion of work under operation takes place. Through this motion, the tailstock center is relieved from excess pressure due to expansion of the work and does not wear so rapidly. Lubricant can be applied through a hole in the adjusting screw.

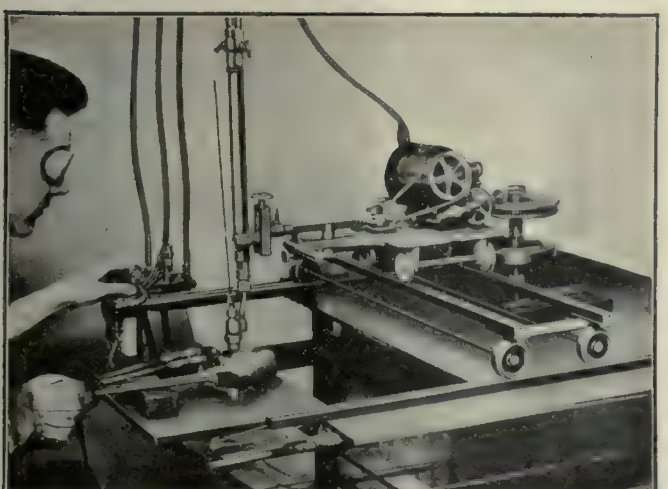
The anti-friction center, Fig. 2, for use in lathe and grinding machine tailstocks either in conjunction with, or separately from the anti-expansion center which was described in an earlier edition of *American Machinist,* is now made with larger balls in the front race.

Centers with Morse tapers from Nos. 1 to 6 are regularly carried in stock. Centers with other tapers and special centers, including centers for pipe and wood work can be furnished to order. Centers for grinding machines have heads of reduced diameter so that the wheel can pass over them in grinding small work.

"GEWE" Automatic Welding Machine

The illustration herewith shows an automatic welding machine that has recently been placed on the market by the General Welding and Equipment Co., Boston, Mass.

The welding rod passes through the center of the torch and is fed downward by gravity. The torch is mounted at one end of a connecting rod that is given motion by a crankpin at the other end. As the connecting rod passes through a pivoted guide, adjustable as to position, it will be seen that the torch will travel in an egg shaped path, the proportions of which can be changed, according to the position of the pivoted guide. In addition, the whole machine may be given motion at a right-angle to the mean of the motion imparted to the connecting rod. A combination of these two motions will cause the torch to travel in the path of an approximate cycloid. As the motion of the whole machine can be given more or less amplitude, the torch may be made to travel through a variety of paths.



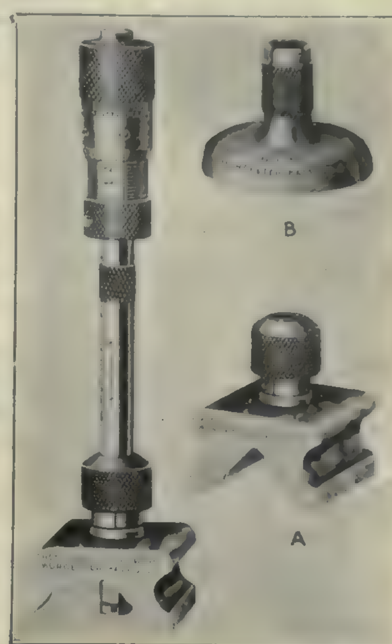
"GEWE" AUTOMATIC WELDING MACHINE

The combination motion is used in welding a seam. For heavy welds an additional torch is supplied which precedes the welding torch and preheats the metal.

The machine has two speed adjustments, one by means of a friction wheel and disk and the other through a rheostat controlling the motor. By means of the rheostat not only can finer speed adjustments be made but variations of speed can be made at points where the thickness of the metal varies.

Reed Inside Micrometer and Height Gage

The Reed Small Tool Works, Worcester, Mass., has recently developed an inside micrometer having a lower range than the one illustrated on page 388, Vol. 56, of *American Machinist*, the range being from 2 to 7 in. with the five rods furnished. With five additional rods the range can be increased to 32 in.



REED INSIDE MICROMETER AND HEIGHT GAGE

The micrometer is graduated to read to 0.001 in. and the diameters of the barrel and thimble allow for wide spacing of graduation lines and good sized figures.

The tool can be quickly converted into a height gage by use of the attachment shown at *A* and a range of 3 to 32 in. can be attained by using a rod of proper length. The rod is put through the hardened base until the anvil finds the surface from which the measurement is to be taken. A quick-clamping knurled nut, easily operated by the fingers, firmly holds the measuring rod in a perpendicular position. The V-shaped groove in the bottom of the base adapts the tool for use in cylindrical work, measuring distances between shafts and for alignment purposes.

By inserting a drill rod in the base, and attaching any standard indicator the tool can be converted into a surface gage.

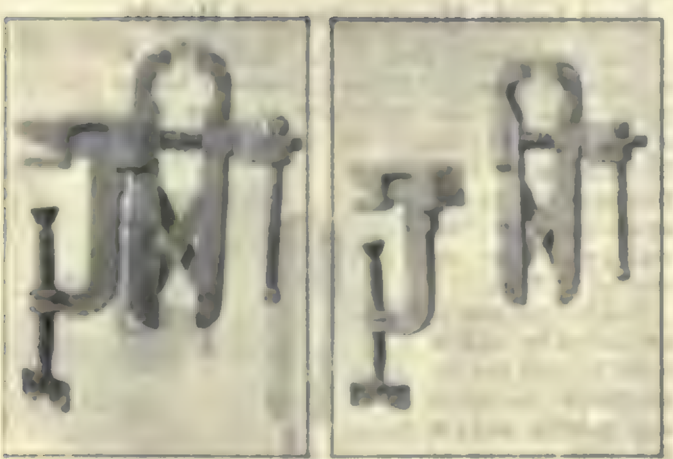
The round base *B* can be used in place of the base *A* when the micrometer is used as a height gage only on plane surfaces. The upper end of the support is split to afford sliding friction as the rod is inserted and tends to prevent looseness should wear take place from constant use.

Combined Hand and Bench Vise

A combined hand and bench vise, designed for the use of toolmakers, patternmakers and others having occasion to manipulate small pieces of work in filing or other operations in which the work cannot be held with sufficient firmness in the grip of the fingers alone, has been placed on the market by the Malleable Iron Fittings Co., Branford, Conn., and is shown in the accompanying illustration.

It is made of semi-steel and is in two main parts. The anvil clamp is to be attached to the edge of the work bench or other convenient point of support and is provided with a tapered dovetail slot into which the vise proper is fitted. To be used as a bench vise the tool has but to be set in place in the slot where it will be held firmly without setscrews or other means of fastening.

The capacity of the vise is 1½ x 1½ in. The panto-



COMBINED HAND AND BENCH VISE

graph arrangement holds the jaws parallel at any amount of opening within its range. Instead of the usual wing nut with which hand vises are provided this one has a sliding pin handle similar to the handle of a regular bench vise; the offset nut allowing the pin to be moved from end to end without interfering with the projecting screw.

The vise and contained work may be lifted from the bench support at any time without effort and used as a hand vise. Either plain or serrated jaws are furnished.

Oilgear Horizontal Press

The accompanying illustration shows a horizontal hydraulic press that has recently been placed on the market by the Oilgear Co., 60 to 64 Twenty-seventh St., Milwaukee, Wisconsin.

The forcing capacity of the press is 25 tons at speeds varying from ½ to 6 in. per minute. The maximum traversing speed of the ram is 37 in. per minute on the outward stroke and 56 in. per minute on the return stroke. Ram speeds can be instantly changed by the operation of a control handle located on top of the pump. The pump is driven by a constant-speed, 2-hp. electric motor and no accumulator or auxiliary pump is required. Suitable overload relief valves prevent injury in case the ram is driven against a stop at high speed.

The cylinder is 9 in. in diameter and the full capacity

OILGEAR HORIZONTAL PRESS

pressure exerted on the ram piston is 800 lb. per square inch.

The diameter of the ram is 5¼ in., and the length of the stroke is 30 in. The axis of the ram is 32 in. above the floor and the distance between the stop supports is 24 in. V-shaped stops can be located along the supports at regular intervals and held in place by heavy steel pins.

The maker states that the ram begins its stroke without shock, and that its push is without pulsations.

S. H. D. Automatic Universal Tool-Grinding Machine

The Hotchkiss Co., Paris, France, has recently placed on the market the automatic universal tool-grinding machine of which a general view is shown in the illustration herewith. The machine is primarily intended for grinding lathe, planer, shaper and slotter tools, though attachments for grinding milling cutters and twist drills can be furnished.

The machine is belt driven but can be furnished with motor drive if desired. One of the advantages claimed for the machine is that tools of high-speed steel can be ground without developing cracks on the cutting faces or softening the cutting edges, as the tools are

S. H. D. AUTOMATIC UNIVERSAL TOOL-GRINDING MACHINE

automatically traversed over the face of the wheel and the amount of metal removed at each pass is relatively small.

The reciprocating motion is obtained by an eccentric and an adjustable connecting rod actuated by worm gearing beneath the machine.

The slide rest carrying the toolholder is so arranged

that it can be swung to an angle of 90 deg., and the reciprocation motion obtained from either one of two drums placed at right-angles to each other so that the tool to be ground can be traversed parallel to the axis of the wheel, or at a right-angle thereto. The feed in either case can be operated automatically or by hand. The machine is provided with five stops and four graduated index plates by means of which tools can be set and ground to any desired angle, as shown in the diagram furnished with the machine. A gage attached to the machine provides for setting the tool to the proper height in relation to the grinding wheel.

Among the advantages claimed for this machine are the facilities it gives for the standardization of cutting tools; simplicity and ease of operation; minimum time for setting up to grind tools of any shape, profile or length; accuracy of operation as regards cutting angle, rake and clearance; ability to grind tools with carved faces as accurately as tools with flat faces; high finish given to cutting face; automatic feed and fool-proof in operation.

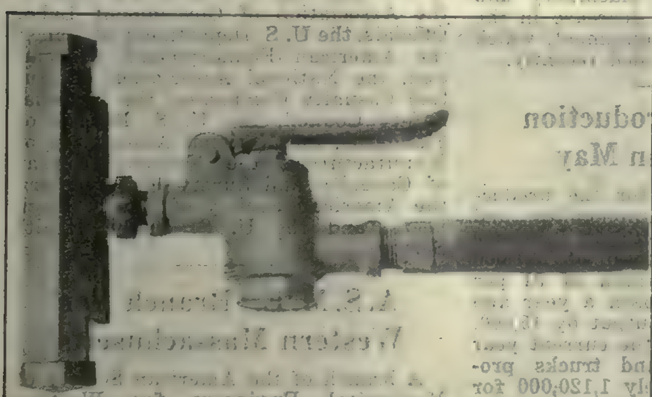
The base of the machine forms a tank for the grinding compound which is circulated by a Brown & Sharpe pump.

The regular equipment includes four grinding wheels, one 8-in. and three 2-in. The large wheel runs at 2,000 r.p.m. and the small wheels at 6,000 r.p.m., and to avoid accidents a stop is provided which prevents the large wheel being run at the higher speed.

The machine is being marketed through J. B. Corrie & Co., 15 Victoria St., Westminster, London, S. W. 1.

Pneumatic Vibrator for Foundry Use

A pneumatic vibrator or "rapper" intended for use in foundries in the operation of withdrawing the upper part of a mold from a pattern or in other industries wherever a gentle jarring action is needed, has been placed on the market by the Malleable Iron Fittings Co., Branford, Conn., and is shown in the accompanying illustration.



SMALL FOUNDRY "RAPPER"

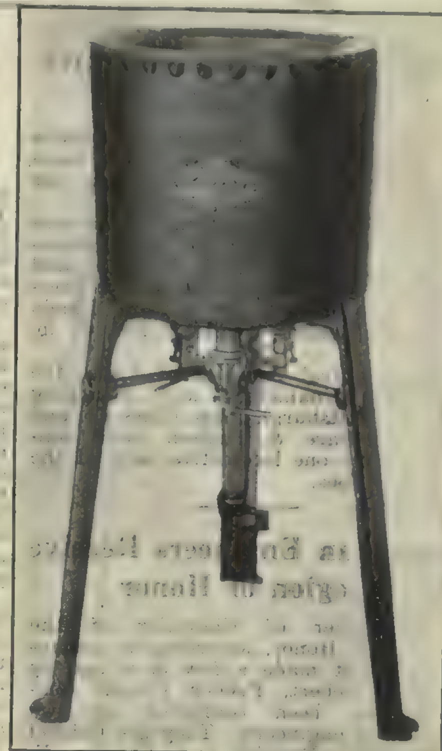
It operates upon the principle of a pneumatic hammer but is not intended to deliver a blow of any moment. It may be used anywhere that a supply of air under a pressure of 20 lb. or greater is available.

It is always ready for use and may be kept on the molding bench from which it may be picked up and used as readily as an ordinary mallet. The operator has only to place either end of the tool against his flask and press the trigger of the air valve with his thumb.

Johnson No. 300 Soft Metal Melting Furnace

The Johnson Gas Appliance Co., Cedar Rapids, Iowa, has recently placed on the market the melting furnace illustrated herewith and designated as No. 300.

The furnace stands 28 in. high, weighs 100 lb. and has a removable cast-iron melting pot with a capacity for holding 150 lb. of metal.



JOHNSON SOFT METAL MELTING FURNACE

Gas is used for fuel and is delivered to the furnace through three bunsen burners. The maker claims that with a consumption of about 40 cu.ft. of gas per hour a temperature of 2,250 deg. F. can be developed and that melted metal can be kept in the molten state by the use of two burners.

The burners are equipped with shut off valves, pilot lights and regulators. The regulators are constructed with orifices that can be adjusted to varying qualities and pressures of gas and the maker states that by their use a sharp, solid jet of gas can be sent up the center of the mixing tube with great pressure and without the use of a forced air blast or blower, producing a flame of high temperature.

Milliken Angle Plates

The angle plates illustrated herewith have been placed on the market by the Milliken Machine Co., West Newton, Mass.

The angle plates are made in seven sizes and are planed on the outside surfaces and edges.

The sizes range from 3 in. wide by 3¾ x 3¾ in. long,

MILLIKEN ANGLE PLATES

and high to 12 x 12 x 12 in. Beginning with the smallest, Nos. 1 and 2 are without stiffening ribs, Nos. 3, 4 and 5 have one rib and Nos. 6 and 7 have two ribs.

News Section

Railroads Place Locomotive Contracts

According to an announcement made a few days ago the American Locomotive Co. has received orders for twenty-nine new locomotives.

The Chicago & Eastern Illinois contracted for ten Mikado type locomotives weighing 315,000 lb. each, and the Southern Railway's Queen & Crescent division will get fifteen Mikado type locomotives weighing 288,000 lb. each.

The Central America of Cuba, the National Enameling and Stamping Co., the Pittsburgh Plate Glass Co. and the Delaware & Hudson have contracted for one locomotive each of the smaller types.

American Engineers Receive Legion of Honor

The order of Chevalier of the Legion of Honor, according to an announcement made a few days ago by Gaston Liebert, French Consul General, has been conferred on two American engineers. They are Colonel Arthur S. Dwight and Charles F. Rand, president and treasurer, respectively, of the American Institute of Mining and Metallurgical Engineers.

The cross of the order, bestowed for distinguished service during the war, will be conferred by M. Liebert at a luncheon in the Engineers Club on July 20. Colonel Dwight helped organize the First Reserve Engineer Regiment, which as the Eleventh Engineers was the first unit of the American Expeditionary Force to go into action. He was decorated with the Distinguished Service Order by the British and was cited in orders by General Pershing.

Mr. Rand discovered large soft iron ore deposits on the north coast of Cuba and built the Barraco Railroad there. In 1913 King Alfonso XIII of Spain decorated him with the Grand Cross of Knight Commander of the Order of Isabella, Catolica.

Ford Plans Assembly Plant in Mexico

According to recent reports the Ford Motor Company plans the establishment of a large plant for the assembling of its cars in Mexico.

Representatives of the company, the advices stated, recently conferred with authorities of the State of Coahuila and business interests of Saltillo with a view to the possible selection of Saltillo as the site for the proposed plant. As a result of these conferences, the Governor of Coahuila has offered the Ford company all possible facilities, including the donation of land, exemption from taxes for at least fifteen years and any other assistance which it may be possible to extend.

New York Metal Trades Show Employment Increase

According to a statement just issued by the Department of Labor of New York state, based on returns received from 1,514 representative manufacturers there was an increase of 2 per cent in employment during June as compared with the month of May.

The outstanding increase of the month was in the metal and machinery industries, especially in the railroad equipment and repair shops. The firms making locomotives and freight cars reported increases in the number of their employees varying from 15 to 100 per cent. Most of the railway repair shops, especially the locomotive shops, added a large number of workers. The firms making structural steel for building and for railway construction also reported large increases.

Those making heating systems for buildings and car heating apparatus increased their forces. Employment in the iron and steel mills continued to rise. Most of the establishments making automobiles and parts employed more workers in June than in May. There was an increase in the manufacture of airplanes and firearms, but employment in the cutlery industry continues rather low. Among the establishments making machinery and electrical goods there were general increases, especially in the manufacture of elevators, printing machinery and electrical goods, but a decrease in the manufacture of radio equipment, which has been greatly expanded recently.

June Auto Production Greater than May

Preliminary figures for the production of passenger automobiles and trucks during the month of June are reported to show a total of 271,000 machines. This is a gain of 51 per cent over the same month a year ago and exceeds the May output by 15,000. The second quarter of the current year shows 746,000 cars and trucks produced and approximately 1,120,000 for the first half of 1922. The total production for the entire 12 months of 1921 was 1,668,000 cars and trucks.

Machine Tool Builders to Co-operate with the Department of Commerce

The committee appointed by the National Machine Tool Builders' Association to co-operate with the Bureau of Foreign and Domestic Commerce, Department of Commerce, is composed of: J. Wallace Carrel, Lodge & Shipley Machine Tool Co., Cincinnati, Ohio; W. LeCoste Neilson, Norton Co., Worcester, Mass.; Paul E. Thomas, Kempsmith Mfg. Co., Milwaukee, Wis.; J. E. Andress, Barnes Drill Co., Rockford, Ill.

New Foundry Safety Code Approved

Adequate provision for the protection of industrial workers in foundries in the iron, steel, tin, zinc, lead, aluminum, and other industries is included in the National Safety Code for the protection of industrial workers in foundries, which has just been approved by the American Engineering Standards committee.

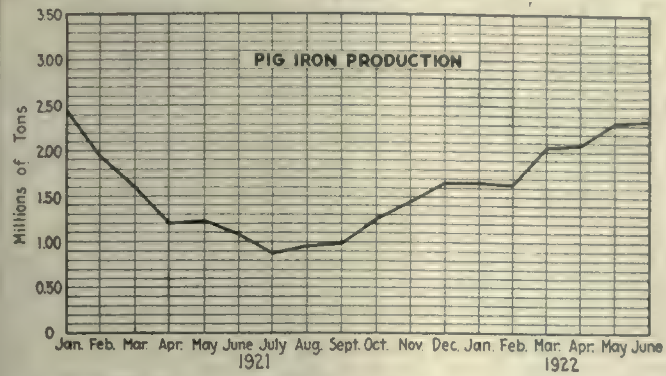
This code is a revision of that developed by the American Foundrymen's Association and the National Founders Association, joint sponsors of the new code. The revision was worked out by a thoroughly representative sectional committee under the auspices and procedure of the American Engineering Standards committee including four representatives of makers and owners of foundry equipment, four of governmental bodies, two of technical associations, two of insurance organizations, and a representative of foundry employees.

The approved code deals with foundry conditions only, omitting such subjects as building construction, exits, stairways, elevators, lighting, sanitation, etc., as these subjects are covered by other codes which have an official status before the American Engineering Standards Committee.

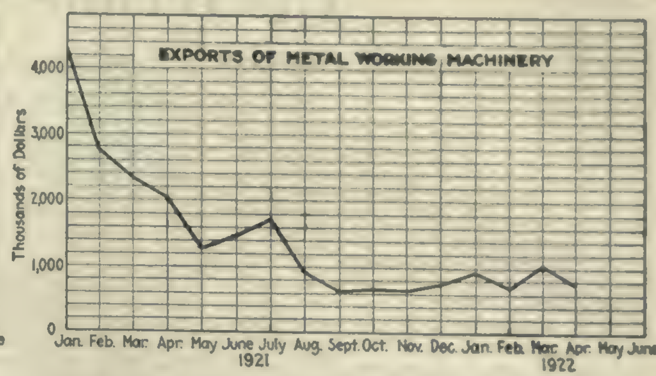
The sectional committee which revised the foundry safety code and recommended it for approval by the A. E. S. C. included representatives of the National Founders Association, the Association of Government Labor Officials, the U. S. Department of Labor, the American Foundrymen's Association, the National Association of Mutual Casualty Companies, the National Safety Council, the U. S. Bureau of Standards, the National Association of Manufacturers, the National Bureau of Casualty and Surety Underwriters, the American Society of Safety Engineers, and the U. S. Public Health Service.

A.S.M.E. Branch for Western Massachusetts

A branch of the American Society of Mechanical Engineers for Western Massachusetts was formed at a meeting in Springfield, July 10. This is in pursuance of a vote at the annual meeting of the Engineering Society of Western Massachusetts to affiliate with the national organizations representative of the different branches of the engineering profession. Charles L. Newcomb, works manager of the Worthington Pump and Machinery Co., Holyoke, was chairman of the organization committee. Officers are to be elected at a later meeting. Plans were discussed for a regional meeting of the American Society of Mechanical Engineers in Springfield, Sept. 25 to 27, with delegates from all New England divisions. It is estimated that the Western Massachusetts branch will comprise 500 members.



Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Association.



Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.

INDUSTRIAL expansion to an extent little realized, no doubt, by the average person is shown in the figures recently compiled by Dow, Jones and Co., indicating that many branches of industry, more particularly the equipment classes, are richer today than ever before in their history. At the close of their last fiscal year, Dec. 31, 1921, companies here selected were in possession of cash working capital more than 100 per cent greater than on December 31, 1914. On December 31, 1921, it is shown that 144 companies were in possesson of cash working capital 100 per cent greater than they possessed on December 31, 1914; in other words, $4,306,708,230 last year as compared with $2,036,611,447 in 1914. The inventories of these same corporations standing at $1,730,217,302 last year, compare with inventories of $3,745,510,950 on December 31, 1920, showing a shrinkage of $2,015,293,648, while the inventories on Dec. 31, 1914, stood at $1,281,306,304. Viewed in the light of the enormous growth of business during the war period, the financial status of these 144 companies is quite close to normal conditions with war earnings largely retained.

Metal working machinery exported from the United States during the month of May had a total value of $892,078, as compared with the April figure of $786,951, and the May total of a year ago of $1,275,971. While a decline is shown from the month of March, the high point for the current year with a total of $1,057,106, the exports for the month, nevertheless, show a steady and sustained improvement taking place since September, 1921. Exports of machinery of all classes for May totaled $19,415,994 as compared with the April total of $19,191,148. Textile and agricultural machinery lead with totals of $1,520,512 and $1,603,574 shown respectively. Exports of lathes were valued at $66,604; boring and drilling machines at $69,424.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

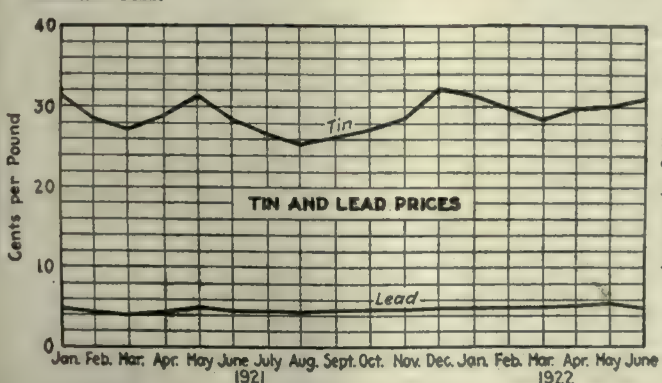
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.025	$0.0236	$0.0283
Cold finished shafting	per lb.	0.0335	0.032	0.0435
Brass rods	per lb.	0.155	0.1533	0.159
Solder (½ and ½)	per lb.	0.21	0.213	0.203
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	4.00	4.06
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	......
Lard cutting oil	per gal.	0.575	0.608	......
Machine oil	per gal.	0.36	0.40	......
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	60%@ 60–10%	50%@ 60–10%

Pig iron production for June reached 2,361,028 tons, an increase of 45,651 tons over May, and the highest point touched since January, 1921. The figure is especially interesting in view of the coal strike. In many quarters the shutting off of coal production had been looked upon as a factor operating against a favorable iron output.

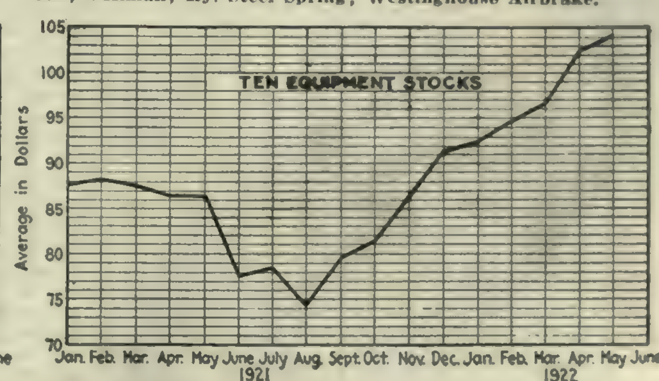
Steel ingot production for the month, according to the compilations made by the American Iron and Steel Institute, amounted to 2,634,477 tons. This is based on the returns filed by 30 companies which, in 1921, produced 87.5 per cent of the total. It is, however, somewhat under the May production of 2,711,141, but may be accounted for by the difference in the number of working days in the two months, and brings the half yearly reported total up to 13,499,386 tons with an apparent total of 15,422,508 tons indicated. Unfilled tonnage of the U. S. Steel Corporation at the end of June stands at 5,635,531 tons, an increase of 381,303 tons over production in May.

Exports of iron and steel for the month of May increased encouragingly. May exports amounted to 230,062 gross tons as compared with 142,551 tons in the corresponding month of last year. Japan continued a heavy buyer but Canada and South America now lead as steel importers.

Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; Westinghouse Airbrake.



The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

David Harum said that fleas were a blessing to dogs, who were thereby kept from brooding upon the fact that they were dogs, and it is perhaps well that there are strikes and foreign complications to keep American business men from becoming self-conscious of the nation's prosperity. Early last week the strike news and the cables from Germany appeared to indicate serious trouble here and abroad, but the markets were stolid and unaffected. By Wednesday the President had taken action which will probably end both the coal and railway strikes and the German mark, which had sold at .18, was up to .25 on rumors that Germany would be granted a moratorium on her reparation payments.

Prospects for German Loan

It was also reported that France would abate her demands sufficiently to justify the bankers in arranging an external loan to the German republic. Later advices were less definite and the mark reacted to .22, but the tone of the European markets is so much better that the foreign situation is regarded as much more cheerful by those who base their diagnosis upon symptoms rather than the patient's groans.

Meanwhile the Bank of England has reduced its rate to 3 per cent, and a reduction in our own Federal Reserve rate to 3½ per cent is expected and suggested by the weekly statement which shows a gain of $15,000,000 in the gold held and a reserve ratio of 77.3, which is ½ per cent above the previous week. The gain in gold was a surprise. It is understood to be due to the arrival of shipments from Great Britain made to cover at least part of the interest on her debt to our Government.

If these shipments continue the result will be a further reduction in interest rates and a money market in which it may perhaps be possible to float a British loan. By some this is thought to be the purpose that the financiers of Lombard Street have in view, but whatever the object the fact that England is willing to part with her gold at this time is evidence that the British do not anticipate any very serious trouble in continental Europe.

My own theory, which is entirely inferential, is that the money markets of both Great Britain and the United States are being prepared for a huge German loan to be brought out in the autumn and that its issuance, which will cause more or less inflation, will mark the commencement of an upward movement in prices on both sides of the Atlantic. If this theory is correct the German mark will sell higher and the profit that is to be made in buying it at its present discount is, I think, one of the considerations that will move the bankers to act.

At all events the European crisis which earlier seemed to be impending appears to have passed and President Harding's admirable firmness in dealing with the coal and railway strikes argues their early ending. By the time they are ended and the financial distress of Germany has been relieved something else disturbing will no doubt turn up, but until then any review of conditions in the United States must be a twice told tale of prosperity, present and prospective.

The markets are all about normal. The extraordinary activity in building continues. Lumber mills are "getting a flood of new orders" and in New York last week second hand brick sold at $16 a thousand. Continued activity is reported in the steel industry and copper is firm at 14 cents. The dry goods market is normally active. An eager demand is expected at the "spring opening" of the American Woolen Co. next week.

Spun silk has declined nearly 30 cents a pound from the top. The break reflects the weakness in the Japanese market which is in turn probably due to the German crisis. The American demand is, however, quite equal to the offerings at the decline, which has been regarded in the trade as providing manufacturers with an unusual opportunity. The constant increase in the demand for and output of artificial silk is one of the continually surprising sensations of the silk business.

Rubber is quiet but steady pending a definite announcement of an Anglo-Dutch agreement to limit production.

Coffee has been easier and a slight but insignificant recession in the sugar market is to be noted. A better demand and a strong market for hides is reported and the leather trade is improving with prices on choice tannages stiffening.

Crop Outlook Better

Raw cotton and cotton futures have been "fluctious" as usual in the summer time. Unfavorable crop news puts the market up. The converse puts it down. There is, however, a disposition to admit that the crop would be a large one were it not for the weevil and the question of whether this enemy of cotton is quickest killed by arsenate of lime alone, or in combination with molasses, is angrily debated in the cotton states.

The grain crops promise well, but the indicated crop of corn is 221 million bushels under last year's, while the yield of oats shows an increase of 127 million bushels. The total of the spring and winter wheat crops is put at 22 million bushels under 1921. Railroad traffic holds up remarkably well considering the labor troubles and big autumn earnings with a possible car shortage are expected.

A summer somnolence pervades the stock market, but railway shares wake up occasionally and advance sharply. The New York *World* says that "financiers expect a long bull market" and the expectation seems to be reasonable.

Liberty Bonds are all a little more above par. Small investors who bought them as a matter of patriotism and carried them through the depression are now justified in exchanging them for other good securities that will pay more. Good domestic bonds are still readily salable and new offerings are quickly absorbed, but the developments in Germany have "queered" some of the foreign issues recently brought out and the underwriters will have to take them up.

A $10,000,000 loan to Cuba is under consideration and the Republic of Salvador is seeking to borrow $18,500,000 here. Some important public and private issues for Canadian account are also being planned. A marked increase in business activity across the border is reported, but its continuance is to some extent dependent upon the outturn of the wheat crop and the price obtained for it.

Sane protectionists take comfort in the growing opposition to the pending tariff bill and the possibility of its abandonment, while business men generally are glad to hope that the bonus bill has been almost smothered and asphyxiated by the tariff debate. A fellow editor remarks "That special Providence which is said to have a special care for drunken men, little children and the United States evidently continues to be on guard in spite of all our efforts to dislodge it. In spite of turmoil and discouragement abroad which must delay complete recovery we see at home a grateful progress in recovery."

From this cheerful view no careful observer can dissent and for the next few months at least those who calculate upon the normal and allow a reasonable margin of safety are not likely to go far wrong.

Naval Academy Selects Carnegie Institute for Post-Graduate Work

Carnegie Institute of Technology at Pittsburgh has been selected by the United States Naval Academy at Annapolis to give advanced courses in metallurgy to its graduate officers.

Beginning next September, the Naval Academy will send two ordnance officers, graduates of the Academy, for a year's study in advanced metallurgy to the institute. Their studies will be graduate work in advanced metallurgy with some studies in electricity and physical chemistry. Other groups of graduate officers will be assigned each year to various colleges or universities to study along specialized lines. F. F. McIntosh, associate professor in metallurgy, at Carnegie Tech, will supervise the Naval Officers.

Expansion of Australian Machinery Market

A steadily expanding market for machinery in Australia is shown by the latest statistics compiled by the Bureau of Foreign and Domestic Commerce. Imports of industrial machinery, excluding agricultural machinery, amounted to £9,059,871 for the fiscal year ending June 30, 1921, as against £4,302,419 for 1913. A large increase may also be observed in the value and the percentage of machinery imports from the United States in 1921, as compared with pre-war figures. In 1913 American manufacturers furnished machinery valued at £1,245,516, or 29 per cent of the total, as against £3,884,396, or 43 per cent, in the fiscal year ending June 30, 1921.

The following table gives the annual machinery imports into Australia since 1909, showing the participation of the United States and the United Kingdom in this trade:

AUSTRALIAN IMPORTS OF MACHINES AND MACHINERY, INCLUDING MACHINE TOOLS BUT EXCLUDING AGRICULTURAL MACHINERY

Years	Imports from United States Value	Imports from United Kingdom Value
1909	£649,993	£1,684,736
1910	832,694	1,559,504
1911	1,103,686	1,813,345
1912	1,330,537	2,433,860
1913	1,245,516	2,471,6[illegible]8
1914-15	1,305,450	1,932,988
1915-16	1,238,306	1,439,683
1916-17	1,442,303	1,190,000
1917-18	1,240,667	642,079
1918-19	1,960,785	1,068,098
1919-20	2,145,652	1,898,748
1920-21	3,884,396	4,638,997

The following table shows some of the principal items imported from the United States and the United Kingdom 1920-21:

PRINCIPAL MACHINERY IMPORTS INTO AUTRALIA FROM THE UNITED STATES AND THE UNITED KINGDOM IN 1920-1921

Items	1920–21 From United States	1920–21 From United Kingdom
Engines:		
Gas and oil	£164,872	£236,722
Others	250,349	153,629
Machine tools	534,016	849,189
Mining machinery	87,333	44,919
Sewing, stitching, and knitting machinery	401,782	415,392
Printing machinery	192,651	70,996
Electrical machinery, appliances, etc.	777,014	1,087,416
Total	2,408,017	2,858,263

The United Kingdom and the United States have between them practically monopolized the Australian machinery market. The only other countries supplying appreciable quantities are Sweden, Canada, Switzerland, France, and Belgium. Imports from these countries in 1920-21 were as follows: From Sweden, £319,425; Canada, £82,510; Switzerland, £48,931; France, £26,914; and Belgium, £11,200.

German goods have been excluded by the provisions of Australian wartime legislation, but beginning next August they may again enter the field. Machinery imports from Germany attained a maximum of £387,100 in 1913, which represented only 9 per cent of the total imports in that year.

The growth in imports from the United States, as compared with the pre-war years, is particularly striking in view of the advantages enjoyed in the Australian market by the United Kingdom, among which may be mentioned substantially heavy preferential tariffs; favorable exchange rates; and close political, commercial, and financial affiliations. Many of the dealers in imported machinery have intimate connections with Great Britain, and some are actually branches of British houses. A considerable number of Australian industrial establishments are financed by British capital. As regards the matter of commercial facilities, three of the most important banks in Australia are British and the rest have branches in Great Britain, while no American banks have yet been established in Australia.

Australia is developing steadily and American machinery manufacturers should not overlook the opportunities presented for the future. The estimated value of Australian production by industries is indicated in the accompanying table, from the latest quarterly summary of Australian statistics (December, 1921). The amounts shown under the heading "Manufacturing" comprise the value added by the process of manufacture; in other words, the difference between the cost of the raw material and the value of the finished product. It will undoubtedly surprise many to observe that manufacturing is Australia's second industry in importance.

ESTIMATED VALUE OF AUSTRALIAN PRODUCTION

Items	1910	1913	1919–20
Agricultural	£39,752,000	£46,162,000	£72,234,000
Pastoral	56,993,000	57,866,000	109,062,000
Dairy, poultry, and bee farming	17,387,000	20,341,000	38,830,000
Forestry and fisheries	4,789,000	6,338,000	10,170,000
Mining	23,222,000	25,810,000	19,725,000
Manufacturing	45,598,000	61,586,000	98,162,000
Total	187,741,000	218,103,000	348,183,000

Washington Notes

By Paul Wooton

A torpedo plane, the last word in aircraft construction of its kind, will be evolved from tests at present under way at the Naval Air Station, Anacostia, under the supervision of the Bureau of Aeronautics, according to reports issued by the Navy department. Daily test flights, with types of torpedo planes which embody the most advanced ideas of foreign and American builders, are being held under the direction of the foremost authorities on Naval aircraft design, and the next few weeks should give to Naval aviation the best torpedo plane in the world.

A. H. G. Fokker, designer and builder of the famous Fokker monoplane used by Germany during the World War for pursuit and combat work, is now at Anacostia. He is directing the tests of his own plane, which is an adaptation of the famous German Fokker, improved and redesigned to meet the requirements of swift and accurate torpedo attack by airplane on battleships. In competition with the Fokker plane are types of British and American design, and with the rigid tests under way each type is being judged on its merits.

These developments are merely in line with a consistent policy of leading the world in advanced ideas along the lines of national security—a policy which discards the obsolete and forges to the front with the best in the interest of national defense.

The War Department appropriation bill carrying funds for the year which began July 1, by approval of Congress and the President, authorizes $26,250 for the Ordnance Department of the army for testing machines for materials of this department.

Appropriations for the District of Columbia for the year which began July 1, under Congressional allotment, include $250,000 for repairing the heating and ventilating systems in District public schools; $45,000 for tools and machinery for manual training instruction; and $12,500 for a pumping engine, triple expansion, motor driven, for the fire department.

The War Department appropriation bill whose funds became available July 1 on approval by Congress and the President authorizes the expenditure of $150,000 for the construction at the army barracks in the Hawaiian Islands of a refrigerating plant.

Brazil Will Hold Engineering Congress

Of special interest to *American Machinist* readers is the announcement that *Ingeniería Internacional*, the McGraw-Hill Spanish publication, is the recipient of signal honors. From Sebastiao Samparo, commercial attache of the Brazilian Embassy, Washington, D. C., has come a pressing and cordial invitation. It is an invitation to take part in the International Congress of Engineering to be held in Rio de Janeiro, Sept. 7 to 30, 1922.

The date, September 7. is important for it marks the first centenary of Brazilian independence. Not only will the International Congress of Engineering be opened on that date, but the republic, on that day also, will throw open the gates to her great International Exposition with ceremonies befitting so momentus an occasion.

And a momentus occasion it will surely be. With infinite wisdom this new republic has paid a rare tribute to the engineering profession. She has recognized the premier place of the technical man in world industrial development. She has sensed the benefits to be derived from gathering them together on her shores; and she charged her own Club de Engenharia in the city of Rio with the huge task of organizing an International Engineering Congress, instructing its members to spare no expense to make it a success. An effort such as this bespeaks an ardent desire on the part of Brazil to promote an international fraternal feeling among the engineering profession. More than that, it shows how keen she is to acquaint the profession with the stupendous problems confronting her in the development of the vast resources within the borders of the republic. For this reason the congress deserves the serious thought of every reader interested in expanding the markets for American machinery.

Subjects of a far reaching nature are to be brought before the meeting. They are subjects of great moment to Brazil and her future industrial development and in lending the republic assistance in solving the great problems there is to be found an excellent opportunity to sow seeds for future trade.

The director of *Ingeniería Internacional*, V. L. Havens, is preparing to

attend the Congress and the exposition. He will go as a representative of the paper, and possibly, also, as a representative of one or more engineering societies. In the firm belief that Brazil's problems of railway, iron and steel, coal and other industrial development hold opportunity of inestimable value during the next decade, the *American Machinist* will take pleasure in passing to Mr. Havens any inquiries its readers may have regarding the congress and its aims.

Rio is less than a fortnight distant from New York. What a wonderful opportunity for machine tool builders to enjoy a healthful vacation and establish connections of great future worth!

Business Items

The Standard Mold Co., Akron, Ohio, manufacturers of rubber molds, cores and various specialties, has awarded a contract for the construction of a new building which, it is stated, will increase its present production by approximately 50 per cent.

The Auto Specialties Co., St. Joseph, Mich., with a branch plant at Windsor, Ont., manufacturer of automobile jacks, shock absorbers, malleable castings, etc., is disposing of a bond issue of $350,000, a portion of the proceeds to be used for plant extensions.

The Doehler Die Casting Co., Court and Ninth Streets, Brooklyn, N. Y., has arranged for an increase in capital from $1,500,000 to $2,000,000.

The Turner Machine Co., 28 Eagle Street, Newark, N. J., manufacturer of special machinery, has arranged for an increase in capital from $25,000 to $350,000 for general expansion.

The Detroit Stoker Co., 7342 Woodward Avenue, Detroit, Mich., has acquired the plant of the Van Blerck Motor Co., Monroe, Mich., for a consideration of close to $75,000. The new owner will use the plant for the manufacture of stokers and parts, and will take immediate possession. Employment will be given to about 200 men.

The Bethlehem Motors Corporation, Allentown, Pa., recently organized to take over the plants and assets of the former corporation of the same name, has arranged for the immediate resumption of operations at the Pottstown, Pa., works. Repairs and improvements will be made to machinery and a working force recruited at once. The plant will be operated on a 10-hour day basis, the same as the main works at Allentown, which recently was started up.

The Reliance Steel and Tool Co., 24 Murray Street, New York, N. Y., has filed notice of reduction in capitalization from $500,000 to $10,000.

The Vaughn and Bushnell Manufacturing Co., 2114 Carroll Avenue, Chicago, Ill., manufacturer of tools, has filed notice of increase in capital from $50,000 to $400,000, and 3,000 shares of stock, no par value, for general expansion.

The Franklin Automobile Co., Syracuse, N. Y., is reported to have finished the month of June by breaking all previous production records for that month. The output was the second largest monthly production in the history of the company.

The Westinghouse Electric International Co., Mexico City, Mexico, it is announced, recently has taken larger quarters in the Boker Building, Isabel la Catolica, and 16 de Septiembre Streets with C. V. Allen, for many years manager of Westinghouse interests in Mexico, in charge.

The W. R. Martin Co., Louisville, Ky., is reported to have closed a contract recently for the equipment necessary for the installation of a complete forge shop in which its business in forging for the mining industry will be taken care of.

The Westinghouse Electric International Co., Buenos Aires, Argentina, announces the occupation of larger quarters in that city, the new address being Avenida de Mayo 1031, with Louis F. Peck as managing director.

The Manufacturers' Tool and Supply Co., South Bend, Ind., now located at 314 St. Joseph St., has broken ground at the corner of S. Main and Calvert Sts. for their new building. The structure which will be of concrete and 55 by 132 feet is expected to be finished by September 1.

The Black & Decker Manufacturing Co., Townson Heights, Baltimore, Md., paid a dividend of 2 per cent on the preferred stock for the second quarter and at the same time paid a dividend of 2 per cent for the fourth quarter of last year.

The Branford Brass Foundry Co., Inc., Branford, Conn., has been incorporated under the laws of Connecticut, to engage in the brass foundry business. The company will have a capital stock of $50,000, and the incorporators are: Albert V. Neilson, Frederick A. Ells, and Hugh A. Cox, of the town of Branford.

The Collins Co., manufacturers of tools, Collinsville, Conn., held their annual meeting at Hartford, Conn., July 11, elected Charles E. Chase, chairman of the board of the Hartford Fire Insurance Co., Hartford; and Anson T. McCook, as directors to succeed Richard C. Colt and William Hill. The officers chosen include: Charles L. Taylor, president; C. H. Clark, vice-president; F. Spencer Goodwin, secretary; and Meigs H. Whaples, treasurer, and these together with Arthur L. Shipman, Edward K. Root, Walter L. Goodwin, William A. Hitchcock, George H. Sage, Philip B. Gale, and Charles E. Chase, constitute the board of directors.

The Guy Steel Casting Co., West Hartford, Conn., has recently filed papers of incorporation under the laws of Connecticut. The capital stock of the company is $50,000, and they will carry on a business of metal casting and steel treating. The incorporators of the company are: W. R. Bennett and John E. Sinnott, both of Hartford, Conn., and George B. Kinghorn, of Southington, Conn.

Personals

R. J. COBBAN has been made manager of the Butte office, Westinghouse Electric and Manufacturing Co.

W. T. BLACKWELL has been appointed manager of the interior lighting section of the merchandising department, Westinghouse Electric and Manufacturing Co., with headquarters at South Bend, Ind.

J. G. BENEDICT, general manager of the Landis Machine Co., Waynesboro, Pa., sailed July 8th for a combined business and pleasure trip abroad. Mr. Benedict will be gone for about two months and his itinerary will include England, France, Holland, Belgium and Germany.

J. W. ROBINSON has been promoted to the managership of the central station division, of the Chicago office, Westinghouse Electric and Manufacturing Co.

EDWARD R. ABBOTT, formerly New York representative for the Taft-Peirce Manufacturing Co., is now with the Du Pont Engineering Company, Wilmington, Delaware, as sales representative for their Wilmington shops, recently opened to contract work as a permanent feature of the Du Pont activities.

NORMAN STEWART of the Chicago office, Westinghouse Electric and Manufacturing Co., has been appointed branch manager of the Minneapolis office of the company.

WILLIAM F. NANK, formerly auditor of the Carroll Foundry and Machine Tool Co., has been appointed branch manager of the Mason Tire and Rubber Co., Kent, Ohio, with headquarters in Canton.

C. E. ALLEN, of the Chicago office, Westinghouse Electric and Manufacturing Co., has been appointed district manager of the St. Louis office.

A. C. HABERKORN, formerly Detroit branch manager of Manning, Maxwell & Moore, Inc., and E. E. Wood, formerly sales manager of the Jones & Lamson Machine Co., have formed a partnership under the name of Haberkorn & Wood and have opened an office and warehouse at 620 E. Hancock Ave., Detroit, Michigan, where they will handle a line of machine tools, cutting oils and compounds and permanent mould aluminum castings.

D. O. TYLER has just been made manager of the turbine section, Westinghouse Electric and Manufacturing Co., Pittsburgh.

HARRY B. CURTIS, secretary and treasurer, of the Bridgeport Hardware Manufacturing Co., Bridgeport, Conn., was elected a member of the board of directors of the Mechanics and Farmers Savings Bank of Bridgeport, at its annual meeting held July 11.

Obituary

CHARLES PHILLIPS, superintendent of the Bridgeport Metal Goods Manufacturing Co., Bridgeport, Conn., died at his home in that city, July 4, after a short illness. Mr. Phillips was fifty-nine years old, and at one time was connected with the Bridgeport Brass Co., Bridgeport, in an official capacity.

HARVEY E. MILLER, vice-president of the Fairbanks Co., of Cuba, died July 9 at Hutchinson, Kan., from injuries he received in the Santa Fé collision at Burrton, Kan., on the day before.

Mr. Miller and his father before him

were pioneers in the scale business. He was 62 years old and had been with the Fairbanks Co. for forty-two years. As a boy he learned to build scales from his father and soon became an expert.

JOHN M. GOODWIN, general manager of the New Process Twist Drill Co., Taunton, Mass., died on July 4.

WILLIAM T. MURPHY, president of the Standard Machinery Co., Auburn, and prominent in manufacturing circles throughout Rhode Island, died at Greenfield, Mass., July 9, following a three days illness.

Mr. Murphy was a member of the Providence Chamber of Commerce and president of the Metal Trades Council. He was a native of Providence and was 40 years of age. He received his early schooling at the Point Street grammar school and English high school. At the conclusion of preparatory courses he entered Brown University, from which he was graduated in 1903.

A few months later he became associated with the late Michael J. Houlihan in the construction of machinery, and eventually the machine company of which he was the head was established. Recognized as the practical man in the promotion of the Standard Machinery Company, he succeeded Mr. Houlihan as president.

THEODORE J. MENTON, vice-president, Schaeffer and Budenberg Manufacturing Co., Brooklyn, N. Y., died July 9, at his home in that city. He was born at Elgin, Ill., forty-five years ago and had been a resident of Brooklyn for thirty years. He had been connected with the manufacturing company for twenty-five years.

J. HOBART BRONSON, president and treasurer, of the Oakville Co., manufacturers of metal and wire goods, Oakville, a suburb of Waterbury, Conn., died at his summer home in Litchfield, Conn., July 6, after a very brief illness. Mr. Bronson, who was eighty years old, was about in his usual health the day previous to his death. He was formerly president of the Citizens National Bank of Waterbury, Conn., and has been prominent in industrial and civic affairs in and about Connecticut. Mr. Bronson is survived by his wife, one son, Captain Bennet Bronson, two grandchildren, and a brother, Dr. Edward B. Bronson, of New York city.

Book Reviews

Human Factors in Industry. By Harry Tipper, manager, Automotive Industries. Published by the Ronald Press Co., New York City, cloth binding, 280 pages, price $2.

Probably at no previous period has there existed so great a need for an intensive study and a clear conception of the strong currents of economics and sociology, more especially that subdivision known as the labor problem, than there does today. Certainly in no previous period have men of industry, employers of labor and executives generally, had so little cause to complain of a lack of literature on the subject from the pens of able minds. True enough, much of it is burdensome and tiresome to read, but here and there exceptions are found—exceptions in the form of short, clear-cut discussions of the great subject. Of such is the little book of less than 300 pages from Mr. Tipper, which has been issued only recently by the Ronald Press.

In the opening chapters the author surveys the growth and development of labor unions and the trade union idea during the past century. An analysis of the currents and counter currents operating in present day industry in general, their connection with group organization among manufacturers, and the much-discussed collective bargaining schemes occupy the early chapters.

Just what the outlook is for various proposals intended to correct the situation, as it is generally known, is surveyed in the latter part of the book. Bonus and profit sharing systems, wage schemes, incentive and fatigue are investigated and their values set down. The final chapters are devoted to an analysis of the industrial relations departments, the open shop and the immediate future outlook.

Notes on Mechanical Drawing. By Rolland S. Wallis. Paper cover, 64 pages. Published by the engineering extension department, Iowa State College, Ames, Iowa, price 50 cents.

The book is a supplement to the drawing courses conducted by that department, and is an elementary discussion of the technique of various drafting tools, the principles of projection, lettering and drafting room geometry.

Pulling Together. By John T. Broderick. With introduction by Charles P. Steinmetz. One-hundred-forty-one 5 x 7 in. pages, red cloth boards. Published by Robson & Adee, Schenectady, N. Y. Price $1.

A book dealing with human relations in industry, advocating in particular employee representation in management. The story is presented as a dialogue between the president of a corporation employing 30,000 people and a traveling machine tool salesman. On account of the style adopted and the plain, direct way of telling, the book will make excellent reading for both plant executive and for employee. It will probably not leave the plant owner or manager entirely sold on the matter of employee representation, but will go far to convince him that there is much to be said for it and that it might under the right conditions and if properly applied solve many of his labor difficulties.

Labor leaders, minor executives and those they direct, if open-minded, should profit by a reading of "Pulling Together," if only to be told again that "the interests of those engaged in industry, whatever the nature of the functions they exercise or of the service they perform, are, or should be, identical, not dissimilar, and therefore that their relations should be harmonious, not antagonistic." Also "that the industrial system is dependent for its existence upon co-ordinated effort and the human beings who supply that effort have motives and purposes that are common and cannot be otherwise."

Graphical Methods. William C. Marshall, M.E., C.E. First edition. McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, and 6 and 8 Bouverie St., London, E. C., England. Two hundred and fifty-three 6 x 9-in. pages and 220 illustrations. Price $3.

Graphs have come into such universal use that a book of this kind, containing as it does, examples of graphs for almost every conceivable purpose together with full and complete instructions for their preparation and use, is of incalculable value to the business as well as the professional man.

The book opens with an introduction giving a short but comprehensive history of graphical methods and a list of their classification. The various chapters cover "Kinds of Graphs," "Making of Diagrams," "Applications," "Determination of Laws," "Routing and Organization," "Calculations," "Nomography and Mechanical Records."

Trade Catalogs

Boring and Turning Mills. The Colburn Machine Tool Co., Cleveland, Ohio. Bulletins B-101, B-102 and B-103 descriptive of Colburn heavy duty boring and turning mills. Bulletin B-101 contains details and specifications on the 42 in. machine, while bulletin B-102 is descriptive of the 90 in. machine.

Oil Burning Systems. Schutte & Koerting Co., Philadelphia, Pa. A general catalog just off the press, containing complete descriptive and technical data on the Koerting fuel oil burning systems. The various bulletins composing the catalog contain considerable general information on the installation, operation and maintenance of oil burning plants, their requirements, characterisics and functions. Contained also within the pages are a great many illustrations in color and 25 tables of important data.

Milling Machines. The Ingersoll Milling Machine Co., Rockford, Ill. A circular letter in folder form with cuts showing a four head Ingersoll adjustable rail milling machine and its use on special work in various manufacturing plants.

Arc Welding in Electric Railway Shops. The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. Leaflet No. 1824, describing arc welding on worn and broken brake shoes, bearings, frames, bolsters, etc. Illustrations showing methods are given as are also figures showing the savings possible in reclaiming worn out parts.

Tool Steel. Vanadium-Alloys Steel Co., Latrobe, Pa. A sixteen-page bulletin on the subject of non-shrinkable die steel with useful information regarding methods to be followed in its heat treatment.

Resistance Thermometry. The Brown Instrument Co., Philadelphia, Pa. Catalog No. 90, consisting of 24 pages, containing a discussion of resistance thermometry. Various types of resistance thermometers are illustrated and described with instructions given regarding their operation, care and maintenance.

Twist Drills. The Whitman and Barnes Co., Akron, Ohio. Circular letter in folder form containing illustrations showing the application of the company's twist drills and reamers to various types of work.

Bolt and Nut Machinery. Pawtucket Manufacturing Co., Pawtucket, R. I. A bulletin of twenty-three pages, containing illustrations and specifications pertaining to the numerous sizes of cold-punched nut presses made by this company for the production of square and hexagon U. S. Standard nuts; a twelve-page bulletin descriptive of various sizes of bolt forging machines; a twelve-page bulletin containing data and illustrations on several sizes of bar, lever and cutting shears; a four-page circular describing the two sizes of Knowles key-seating machines.

(We regret that the title of the above mentioned catalog was printed incorrectly last week as **Bolt and Hub Machinery** and are pleased to correct the error.)

Pamphlets Received

Changes in the Economic Life of the Chinese People. Trade information Bulletin No. 5 by Julean Arnold, Commercial Attache, American Embassy, Peking, published by the Department of Commerce, Washington.

Commercial Aviation-Air Mail Service. A pamphlet of 168 pages with index, being the hearings before the committee on Post Roads of the House of Representatives on the bill H. R. 11193 to encourage commercial aviation.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York city.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4,600 Prospect Ave., Cleveland, is secretary.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Machine Tool Builders' Association. Annual convention, New York city, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances—Maximum quotations on steel sheets at Pittsburgh mill, 10c. higher on blue annealed and galvanized; 15c. per 100 lb. on black. Structural steel quoted at minimum of $1.70, f.o.b. Pittsburgh, on current business; $1.80 on small tonnages with deliveries uncertain. Price of $1.60 per 100 lb., however, still existent on contracts, for large tonnages, already made with regular trade. Electrolytic copper market quiet but firm; fabricated copper and brass products up ½c. per lb. in New York warehouses. Zinc market showing strong upward trend, prices firm. Flaxseed market tending upward; linseed-oil higher. Raw oil up 2c. in Chicago and 8c. per gal., 5 bbl. lots, in Cleveland.

Declines—Tin quoted at 31½c. as against 31¾c. and lead at 6c. as compared with 6¼c. per lb., in New York warehouses, one week ago

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.00
Northern Basic	26.52
Southern Ohio No. 2	26.02
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.16
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	27.82
Virginia No. 2	29.24
Basic	26.50
Grey Forge	25.50
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound

	Light	Medium	Heavy
Detroit	10.0	8.0	[illegible]
New York	9@10	6.0	3.0
Cleveland	6.75	4.5	2.[illegible]
Chicago	5.0	4.5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]@2.[illegible]	3.63	3.[illegible]	3.63
No. 12	2.4[illegible]@2.[illegible]	3.68	3.30	3.[illegible]
No. 14	2.[illegible]@2.70	3.73	3.35	3.73
No. 16	2.70@2.[illegible]	3.83	3.45	3.83
Black				
Nos. 17 and 21.	3.0[illegible]@3.25	4.15	3.[illegible]	4.30
Nos. 22 and 24.	3.[illegible]@3.3[illegible]	4.20	3.[illegible]	4.30
Nos. 25 and 26.	3.1[illegible]@3.35	4.25	3.90	4.35
No. 28	3.1[illegible]@3.40	4.35	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11.	3.15@3.45	4.35	3.85	4.45
Nos. 12 and 14.	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21.	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24.	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	6[illegible]%	53%	60½%	47½%	6[illegible]%	4[illegible]%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	5[illegible]%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32-5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	3.63	2.81	3.48
Cold rolled strip steel	6.25	8.25	6.15
Floor plates	4.80	4.66	5.08
Cold finished shafting or screw	3.35	3.30	3.40
Cold finished flats, squares	3.85	3.80	3.90
Structural shapes (base)	2.68	2.51	2.68
Soft steel bars (base)	2.58	2.41	2.58
Soft steel bar shapes (base)	2.58	2.41	2.58
Soft steel bands (base)	3.23	3.06	3.23
Tank plates (base)	2.68	2.68	2.38
Bar iron (2.20 at mill)	2.56	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
[illegible]	8.00		12@13
[illegible]	6.50		11@12
[illegible] to [illegible]	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	31.50
Lead (up to carlots), St. Louis, 5.50; New York	6.00
Zinc (up to carlots), St. Louis, 5.30; New York	6.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19@20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.00	23.00
Copper wire (carlots)	16.50	17.00	16.25
Copper rods (ton lots)	19.50	22.00	19.50
Copper tubing (100-lb. lots)	23.75	24.00	23.00
Brass sheets (100-lb. lots)	12.25	1[illegible].00	18.75
Brass tubing (100-lb. lots)	21.00	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	15.25	16.00	15.75
Brass wire (carlots)	17.75	17.75	.....
Zinc sheets (casks)	8.25	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	21.00	22.00	20.00
Babbitt metal (fair grade)	24.25	41.50	36.00
Babbitt metal (commercial)	11.00	16.00	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.75	11.50
Copper, heavy, and wire	11.75	11.25	10.50
Copper, light, and bottoms	9.75	9.50	9.75
Lead, heavy	4.75	4.75	4.75
Lead, tea	4.25	3.50	3.75
Brass, heavy	7.00	6.00	7.00
Brass, light	6.00	5.00	6.00
No. 1 yellow brass turnings	6.50	6.00	6.50
Zinc	3.00	3.00	3.00

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7.25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.07½@\$0.10	\$0.12	\$0.11¼
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13¼x13¼	per M. 50.00	per lb.	.10
Wiping cloths, 13¼x20½	per M. 55.00	per lb.	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.15	.98
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville		per net ton \$9.00	
Coke, prompt foundry, Connellsville		per net ton \$9.00	

SHOP SUPPLIES

(Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	65–10%	60%
1⅛ and 1¼x3 in. up to 12 in.	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	.....	\$4.00 off
Button head bolts, with hex. nuts	25%	\$3.90 net	.....
Hex. head and hex. nut bolts	30%	....	65-5%
Lag screws, coach screws	50%	....	60-5%
Square and hex. head cap screws	70–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60%	50-5%
Bolt ends, with hot pressed nuts	50%	....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70–10%	80%
Case-hardened nuts	60%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$4.50	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50		3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$4.00	\$3.25	\$3.10
Cone heads, ditto (net)	4.10	3.35	3.20
1¼ to 1⅜-in. long, all diameters, EXTRA per 100 lb	0.25	....	0.15
⅝ in. diameter EXTRA	0.15	....	0.15
⅞ in. diameter EXTRA	0.50	....	0.50
1 in. long, and shorter EXTRA	0.50	....	0.50
Longer than 5 in. EXTRA	0.25	....	0.25
Less than 200 lb. EXTRA	0.50	....	0.50
Countersunk heads EXTRA	0.35	......	\$3.35 base
Copper rivets	55–5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls):			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88			
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40 10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$3.85	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32		1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Bridgeport—The Amer. Chain Co., Inc., [illegible] Connecticut Ave.—one power press, scope 10 or 12 in. with a bolster plate about [illegible] x [illegible] in. (used).

Conn., Bridgeport—Auto Owners Repair Wks., 3003 Main St., F. Scherer, Purch. Agt.—one [illegible] grinder, and a large hand-feed drill press.

Conn., Bridgeport—The Butler Machine Co., foot of Pembroke St.—one set Warner [illegible] bending rolls, 8 ft. long, with drop housing.

Conn., Bridgeport—The Dawn Mfg. Co., [illegible] Fairfield Ave., manufacturer of washing machines, R. A. Leckie, Purch. Agt.—one four-spindle press, one 20 in. back feed drill press, one plain milling machine.

Conn., Bridgeport—The Grant Mfg. & Machine Co., [illegible] Ave., W. B. McNaughton, Purch. Agt.—one No. 0 and one No. 1 wire feed screw machines (Brown & Sharpe).

Conn., Bridgeport—The Lacey Mfg. Co., 30 Middle St., F. G. Hubbard, Purch. Agt.—one No. 2 [illegible] arch screw press.

Conn., Bridgeport—The Prestoy Mfg. Co., 919 Connecticut Ave., (metal stampings, etc.)—one 30 in. power shear for cutting stock up to .020 in.

Conn., Bridgeport—Rooks Auto Repair Wks., 75 Evitts Lane—one small lathe for garage.

Conn., Bridgeport—United Welding & Repair Co., 1772 Main St.—one double spindle drill press and small lathe.

Kan., Rosedale—Millers Shop, 106 Alsey Ave.—adjustable wheel chuck, Universal face plate, and spring chuck, No. 2 Mosley lathe.

Kan., Wichita—North Main Street Garage, 717-719 North Main St., W. L. Gunn, Purch. Agt.—gear cutting machine (power equipment).

Kan., Wichita—The Rex Auto Specialty Co., 430 North Main St., J. Taylor, Purch. Agt.—power drill press, lathe, belting, boring machine, gear cutting machine, shafting, hangers, bearings, and pulleys, for manufacturing auto accessories.

Kan., Wichita—Square Deal Furniture & Clothing Co., 314 North Main St., A. L. [illegible], Purch. Agt.—drill press, lathe and small tools.

La., Shreveport—Southwestern Gas & Electric Corp.—equipment for new machine shop.

Mich., Bay City—Garber Machine Co.—equipment for foundry and machine shop including one stave rattler, iron and wooden flasks, ladles with shanks, 9 in. cupola fan, large portable coke core oven.

Mich., Detroit—Best Stove & Stamping Co., [illegible] East Atwater St.—press for making metal stampings for stove parts.

N. J., Trenton—Skillman Hardware Mfg. Co., West End Ave.—two presses for stamping room.

N. Y., Buffalo—F. M. Beck, 225 Porter Ave.—machinery and equipment for garage on [illegible] St.

N. Y., Buffalo—Bd. Educ., 1401 Telephone Bldg., will receive bids until July 26 for Vocational School equipment—milling machines, shapers, engine lathes, interior sliding spindle, drill press, high speed metal saw, floor grinders and bench lathes. Printing equipment including automatic feeder. [illegible] No. 1 machine and magazines. Automobile equipment including electric motor drill, bench grinders, high speed motors, test bench starter and generator vise, and tube vulcanizing equipment. Oxy-acetylene welding equipment (complete). Electrical equipment including motor generator set (complete), high speed, ball bearing, sensitive drill, motor head engine lathe, 715 r.p.m. motor complete with rails and fitted with pulleys, 9 in. diameter, 8 in. face. Woodworking equipment including patternmakers' lathe.

N. Y., Buffalo—Regent Motor Car Corp., Inc., c/o C. E. and H. E. Barnes—equipment for the manufacture of gasoline engines.

N. Y., Buffalo—J. Van Ravels, 1314 Fillmore St.—small tools, machinery and equipment, also one 1,050 gal. tank for service station on Fillmore and Rodney Aves.

N. Y., Endicott—Endicott Forging & Mfg. Co., North St.—additional machinery and tools.

N. Y., New York—Flywheel Exchange, 213 West 64th St.—one No. 2 Miller with dividing head, quick change lathe.

O., Akron—Mechanical Mold & Machine Co., Crosier and High Sts.—equipment for machine shop.

O., Canton—Rose Spring & Machine Co., 12th St., N. E., D. Rose, Purch. Agt.—one Head cylinder grinding machine, and other smaller machine tools for proposed shop addition.

O., Wadsworth—Ohio Injector Co., C. E. Young, Supt.—lathes, boring machines, drill presses and other machinery for machining valves, etc.

Okla., Picher—The American Machine Wks.—engine lathe, 24 to 28 in.

Pa., East Pittsburgh — Westinghouse Electric & Mfg. Co.—hand shears and equipment for tin shop at Trafford City, Pa.

Pa., Phila.—Hellwig Silk Dyeing Co., 9th and Buttonwood Sts., J. Knup, Sr., Purch. Agt.—lathes, planers, drill presses, etc., for machine shop.

Pa., Phila.—Proctor & Swartz Co., 7th St. and Taber Rd.—auto screw machines, lathes, planers, boring mills, and other machinery for new factory.

Pa., Sellersville—United States Gauge Co.—grinding machine equal to Brown & Sharpe No. 2 Universal. Must be 90% new.

Vt., St. Albans—Central Ry. of Vermont, H. M. Dewart, Purch. Agt.—additional machine tools.

Va., Richmond—Allen & Pietri, 1215 West Broad St.—one medium lathe, 1 acetylene welding machine, and a motor complete with valves and tanks.

Va., Richmond—Alsop Motor Corp., 918 West Broad St.—small lathe, drill press, arbor press, and emery wheel.

Va., Richmond—J. A. Heisler, 309 North Laurel St.—one electric drill and small lathe.

Va., Richmond—Holland & Snead, 412 North 5th St.—one small lathe for auto repair shop.

Va., Richmond—T. T. Hulcher, 7 South 7th St.—large lathe.

Va., Richmond—Layne Auto Repair Shop, 221 West Broad St.—lathe and drill press.

Va., Richmond—Satterwhite Machine Shop, 1424 East Franklin St.—milling machine.

Va., Richmond—J. H. Shoot Machine Shop, 1445 East Franklin St.—key way cutter.

Va., Richmond—D. W. Vaughn & Son, 820 West Broad St.—lathe, drill press and emery wheel.

Va., Richmond—G. C. White & Son, 406-408 North 5th St.—drill press, hand electric drill, and small lathe.

Wis., Appleton—Fox River Auto Co., Washington St.—machinery for auto repairs, also air compressor and electric motor.

Wis., Appleton—G. R. & S. Motor Co., 728 Washington Ave.—equipment for auto repair shop.

Wis., Manitowoc—Aluminum Goods Mfg. Co., 15th and Franklin Sts., G. Vitts, Purch. Agt.—rolling mill presses.

Wis., Menasha—Jaeger-Wheeler Co., 417 2nd St.—machinery for proposed auto repair shop at Neenah.

Que., Montreal—I. Benoit, 2163 Clare St.,—machinery and equipment for proposed garage ($75,000).

Que., Montreal—Hart Motor Co., Registered, 19 Concord St.—lathe and small tools for automobile repair shop.

Machinery Wanted

Ala., Brewton—Neal Lumber & Mfg. Co., E. L. McMillan, Pres.—machinery and equipment for the manufacture of lumber.

Ala., Ensley—Storey-Matthews Mfg. Co.—woodworking machinery for the manufacture of furniture.

Ala., Fairfield—Chickasaw Bldg. & Car Co.—machinery and equipment for proposed foundry.

Ark., Arkansas City—Moore Oil & Refining Co.—machinery and equipment for proposed addition.

Cal., San Jose—The California Prune & Apricot Growers' Assn., Market and San Antonio Sts.—machinery and equipment for by-products specialty plant.

Cal., Susanville—California Fruit Growers' Exchange—machinery and equipment for fruit packing house.

Conn., Bridgeport—Acme Metal Treating Co., 513 John St., H. F. Sanford, Purch. Agt.—furnaces for heat treating, also pressure blowers.

Conn., Bridgeport—The Feeney Tool Co., 751 Central Ave.—full equipment for proposed foundry (small).

Conn., Litchfield—Bantam Ball Bearing Co., Bantam St.—machinery and equipment for addition to factory.

Fla., Lakeland—Lurie Sugars, Inc.—machinery and equipment for the manufacture and refining of sugar, also for the cultivation of sugar cane.

Fla., Tampa—The Electric Motor Co., 114 South Franklin St.—machinery and equipment for new plant addition.

Ind., Petersburg—Simplex Lock Rim Co., (manufacturer of metal rims for auto wheels)—machinery for addition to plant.

Kan., Hardtner—S. M. Mercer—leather working machinery, including one harness sewing machine and hand creaser.

Kan., Wichita—Haines & Noll, c/o Haines Tile & Mantel Co., 152 North Market St.—machinery for the manufacture of tile, belting, hangers, pulleys, shafting, etc.

Kan., Wichita—Miller Theatre, North Market St., S. Chambers, Purch. Agt.—refrigeration cooling system for theatre, $50,000.

Ky., Horse Cave—W. A. McGuire—machinery and equipment for creamery and cold storage plant.

Mich., Detroit—Ford Motor Co., Highland Park—equipment for assembling automobiles for proposed new factory addition.

Mich., Marion—The Press—one 8 column folio chassis.

Mo., Cape Girardeau—The Missourian—printing equipment for newspaper plant.

Mont., Billings—Northwest Refining Co., R. M. Hodgens, Mgr.—machinery and equipment for proposed refinery at Laurel.

Neb., Cambridge—J. W. Hammond—one 2 revolution pony press.

Neb., Lincoln—W. A. Parvins Garage, 821 South 11th St.—one air compressor (200 lb. pressure), 2 hp. motor attached, horizontal type (used).

N. Y., Buffalo—Bd. of Supervisors of Erie County, 29 City and County Hall, E. F. Jaeckle, Clk.—machinery and equipment for laundry, bakery, and work shop at the County Home, at Wende.

N. Y., Buffalo—Great Lakes Dredge & Dock Co., Morgan Bldg.—machinery and equipment for repair shop at the foot of Katherine St.

N. Y., Buffalo—Lautz Marble Corp., 861 Main St.—machinery and equipment for cutting and dressing marble, for proposed factory at 7 Norfolk Ave.

N. Y., Buffalo—E. F. Neubecker, 334 Colvin St.—machinery for cabinet work and for the manufacture of window frames, plant on Cornwall Ave.

N. Y., Buffalo—J. F. Pfister Co., 22 Metcalfe St.—machinery and equipment for vinegar and pickle factory.

N. Y., Buffalo—Queen City Candy Co., 453 Jefferson St., M. Brownstein, Purch. Agt.—machinery and equipment for candy factory at 396 Broadway.

N. Y., Buffalo—Twin Filter Co., Inc., c/o G. W. Barker, Dir., 78 Tioga St.—machinery for the manufacture of water filters.

N. Y., Buffalo—T. Tzelzo, 5 West Chippewa St.—machinery and equipment for proposed candy factory at 452 Pearl St.

N. Y., Cattaraugus—Setter Bros., Inc., machinery for the manufacture of wood engraving blocks, veneers, etc.

N. Y., East Rochester—Erie Mop & Wringer Co., West Commercial St.—additional machinery and equipment.

N. Y., Geneva—Rice Bros. Nurseries Co., Fram Castle Rd., J. F. Rice, Mgr.—equipment for new $75,000 packing plant and storage buildings, now under construction.

N. Y., Jamestown—Colonial Engraving Co., Inc., c/o L. C. Petrie, R. D. No. 75—equipment for printing, publishing and engraving plant.

N. Y., Jamestown—Empire Case Goods Co., 142 Foote St.—machinery and equipment for proposed plant, for the manufacture of dining room furniture.

N. Y., New Rochelle—V. Mastromarino, 253 Huguenot St.—wrecking crane for garage and service car use.

N. Y., Salamanca—H. Neff—machinery and equipment for proposed 600 ton coaling station.

N. Y., Watkins—S. N. Gutwater Co.—machinery and equipment for the manufacture of Christmas tree ornaments, for remodeled factory on Franklin St.

N. C., Asheville—Biltmore Industries—one Davis & Furber 48 in. wool card (late model).

N. C., Gibsonville—O. W. Mann Lumber Co., J. W. Burke, Purch. Agt.—additional machinery for plant.

N. C., Lincolnton—Lincolnton Creamery & Ice Co.—ice and refrigeration machinery.

N. C., Rose Hill—The Atlantic Coffin & Casket Co., E. M. Carr, Mgr.—one 6 x 15 in. moulder for woodworking shop, Yates or Woods preferred (used).

O., Bellaire—C. L. Dorer Fdry. Co.—machinery and equipment for proposed foundry addition.

O., Cleveland—The City of Cleveland, Comr. of Purchases and Supplies, City Hall—one 4 ton gasoline industrial locomotive crane.

O., Columbus—Columbus Builders Supply Co., 145 North Front St., H. K. Hill, Vice Pres.—loading and unloading machinery, aerial tramway, etc.

O., Columbus—Expression Piano Player Co., 1278 West Broad St., C. E. Bard, Genl. Mgr.—woodworking machinery, including small saws, planers and cutters, also some metal working machinery.

O., Columbus—W. L. Lillie Co., 233 East Gear St.—$200,000 worth of woodworking machinery for proposed factory.

O., Columbus—J. H. and F. A. Sells Co., Chestnut and Pearl Sts., manufacturer of horse collars and pads—special machinery for factory nearing completion at 280 North 6th St.

Pa., Connellsville—Fayette Baking Co. (Connellsville), Purch. Agt. for Premier Baking Co., New Kensington—conveying machinery.

Pa., Erie—Union Iron Wks., Inc., 15th and Cascade Sts., G. W. Bach, Genl. Mgr.—machinery and equipment for iron works, foundry, etc.

Pa., Leechburg—Bd. Educ.—equipment for vocational dept. of new high school.

Pa., New Castle—R. D. Yaple, 107 South Mulberry St.—one large size power loom for weaving heavy rugs.

Pa., Nordmont—C. W. Sones, c/o Nordmont Chemical Co.—machinery and equipment for saw mill; also machinery and equipment for proposed clothes pin factory.

Pa., Phila.—Hulton Dyeing Co., 3819 Frankford Ave., M. B. Kampe, Purch. Agt. —bleaching and dyeing machinery.

Pa., Phila.—B. S. Pincus Co., 21st and Market Sts.—conveyors, grinding machines, refrigerating and other machinery for packing plant.

Pa., Phila.—G. Spruance Co., 312 North 3rd St.—grinders, mixers, etc., for paint factory.

Pa., Phila.—L. Sternberg, 1208 Race St.—English necktie frames, also machinery for manufacturing full fashioned neckties.

Pa., Sewickley—Bd. Educ.—equipment for vocational dept. of proposed high school.

Pa., Sharon—G. Boyadjis, West State St. mechanical refrigeration machinery for remodeled restaurant.

Pa., Sharon—Standard Tank Car Co.—additional machinery for proposed car and assembling plant addition.

Pa., Sharpsville—J. A. Bolton—tools, air compressor, etc., for gas filling and service station now under construction.

Va., Richmond—J. T. Nuckols, (contractor), 7th and Duval Sts.—six 4 ton scales for new freight depot of Chesapeake and Ohio Ry. Co., Brooke Ave., Norfolk.

Wis., Altoona—Bd. Educ.—equipment for manual training dept. and laboratory in new high school.

Wis., Appleton—J. Conway, Oneida and Washington Sts.—laundry equipment including mangles, tumblers, and mechanical dryers, etc.

Wis., Green Bay—H. F. Witlig, Route 1—laundry machinery including a tumbler and dryer.

Wis., Hawkins—Northern Sash & Door Co., J. Jesdahl, Purch. Agt.—woodworking machinery.

Wis., Madison—The Kennedy Dairy Co., 618 University Ave.—refrigerating machinery for proposed ice cream factory.

Wis., Manitowoc—Aluminum Goods Mfg. Co., 15th and Franklin Sts.—one 20 ton crane for use in warehouse.

Wis., Milwaukee—The Holeproof Hosiery Co., 404 Fowler St.—special machinery for knitting hosiery.

Wis., Milwaukee—N. K. Lambro, 636 35th St.—electrically driven shoe repair machinery.

Wis., Milwaukee—H. Wilhelm, 600 1st Ave.—crushing machinery.

Wis., Neenah—C. A. Douglas, 251 East Dewey Ave.—belt or electric driven air compressor.

Wis., Neenah—F. S. Durham, 206 West Wisconsin Ave. (feed grinding, etc.)—one attrition mill with electric motor.

Wis., Waukesha—Harvey Paper Specialty Co., Main St.—special machinery.

Wis., Waupun—A. N. King—job press for power equipment (size 12 x 18).

Ont., Petrolia—Peninsula Sugar Co.—complete equipment for proposed sugar refinery, daily capacity 600 tons.

Ont., Toronto—The Provisional Government—conveyors for storage of coal and hoists for dairy building at Guelph Agricultural College.

Que., Montreal—Shell Oil Co., 3608 Notre Dame St.—tanks, gasoline and oil handling equipment for proposed distributing stations.

Que., Montreal—E. C. Vinet, 547 Iberville St.—forge and other equipment for blacksmith shop.

Metal Working Shops

Cal., Richmond—Republic Steel Package Co., 7930 Jones Rd., Cleveland, O., plans to build a branch factory here, for the manufacture of steel tanks and oil field equipment. Private plans.

Cal., San Francisco—E. T. Meakin, 409 6th St., has awarded the contract for the construction of a 1 and 2 story, 75 x 100 ft. machine shop on South west Folsom and 14th Sts. Estimated cost $18,000.

Cal., San Francisco—J. Pasqualetti, Humboldt Bank Bldg., is having plans prepared for the construction of a 2 story garage on Bush and Franklin Sts. Estimated cost $40,000. Meyer & Johnson, 742 Market St., Archts.

Cal., Vallejo—The Western Die Casting Co., 2927 Newbury St., Berkeley, has awarded the contract for the construction of a 1 story, 125 x 162 ft. factory on Nape St., here, for the manufacture of Winslow carburetors. Estimated cost $25,000. Noted June 1.

Conn., Milldale—Clark Bros. Bolt Co. has awarded the contract for the construction of a 1 story, 50 x 105 ft. factory addition. Estimated cost $25,000.

Ill., La Grange—Kastory Mfg. Co., 301 Hillgrove Ave., has awarded the contract for the construction of a 1 story, 100 x 125 ft. factory, for the painting and repairing of auto bodies.

Ind., Indianapolis—R. H. Hassler, Inc., 1535 Naomi St., plans to build a 3 story, 37½ x 120 ft. sales and service station on Meridian and Joseph Sts. Estimated cost $75,000. Fitton & Mothershead, 540 North Meridian St., Archts.

Mass., Lowell—Saco-Lowell Shops, 77 Franklin St., Boston, is having plans prepared for the construction of a factory additions, for the manufacture of textile machinery, on Kitson St., here. Architect not announced.

Mich., Detroit—Ford Motor Co., Highland Park, plans to build a 1 story, 245 x 1570 ft. automobile factory (addition to former Lincoln plant) on Livernois Ave. A. Kahn, 1,000 Marquette Bldg., Archt.

Nev., Reno—Washoe County, E. H. Beemer, Clk., will receive bids until July 29 for the construction of a garage. G. A. Ferris & Son, Colonial Apts., Archts.

N. J., Camden—Cadillac Auto Co., 525 Market St., is having plans prepared for the construction of a 4 story, 48 x 126 ft. auto show room and service station on 11th and Market Sts. Estimated cost $100,000. Lackey & Hettel, 509 Federal St., Archts.

N. Y., Batavia—C. Mancuso & Son, 322 Main St., has awarded the contract for the construction of a 2 story, 81 x 100 ft. garage and salesroom. Estimated cost $40,000.

N. Y., Green Island—The Ford Motor Co., Highland Park, Mich., has awarded the contract for the construction of a 1 story automobile factory here.

N. Y. Retsof—Retsof Mining Co. has awarded the contract for the construction of a machine shop. Estimated cost $225,000.

N. Y., Rochester—Gallagher Motor Co., Inc., plans to build a 72 x 150 ft. garage and salesroom, 32 ft. high, on Monroe Ave. Estimated cost $50,000. Architect not announced.

O., Cleveland—I. Feigenbaum, Ulmer Bldg., is having plans prepared for the construction of a 1 story, 40 x 120 ft. garage at 3643 Carnegie Ave. Estimated cost $50,000. Best & Hoefler, 6523 Euclid Ave., Archts.

O., Cleveland—W. Koehl, Archt., Park Bldg, is receiving bids for the construction of a 2 story, 50 x 130 ft. commercial building and garage addition on West 30th St. and Lorain Ave., for West Center Sales Co., c/o Architect. Estimated cost $50,000.

O., Cleveland—The Standard Equipment Co., Lorain Ave. and West 106th St., plans to build a 1 story, 60 x 200 ft. forge shop. Estimated cost $40,00. I. T. Domizi, Lorain Ave. and West 106th St., Engr. and Archt.

O., Cleveland—Studebaker Corp. of Amer., 2020 Euclid Ave., has awarded the contract for the construction of a 3 story, 140 x 148 ft. service building on East 25th St. near Payne Ave. Estimated cost $250,000. Noted July 22.

Pa., Phila.—Hellwig Dyeing Co., 9th and Buttonwood Sts., has awarded the contract for the construction of a 1 story, 40 x 100 ft. and 40 x 240 ft. machine shop in the Wissinoming Dist.

Pa., Phila.—Procter & Swartz Co., 6th St. and Tabor Rd., will build a 1 story, 125 x 450 ft. machinery factory. Estimated cost $100,000. Private plans.

Pa., Phila.—Universal Service Motor Co., 1407 Locust St., has awarded the contract for the construction of a 6 story, 70 x 116 ft. garage on Broad and Manning Sts. Estimated cost $250,000.

Pa., Sharon—Standard Tank Car Co. will build a 50 x 100 ft. car and assembling plant addition. Estimated cost $75,000.

Wis., Appelton—G. R. & S. Motor Co., 738 Washington Ave., is having plans prepared for the construction of a 1 story 100 x 320 ft. garage. Estimated cost $40,000. E. A. Wettingel, 578 Pierce Ave., Archt.

Wis., Neenah—Jaeger-Wheeler Co., 417 2nd St., Menasha, is having plans prepared for the construction of a [illegible] story, [illegible] ft. garage and repair shop on Main and Commercial Sts. Estimated cost $40,000.

Wis., Neenah—E. A. Wettengel, Archt., 118 Pierce Ave., Appleton, is receiving bids for the construction of a 1 story, 50 x 50 ft. and 60 x 120 ft. garage on North Commercial St., here, for Jaeger-Wheeler Co., Neenah. Estimated cost $15,000.

B. C., Kimberley—Consolidated Mining & Smelting Co., Ltd., will build a [illegible] ton concentrator plant. Private plans.

Mexico, Coahuila—Amer. Smelting & Refining Co., 120 Bway., New York, N. Y., will construct a smelting and refining plant here, including several buildings. Estimated cost $1,000,000. Private plans.

Ont., Ford—Ford Motor Co. of Canada has purchased an extensive site, and is having plans prepared for the extension of its auto factory and the construction of a plant for the manufacture of tractors. Estimated cost $6,000,000.

General Manufacturing

Ark., Arkansas City—Moore Oil & Refining Co., plans to build an addition to its refinery, will increase its daily capacity from 5,000 to 10,000 bbls.

Cal., Oakland—Antiseptic Laundry Co., 2960 Manila Ave., has awarded the contract for the construction of a 1 story laundry addition on Bway. near 40th St. Estimated cost $7,500.

Cal., Pittsburgh—The California Bean Growers' Assn., 120 Battery St., San Francisco, has awarded the contract for the construction of a 1 story, 80 x 350 ft. warehouse, and a 5 story, 30 x 40 ft. mill, 1st unit of their plant here. Estimated cost $[illegible]. Noted July 13.

Cal., Sacramento—Consumers Ice & Cold Storage Co., 801 D St., will repair and build additions to its plant. Estimated cost $17,500.

Cal., San Francisco—Eames Co., 68 1st St., manufacturer of truck and wheel goods, is having plans prepared for the construction of a 1 story factory on Howard St. [illegible] M. V. Pelton, 1st Natl. Bank Bldg., Archt.

Cal., San Francisco—Petri Italian-American Cigar Co., Inc., 419 Jackson St., has awarded the contract for the construction of a 4 story, 137 x 137 ft. cigar factory on Battery and Vallejo Sts. Estimated cost $200,000.

Cal., San Mateo—E. Riggins (publisher San Mateo News-Leader), has awarded the contract for the construction of a 1 story publishing plant. Estimated cost $10,800.

Fla., Orlando—W. F. Blackman and Associates plan to build an ice and cold storage plant. Estimated cost from $50,000 to $[illegible].

Ill., Chicago—Natures Rival Co., 306 South Franklin St., has awarded the contract for the construction of a 3 story, 132 x 144 ft. factory, for the manufacture of [illegible] on Irving Park Blvd. and [illegible] Ave. Estimated cost $[illegible]. Noted June 29.

Ill., Chicago—O. V. Palmquist & Co., 4334 North Clark St., has awarded the contract for the construction of a 1 story, 60 x 163 ft. factory, for the manufacture of sash, [illegible] at [illegible] East Ravenswood [illegible]. Estimated cost $[illegible].

Ill., Chicago—U. S. Sample Co., 901 South Wells St., has awarded the contract for the construction of a [illegible] story, [illegible] ft. printing [illegible] and Taylor Aves. Estimated cost $[illegible].

Ill., North Chicago—Davis-Watkins [illegible] Mfg. Co., 120 North Wells St., [illegible] has awarded the contract for the construction of a 1 story, [illegible] ft. addition to its plant here. Estimated cost $70,000.

Ind., Indianapolis—[illegible] Printing Co., [illegible] story, [illegible] ft. printing plant. Estimated cost $40,000.

La., [illegible]—The [illegible] Trust Co., [illegible] large [illegible] plant [illegible] daily capacity [illegible] cu.ft. Architect not announced.

Me., Portland—Oakhurst Dairy Co., [illegible] plans to build a 2 story dairy also a power plant unit. Estimated cost $100,000.

Mass., Belchertown—Dept. of Mental Diseases, State House, Boston, has awarded the contract for the construction of a 2 story service, and two two dormitory buildings, at State Colony Group, here. Estimated cost $250,000.

Mass., Palmer—D. O. Pease Mfg. Co., 161 Summer St., has awarded the contract for the construction of a 1 story, 75 x 200 ft. yarn mill. Estimated cost $45,000.

Mass., Pittsfield—Berkshire Woolen & Worsted Co., Pecks Rd., has awarded the contract for the construction of a 3 story, 60 x 160 ft. spinning mill and carding building, at its plant. Estimated cost $40,000.

Mass., South Boston (Boston P. O.)—John West Thread Co., 297 Congress St., Boston, has awarded the contract for the construction of a 2 story, 60 x 200 ft. addition to its plant on Covington St. Estimated cost $100,000.

Minn., Minneapolis—The Royal Wet Wash Laundry Co., 1401 Plymouth Ave., had plans prepared for the construction of a 2 story, 88 x 140 ft. addition. Estimated cost $45,000. J. B. Greenberg, Mgr. Liebenberg, Kaplin & Martin, 617 McKnight Bldg., Archts.

Mont., Laurel—Northwest Refining Co., Billings, plans to build a refinery here, daily capacity 2,000 bbls. R. M. Hodgens, Billings, Mgr. H. O. Simmone, c/o owner, Engr.

N. J., Trenton—Skillman Hardware Mfg. Co., West End Ave., has awarded the contract for the construction of a 1 story, 32 x 60 ft. hardware plant on Edgewood Ave. Estimated cost $5,000.

N. J., Trenton—Whitehead Bros. Rubber Co., Whitehead Rd., has awarded the contract for the construction of a 2 story, 45 x 60 ft. rubber plant. Estimated cost $25,000.

N. Y., Buffalo—Lautz Marble Corp., 861 Main St., plans to build a marble work shop at 7 Norfolk Ave. Estimated cost $85,000. Private plans.

N. Y., Buffalo—J. F. Pfister, 22 Metcalfe St., plans to build an addition to vinegar and pickle factory. Estimated cost $15,000.

N. Y., Rochester—Rectograph Co., Inc., 307 St. Paul St., plans to build a 1 story factory for the manufacture of photo supplies, on Hollenback St. Estimated cost $16,000.

N. Y., Wende—The Bd. of Supervisors of Erie Co., 29 County Hall, Buffalo, will receive bids until July 25 for the construction of an administration, bakery, laundry and other buildings at the County Farm here. Estimated cost $225,000.

N. C., Lincolnton—Lincolnton Creamery & Ice Co. plans to rebuild its ice plant which was recently destroyed by fire. Estimated cost $100,000. Architect not announced.

O., Cleveland—Cleveland Kraut & Pickle Co., 1191 East 22nd St., is receiving bids and opens same about Aug. 1, for the construction of a 2 story, 60 x 80 ft. factory at 2222 Lakeside Ave. Estimated cost $60,000. D. S. Duncan, Secy. and Mgr. Private plans.

O., Cleveland—Cleveland Sanitary Wipers Co., 15815 Bway., plans to build a 2 story factory. Estimated cost $50,000. S. I. Fineman, Mgr. Architect not selected.

O., Cleveland—Wilberite Roofing Co., 2700 Brook Park Rd., has awarded the contract for the construction of a 1 story, 35 x 130 ft. heating house. Estimated cost $40,000.

O., Dayton—Lowe Bros. Co., 450 East 3rd St., has awarded the contract for construction of a 7 story, 80 x 270 ft. mill, for the manufacture of paint, on Wayne Ave. Estimated cost about $175,000.

Okla., Ardmore—R. H. Harris & Son, Ada, plans to build plant here for the manufacture of bricks; about 20,000 daily capacity. Private plans.

Pa., Berwyn—Hester Price Canning Co. plans to rebuild its canning factory which was recently destroyed by fire. Estimated cost $40,000. Architect not announced.

Pa., Erie—Bd. Educ. will receive bids until Aug. 20 for the construction of a 2 story, 200 x 300 ft. high school, containing a vocational department, on West Side. Estimated cost $425,000. W. W. Myers, Library Bldg., Archt.

Pa., Mercer—Raymilton Refining Co., Raymilton, plans to build a refinery, here; will also remove its plant from Raymilton to Mercer in the early spring. Capacity of present plant to be increased 5 times. A. Hastings, Raymilton, Mgr.

Pa., Phila.—Hulton Dyeing Co., 3819 Frankford Ave., has awarded the contract for the construction of a 2 story, 62 x 203 ft. dyeing factory on Coral St. and Wheatsheaf Lane. Estimated cost $60,000.

Pa., Phila.—B. S. Pincus, 21st and Market Sts., has awarded the contract for the construction of a 3 story, 48 x 100 ft. packing plant at 454 North American St. Estimated cost $30,000.

Pa., Phila.—R. E. White, Archt., Penna. Bldg., is receiving bids for the construction of a 2 story, 62 x 188 ft. factory, for the manufacture of paint, on Richmond and Tioga Sts., for G. Sprunance, 312 North 3rd St. Estimated cost $50,000.

Pa., Reading—Central Abattoir Co., Chestnut St., will soon receive bids for the construction of a 3 story addition to its packing plant. Estimated cost $175,000. Himmelsbach & Schlich, 136 Liberty St., New York, Engrs. Noted June 15.

Tex., Cross Plains—J. D. Ford (representing owner) plans to build a large oil refinery on Haley Farm. Private plans.

Wis., Madison—The Kennedy Dairy Co., 618 University Ave., has awarded the contract for the construction of a 2 story, 85 x 132 ft. ice cream factory. Estimated cost $80,000. Noted June 1, 1922.

Wis., Milwaukee—Federal Eng. Co., 444 Milwaukee St., is receiving bids for the construction of a 6 story, 64 x 64 ft. textile mill addition on 5th St., for the Holeproof Hosiery Co., 404 Fowler St. Estimated cost $50,000.

Wis., Racine—H. & M. Body Corp., 608 Center St., has awarded the contract for the construction of 26 additional dry kilns, and also for alterations to its plant. Estimated cost $200,000. Noted June 29.

Wis., Waukesha—Harvey Paper Specialty Co., Main St., plans to build a 1 story 80 x 122 ft. plant. Estimated cost $40,000. Architect not selected.

Wyo., Casper—The Texas Co., Battery Pl., New York, plans to build an oil refinery, here.

Ontario—Pure Gasoline Co., 13 King St. W., Toronto, has purchased sites in Kitchener and Niagara Falls, and is having plans prepared for the construction of gasoline stations. Estimated cost $50,000. Private plans.

Ont., Guelph—The Provisional Government, Toronto, will soon receive bids for the construction of a dairy and cold storage equipment for Guelph Agricultural College, here. Estimated cost $96,000 and $17,000 respectively. Educ. Dept., Toronto, Archts.

Ont., Hamilton—Canadian By-Products Co., Home Bank Bldg., will soon have plans prepared for the construction of a plant for the manufacture of fire bricks. Estimated cost $35,000.

Ont., London—Shell Oil Co., 3608 Notre Dame St., Montreal, Que., has purchased site here and will build a receiving and distributing station. Estimated cost $250,000.

Ont., Milton—Milton Pressed Brick Co., 48 Adelaide St., West Toronto, will build a new down draft brick kiln, here.

Ont., Palmerston—I.X.L. Mfg. Co. plans to rebuild its 2 story battery factory which was recently damaged by fire. Estimated cost $25,000. Private plans. J. Youngson, Mgr.

Ont., Petrolea—Peninsula Sugar Co. has had plans prepared and will take bids about Aug. 1 for the construction of a 1 and 2 story, 250 x 800 ft. sugar refinery, and a 1 story, 175 x 225 ft. power house. Estimated cost $1,000,000. F. H. Hubbard, Genl. Mgr. A. Schoen, Archt. Honolulu Iron Wks., 8047 Hamilton Blvd., Detroit, Mich., Engrs. Noted Dec. 22.

Ont., Toronto—Farmers Dairy Co., Walmer Rd., has awarded the contract for the construction of a 2 story, 106 x 120 ft. addition to its dairy. Estimated cost $175,000.

Ont., Welland—Welland Cotton Mills, Ltd., is having plans prepared for the construction of a cotton mill on Queen and Duncan Sts. Estimated cost $200,000. L. B. Spencer, 60 Merritt St. W., Secy. W. J. Westaway Co., 38 Main St. W., Hamilton, Archts.

American Machinist

Volume 57 NEW YORK, JULY 27, 1922 Number 4

Storing and Clarifying Oil in Shops

Methods Used in Twelve Well-Known Plants—Tanks, Separators, Mixtures and Other Details—Clarifying Reduces Danger of Infection to Workers

THE handling of oil, both cutting and lubricating, is a problem that may be attacked in many ways. Some side-step it altogether but the great majority attempt some sort of solution, varying with their needs and the expenditure which is felt to be justifiable.

A few plants have installed quite elaborate chip and oil houses for cleaning the oil from chips, for clarifying the oil, and returning it to the system from which the shop is supplied. The question of keeping cutting oils and compounds clean and sanitary is also receiving more attention. Comparatively few shops seem to have a well-planned system of looking after oil expense, although shops which have made a study of the problem feel that it well repays all their time, trouble and cost. Some contend that clean, filtered oil, free not only from chips but from the minute particles which seem to wear from tools and bearings and form a sludge, helps to secure accurate work. Impure cutting oils are said to increase the percentage of scrap and otherwise interfere with obtaining accurate work.

CAN YOU SAVE money by reclaiming the oil used in your plant? Replies to inquiries made by *American Machinist* indicate a difference of opinion as to the economy of filtering and clarifying oils.

Each plant should know the best way to handle its oils. As guides to what may be done and what may be expected, study these opinions of some who have carried on investigations in their plants.

In order to show just what some of our leading shops are doing in this matter we are reprinting a number of letters received in response to our inquiry concerning their methods. These letters give a brief outline of their experiences with different systems, or without special apparatus, in some cases. Here they are:

American Tool Works Co.

We are using the Richardson-Phenix system, with a capacity of 1,200 gallons, which provides a gravity delivery from our screw machine pans to the filter station. Here the oil is filtered and chemically sterilized before being returned to the screw machines by means of a motor-driven pump.

We have found the advantages to be as follows: No petty pump troubles, slipping belts, etc. No priming of pump after each stopping of the machine. Uniform pressure without surge. Increased volume of flow. Pans on machines practically dry. Chips have time to drain, leaving but little oil to be removed in centrifugal machine. Work is cleaner, with little clinging oil, consequently less waste. Floors kept much cleaner. Clean oil permits higher cutting speeds, also gives longer life to the cutting edges of tools.

We have no comparative figures showing the difference between the new and old systems, but have observed the advantages enumerated above during the five years' usage of this system.

We have not noticed any advantages from the standpoint of the quality of work, as the variation of work is usually attributed to poor tool design or grinding, rather than to oil. We have tried several kinds of oil with varying degrees of satisfaction, finally determining upon a mixture of about 50 per cent each of lard and mineral oils.

We have no means for filtering and clarifying used oils. We had some used motor crankcase oil, mostly Mobile A brand, filtered and clarified. We mixed this filtered oil with an equal quantity of new so-called engine oil, the regular oil used for lubricating machine tools and transmission machinery around the shop. We found it would not do for electric motor bearings and abandoned it there. We then mixed it 30 new and 70 old, and have used it so for some time for general run of shop transmission oiling. We question, however, the economy of its use, believing the most efficient oiling effect that can be secured from new oil is none too good. To use a poor oil means more friction, more power and more coal. To use filtered oil mixed with good oil means that the friction reducing qualities of the good oil are decreased. We have therefore abandoned the filtration of oil and are now mixing the used oil with fuel oil and burning it in our heat-treating furnaces.

For oil storage we have a fireproof oil room with a barrel-size, round vertical sheet-iron tank with tin pump—such as can be had from any supply dealer—for each kind of oil used. We believe that barrel-size square oil-storage tanks with good substantial pumps, such as are furnished singly or in multiple by several concerns, placed in fireproof oil room for main storage are good.

We also use 10 to 20 gal. tanks with pumps, placed at frequent intervals around the shop. This seems to be about as good an all around system as can be devised for a small plant like ours. Our shop hardly warrants a piping system from a central station.

We believe it is a good plan to have an oil distributing station in the toolcrib, and have hand oilcans filled by an attendant from pump tanks, and passed out immediately on call.

Under our scheme we store all tools, jigs and fixtures used exclusively in our department in one place, under the care of the foreman and his general laborer and trucker. In this connection we believe it is very economical to have a 10-gal. supply can regularly replenished by the department laborer and placed conveniently for operators to help themselves.

We do not use oil for cutting on any machines except a gear hobber. This oil is filtered only, and used over again.

Brown & Sharpe Manufacturing Co.

We have given considerable thought to the question of the purifying of oil and have experimented to some extent in the use of clarified oils, but in the slight experience that we have had we have felt that as far as better cutting qualities were concerned, there was no gain in the transaction.

We put all of our chips through a centrifugal machine, and we know that there would be some saving if we treated the chips still further by the use of steam, but from any data that we have been able to collect, we feel that the amount that would be saved would not be sufficiently large to warrant the expenditure and the use of room to undertake this operation. Clarified oil, of course, is better to handle and more attractive.

As to storage, we receive oil in barrels and keep it there, carrying it in the barrels to such parts of the works

as we may require it. We have fitted trucks upon which the barrels can be placed, and easily emptied into the receptacles at the point of use. After whipping out the chips the oil is collected in barrels and mixed with other oil as it comes to use.

Elgin National Watch Co.

The best grade of lard oil is used in our automatic machines. As it thickens, we put in machine oil to permit of its passing through the felt filter as it returns to the machines from the oil tanks.

The oil is used for both lubricating and cutting. It is pumped into the machines and returned again and again to the tank through the filter and back. We find that the oil deteriorates by constant use and find it profitable to replace it in about six months after continuous use.

Table of Oil Tests

These tests were made by sawing slots in stacks of watch main winding wheels until the saw broke.

Direction of saw while running, against the work. Saws 0.008 in. thick; temper, dark straw color; speed of slide, 1 ft. per min.; speed of saw, 219 ft. per minute. Oil from tank passed through a 0.15-in. hole on to saw; three saws used in each test.

Kind of Oil	No. of Slots 1st Saw	2nd Saw	3rd Saw	Total No. of Slots	Average Slots Per Saw
Benzon — Lard	1	1½	½	3	1
Benzon 75% — Lard 25%	2½	3½	9½	15½	5½
Benzon 50% — Lard 50%	340	139	375	854	284⅔
Pt. Lincoln — Lard	8½	1½	5½	15½	5½
Pt. Lincoln 75% — Lard 25%	5	2½	19	26½	8⅚
Pt. Lincoln 50% — Lard 50%	464	144	427	1035	345
Lard	670	1380	1130	3180	1060

H. H. Franklin Manufacturing Co.

Our original chip handling installation was very crude and consisted of transferring all chips by the wheelbarrow method and elevators to the basement, where they were put through a pair of ordinary belt-driven extractors and a portion of the oil extracted in this way. Eight men were required to transport the chips from the machine shops to the oil extracting department.

With the present system, which has been in operation about two years, a vertical chip chute was extended from the sixth floor of our machine shop building to the third floor, passing through each of the machine shop departments with the exception of one located on the second floor of the building mentioned. The chips are dumped directly from trucks and wheelbarrows on the individual floors into this chute, and are carried by gravity to a chip storage bin in the oil reclaiming department.

The equipment in this department consists of a steam-driven extractor and two DeLaval centrifugal machines, one for clarifying and the other for purifying the reclaimed oil. The chips are loaded by means of forks into the large baskets of the extractor and the baskets are handled by a light air-operated hoist from this position into the extractor itself.

The extractor is turbine driven and the exhaust from the turbine is delivered directly to the basket of chips, where its heat results in a thinning and freeing of the oil from the chips. The extracted oil drains by gravity into a sump, where it is pumped to an overhead storage tank and where it is again lead by gravity through the clarifier and purifier in series, and then pumped directly into an oil storage tank on the floor above, where it can be drawn by gravity into the distribution truck tanks whenever it is needed.

In regard to the saving effected by this method, it can be summarized in the following manner:

The total yearly saving, based on normal production, in labor required to handle the chips	$5,900
Saving in oil over the old system, per year	24,000
Total yearly saving of [illegible] per ton in handling of chip cars	1,352
Total yearly saving	$31,252

Where oil reclamation is practiced the use of standard separating machines of the centrifugal type seems to be almost universal. For cleansing and purifying, the oil is then led to reservoirs, filters and clarifying apparatus in turn. New oil is added in all cases to maintain the standard necessary for good work.

Sterilizing and clarifying oils may eliminate skin affections which are all too common in many shops.

We neglected to mention the fact that locating the oil reclaiming room on the third floor permitted us to place the chip storage bins directly over the railroad track, where the chips are lead by direct chutes into the cars.

In reference to the advantage of a carefully clarified oil over the use of a new oil, we cannot say that we are particularly enthusiastic over recommending a reclaimed oil in place of fresh oil. We find the opposite to be the case. That is, the reclaimed oil—in order to produce results comparable with the exclusive use of new oil—requires the addition of about 25 per cent of fresh oil to the reclaimed product.

We have at several times experienced some trouble with oil foaming in the automatic screw machines. We have finally traced this trouble to the apparent presence of water in the reclaimed oil, and believe that it is due entirely to the defective operation of the separators used for extracting the water and other impurities. As a basis for future installations, we would strongly recommend the use of a belt-driven extractor in place of the steam-driven machine which we are using, and the elimination of the direct heating of the chips by steam. It might be possible to arrange for an indirect heating of this extract, without the danger of too much condensation entering the extracted oil.

General Electric Co.

The General Electric Company uses both DeLaval centrifugal clarifiers and Richardson-Phenix screen filters. The DeLaval clarifiers are used chiefly for filtering bearing oil used in testing machines. The oil reclaimed in the testing section is again used in machine bearings in the testing. The Richardson-Phenix filters are used in connection with further test turbine extractors for reclaiming oil from chips and turnings in the automatic and machine departments. The oil reclaimed in these departments is first built up or renewed by the addition of a small portion of new oil.

In regard to extracting oil from chips and turnings, we use centrifugal extractors located in various sections of our plant either in or in close proximity to our automatic and machine departments. The amount of oil which may be extracted from a ton of chips varied according to local conditions. In shops where chips and turnings are allowed to drain, for a period of ten or twelve hours, the amount of oil reclaimed by the extractor will average approximately 15 or 20 gal. per ton of chips. Where chips are taken immediately from machine pans and put into the extractor, the amount of oil reclaimed will obviously be very much greater.

Referring to the question of whether in our experience clarified oil gives a more uniform product and increased percentage of perfect work, would state that this proposition may be said to be a self-evident one. The higher the point to which oils are clarified and refined, whether oils in original form or used oils, the more uniform and satisfactory would be the result of the machine processes with a corresponding decrease in defective work.

Meisel Press Manufacturing Co.

We use a refrigerant base, diluted with paraffine in exact proportions.

When it is necessary to refill a machine, we drain off all old oil and refill with the new mixture in the exact proportions, so maintaining a uniform standard of cutting oil.

The old oil drained off (which as you will appreciate, has accumulated much foreign matter, such as kerosene oil, chips, etc.) is placed in a filtering tank, and after being filtered, is sterilized, and pumped into a storage tank, and then used as a carrier for diluting with new refrigerant base.

There is no question in our minds but that a clarified cutting oil is conducive to better results, since it is free from foreign matter, such as chip dust, or, in other words, chips that have become very minute like powder grains. This chip dust destroys the cutting edges of tools, and

prevents the best quality of finished surface on the products.

Larger sized turnings and chips are put through an oil extractor and the oil from this process goes through the same filtration and sterilizing process as above mentioned.

We presume it is generally appreciated that the price per gallon of oil as used by our method, is gradually lowered from the first cost, until it is necessary to purchase more paraffine, because as long as there is sufficient quantity of oil in the filtration tank, the cost of oil consists only for the cost of new refrigerant base, plus the cost of filtration and sterilizing of old oil. So a cutting oil whose first cost represents cost of refrigerant base, plus cost of paraffine, and which, in the proportion we dilute, might represent 45 cents per gal. eventually may cost only half that.

We also believe that cutting oil has a relative proportionate tangible value to machine oil, as regards its effect on the overhead burden upon a machine, and that a first-class cutting oil, therefore, is just as good insurance, as pertains to machine equipment, as is fire protection for buildings.

PEERLESS MOTOR CAR CO.

Our cutting oils are bought by the barrel and stored in two 1,000 gallon tanks. From these tanks the supply as needed is pumped by means of Wayne hand oil-tank pumps into a Wayne portable lubricating cart. In this way the cutting oil is delivered from the oil shed to the different departments and machines as new oil is required.

In connection with the machines we have an oil separating and clarifying department. The oily chips and work are brought from the automatic screw machines in metal boxes and then forked or shoveled into a 36-in. separator, centrifugal type, made by the Oil and Waste Saving Machine Co., Philadelphia, Pa. From this separator the oil flows to a reservoir of 50 gal. capacity. From the reservoir the oil is pumped into a Peterson power-plant oil filter, Size 13, made by the Richardson-Phenix Co., Milwaukee, Wis.

After the oil is filtered it is supplied to the machines as required. New oil is added as required to keep life in the oil. In this way we are using the cutting oil over and over again. The cutting oil we are using is a mixture of Fiske Bros. No. 1770 oil and C. H. Clark oil.

Regarding cutting oils that are clarified, I have looked into this matter and taken it up personally with some of our factory men. I cannot see where you can gain a better lubricant by using the same oil over and over again by filtering, clarifying or sterilizing same. It seems to me that the oil being used for a long time, a certain amount of life is taken out and it will get thinner, and a certain amount of impurity will mix in with it. We add new oil to the oil that has been clarified and in this way try to keep the body and life in our oils.

We have noticed something peculiar about oils that have been sterilized and filtered. We have two filtering stations, one in the screw machine department and one in the motor running department. Before we installed the filtering stations our men were troubled with skin affections such as pimples, boils, etc. Now this trouble has ceased.

I would not like to say that this trouble was caused by the oils, as it may have been an epidemic of some kind at that particular time, but the same trouble happening in both departments and being eliminated, it would seem as though it was caused by impurities in the oils.

PRATT & WHITNEY CO.

Our practice is to keep separate the chips from the departments using widely different oils and by means of chutes to run them into large settling bins from which, by gravity draining, we reclaim about one-half the total quantity of oil. The chips are then put in a centrifugal separator and the remainder of the oil extracted. Tests have shown that what little oil is left in the chips is not over 1 per cent by weight. This oil is then run through several DeLaval machines, one for extracting liquid, such as moisture, and one for extracting solid matter. The oils are heated to render them antiseptic.

The resulting oil we have found to be the equal of new oil as far as productive results have shown. It is not quite as clear, but this may be due in our works to the admixture of small quantities of black oil which is still used in some instances. We have found that thirteen baskets of six bushels each, of chips each yield 148 gal. of oil, or, roughly, 2 gal. to the bushel.

WESTINGHOUSE AIR BRAKE CO.

In order to secure a good finish on parts from our automatic screw machines, it is necessary to filter the cutting oil periodically. In our practice the oil is filtered on an average of every three or four weeks.

The oil used in our standard production of motor-driven compressors during wearing in and test, is purified and used over and over again and until recently we used an ordinary oil filter but have lately installed a DeLaval centrifugal separator, which has given very satisfactory results. This machine has materially reduced the abrasion on the bearings due to the total elimination of fine sand and metallic particles in the oil.

WHITE SEWING MACHINE CO.

We do not reclaim any oil in our plant. We collect certain kinds of oil, however, such as coal oil, and return it to the refinery for credit which they allow us. The amount of oil we use is comparatively small; in fact, so small as not to warrant the installation of equipment for reclamation.

In regard to cutting oils, we have not found it necessary to filter the oil, or otherwise clarify it other than is done in the individual automatics and screw machines—that is, using the strainer and settling tank, which is an integral part of the machine itself.

We are well aware of the claims made by some of the manufacturers of mechanical filters. It has been our observation, however, backed up by the experience of our operators who have worked in other plants on similar classes of work, that there is no great saving nor betterment to be expected by the clarifying of the oil. We find that far greater results are obtained for better work by choosing the proper oil.

I wish to add, however, that if our raw stock contained mill scale such as if found on hot-rolled stock we might find it necessary to filter the grit and abrasive substances out of the oil. Our raw stock, however, is all cold-drawn, which possibly explains why we do not take extra care of the filtering of the oil.

WHITIN MACHINE WORKS

We have just installed a DeLaval system of oil filtration which is used in connection with a steam operated Oil and Waste Company's centrifugal extractor, and can report the best results. We have made very large savings in the amount of oil reclaimed from our chips.

The hospital reports also that scratches and wounds heal much quicker now that the oil has run through this pasteurization process and the workmen would rather use the reclaimed oil than the new oil in many cases.

We have combined this machinery with an oil storage building which has also worked out to our satisfaction. We feel that the DeLaval system of reclaiming the oil is the best that we have seen.

Increasing Production by Personal Consideration

BY CHARLES W. LEE

The subject of increased production has been so much in vogue during the—shall we say recent—inactivity, that a few words along that line may not be amiss.

The superintendent of a factory that I used to visit was much annoyed because some of "the hands" were in the habit of using the window ledge outside his office as a seat during the noon hour, and accordingly caused to be made and fastened on the ledge, a plate which supported numerous sharp spikes. The next noon the first "hand" failed to notice the innovation, and sat in the usual place with the result of torn trousers; this, it will be readily seen, increased production—for the tailor.

However this may be, in the course of time, this factory achieved a new superintendent, and after learning the ropes a little, one of the first things he did was to remove the spiked plate. He then set up a comfortable bench which the "hands" could occupy during their periods of relaxation.

Now I firmly believe, and I hope the editor will print what I write, that this little gracious act tended to increase the production of that factory: Anyhow, *something* had to pay for the nice little grass plot with flowers in the center, and surrounded by other benches which I noticed at my next visit to the place.

SPECIAL AUTOMOTIVE

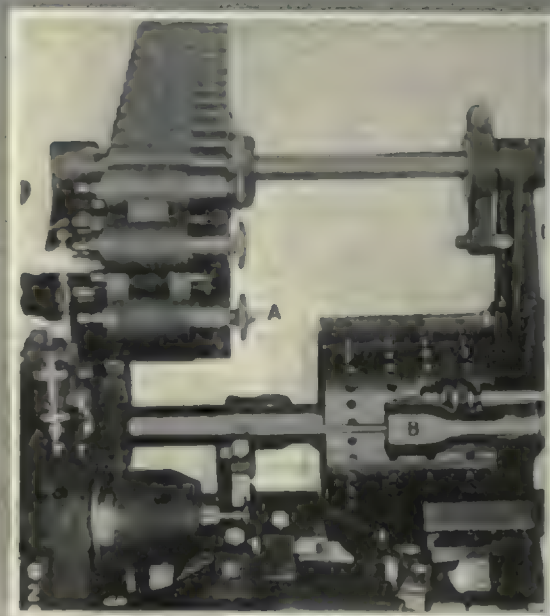


Fig. 1—Reed-Prentice four-way drilling machine operating on tractor differentials. The housings are centrally located and the four holes are drilled 90 deg. from each other. Time 1½ minutes. Fig. 2—Cleveland automatic screw machine with magazine feed turning valve heads. The magazine brings the valve *A* to the holder *B* which puts it in the chuck. Time 1 min. each.

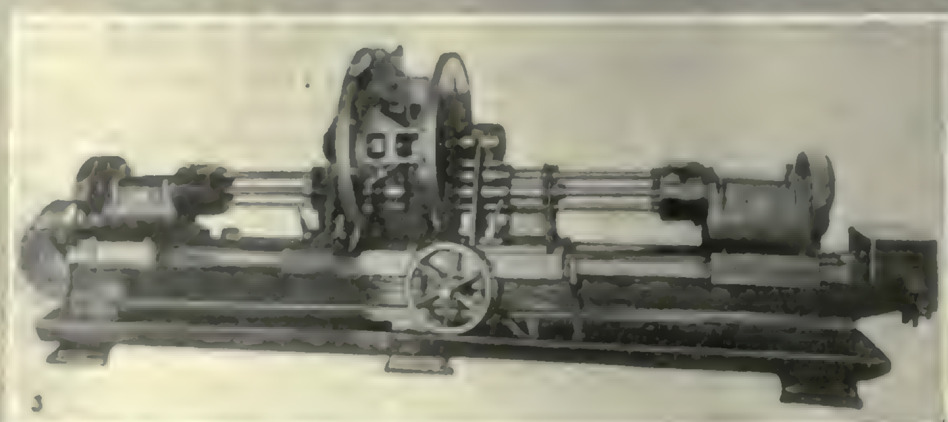
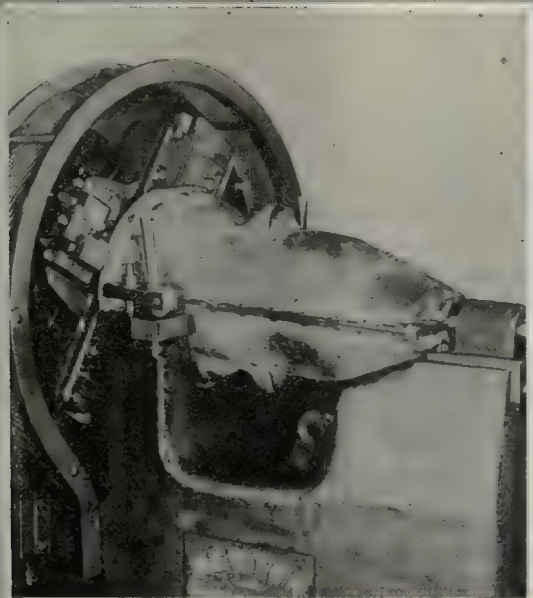


Fig. 3—Hoefer special machine drilling and reaming transmission cases. Tolerance 0.0005 in. on essential dimensions. Production time 6 min. from floor to floor.

MACHINING METHODS



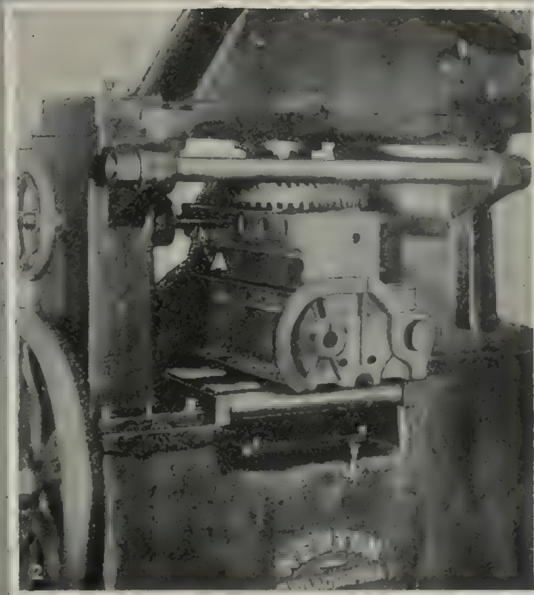


Fig. 1—Newton special machine facing and turning the flanges of two oil pans bolted together. The cutter head revolves. Fig. 2—Newton special milling machine located on roller conveyor line. Work is clamped by screw *A*. The cutter head swings on column at right and the feed is by gear segment and pinion operated by the handwheel.

Fig. 3—Newton eight-spindle machine facing bolt bosses on cylinder blocks. The cutter heads are operated by crank motion.

Standard Tapers

A Statement of the Case for Existing Standards—Suitability of Tapers for Specific Jobs—Some of the Objections to the Jarno Taper

BY LUTHER D. BURLINGAME
Chairman, Joint Committee of A. S. M. E. and S. A. E. on Standardization and Unification of Screw Threads

A FERTILE field for investigation and discussion has been opened by the series of articles appearing in *American Machinist* under the heading "Shall We Standardize Tapers?" These articles give the opinions of fifty-eight manufacturers as to their present practice and recommendations for standardization and while it cannot be said that these fifty-eight manufacturers give quite "57 varieties" of opinion as to what should be done yet the great variety of opinions and the reasons given show the extreme difficulty in the way of finding a practical basis of standardization which would meet universal approval. In fact not only this series of articles giving such widely varying views but also an investigation which was made in 1918 with a view of establishing standards for large taper shanks and sockets and which was presented as a paper at the annual meeting of the A. S. M. E. in December of that year, lead me to believe that the greatest possibility of effective standardization will be by the adoption of at least *two standards for tapers* rather than by trying to bring all to a single standard, regardless of the needs, and regardless of what might result from the overthrow of basic standards so long recognized and so widely used.

I was much impressed with the point made by George E. Merryweather in his contribution on page 725, Vol. 56, of *American Machinist*, entitled "Shall We Standardize Machine Tools?" He shows the danger of jumping into such standardization without a conception of what it might mean, and of the results which would follow. I do not wish to be put in the position of not favoring standardization, as I am now working with several committees whose earnest efforts are to bring about practical standardization where it can be done, but I do feel that there is a danger of overdoing this matter.

Standardization should not be carried so far that it will fail to meet the requirements and where those requirements are such as to call for varying standards; they should be duly recognized, each in its turn becoming a standard.

NEED OF FINER THREADS

An illustration of this is in the use of screw threads, where the attempt to hold all work to the United States standard screw thread, even though it is much too coarse for many uses has led to a great variety of finer threads being used because no standard for fine threads had been adopted. By frankly recognizing the need of finer threads and establishing a standard for them years ago this confusion would have been avoided, and two recognized standards would have been available, each useful for a particular field of work. The effort to bring this result about at this late date will eventually help the situation, but a far-seeing policy in the past by which at least two standards would have been recognized would have avoided the present confusion.

So it is with tapers. There are certain needs in which a taper as slight as ½ inch to the foot is preferable to a steeper taper because it is desired to have tools, such as end mills, etc., drive in so as to hold firmly, and drive by the "bite" of the taper surfaces in contact; and to have this taper just such that even when driven in tightly it can be readily removed when tools are to be changed. One-half inch taper per foot meets these requirements.

On the other hand, there are needs, such as in drill presses and lathes, where the end pressure comes on the tool or center tending to crowd it more firmly into position and where a taper of approximately ⅝ inch to the foot gives sufficient "bite" and allows for the tool or center to be more easily freed when a change is to be made.

INTRODUCTION OF "MAGNUM" TAPERS

In cases of large tapers, where auxiliary driving means are required, and where the "bite" is not depended on for driving, but instead keys or clutches are used for this purpose, and where the parts are so heavy that greater difficulty might be experienced in removing them, a steeper taper still of ¾ inch to the foot is desirable. Such a standard has already been proposed under the name of "Magnum" tapers and is an extension of the B. & S. tapers to larger sizes than had previously been standardized.

These varying needs have led in the past to the establishment of several standards each of which is best suited to its particular use and two of which have become so widely used and so firmly established as basic standards that it is believed it would be a mistake to attempt to change them.

As a result of the study given to this matter, and for the reasons which follow, I believe that the Morse taper should be adopted as a world standard, for lathes, drill presses and machines of like character, up to the largest size already established, No. 7, and that the B. & S. taper, should be made the world standard for milling machines, gear cutting machines, etc.; the "Magnum" standard being used for all types of machines where still larger tapers are required.

That it is desirable to have more than one standard is voiced by a number of those replying to the *American Machinist* questionnaire.

For example, No. 7 says:

> The value of one standard taper is questionable because of the variety of uses to which taper shank tools are put. The Brown & Sharpe taper is unquestionably superior for milling machine work, because the greater the taper the easier it is to loosen the shank in socket, due to jarring in operation; but a greater taper is more satisfactory in drilling machines, and boring machines, on account of ease of extraction . . . . No great hardship would be noticed if the Brown & Sharpe taper were continued in use for milling machines, and the Morse taper adopted for other machine tools.

No. 22 says:

> Modern milling machines are equipped with Brown & Sharpe tapers; drill presses, radial drills and boring mills

with Morse tapers . . . . the Brown & Sharpe taper having a smaller included angle is better suited for milling machines, gear cutters or any type of machine, where a great side thrust is exerted. This side thrust has the tendency to cause the tapered end of the cutter arbor to work loose. The Brown & Sharpe taper has a greater frictional driving power than the Morse. . . . all our gear-cutting machines for the trade are equipped with Brown & Sharpe tapers. In our milling department we have adopted No. 11 and No. 14 Brown & Sharpe tapers as our standard.

No. 27 says:

For drill presses and lathe centers it seems there can be no objection to the Morse taper, but for milling machines we would prefer the Brown & Sharpe half-inch taper per foot.

No. 53 says:

We will be satisfied to use Brown & Sharpe tapers for our milling tools and Morse tapers on our drill presses.

A third standard which has come into use to some extent (the Jarno taper), while having advantages in the simple relations of its various dimensions has objections which it is believed would militate against its being adopted as a universal standard.

In the discussion referred to above, published in the *American Machinist,* while the Morse taper was given the preference if a single standard was to be adopted, and the B. & S. taper was generally preferred for milling and gear cutting machines, there seemed to be quite a leaning toward the Jarno taper.

Origin of the Jarno Taper

This Jarno taper was first proposed by Oscar J. Beale of the Brown & Sharpe Manufacturing Co. in an article in *American Machinist* Oct. 31, 1889 and takes its name from the "pen name" under which Mr. Beale wrote. It is approximately the same taper per foot as the Morse taper, being a taper of 1 in 20, where the Morse taper is approximately 1 in 19⅕, and the B. & S. taper 1 in 24.

It is so close to the Morse taper that the fact that it has come somewhat into use is causing considerable confusion from the fact that it is not easy by inspection to determine which of the two tapers, Morse or Jarno, is used in a machine and the attempt to fit tools made to one of these tapers to machines having the other is a source of not only annoyance but of real loss. If it were not for the fact that the Morse taper, which approximates ⅝ in. to the foot, varies in nearly all its sizes from being exactly this taper, so that no two sizes are the same taper per foot, it would no doubt be more favorably considered as a standard; although this variation is not the practical objection which it appears in theory for gages once made will produce duplicate and thus interchangeable work.

Another objection to the Jarno taper is that the sizes vary uniformly by tenths of an inch in diameter at the small end. This has been pointed out by a number of those whose opinions are published in *American Machinist* as being an advantage. It is my belief, however, that it is not an advantage, but a serious objection to this system, as the proper requirements should grade the sizes of tapers in geometric progression from the smallest to the largest so that the larger sizes would be spaced much farther apart than the small sizes. See Fig. 1. I have pointed out the reasons for this in an article on "Geometric Progressions by Short-Cut Methods" on page 743, Vol. 56, of *American Machinist.*

For the same range which is covered by the Morse tapers in eight sizes the Jarno taper has 21, and this number of sizes would be increased to what would certainly be prohibitive if carried up to the sizes of the large taper shanks and sockets.

Another objection to the Jarno taper is that the formula is only applicable, as far as proportions of length to diameter go, to tapers of small or moderate size. As soon as large sized tapers are reached, such as say 4 in. in diameter, the Jarno formula would be entirely out of proportion, as it would call for a taper 20 in. in length, almost double that which good practice would require.

The correspondent of *American Machinist* No. 48, criticises the length of the Jarno taper even for the comparatively small sizes. He says: "In order to use a Jarno taper we have considered modifying the length, as there is no doubt that the general feeling exists that the Jarno taper is rather long."

Another reason, important from a practical standpoint, why the Jarno taper should not be used as a

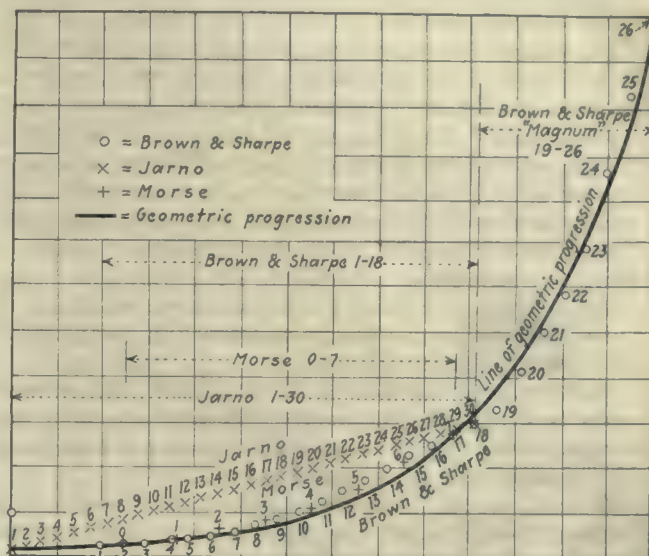


FIG. 1—TAPER SIZES IN RELATION TO A GEOMETRIC PROGRESSION CURVE

basis for a general standard to supplant the use of the Morse and B. & S. tapers now used, each in well-defined lines of machines, is that these latter standards are at present so extensively in use that great expense and confusion through a long period of years would be caused by attempting to make a change. Take the milling machine, for example, with its collets, arbors, shank cutters, etc., with vertical spindle and many other kinds or attachments now interchangeable not only with machines of the same make but also in various makes of machines. It is little realized through what a long period such a product must be interchangeable.

A short time ago, when the question of standards for tapers was raised as to whether they could be modified through a long period of years, an arbor with a taper shank was taken from stock and placed in the original universal milling machine built by J. R. Brown & Sharpe in 1861. It was found that the taper hole of the old machine was still standard after more than sixty years, so that the present day equipment would interchange.

Correspondent No. 40, after speaking of the many hundreds of thousands of machines in use, using tapers, says:

We should think it would be a very serious matter after so many years of having an established taper, such as the Morse taper, to consider making any change. From our own standpoint you can understand it would be a very

serious matter for us to consider, and we should hesitate about doing so.

No. 14 says:

If the Jarno taper were considered at the present time as the standard, there would be more opposition from the general public because it is little known, and this would require replacing the two well-known tapers, Brown & Sharpe and Morse.

Twenty-five years ago, there were many more tapers in use than at present, and the need for standardization was more apparent. Today the Brown & Sharpe and Morse tapers greatly predominate.

The records of our factory show that we have 721 machines with the Morse taper, 327 machines with the Brown & Sharpe, and 23 with the Jarno.

Attitude of British Engineers

It is believed that what has been said regarding the American practice would also hold true of practice throughout the English-speaking world. The British Engineering Standards Association has given much study to this matter of tapers. As far back as July, 1918, the sub-committee on milling cutters and small tools discussed the question of tapers with a view of arriving at the most suitable standard to recommend for end mills. They recognized three accepted tapers, the Morse, the Brown & Sharpe and Jarno, and after consideration in detail the vote was unanimous in favor of the Brown & Sharpe for this particular use. The considerations leading up to this decision as given by the committee were:

Jarno taper. Difficulties in adoption owing to its present limited use, although its simplicity and practical advantages were appreciated.

Morse taper. Insufficient range of sizes, and in some cases lack of sufficient length. It was also felt that comparatively few machines were now being made with Morse taper hole in the spindle.

B. & S. taper. Was considered to offer a reasonable range of sizes, a suitable taper, and, in addition, had the advantage of being the standard generally in use.

In their published "Book of Standards for Milling Cutters and Reamers No. 122-1920," the British Engineering Standards Association gives data for and recognized both the Brown & Sharpe and Morse tapers to be used for shanks of end mills.

It is reported by Robert Grimshaw, in *American Machinist*, May 9, 1907, that the German manufacturers of twist drills meeting in Hanover declared that the proposed introduction into Germany of the metric taper, instead of being an advantage would be a disadvantage; that while these manufacturers realize that there were some variations in the Morse tapers, they claimed that this would not be a serious disadvantage to the use of that taper "because such tapers are not made according to measure but according to gages ground exactly to size, so that it makes no difference whether or not the measurements are in even millimeters or fractions thereof. . . . Twist drill manufacture has become a specialty; they are made in great quantities, and all dimensions are exact to the standards."

Mr. Grimshaw goes on further to say that from the German standpoint—

"There are further commercial reasons for keeping the Morse taper. Twist drills are a staple commercial article, price, dimensions and quality of which cannot be established by German makers. At present there are necessary a great number of special machines to make them. If it were required to bring out a metric taper it would be necessary to put in new special machinery specially therefor. Furthermore to double the amount of stock necessary to be kept by dealers would be a heavy burden. . . . The expense of such increased stock would have to be borne not only by manufacturers, but also by the dealers."

The question was raised with the Brown & Sharpe Manufacturing Co. by the British committee on cutters as to the arguments for having varying lengths of taper for a given size. They were answered, based on the experience at the Brown & Sharpe works in the following way:

"A reason for having several varying lengths is that in some cases the shank of the taper extends through the bearing for the spindle, so that the key for driving out the shanks will come back of the bearing. This necessitates a taper longer than would otherwise be required, an illustration being No. 10 used in milling machines with a depth of 5 11/16 in. In other cases, where the taper is used in a collet, and it is desired to drive the shanks out without previously driving out the collet, it is necessary to have the keyway forward of the end of the spindle, or forward of the larger sized collets, and unless the taper holes are made shorter than standard, an excessive overhang results. For this reason shorter tapers are used in such places, so that it will be found that some are shorter and some longer than standard.

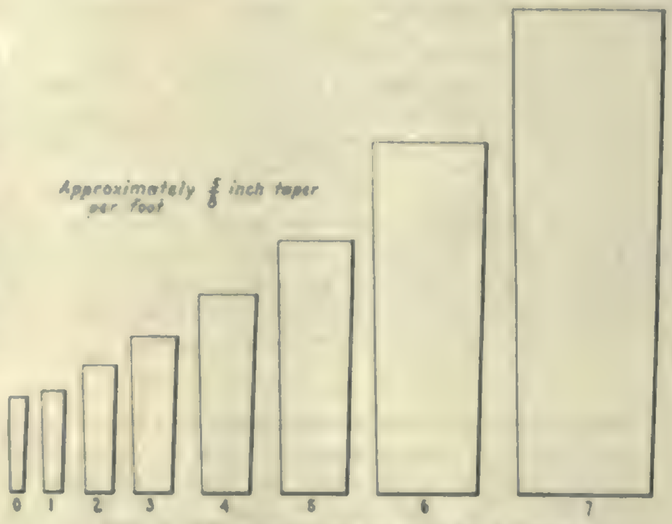


FIG. 2—PROPORTIONS OF MORSE TAPERS

MORSE AND BROWN & SHARPE TAPERS COMPARED

Morse No.	Taper Ft.	Diam. Small E	Depth Taper	Brown & Sharpe No.	Taper Ft.	Diam. Small E	Depth Taper
				1	0.500	0.200	15/16
0	0.625	0.252	2	2	0.500	0.250	1 3/16
				3	0.500	0.312	1 1/2
1	0.600	0.369	2 1/8	4	0.500	0.350	1 11/16
				5	0.500	0.450	2 1/8
2	0.602	0.572	2 9/16	6	0.500	0.500	2 3/8
				7	0.500	0.600	2 7/8
3	0.602	0.778	3 3/16	8	0.500	0.750	3 9/16
				9	0.500	0.900	4 1/4
4	0.623	1.020	4 1/16	10	0.516	1.045	5
				11	0.500	1.250	5 15/16
5	0.630	1.475	5 3/16	12	0.500	1.500	7 1/8
				13	0.500	1.750	7 3/4
				14	0.500	2.00	8 1/4
6	0.626	2.116	7 1/4	15	0.500	2.25	8 3/4
				16	0.500	2.50	9 1/4
7	0.625	2.750	10	17	0.500	2.75	9 3/4
				18	0.500	3.00	10 1/4

B. & S. "Magnum"

	No.	Taper Ft.	Diam. Small E	Depth Taper	
"Morse" recommended as World Standard for Lathes, Boring mills, drill Presses, etc.]	19	0.750	3.25	12	"B. & S." recommended as World Standard for Milling Machines, Gear Cutting Machines, etc.
	20	0.750	4.125	14	
	21	0.750	5.00	16	
	22	0.750	5.875	18	
	23	0.750	6.75	20	
	24	0.750	8.50	24	
	25	0.750	10.25	28	
	26	0.750	12.00	32	

"Magnum" recommended as World Standard for all cases where large sizes are required.

"Where no such limiting conditions exist, it is intended to have the lengths of tapers made standard."

The variation of some of the Morse tapers and of the No. 10 Brown & Sharpe taper from a taper uniform with the remainder of the series was challenged by C. Franklin Rothera in *American Machinist*, page 893, Vol. 56, where he speaks of the difficulty of answering the queries of his pupils as to the reasons for these variations of tapers, he considering that these variations are an important reason for bringing about a change.

Difficulty of Changing Now

This question was also raised by the above-mentioned British committee as to whether a change could be made in the Brown & Sharpe No. 10 taper so that it would in future be made exactly ½ in. taper per foot. They were answered in this way:

The No. 10 Taper was no doubt originally intended to be ½ inch per foot but in the early days, before measuring tools

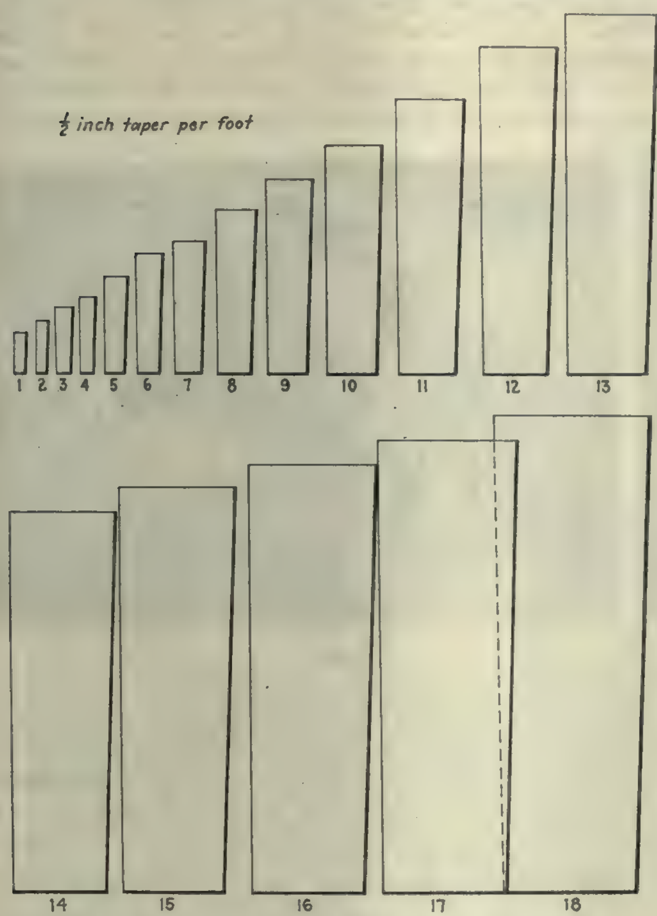


FIG. 3—PROPORTIONS OF B & S TAPERS

of precision were available, before the importance of standardization was realized, and after Brown & Sharpe had adopted this taper from others who had begun to use it, this standard became so firmly established that when it was known that it was not of an even ½-in. taper to the foot it was thought best to perpetuate the variation rather than to become involved in the difficulty of making a change.

This difficulty of making a change applies in a still greater degree at the present time, there now being hundreds of thousands of machines and attachments having this taper and many times that number of arbors, end mills and other tools which fit the taper holes, besides the equipment of gages found in every manufactory where these tapers are produced, both in America and abroad.

The change from 0.5161 to 0.5 per foot would be so great that the parts would not practically interchange, that is, an end mill or arbor made to the new standard could not be satisfactorily used in a spindle or collet of the old standard. At the same time they would be so nearly alike that it would be difficult to detect the difference by inspection, and through a long period of time this would cause great annoyance and expense, besides bringing serious criticism upon the manufacturers on the ground that their work was not being accurately made.

If this were changed the new standard would not be the Brown & Sharpe taper which through a period of sixty years' use we feel has become so established and so widely used as to make us in a sense custodians for its preservation.

The comparative sizes of the Morse and Brown & Sharpe tapers are indicated in Figs. 2 and 3 where each size is shown to a scale of approximately one-half full size, the sizes including the "Magnum Tapers" being given in the accompanying table, Fig. 4.

For any who are interested in a more complete study of the origin and development of the different standards for tapers and the principles on which tapers depend, reference may be made to the article, "Standards for Large Taper Shanks and Sockets" by the author, reprinted on page 537, Vol. 50, of *American Machinist*.

Now is the Time

It is felt that all the information it is possible to give regarding tapers should be brought to the front at this time, as there is a joint committee of the American Society of Mechanical Engineers and the National Machine Tool Builders' Association working on standardization. The matter of tapers is one of the subjects to have attention by the committee.

Charles le Maistre, secretary of the British Engineering Standards Association, who is working in close co-operation with American interests looking toward standardization, while speaking at a recent meeting of the North East Coast Institution of Engineers and Shipbuilders held at Newcastle-upon-Tyne said, regarding the general principles underlying standardization: "Industrial standardization does not necessarily involve the idea of actual perfection; it is rather the registering of what is best in present practice as against attempting to set up an ideal. It is quite easy to set up a standard, but it is altogether another thing to get that standard widely adopted, and a standard which is not in accordance with the fundamental needs of industry, that is, which does not fulfill a recognized want is economically a bad one. It is a wasted effort and a pitfall for the unwary."

It is believed that applying this sound advice, based on most extended experience in standardization, to the question of tapers will lead to the recognition as standard of the two tapers here advocated, namely the Morse and the Brown & Sharpe.

Awakening the Worker's Interest

By Robert Grimshaw

A foreman's first step in awakening interest on the part of the worker is to have it himself. Next, he should prove that he has it by manifesting it. To be interested merely in the product is not, in itself, sufficient. He must be interested also in the means of making it and, above all, he must impart this interest to the operatives to whom he entrusts the carrying out of his orders or the orders of his superiors transmitted through him.

Interest is like magnetism—it can be imparted. True enough, its degree and permanence vary with the material magnetized, but as the choice of the human material usually rests very largely with the foreman, he can seldom complain if he gets poor results.

Machining and Assembling Operations on Pneumatic Tools

The Third of Four Articles—Milling and Grinding Operations on Connecting Rods for Air Motors—A Ball-and-Socket Joint—Swaging and Milling

By HOWARD CAMPBELL
Western editor, American Machinist

THE Independent Pneumatic Tool Co. has developed, for use in the air motor, a connecting rod that is formed from heavy sheet metal. There are several machining operations after the forming operation, one of which is that of straddle-milling the large end. This operation is illustrated in Fig. 23. That part of the fixture which holds the rod consists of a rectangular block standing on its side, as shown. The block has a slot in which the rod is located for milling, as shown at *A*. The slot and holes for the small and large ends of the rod are just large enough so that when the nut *B* is loosened, the rod can be slipped in and out of the fixture. Tightening the nut *B* clamps the rod in place, as shown. A finished rod is shown at *C*.

The set-up for grinding the crankshaft bearing in a new style inner rod is shown in Fig. 24. This operation is performed after the rod and piston are assembled, as shown at *A*, to insure that the ground hole will be square with the piston. A hole is bored in the block *B* so that when the assembly is placed in the fixture, the piston slips into the hole and the bearings rest in the V-block *C*. The assembly is held in place by screwing the setscrew *D* down onto the piston. The machine is a Bryant chucking grinder.

The fixture used in gang-milling the inside faces of a number of old-style rods can be seen in Fig. 25. The rods, one of which is seen lying on the fixture, are placed between the blocks with the ball ends down. Pressure is brought to bear against the first block by the action of a large screw in the end of the fixture, and as this screw is tightened, the pressure is distributed so that it holds all the blocks and pieces firmly in position. Heavy springs between the blocks tend to spread them when the pressure is relieved, thus assisting the operator in removing the pieces.

The fixture used for straddle milling the sides of another kind of rod is illustrated in Fig. 26. One of the rods is lying on the top of the fixture at *A*. The rod is held in the fixture at *B*. The block *C*, which is hinged at the bottom, is swung up against the rod and the clamp *D* is swung over so that the setscrew *E* can be tightened against the back of the block *C*, thus holding the rod rigidly in place. The cutters straddle block *C* and mill the sides of the rod.

A unique punch press operation is shown in Fig. 27. Some of the connecting rods are assembled to the pistons by the use of the socket shown at *A*. The socket is a screw machine product, having a stud turned on one end and a cup formed in the other end. The bottom of the hole *B* has a full radius, and a hole is drilled through the bottom so that the connecting rod can be suspended from the ball end. Movement of the handle *C* spreads the two halves of the die so that the rod can be placed in position. Then the piece *A* is placed in the hole with the cup over the ball of the rod and the press is operated. The punch *D* comes down, forcing the piece *A* into the bottom of the hole, and the shell of the cup is closed around the ball, forming a ball and socket joint. Both of the handles *E* have to be pressed down by the operator before the clutch of the machine can engage, making it impossible for the operator to have his hand under the ram while the machine is in motion.

After the rod and socket have been joined, the stud on the upper end of the socket is screwed into a tapped hole in the center of the piston head, from the inside, of course, and a nut is screwed on. The end of the stud is then peened over the nut so that the stud cannot work loose.

The set-up of a double head Hartness flat turret lathe for machining ratchet levers is illustrated in Fig. 28. Two pieces are bored and faced at the same time, the bore being held to a limit of 0.002 in. The produc-

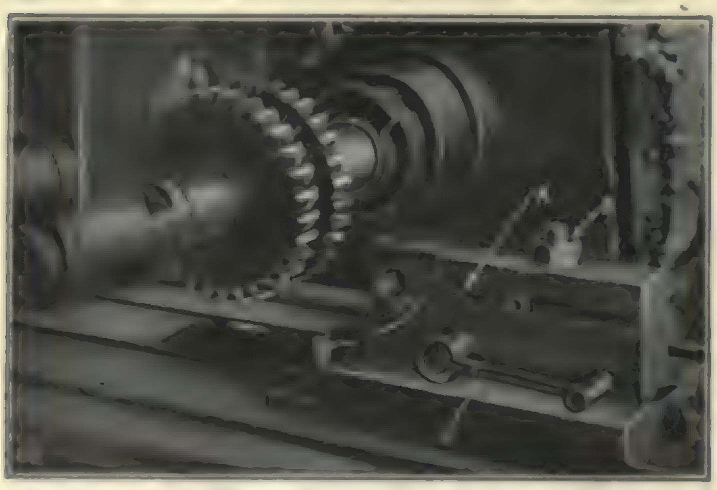
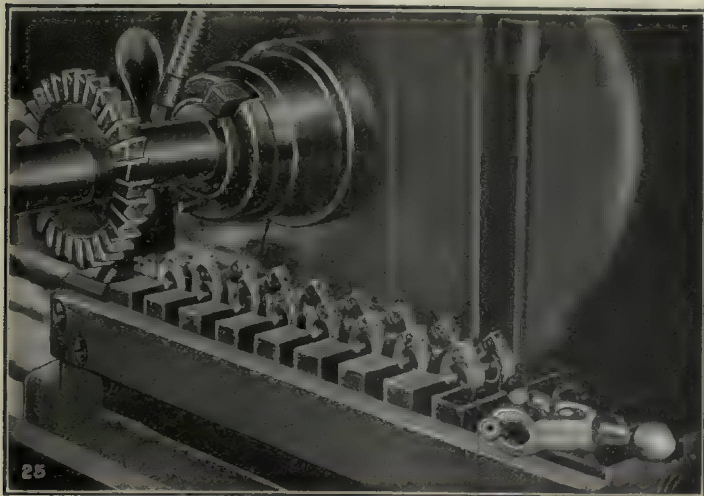


FIG. 23—MILLING AIR-MOTOR CONNECTING RODS. FIG. 24—GRINDING THE CRANK BEARING IN A CONNECTING ROD



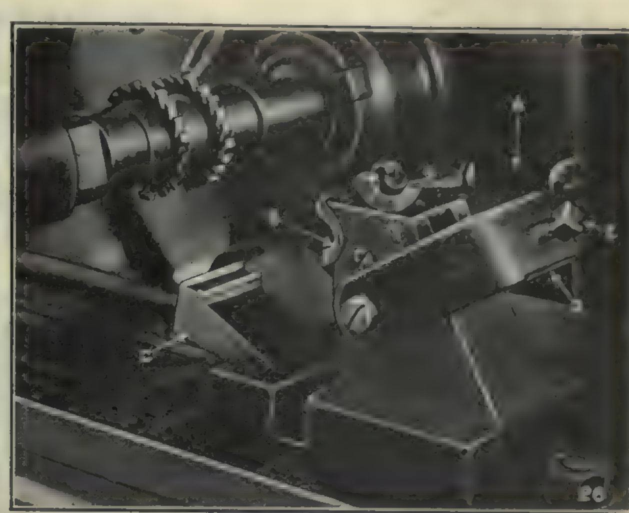


FIG. 25—MILLING INSIDE FACES ON CONNECTING-ROD BEARINGS. FIG. 26—STRADDLE-MILLING A CONNECTING ROD

tion of this machine is an average of 70 pieces in nine hours.

Another punch press operation is that of forming the dividing collar as shown in Fig. 29. The collar is made from No. 11 gage (0.120 in.) sheet steel stock, dead soft. This is cut to strips $\frac{15}{32}$ in. wide and $4\frac{3}{16}$ in. long in a previous operation. In the present operation the piece *H* is laid in the groove between the two pins *A*. The operation of the press causes the punch *B* to press the stock down on the bar *C* which also descends, as it is held in the position shown by strong springs. While this is taking place the blocks *D* and *E* are being pushed together by the action of the pieces *F* and *G*, thus forming the strip into the circular piece shown at

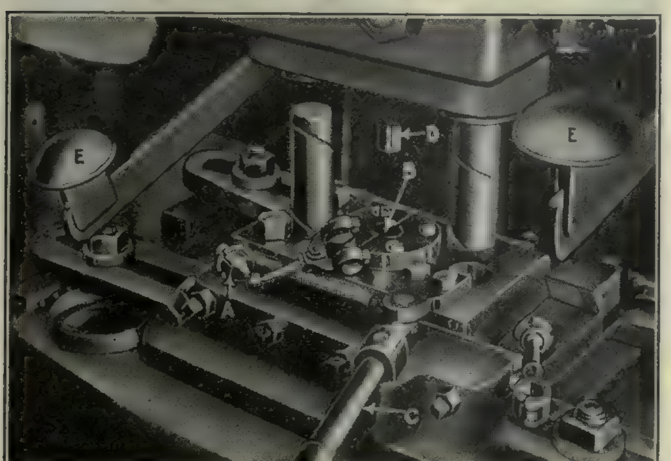


FIG. 27—FORMING A BALL-AND-SOCKET JOINT

H. As the ram ascends, the springs which can be seen in the illustration draw the blocks *D* and *E* back into the original position, releasing the piece. The radius in the top of the bar *C* conforms to that in the blocks *D* and *E*, so that the piece will be formed in a circle.

A simple, though interesting, operation can be seen in Fig. 30—that of milling the grooves in the live air handle sleeve. Although three cutters are used in this operation, only one groove is finished at a cut. The central cutter, which is a little smaller in diameter than the other two, mills the bottom of the groove, while the other cutters mill alternate sides of the two grooves to the right and left of the center groove. A finished handle can be seen standing on the table of the machine beside a handle in which the grooves have not yet been cut. The sleeve is mounted on a mandrel held between the dividing head center and the dead center.

The illustration, Fig. 31, is that of swaging the hole in a pinion gear, which is done in such a manner as to leave a key. A broaching operation precedes swaging.

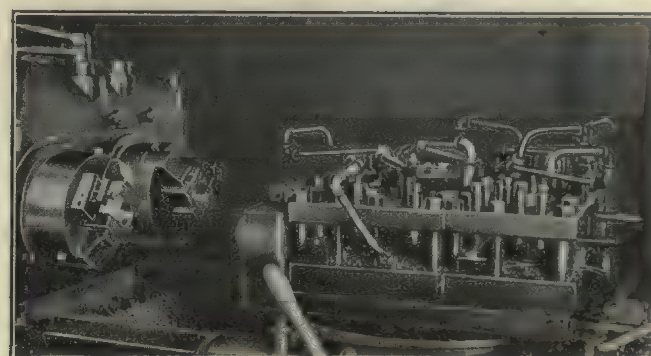


FIG. 28—USING THE DOUBLE-SPINDLE HARTNESS FLAT TURRET LATHE

The gear blank is 1.100 in. O.D. and 0.6562 in. long. A $\frac{1}{2}$-in. hole is drilled to admit the broach. The broaching operation leaves the hole 0.515 in. in diameter, with a key 0.060 in. high and tapered on each side 19 deg., or 38 deg. included angle. The broach is $25\frac{3}{4}$ in. long, on which the teeth occupy $19\frac{1}{8}$ in., leaving a plain end or

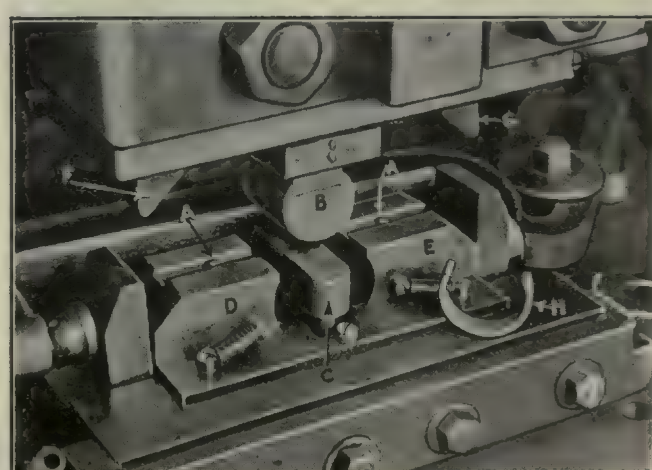


FIG. 29—FORMING A DIVIDING COLLAR

guide of 6½ in. The first tooth of the broach is 0.395 in. high and the last three teeth are 0.515 in. high.

The swage, which is shown in position in Fig. 31, is 7½ in. long, 0.512 in. in diameter at the bottom end, and 0.520 in. in diameter just below the groove indicated at *A*. That part of the swage from the groove to the upper end is approximately $\frac{1}{32}$ in. under size, which allows the swage to pass through the piece without sticking. The pinion locates in a recess in the collar

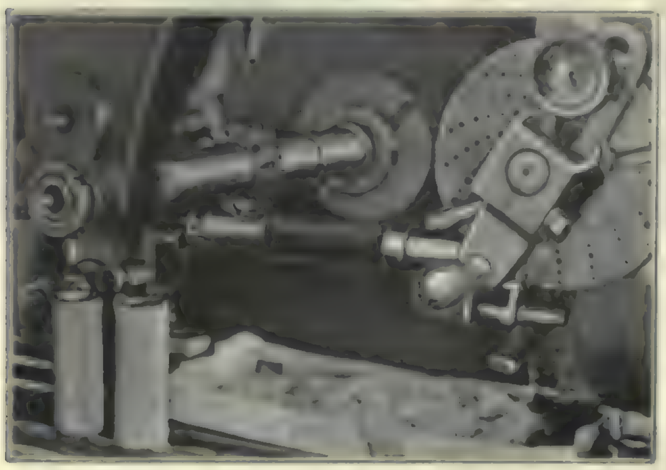


FIG. 30—MILLING THE GROOVES IN AN AIR-DRILL HANDLE

B. The lower end of the swage, being a couple of thousandths smaller than the hole, can be inserted into the pinion and the upper end centers into the sleeve *C*. This tool leaves both hole and key the correct size.

Using the Duplex Milling Machine

Another milling operation is that of milling the "tang slot" in an air drill sleeve, Fig. 32. The fixture consists of a V-block and clamp as shown, and the milling is done with two end mills that operate simultaneously. This job is done on a Pratt & Whitney duplex milling machine similar to that used for milling the slots in the roller cage, Fig. 19. Slots are milled on

FIG. 31—SWAGING THE HOLE IN PINION BLANK

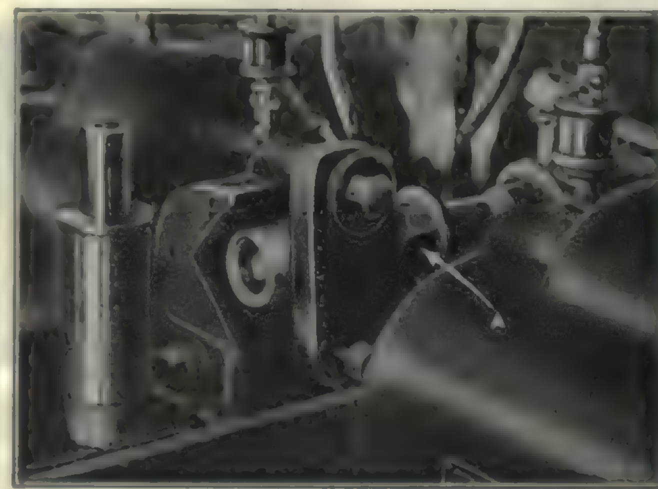


FIG. 32—MILLING THE "TANG SLOT" IN A DRILL SLEEVE

both sides of the piece simultaneously, the table traveling back and forth the length of the slot while the two cutters are gradually being fed into the piece. After the slot has been milled through, the cutters automatically withdraw and the machine stops. An unfinished piece is shown standing on the table of the machine.

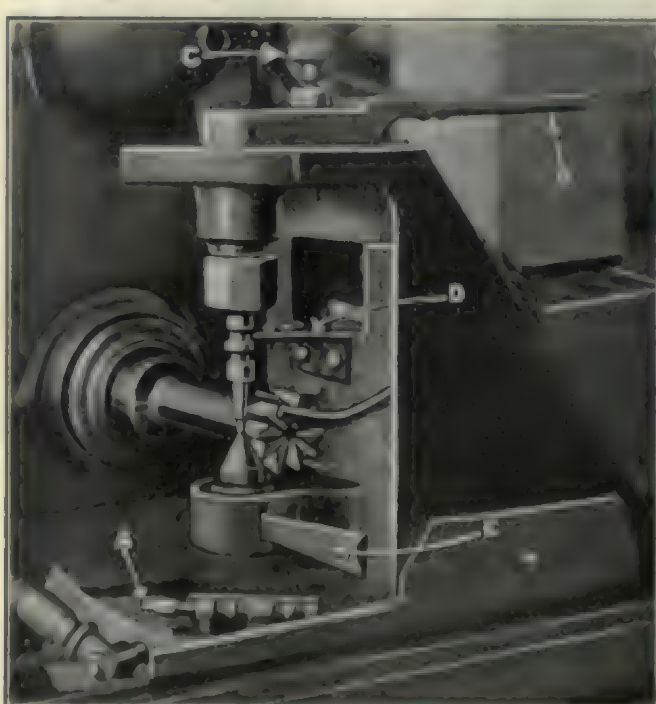


FIG. 33—MILLING FLATS ON A VALVE

The operation shown in Fig. 33 is that of milling two flat spots on opposite sides of the end of a valve, a finished example of which is shown at *A*. The lower end of the valve is held on a center and the upper end is held in a collet chuck which swings with the handle *B*. Two holes are provided in the upper face of the fixture, one being on either side of the axis of the handle, into which the spring-pin *C* fits, to insure the valve being swung 180 deg. between cuts. The stop *D* is provided so that the valve will be chucked in the correct position, and the lower center, which rests on a strong spring, can be withdrawn by the handle *E* to allow the pieces to be changed.

Methods of Machine Tool Design

Continuation of the Fifth Section—Effect of Feed Requirements on the Design—Solution of Problem on Designing Gear Drive for Heavy Lathe

BY A. L. DELEEUW
Consulting Editor, *American Machinist*

WHEN the amount of feed pressure has once been determined, it becomes possible to make a fairly close estimate of the amount of power required for the feed. In order to do so, it is necessary to lay out the general scheme of the feed mechanism. As a rule, this is possible because we have, at that time, a general idea of the construction of the machine to be designed and, though we may not be able to lay out the feed mechanism in all its details, we can develop a diagram which will show practically all the essential elements.

For instance, if we were designing a very heavy lathe in which the carriage is pulled by means of a heavy lead screw centrally located in the bed, we would know at once that there would be a gear at the end of the spindle or of some shaft of which the speed bears a constant relation to the speed of the spindle; we would have two studs on which change gears would be located and we would have perhaps one or two sets of transmission gears in order to reach the lead screw. After this we would have to consider the lead screw itself with its thrust bearings. Knowing the feed pressure and the approximate size of the lead screw, we can figure out the efficiency of the screw as well as the efficiency of the sets of gears which we have imagined. In this manner we can calculate the total amount of power required for this mechanism, and, though we are not absolutely sure as to the actual number of gears to be employed nor of the exact elements of the screw or its thrust bearing, we will come close enough for an estimate of the amount of power required.

In the foregoing calculation we started out with the amount of feed pressure and, as was mentioned before, this is the same as the pressure at the tool point. Designing this lathe, we must have had in mind on what size work this heaviest tool pressure might be required. Suppose the lathe to be a 48-in. machine, and that the kind of work for which it is intended requires the heaviest pressures at a diameter of 16-in. Then we know that the greatest amount of power will be used when we are working on this 16-in. job; but this does not necessarily mean that we will also have the maximum pressure on the face gear. It might be, for instance, that the cuts taken on a 32-in. piece will be less than that on the 16-in. piece, but more than half as much; in which case the pressure on the face gear teeth would be greater with the 32-in. than with the 16-in. job, though the amount of power required would be less. It is therefore necessary to analyze carefully the different kinds of jobs which may be put on such a lathe, and find both the maximum power as well as the maximum pressure on the faceplate.

To illustrate the foregoing, we will take a concrete example. We will imagine a lathe of 48-in. swing, of which the most important work will be the work of turning up 16-in. cast-steel rolls, but which will be required also to turn up larger work, such as shells or sleeves, rings, etc. We are informed that a large amount of metal will have to be removed from these rolls because the castings cannot be expected to come very uniform or close to size. We are also informed that practically all of the other work to be done on this machine will be on forgings which will come fairly close to size, and furthermore, that the percentage of this second kind of work is rather small so that, even if we could not always take the full cut at once, the total efficiency of the machine would not be very much reduced.

We will figure, then, on a maximum cut on the 16-in. work of $\frac{1}{4}$ x $\frac{1}{8}$ in., requiring a tool pressure of 30,000 lb. and at a speed of 45 ft. per minute, thus requiring 1,350,000 ft.-lb. per minute. On the other hand, with the larger work, we will be satisfied with a cut of $\frac{1}{4}$ x $\frac{3}{32}$ in, thus requiring a pressure on the tool of 22,500 lb., and a power of practically 1,000,000 ft.-lb.

We see, then, that the power required for the large work is less than that required for the small work. If the face gear has a diameter of 40 in., then the pressure required for the small work will be $\frac{16}{40} \times$ 30,000 lb. = 12,000 lb., while that required for the large work is $\frac{32}{40} \times$ 22,500 lb. = 18,000 lb. We see, then, that the pressure on the faceplate is greater when the lighter work is done.

When we know the different speeds at which we wish to run the lathe, and the power required at various speeds, we can develop the gear mechanism for the drive. It will be assumed here that the reader has the full knowledge required for the selection of gears of the proper size, shafts of the proper diameter, etc., but we will show here how to determine the loads which may come on each of these gears or shafts. We will further assume that a gear arrangement of the general style as indicated in Fig. 16-D will be used, and that the speeds will range from 4.5 to 230 r.p.m. We will find that the speeds will be the following: 4.5—5.85—7.60—9.89—12.85—16.71—21.72—28.24—36.71—47.72—62.04—80.65—104.85—136-38—177.2—230.4. In Fig. 68 this gear arrangement is shown with the various gears marked *A*, *B*, *C*, *D* and so on.

A Simple Lathe Gear Drive

The arrangement of Fig. 68 is shown here as an illustration, not because it is particularly adapted to a lathe drive which, as a matter of fact, it is not, but because it avoids a number of the complications which would occur in most drives actually used for such a purpose, so that the problem is simplified and lends itself better to our purpose.

The drive is supposed to be by means of a tumbler arrangement of which the driving pinion is *A* and the cone of gears *B*, *C*, *D* and *E*. As a matter of fact, we would probably use sliding gears instead of this tumbler arrangement. After the tumbler, we double the num-

For the author's forthcoming book.

ber of speeds by means of the sliding gears *F*, *G*, *H* and *J*; and after this, we again double the number of gears by means of the peculiarly arranged back gears *K*, *L*, *M* and *N*. In this arrangement the gears *G* and *J*, as well as the pinion *K*, are mounted on a sleeve which turns on the spindle.

If we do not desire such a sleeve arrangement, we can mount these gears on a separate shaft, but in that case, we would have to drive from this shaft to the spindle for a final transmission. The back gear arrangement is so constructed that a single lever movement will bring *K* in mesh with *L* and at the same time *M* with *N*; and that the movement of this lever in the opposite direction will disengage *M* and *L* from *N* and *K* while a continuation of this movement will clutch pinion *K* to face gear *M*.

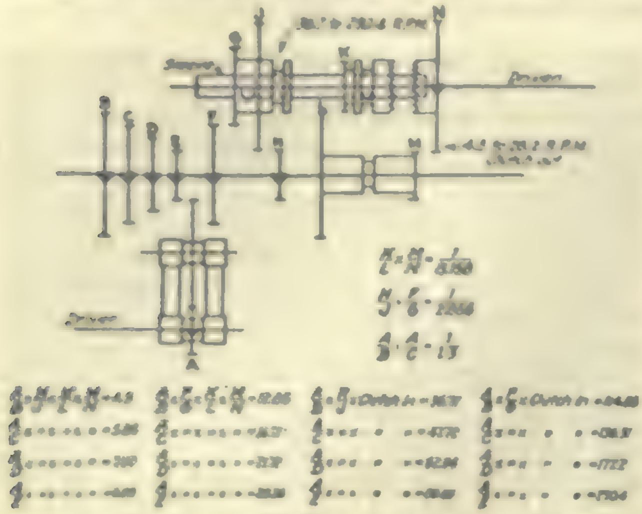


FIG. 68—DIAGRAM OF LATHE GEAR DRIVE

The lowest range of speeds will be obtained with the back gear *K-L-M-N*, with *H* engaging *J*, and with *A* driving *B*, *C*, *D* or *E*. Under those conditions the speeds range from 4.5 to 9.89 r.p.m. Under the conditions of the example we selected, that is, doing the heaviest work on a diameter of 16 in., we will have to use the full power of the machine at a speed of 11 r.p.m. (which gives a speed of 45 r.p.m. on a diameter of 16 in.). We find in the tabulation of Fig. 68 that there is no speed of 11 r.p.m., so that we must choose either 9.89 or 12.85; and as we do not dare to use a speed higher than 45 ft. per minute, we are compelled to run at 9.89 r.p.m. We find, then, that gear *N* must transmit the full power of the machine at 9.89 r.p.m., and we can easily work back and find the pressure from the teeth of gears *M*, *L* and *K*. Knowing the relative size of gears *J* and *K* we can also figure out what pressure would come on the teeth of gear *J*.

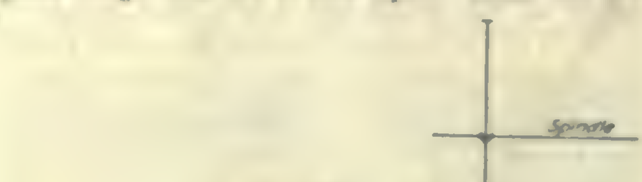


FIG. 69—DIAGRAM OF MODIFIED DRIVE WHICH USES SMALLER GEARS

At a first glance it would seem that the pressure on the teeth of gear *G* would be greater than on that of gear *J*, because its diameter is smaller. However, we notice that *J* is driven by *H*, and *G* is driven by *F*, and that *F* is larger than *H*, and therefore runs at a higher circumferential speed; so that *G* also must run at a higher circumferential speed than *J*, and consequently its tooth pressure must be less.

Furthermore, we notice that the speed which we require for 32-in. work is 22 r.p.m.; so that we select the speed which, in the tabulation, is marked 21.72. This speed is obtained when *F* meshes with *G*, and we found that only three-fourths of the total power is required for this work; so that not only is the tooth pressure on *G* less on account of its higher speed, but also because only three-fourths of the horsepower is employed.

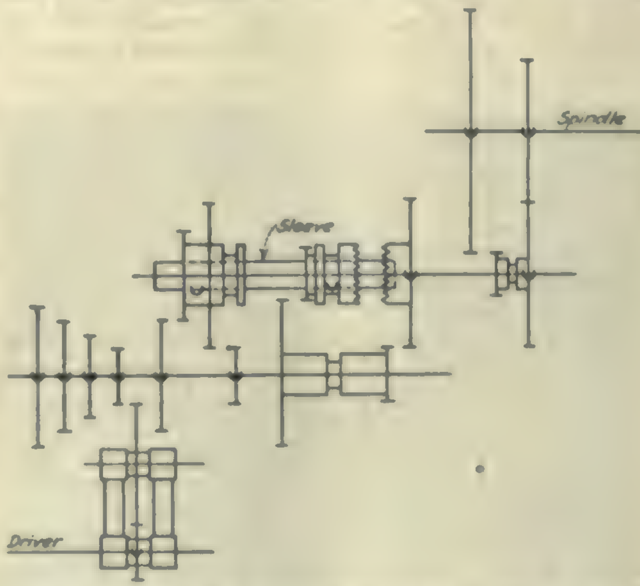


FIG. 70—FURTHER MODIFICATION OF LATHE DRIVE

In the design of commercial machines where nothing is known as to the nature of the work to be done on them, such analysis is not always possible, at least not when we have to consider the amount of horsepower actually needed for the work. However, we can always compare the circumferential speed of the various gears in action and, in that way, determine the maximum amount of tooth pressure which must be provided for.

In special machines where, as a rule, we know the kind of work which must be done, we can follow the entire analysis and study every gear and shaft from the standpoint of the work it is called upon to do.

Gear Speeds

Next in importance to the load on the gears is the speed at which they are to run. It is desirable to keep this speed down to as low a point as possible and to do it by keeping the diameter of the gear down rather than the number of revolutions. If, in the drive of Fig. 68,

we should consider the last shaft not as the spindle but as a shaft which drives the spindle in its turn, we would have been able to reduce the dimension of the entire drive. Fig. 69 shows such an arrangement. The entire drive, with the exception of the last gear, is separated from the spindle, so that it is possible to

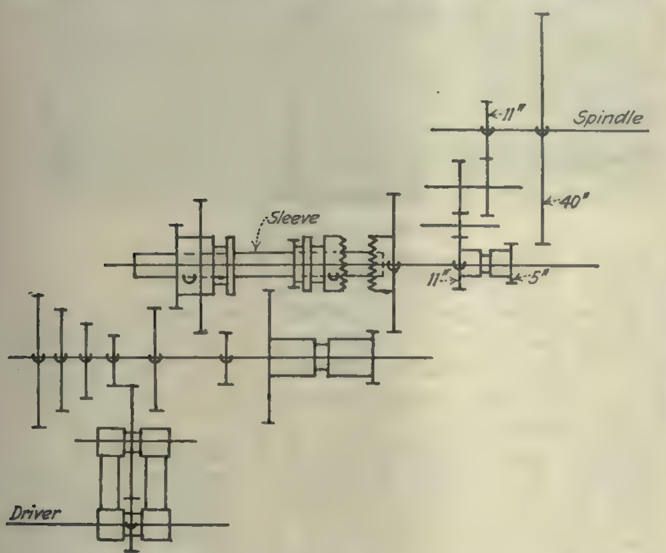


FIG. 71—ANOTHER MODIFICATION OF LATHE DRIVE

run all the gears of the drive at a much higher speed and consequently reduce their size. The advantages of such a scheme are that the entire drive can be built up in a unit which may be used for more than one style or size of machine, thus making a true manufacturing proposition; and that all the gears with the exception of the last one can be kept small.

However, we will have to check up and see whether some new element has crept in which may cause trouble. We see right away that the large gear on the spindle must run from 4½ to 230 r.p.m., and that this gear must be kept down in size if we do not wish to exceed a speed of, say, 700 ft. per minute. At that speed the gear could not be more than 11¾ in. in diameter, and this, of course, is too small for the machine we have in mind. If we wish to make this gear about 40 in. in diameter, we must not run it more than 67 r.p.m. In order, then, to obtain all higher speeds, we must have an additional means of driving from the last shaft to spindle. Such an arrangement is shown in Fig. 70. The last two gears of the last driving shaft are so arranged that they can slide either in contact with the large or the small gear on the spindle. Our arrangement is now such that we can use a 40-in. gear for the heavy drive and a gear of about 11 in. in diameter for the lighter and high-speed drives.

Having looked at this matter in a general way, we must now look at it from the standpoint of details to see whether some new element has crept in which may cause trouble.

If we should have a pinion of, say, 5 in. in diameter driving the face gear, then the sum of the diameters of these two gears would be 45 in., and therefore, the sum of the diameters of any two other gears acting between these same two shafts must also be 45 in. And as the small gear on the spindle cannot be more than 11 in. in diameter, we find that the gear which drives it must be 36 in. in diameter. Not only would such a gear be very clumsy, but it would mean that we speed up from the last driving shaft to the spindle more than 3 to 1, so that our driving unit, which was supposed to run at high speed, will actually have to run at a very low speed, namely, less than ⅓ of 230 revolutions.

An attempt to overcome this difficulty is shown in Fig. 71. It would not be necessary for the designer to re-copy the major part of the gear arrangement as

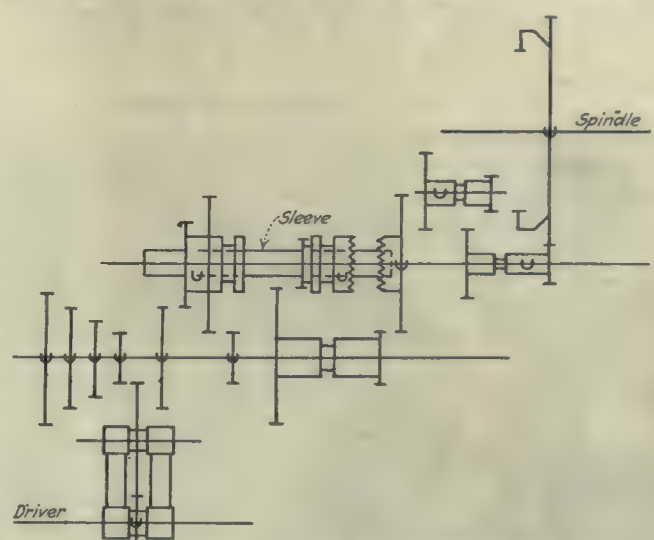


FIG. 72—INTRODUCTION OF INTERNAL GEARING

we are only concerned with the last few gears. On the other hand, it is so easy to make such a sketch that it is well to make every sketch complete so as to be able to keep them on record, in order to show at any later time the steps which have been followed in trying to obtain a solution.

In this Fig. 71 we drive from the last driving shaft

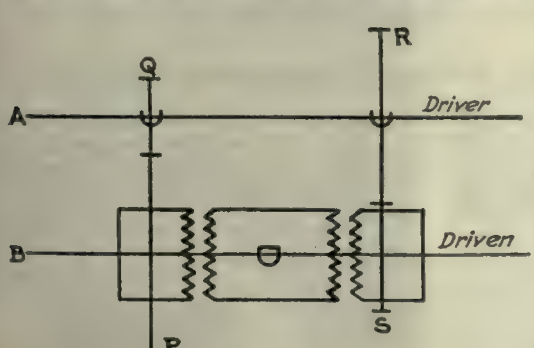


FIG. 73

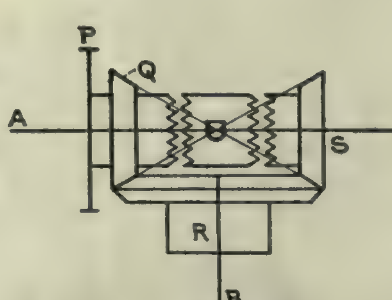


FIG. 74

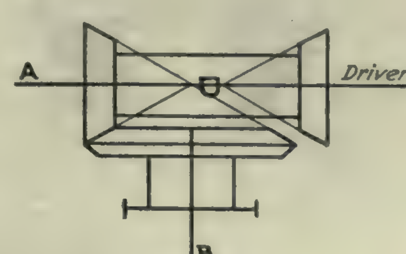


FIG. 75

FIG. 73—SPUR DRIVE WITH IDLE RUNNING GEARS. FIG. 74—BEVEL DRIVE WITH IDLE RUNNING GEARS. FIG. 75—BEVEL DRIVE WITH NO IDLE RUNNING GEARS

to the spindle, either by means of one pair of gears, 40 in. and 5 in. respectively, or else by means of two gears each one 11 in., and some compound gearing between. The ratio between these two drives is 8 to 1, so that, if we have the lowest possible speed, namely 4½ revolutions, when the 5-in. pinion engages the 40-in. gear, we will have 36 revolutions when we use the other set of gears. This function of making a shift of 4½ to 36 r.p.m. is the function of gears *K*, *L*, *M* and *N*, so that, if we should use this new arrangement, we might omit these gears.

After we have found that our proposed arrangement will give us the proper speed, we next examine the direction, and we find that unless we put an idler in the compound gearing the spindle would run in opposite directions when we use one or the other set of gears. This use of an idler is not a desirable thing. For this reason we make another attempt such as is shown in Fig. 72, where the proper direction is restored by making one pinion act on an external gear whereas the other meshes with an internal gear.

It was the writer's intention to bring out the fact that in an attempt to design a set of gears we should look successively at: (1) The load; (2) the speed; (3) the direction. And we should not try to solve more than one problem at a time.

The designer should at all times keep before him the following requirements:

(1) Every gear must have sufficient strength to carry the greatest load that may come on it under any condition of running the machine. Though a certain combination of gears may not be intended for use in the actual running of the machine, so long as the operator is able to effect such a combination, the gear must be of sufficient strength to carry the corresponding load.

(2) No gear must run at a higher circumferential speed than what is proper for the material and workmanship of the gear. There is a wide possible range of running speeds. Whereas cast gears (which are no longer used in the construction of machine tools) should not run at more than 500 ft. when used in a machine shop, herringbone gears, carefully cut, running in oil in a closed frame, may run 2,000 ft. or more, and rawhide gears, fabroil, or bakelite micarta gears may run as high as 2,700 or 2,800 feet.

(3) All idle running gears should be avoided. When speaking of idle running gears we do not mean the gears of a set of sliding gears which are not engaged, nor those of a cone of gears which do not mesh with the tumbler, but gears which are actually meshed with some other gear, though not transmitting power. Fig. 73 shows an arrangement in which such idle gears are used.

The illustration shows *A* as the driving shaft. The same arrangement is sometimes used with *B* as driver, which makes the faulty condition even worse. If the clutch should be connected to gear *P*, then shaft *A* would be running at a higher speed than shaft *B* and gear *S* at a still higher speed. If a construction such as shown in Fig. 73 must be used, then the shaft containing the clutch should be made the driven shaft. Constructions of this kind are particularly objectionable on account of the difficulties of lubrication. This matter will be discussed more in detail later on.

It is sometimes very difficult to avoid idle running gears. The bevel gear reverse shown in Fig. 74 is such a handy device that it is often advisable to forget the fact that at least one of the gears in the combination must run idle.

It is possible to avoid the idle running gears in such a bevel gear drive by the construction shown in Fig. 75, where the two pinions are mounted on a sliding sleeve, allowing one pinion at a time to be brought into mesh. This construction, quite common in the aprons of smaller lathes, is not well adapted for the transmission of considerable power and has other objectionable features, besides.

Prospective Machinery Markets in China—Discussion

By W. H. Rastall
Chief, Industrial Machinery Division,
Bureau of Foreign and Domestic Commerce

My attention has been called to an article entitled "Prospective Machinery Markets in China," on page 888, Vol. 56, of *American Machinist*, and I will be glad if you will again direct the attention of your readers to this subject.

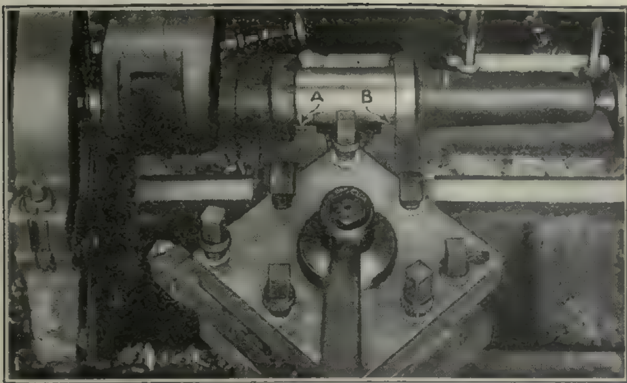
On the subject of exchange it is intimated that because the silver dollar of China is worth half the gold dollar this has a deterrent influence on the purchase of American goods. I feel that it is scarcely accurate to state the case in this way because the silver dollar of China was worth approximately 50c throughout the pre-war period and the present rates may be taken as practically normal. Consequently the position of the Chinese dollar can scarcely be considered a deterrent influence but represents the normal value and should be the basis for healthy trade.

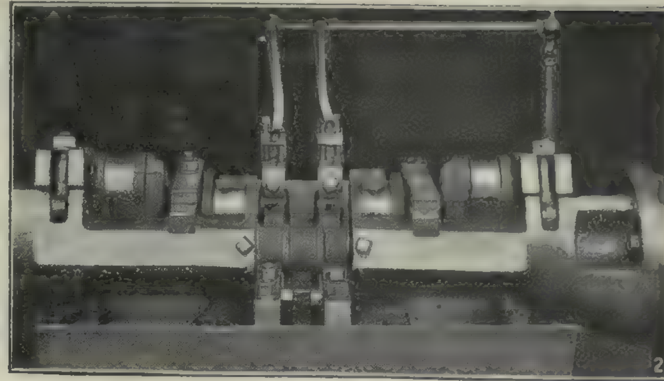
Two years ago we had what was practically a "seller's market" and conditions were most abnormal, and it would be unfortunate if American manufacturers estimated the value of the China market on this basis, for the truth is that the American participation in the machinery trade of China has been constantly improving since 1914, having advanced from about 9 per cent to 54 per cent during that interval, and as expressed in money the increase is even more rapid, having risen from 681,170 haekwan taels in 1914 to 12,181,382 haekwan taels in 1920, as was shown on page 144 of the same volume.

I feel that the American manufacturer of machinery has now a pre-eminent position in the China market. American engineering is vastly superior to that from abroad and this superiority has a definite recognition. If our manufacturers will but arrange for constructive sales programs in support of their products, they may be expected not only to maintain but to improve their already leading position in the China trade.

Public and Private Employment Agencies

Private employment agencies in Pennsylvania are required to take out a license so as to place them under state supervision. There were 278 such licenses issued in 1921. Each agency makes a weekly report of its activities as well as the kind of placements made, the total placements being 85,375 as against 92,561 by the ten state employment bureaus. Such a comparison indicates that the state activities are slowly but surely working their way to the front in matters of this kind. The report of the Bureau of Employment of Pennsylvania for 1921 is full of interesting figures of this sort. It shows the present day trend of governmental supervision of public welfare organizations.



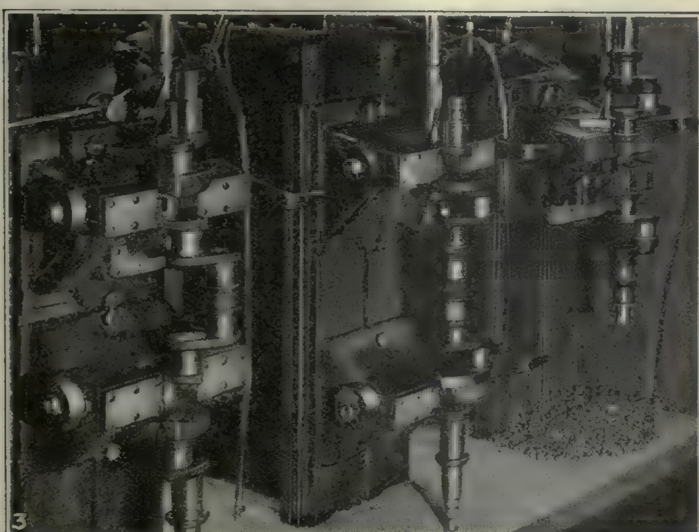


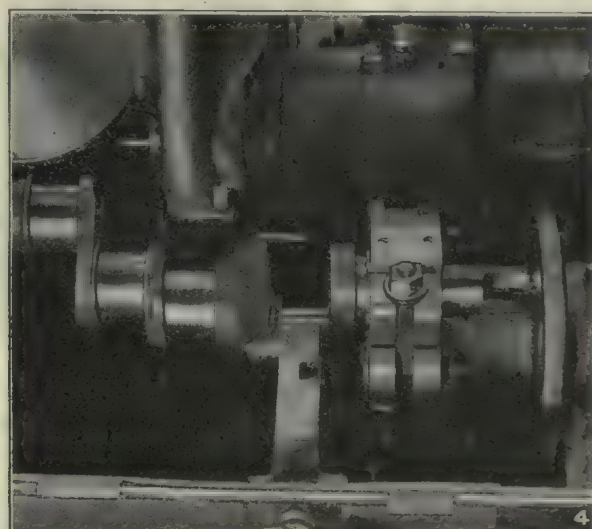
Crankshaft and Camshaft Work

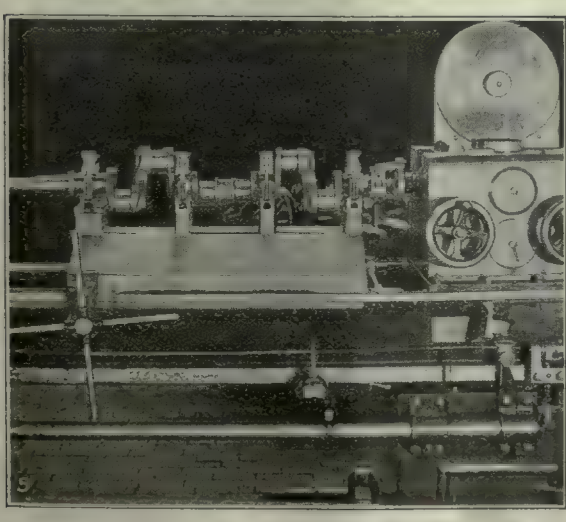
BY FRED H. COLVIN
Editor, *American Machinist*

THE crankshaft described is for a six-cylinder motor and has four bearings of rather large diameter, the crankpins being 2.5 in. Snagging, rough-straightening and spot-grinding bearings Nos. 2 and 3, as well as the rear bearing, are among the first operations. Turning the end bearing is shown in Fig. 1, a square turret-toolpost being used to good advantage. The tool at the left turns the bearings, but for squaring down the shoulders the toolpost is swung corner-wise and the two tools *A* and *B* are fed straight into the work. Turning the toolpost in this position allows the crankpin at the left to swing clear and at the same time prevents overhang of the cutting tools.

The crankpins are turned in double-headed lathes,







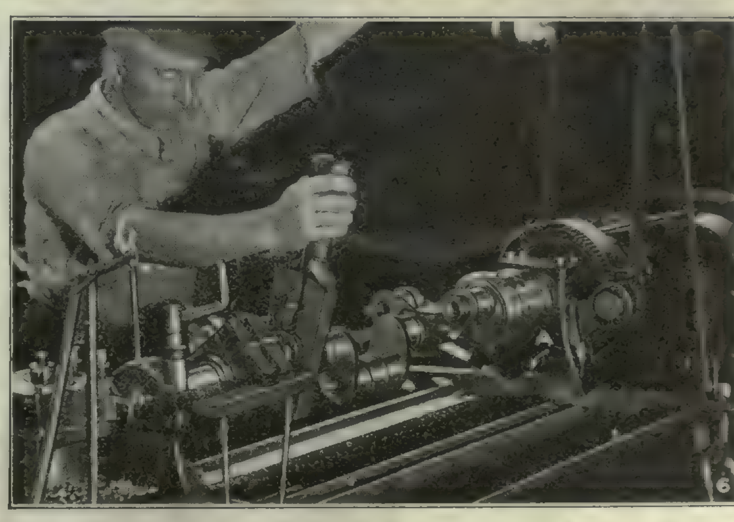


FIG. 1—TURNING AN END BEARING. FIG. 2—TURNING THE CENTER PINS. FIG. 3—DRILLING THE CRANKPINS
FIG. 4—GRINDING THE CRANKSHAFT. FIG. 5—TESTING THE RUNNING BALANCE
FIG. 6—POLISHING THE CRANKPINS

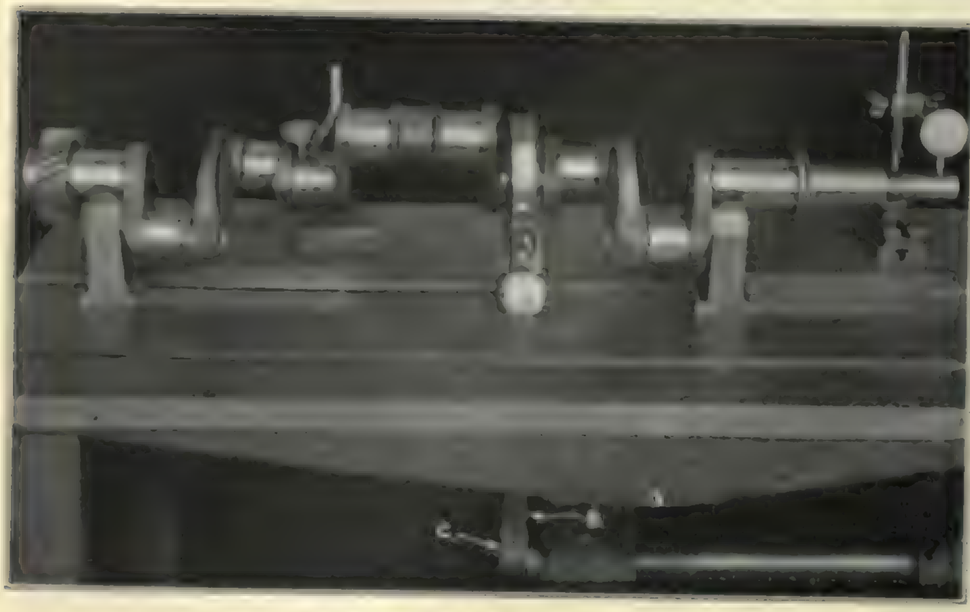


FIG. 7. TESTING FOR DEFLECTION

machine shown in Fig. 5. All bearings are then polished in a lathe as in Fig. 6, the regular type of polishing clamp being used. The main bearings are polished by resting the ends of the clamp against the front of the lathe bed, but with the pins the operator follows them around with the handles of the clamp in his hand. Another polishing clamp is shown at A.

After the timing gear has been pinned in place, the shaft is inspected and straightened on the table shown in Fig. 7. The shaft is supported at the two end bearings and the amount of deflection tested at each of the center bearings. The extreme end of the shaft is also tested to show any eccentricity or "run-out," this being held within very close limits. The supports can, however, be easily moved and the hook A, through the rod B and the cam C, exerts any desired pressure.

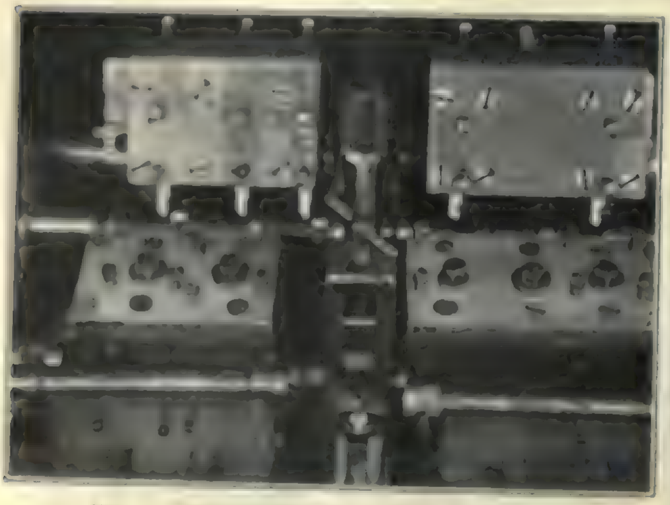


FIG. 2. ROUGH-TURNING THE CAMSHAFT

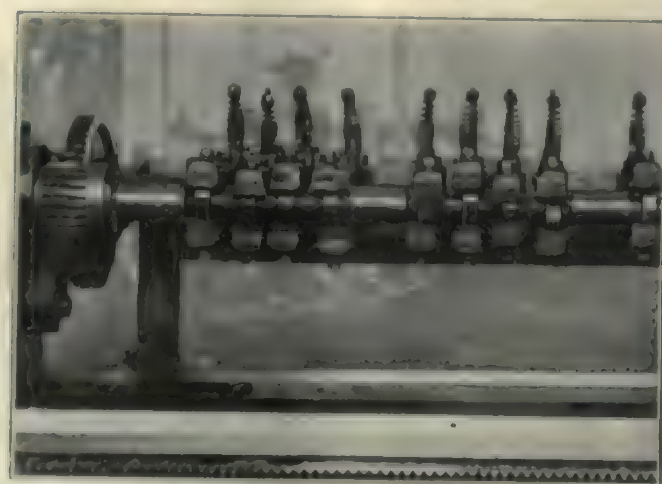


FIG. 9. POLISHING THE CAMS

one of these being shown in Fig. 2, roughing the two center crankpins. It shows how the crankshaft is clamped in the supporting chucks and the type of cutting tools used. The turning tools are in front and the squaring tools are above the pins.

The fixtures for drilling the various crankpins can be seen in Fig. 3. They are of similar design but the jaws are so spaced as to grip the pins being drilled. Each fixture drills the two pins lying in the same line. Self-centering jaws are used, each pair being operated by an independent handle. The jaws allow the work to be easily handled either in or out.

The grinding is done in the usual manner, the driving and clamping fixture being shown in Fig. 4. Each shaft is carefully balanced on the Carwen

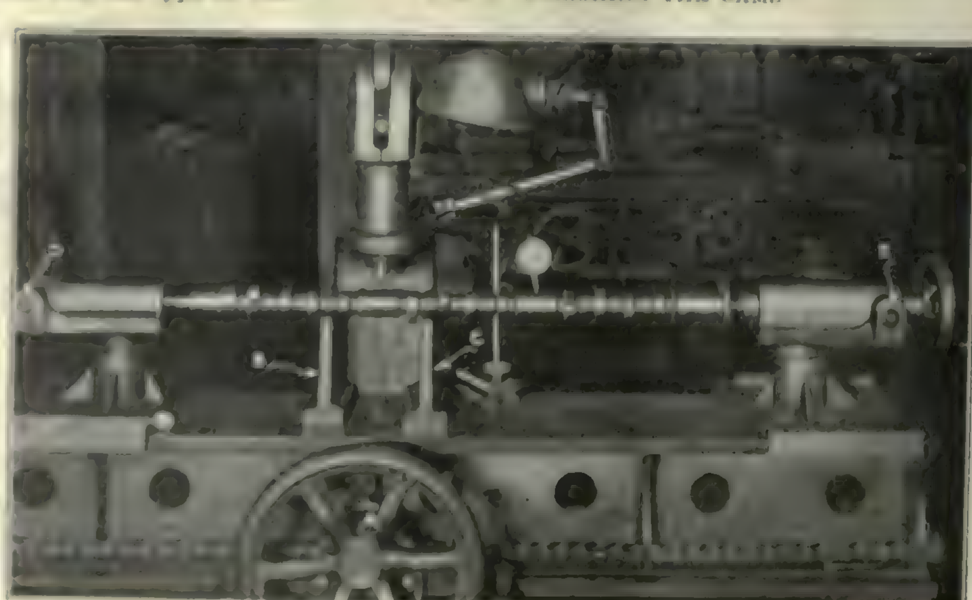


FIG. 10. MACHINE FOR STRAIGHTENING CAMSHAFTS

The camshaft is handled in much the usual manner, cutting to length, careful centering and rough-straightening being the preliminary operations. The flange is next turned and then comes spacing of the cams, and the turning between cams as in Fig. 8, a Fay automatic lathe being used. Near the end of the camshaft is a cam for driving the oil pump. The cams are polished in the device shown in Fig. 9, an old lathe bed being used for the purpose. The polishing jaws or clamps carry felt pads and are held together by spring tension. They are free to move up and down as the camshaft revolves and quickly polish the cams.

Copper plating is used to prevent carbonizing between the cams and bearings. The grinding of the cam is divided into three operations, the last being after the hardening and straightening. In fact there are several straightenings to take care of all spring which may have developed in or between the different operations. The final straightening is shown in Fig. 10, which gives a good idea of the machine used for this purpose. The two centers can be moved at will by means of the handwheel *A*, so as to bring any desired portion under the ram of the straightening press. These centers swing up from the pivots *D* and *E* for quick handling of the work. The supports *B* and *C* are easily moved so as to give a long or short bend. The whole arrangement is very compact as well as convenient, not forgetting the location of the lamp for throwing the light exactly where it is wanted.

Perfecting a Drop Forging

By J. H. G. Williams
Assistant Works Manager, Billings & Spencer Co.

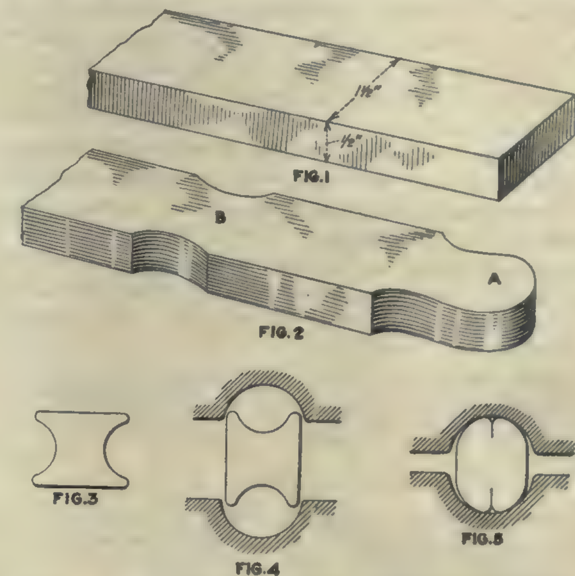
Purchasers of drop forgings often are of the opinion that once the dies are made, it is a simple matter to produce sound forgings, and the manufacturer often is of the opinion, privately of course, that the purchaser is unreasonable, because he cannot understand how difficult it is to produce sound forgings.

This disturbing situation is due to a lack of knowledge of the principles underlying the flow of metal in the plastic condition. Scientific research on the subject has not been linked up with the practical applications. The individual diemakers have accumulated through experience an empirical knowledge. Every set of drop-forge dies is largely the expression of an individual opinion as to the flow of plastic metal. Feeling that it is advantageous sometimes to study the reverse side, the accompanying sketches are exhibited to illustrate how metal did not flow in the manner originally planned.

The forging under discussion is the head of a mechanic's square. The piece is forged double for at least two reasons: The rate of production is increased, and there is less weight of metal involved in the manufacture of two forgings than would be if the two forgings were made singly. The flash or excess metal in the center is punched out, which leaves two forgings supposedly ready to machine for use.

At this stage of manufacture, the forgings were inspected and during the production of the first few dozen certain defects called "laps" and "cold shuts" were discovered, the causes and elimination of which constitute the basis of this paper. Low carbon steel $1\frac{1}{2} \times \frac{1}{2}$ in. was used as raw material. As originally made, the first operation consisted of redistributing the metal from the uniform section shown in Fig. 1, to that shown in Fig. 2. It will be observed in Fig. 2 that there is a mass or bunch of metal at *A* and *B* corresponding approximately to the positions that the bosses will occupy.

There are very substantial reasons for this preliminary distribution of metal. First, the productive life of the die blocks is prolonged by removing from the impressions the burden of this mass movement of metal. Second, by distributing the metal in masses, to the approximate position required by the impressions in the dies, the formation of a true, sound forging is promoted. The next forging step is an extension of the preceding operation. The original uniform section of the bar has now become a non-uniform section in which the metal has been distributed as masses into



FIGS. 1 TO 5. STEPS IN THE FORGING PROCESS

positions from which the forging impression can work or mold these masses into the desired finished shape.

The section of the partially formed forging as it comes from the first or "edger" operation is something like Fig. 3. When placed under the dies for the second or "rough blank" operation, it is given a quarter turn so that the cup shape faces the impression, Fig. 4. The action of the dies upon the lips if the cup-like section is to lap them over somewhat, as shown in Fig. 5. These laps were eliminated by omitting the use of the edgers. It was found after making the first dozen forgings, that the bar stock could be placed between the "breakdown" impressions, without the necessity for any previous preparation of stock, and without the formation of any laps.

Several methods are used for removing the conditions which promote the formation of various defects and all are based upon the principle of providing a central space into which the excess metal may flow. For instance, the center can be punched out, or the thickness of the central web may be forged undersize, previous to finish forging, or the bosses in the finished impression may be hollowed out.

The first forging produced after a hammer set up is carefully examined for forging defects, and adjustments or alterations are made to overcome the objectionable features. By carefully checking up each forging during this period of adjustment, the dies are finally brought into such condition that a continuous run of perfect forgings may be produced.

Abstract of paper read before American Society for Steel Treating.

Grinding Wheel Breakage and Its Causes

Continuing the Discussion of Causes—Details of a Correctly Mounted Wheel—Necessity for Balance—Why Wheels Are Weakened by Balancing Weights

By HAROLD E. JENKS

MANY breakages are directly due to pressure on the side of the wheel. They occur to a limited extent when work is being traversed across the face of the wheel but more especially when grinding is actually done on its side. Also, particularly in snagging operations, large side pressure may be produced by grinding on, or working, the corners of the wheel face.

The effect of side pressure is to produce a bending stress which reaches all points of the wheel as it revolves, and which is tensile on the side of the wheel on which the pressure is applied and compressive on the other. It is impossible to do more than roughly approximate the amount of this stress in any given case, due to the incomplete knowledge of the theory of flat plates, of which this is an example.

The typical break due to side pressure, as indicated in Fig. 4, is a curved crack extending from the wheel face to a point just inside the flange and out again

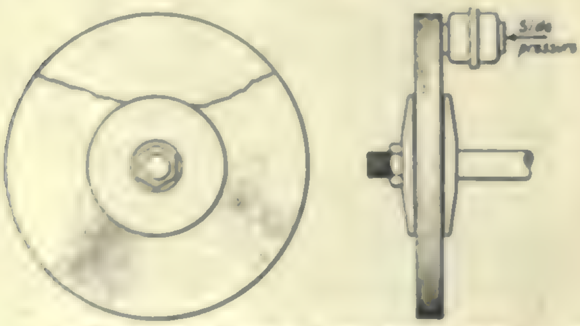


FIG. 4—BREAK DUE TO SIDE PRESSURE

to the face at a point from 150 to 170 deg. from where it entered. It is approximately a hyperbola with its vertex at the point just under the flange.

The best protection against breakage due to side pressure is obtained by flanges of proper design used on wheels of sufficient thickness. Flanges not only greatly reduce the maximum stress due to this pressure, but also prevent a large stress at the circumference of the hole, where it would otherwise combine with the ever present maximum stress due to centrifugal force. The proper design of flanges will be discussed below.

How a Wheel Should Be Mounted

Improper mounting. In order to understand what is meant by improper mounting it is obviously necessary to know the essentials of correct mounting. The subject is of such importance to all grinding wheel users that the following brief statements of these essentials are given. *Fig. 5* shows the details of a wheel correctly mounted.

Care should be taken that the sides of the wheel and the sides of the flanges in contact with the wheel are plane surfaces, in order that an even bearing may be secured. This, of course, does not apply to tapered wheels, in which case the flanges should have the same taper as the sides of the wheel.

The bushing should be of a diameter from 0.002 to 0.005 in. larger than the spindle or arbor on which the wheel is to be mounted, and must have its axis at right-angles to the sides of the wheel, concentric with the circumference. No portion of the bushing should project beyond the sides of the wheel.

The wheel spindle should be perfectly straight and threaded in a direction such that any tendency for the wheel and nut to turn will tighten the nut.

Flanges are used primarily to transmit power from the shaft to the wheel, and for this reason the inside flange must be keyed to the shaft. Both flanges must have plane faces at right-angles to the shaft, except for tapered wheels, where the flange faces are conical, with the axis of the cone coinciding with the axis of the shaft. Flanges should be properly relieved; that is, should be countersunk so as to bear on the wheel only on the part of the flanges nearest the rim. Both flanges should be of the same diameter, which should be at least one-third the diameter of the wheel and preferably one-half.

Blotters or some other form of compressible washers should be used between flange and wheel to insure an even bearing. Their diameter should be at least as large as that of the flanges.

The spindle nut should be tightened only enough to properly hold the wheel. Further tightening is unnecessary and undesirable.

These are the essentials of correct mounting. Failure to observe any of them may cause excessive stress in the wheel. Side pressure producing large tensile stresses may result from any defect in mounting that gives an uneven bearing between flanges and wheel.

Forcing a wheel on a spindle for which it is too small is extremely likely to cause breakage, as large tensile stresses are induced around the circumference of the hole. This case is practically the same as that of heating the wheel spindle, and the same character of stresses results. If the hole is too small it should be carefully enlarged by scraping until a perfect fit is obtained.

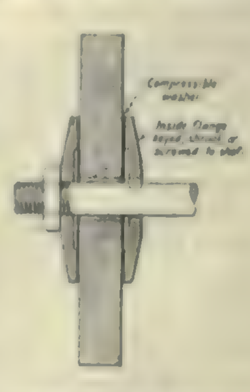


FIG. 5—CORRECT MOUNTING FOR GRINDING WHEEL

Impact on the side or face of the wheel. Probably most breakages due to impact are the result of carelessness or ignorance on the part of the grinding wheel operator. It should be borne in mind that very much larger stresses are produced by a force suddenly applied than by a force of the same intensity applied gradually.

The impact of the particles of the wheel against the work in any form of grinding produces certain stresses in the wheel, but these are carried more by the particles in direct contact with the work than by the wheel as a whole, and are not important as a cause of breakage. In some cases, however, ignorant operators, in order to

increase the speed of cutting, have hacked the face of the wheel in such a manner as to cause breakage due to the excessive impact thus obtained.

Breakages are sometimes caused by bringing heavy pieces of work into too sudden contact with either the face or side of the wheel. Carelessness in snagging a casting suspended from a chain hoist, for example, might easily result in breakage of this kind.

In work where a table traverse is used, the headstock or footstock may be accidentally run into the wheel, which will cause wheel breakage unless something else gives way first. This is not true impact, but approaches it on account of the sudden application of the force. Large stresses due to side pressure are produced.

Catching of the work between the wheel and the rest, in freehand operations is very likely to cause breakage. Such an accident may be the result of improper adjustment of the rest or of carelessness in handling the work, and may have very serious consequences. This is a true case of impact, as the speed of application of the force is practically that of the periphery of the wheel.

Cracks or flaws in the interior of the wheel. Wheel breakage sometimes occurs because of cracks or flaws which are in the wheel before it is put in operation. Such defects may lie under the surface of the wheel and be entirely invisible. Flaws are manufacturing defects, while cracks may also be due to faulty manufacture or to various other causes such as carelessness in handling, packing, transporting or mounting.

Testing for Flaws and Cracks

Most grinding wheel manufacturers use extreme care in testing wheels for flaws and cracks so that a wheel having such defects seldom passes inspection and is shipped outside the factory.

Wheels are tested by running them at about double the recommended operating speed, as previously mentioned. This is a severe test, and should eliminate all wheels having inherent defects of a serious nature. The "ring" of a wheel, or sound produced by its vibration when tapped lightly with some solid object, is also used as an indication of interior cracks or flaws. A wheel with a clear ring is fairly certain to be free from such imperfections, although it has been shown that a poor or dead ring does not necessarily mean a defective wheel. However, the most reliable manufacturers reject all wheels that have a poor ring. It is also worthy of note in this connection that ringing a wheel just prior to mounting it will usually detect cracks that may have been caused by rough handling subsequent to the time the wheel left the factory.

Although as indicated above, manufacturers use every precaution to prevent it, occasionally a defective wheel will survive the tests, and may break in operation because of its imperfections. Sometimes this cause of breakage will be indicated by the character of the fracture, which may show the location and nature of the defect. If the fracture shows a homogeneous mixture of grain and bond with no indication of defects, and if the wheel has been in operation more than a few minutes, it is generally safe to assume that breakage was not due to inherent cracks or flaws.

Variation in density of wheel material. If a wheel is poorly manufactured, especially when the mixture of which it is composed is not properly stirred prior to baking, it may vary in density at different parts. When the wheel revolves, the heavy portions will exert a centrifugal pull upon the remainder of the wheel, and complicated stresses will be introduced therein. It is possible that in some cases these stresses may be sufficient to cause breakage without combination with other stresses in the wheel. However, this is probably of rather rare occurrence, especially in wheels made by leading manufacturers, who use such care to obtain a proper mixture that great variation in density becomes improbable.

Slight variations in density do however occur, as proved by the fact that nearly all concerns balance some wheels by the insertion of a plug of metal near the bushing. We are led to the conclusion then, that many wheels in operation are stressed in greater or less degree due to these variations. Stresses of this type may of course combine with other stresses existing in the wheel and help to produce breakage.

Dangerous Stresses from Lack of Balance

Lack of balance. By balance, as used here, is meant static balance. A wheel is out of balance when, if supported loosely on a horizontal axis through the hole, it has in some positions a tendency to turn about that axis.

A wheel that is out of balance has developed in it stresses of complex character which are due to the centrifugal force of its out of balance portions. These stresses are the same as those just mentioned in connection with variation in density, as such variation may, and in fact usually does cause lack of balance. In cases where the lack of balance is large, breakage may result, either from these stresses or from impact, as will appear below.

If a wheel for any reason goes out of true it will also go out of balance, since its center of rotation will no longer be at its center of gravity. Wheels may go out of true from such causes as a bent spindle, loose bearings, loose frame, improper use, variation in hardness of the wheel material causing excessive wear at some points, or from the hacking of the wheel face previously mentioned. If a wheel is seriously out of true it will deliver a series of blows to work thrust against it thus producing large impact stresses. The stresses due to the centrifugal force of the out of balance portions of the wheel may also become large in this case, and will increase the usual maximum due to the centrifugal force.

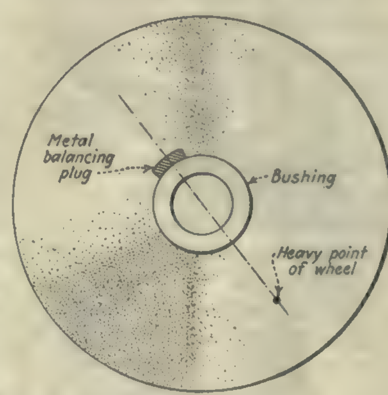


FIG. 6—METHOD OF BALANCING WHEEL

A wheel should not be allowed to stand partially submerged in water or other liquid, as when it is started in motion the wet portion is heavier than the remainder and hence the wheel is greatly out of balance. Several cases of breakage from this cause are known.

Lack of balance due to variation in density of the wheel material, provided it does not exceed a certain specified limit for the wheel in question, is usually corrected at the factory by the insertion of a metal plug in the side of the wheel near the bushing, as shown in

Fig. 6. This plug is placed opposite the heavy point of the wheel, which is the center of gravity of all heavy spots that may exist therein, and is of a weight sufficient to counteract the unbalanced centrifugal force.

Although this plug does balance the wheel, so that the lack of balance will not produce vibration in the machine and chatter marks on the work, this method of balancing does not by any means remove the stresses due to the centrifugal force of the out of balance portion, as this force remains, whether balanced or not.

A serious objection to the plug is that the wheel is weakened by drilling a hole to receive it. As stated above, this hole is drilled near the bushing, where the tangential stress due to centrifugal force is a maximum, so that the wheel is weakened at the point where breakage is already most liable to start.

It is also a fact that this method of balancing may not produce balance for more than a short part of the life of the wheel. For, since the original lack of balance may have been due to several heavy spots, it is evident that if one of these spots is worn off the amount of out of balance and the center of gravity of the heavy portion of the wheel will in general change, so that the balancing weight no longer balances. In the particular case where the entire heavy portion of the wheel is worn away this weight becomes an unbalancing weight, since the wheel would be balanced, or nearly so, without it.

Enough has been said to show that if a wheel contains a balancing weight, we should regard it as a somewhat faulty one, more liable to break than one which needed no balancing, and probably more liable to go out of balance. This does not mean that a large percentage of balanced wheels break, for these wheels are required to pass the same tests in the factory as do all other wheels sent out. Reliable manufacturers at present reject all wheels in which the lack of balance exceeds a certain specified limit.

Locating Initial Stresses

Initial stresses in the wheel. During the process of manufacture of a solid body, initial stresses are sometimes set up in the material of which the body is composed. This is in general due to the fact that the exterior of a heated body cools more rapidly than the interior. The higher the rate of cooling, the greater these stresses are likely to become. Unless great care is used in its manufacture a grinding wheel may have initial stresses existing in it. These may be regarded as incipient flaws or cracks, and may combine with other stresses to increase the maximum stress.

No method has yet been devised for determining the existence of initial stresses in wheels. Manufacturers guard against the occurrence of large stresses of this type by allowing a period of a week or more for the wheels to cool after baking before their removal from the kilns. The speed test referred to above should also tend to eliminate wheels containing extraordinary initial stresses. Hence it is probable that wheels breaking in operation contain only relatively small stresses of this kind, which may be regarded only as a contributing cause of breakage in combination with other and larger stresses.

From the foregoing analysis it is evident that the breakage of a grinding wheel in operation is in general the effect of several combined causes, of which the stress due to centrifugal force is usually one. The part of the wheel around the circumference of the hole may be regarded as its weakest point, since it is there this stress attains its maximum, hence all additional factors tending to produce more stresses near the hole are particularly important.

Manufacturers find that with the majority of broken wheels returned to them for an opinion regarding the cause of breakage, so little information is given that they are unable to arrive at any conclusion whatever. For instance, a customer may return a small fragment of what was a large wheel, with the information that the wheel broke while being used for snagging iron castings. Needless to say, in such cases the cause of breakage remains unknown.

Record of Breaks and Causes

In case there is no question as to why the wheel broke, as when it is run into by the headstock of the machine, no further information is necessary. When there is any doubt as to the cause, however, as much of the following data as can be obtained should be recorded and kept for future reference:

(1) Make, number, original diameter, thickness, diameter of hole, grain and grade of wheel, and diameter at time of breakage.

(2) Name and number of machine on which breakage occurred and condition of same, particularly the spindle and bearings.

(3) Operation for which wheel was used, including the kind of material being ground.

(4) Speed at which wheel was running. (This should be verified after the breakage.)

(5) Wet or dry grinding. If dry, note whether or not the wheel was hot at time of breakage. If hot, give approximate temperature of face of wheel as determined by the touch.

(6) Length of time wheel had been running since last starting up.

(7) Size and condition of flanges.

(8) Description of compressible washers used; if blotters, state size.

(9) Method used for tightening spindle nut.

(10) If wheel was used with automatic feed and traverse, give depth of cut and speed of traverse. In case the work is revolving, give its revolutions per minute.

(11) Describe any marks on sides or face of wheel indicating excessive impact or side pressure.

(12) Give results of examination of fracture, including any defects that could be noted in the wheel material.

(13) State whether or not wheel contained balancing weights. If one was present, give approximate size. Note whether or not the wheel fracture passed through the hole drilled for the weight.

(14) Give operator's opinion of the cause of breakage if he has one, also whether he has noticed any lack of balance in wheel or has had any difficulty in keeping the wheel running true.

This data and a thorough knowledge of the causes of grinding wheel breakage constitute proper equipment for the investigation of any given case. Under some conditions the actual determination of the cause of breakage of a single wheel may be difficult or impossible. In cases, however, where breakages occur consistently with a particular operator or on a particular machine or operation, it is reasonable to suppose that there are one or more principal causes that can by a study of the situation be detected and removed.

The World Trade in Machinery

Exports by Germany, United Kingdom, United States and France—Information Based on Custom House Returns—Effect of Changes in Exchange

BY WILLIAM ALTHOFF

Assistant Chief, Industrial Machinery Division,
Bureau of Foreign and Domestic Commerce

THE present position of Germany as a competitor in the world's machinery markets has been considerably overrated by many writers.

The accompanying chart shows the machinery exports of Germany, the United Kingdom, the United States, and France for the four years preceding the war, as well as during the four years beginning with 1918. Table I shows the percentage furnished by each of these countries in relation to the total of the four combined.

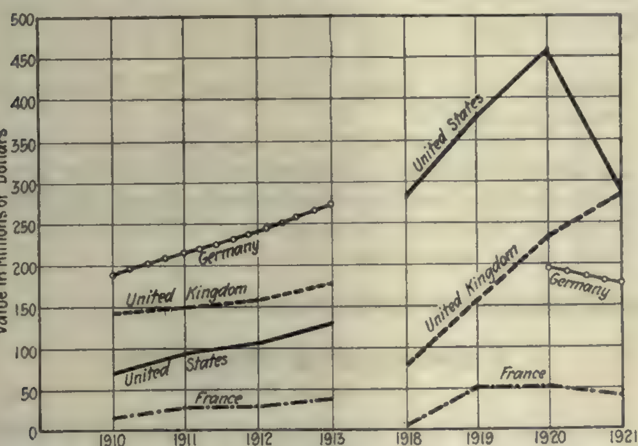


CHART OF MACHINERY EXPORTS OF GERMANY, UNITED KINGDOM, UNITED STATES AND FRANCE

There is also appended Table II, indicating the machinery exports of other important countries during 1920 and 1921, which will afford a basis of comparison with the returns given in Table I.

These figures are based on the custom house returns. It should be remembered that differences exist between the classifications adopted by the various countries and the figures are presented more with the idea of illustrating the general trend of trade than of indicating the precise amounts claimed by each country.

As can be seen from Table II, during the years 1910 to 1913 inclusive, Germany, the United Kingdom, the United States and France exported annually a total average of $530,000,000 worth of machinery. Throughout this period Germany held first place, but its proportion fell from 45.1 per cent of the total of these countries in 1920, to 43.6 per cent in 1913. The proportion of the United Kingdom also declined continually during these years, and in 1913 its share was only 28.8 per cent as against 33.1 per cent in 1910. The United States, on the contrary, secured a larger proportion each successive year, rising steadily from 17.1 per cent of the total in 1910 to 20.8 per cent in 1915.

In 1918 and 1919 the United States furnished the bulk of the machinery exports, the actual amounts being $282,000,000 and $378,000,000 respectively.

During 1920 Germany was again in the field, the total of the four countries ascending well on toward a billion dollars. Of this the United States supplied nearly one-half, 48.9 per cent, the United Kingdom 24.6 per cent, and Germany 20.8 per cent.

The United Kingdom alone showed an increase in the value of its exports for 1921, due largely to heavy shipments of textile machinery on orders that had long been unfilled. Machinery exports from the United States fell off considerably during 1921, this being due in a large measure to the reduction in unit prices and to the extraordinary exchange situation that prevailed.

It should be particularly noted, however, that our machinery exports last year exceeded in value those for 1918, and were more than twice as great as in 1913.

In other words, during 1921 we exported machinery to the extent of $290,000,000 or 36.2 per cent of the total of the four countries combined, as against $130,000,000 or 20.8 per cent of the 1913 total.

The outstanding feature of the figures presented herewith is that in 1920 and 1921, Germany (in spite of the advantages of favorable exchange rates, low wages, government subsidies, etc.) exported only about one-half the proportion it shipped during the pre-war period.

Fundamental conditions at present existing in Germany are such as to seriously impair its position as a competitor in the world machinery markets. To a large extent its low costs have been the result of direct and indirect government subsidies which the German government must necessarily abandon. Government control as applied to grain prices has already been abolished, bringing about a general movement for

TABLE I —MACHINERY EXPORTS OF GERMANY, UNITED KINGDOM, UNITED STATES AND FRANCE
(Values in U. S. Dollars)

	1910		1911		1912		1913	
	Dollars	Per Cent	Dollars	Per Cent	Dollars	Per Cent	Dollars	Per Cent
Germany	193,974,835	45.169	217,407,998	43.529	244,378,193	44.614	273,035,559	43.671
United Kingdom	142,449,170	33.171	150,670,139	30.167	161,363,480	29.459	180,121,988	28.810
United States	73,851,098	17.197	96,504,104	19.322	106,961,269	19.527	130,554,379	20.882
France	19,164,900	4.463	34,875,100	6.982	35,048,800	6.398	41,495,000	6.637
Total	429,440,003	100.000	499,457,341	100.000	547,751,742	100.000	625,206,926	100.000

	1918		1919		1920		1921	
	Dollars	Per Cent	Dollars	Per Cent	Dollars	Per Cent	Dollars	Per Cent
Germany	....	.....	....	.....	197,337,787	20.885	*179,667,830	22.449
United Kingdom	78,450,233	29.246	158,988,618	26.971	232,433,323	24.600	287,256,954	35.891
United States	282,986,853	67.225	378,425,958	64.198	462,933,704	48.995	290,414,115	36.285
France	10,851,618	2.577	52,050,170	8.830	52,138,732	5.518	43,011,022	5.378
Total	372,288,704	100.000	589,464,746	100.000	944,843,546	100.000	800,359,921	100.000

* Estimated on the basis of returns for May to December. Statistics for January to April, 1921, inclusive, have not been published as yet.

The following rates were used in converting the 1920 and 1921 foreign figures into dollars. These rates are the daily average for the year, as supplied by the Federal Reserve Board.

	1920	1921
Germany	1.1751	1.2045
United Kingdom	3.66427	3.849056
France	7.04	7.4554

higher wages. Freight rates and raw material prices are rising rapidly, and labor difficulties are becoming increasingly numerous. There is a shortage of both coal and coke. The forced internal loan contemplated by the German government will undoubtedly be demanded in the near future. The amount is about one billion gold marks, equivalent at present to approximately 70 billion paper marks. This loan will be a heavy burden on industry. The supplementary taxation that must necessarily follow will raise production costs still higher. Furthermore, Germany is becoming sold out and the continuation of production will involve increased purchasing of raw materials from outside sources at prices that will be almost beyond the German buyer, although in line with the general trend of prices in world markets.

These and other factors make it practically impossible to quote firm prices for long-term commitments. The tendency now is to quote prices subject to increases to cover any enhanced production costs that may occur before the goods are delivered. The cancellation of numerous orders placed in Germany by foreign customers is reported.

All of the above conditions have a further peculiar significance when it is remembered that during recent years German suppliers had already found it difficult to deliver machinery in accordance with prices and delivery dates contracted.

TABLE II.—ANNUAL MACHINERY EXPORTS
(Values)

Country	1920 Value in Foreign Currency	1920 Average Rate of Exchange	1920 Value in U. S. Currency	1921 Value in Foreign Currency	1921 Average Rate of Exchange	1921 Value in U. S. Currency
Switzerland (Francs)	276,466,000	16.903	$46,731,046	228,850,000	17.3539	$39,714,400
Sweden (Krona)	156,857,407	20.494	32,146,557	94,055,897	22.5397	21,199,917
Australia (£ sterling)	5,179,252	3.66427	18,978,178	9,497,604	3.849056	36,556,810
Belgium (Francs)	239,041,298	7.38	17,641,248	249,104,342	7.4461	18,548,558
Italy (Lire)	322,929,575	4.97	16,049,600	*	....	....
Canada (Dollars)	9,504,857	.....	9,504,857	4,061,174	....	4,061,174
Japan (Yen)	16,710,135	50.368	8,416,560	12,883,101	48.2485	6,215,903
Netherlands (Guilder)	20,223,677	34.419	6,960,787	*	....	....
Denmark (Krone)	39,932,000	15.775	6,299,273	*	....	....
Norway (Krone)	9,726,900	16.53	1,607,857	*	....	....
Total			$164,335,765			

* Statistics for 1921, for Netherlands, Italy, Norway and Denmark are not available.
Rates of exchange are the daily average for the year, as furnished by the Federal Reserve Board.

A Large Magnetic Chuck

Scarcely a quarter of a century ago O. S. Walker, of Worcester, Mass., started in a small way to manufacture a new and untried device for holding work for grinding, in which the holding power was the attraction of an electromagnet.

At first believed to have but a limited field of application in the toolroom, the early chucks were little more than 4 x 6 in. in size and were considered practical only for the purpose of holding small pieces of hardened steel while grinding off the little material necessary to take out the warp and twist caused by the hardening, and make them flat and parallel.

As an evidence of the growth both in size and application of the magnetic chuck the accompanying picture is shown of a chuck that was shipped recently from the Walker factory to a firm engaged in the manufacture of knives for wood planers, blades for paper and metal cutting shears, and other heavy parts.

The chuck is of the standard single-magnet construction, practically identical in principal with the chuck of 25 years ago, but instead of the pigmy device that could easily be carried in one hand this one is 9 in. wide by 130 in. long, has ten independent magnetic coils, and weighs approximately 1,800 lb. It is supported at the ends upon trunnions 5 in. in diameter and may be swiveled to any desired angle.

Understanding Shop Terms

By Amos Ferber

On page 916, Vol. 56, of *American Machinist*, Robert Grimshaw contributes some entertaining, if not particularly instructive, misinformation in reference to shop terms.

New England did not invent the "shim," though it might have been the first to apply that name. A shim has been, since the days of Noah, a thin piece of packing material for providing adjustment between two otherwise non-adjustable parts. It is never (intentionally) a wedge. I make no claim to knowledge of foreign nomenclature, but I will venture to assert that in the United States a "shim" is known by its name and its purpose is thoroughly understood wherever an automobile exists.

A "dutchman" is a patch of any kind, shape or form, an unpremeditated addition to some part to correct or compensate for somebody's error or oversight in designing or machining that part. It is an abortion, and should never be tolerated except temporarily in case of extreme emergency.

I have heard the term "dutchman" applied, even in New England, to what was obviously a dowel; but such application is the result of ignorance of the "language," even as is the calling of a shim a dutchman in the Philadelphia district—if such be the case.

AN 1,800-LB. MAGNETIC CHUCK

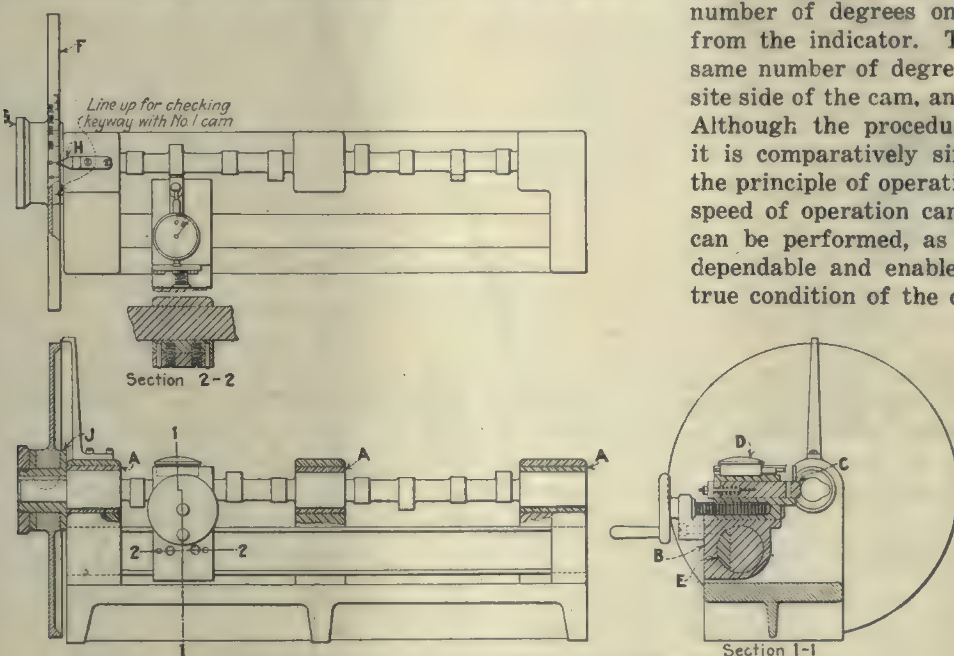
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Fixture for Inspecting Camshafts

By J. L. Strasburg
Assistant Master Mechanic, Saginaw Products Co., Saginaw, Mich.

Checking automotive camshafts is a job requiring accuracy and care. We built a fixture for use in our plant that greatly facilitates the work, and we believe it the finest thing we know of in its line. With this fixture it is possible to check the opening and closing time



FIXTURE FOR INDICATING CAMSHAFTS

of all cams, using any amount of lash desired, also the relation of the intake and exhaust cams, the concentricity of the base circle, the location of the key with No. 1 cam, the lift at any number of degrees and the total lift.

The fixture is shown in the accompanying illustration. It is made so that the shaft is held in three bearings in the same manner that it is mounted in the motor. Springing that might occur with the shaft on centers is thus prevented. These bearings are made of steel, hardened and ground. The sliding block *B* carries the plunger *C* and the Ames indicator *D*. This block can slide from one end of the fixture to the other and is held in position by the segment *E* and by dowel pins and springs, shown in Section *2-2*, that produce the right amount of friction.

The plunger *C* is hardened and ground on the nose, which has the same shape as the nose of the push rods in the motor. *D* is a standard Ames indicator graduated in thousandths of an inch. The 12-in. dial plate *F* is graduated in 360 deg., and made in two parts. By loosening the handnut *G* and moving the dial around until the zero comes in line with the pointer *H* and then tightening the nut, one can get a direct reading in degrees on the part being checked.

To check the position of the keyway with reference to the No. 1 cam, line up the mark on the dial and the line on dial hub *J* and bring the pointer to zero, which will bring the keyway and the No. 1 cam in line. Bring the plunger *C* to position on the base circle of the cam, set the indicator pointer on zero, turn the camshaft so that the plunger comes up on the lift of the cam an even number of degrees on the dial, and take the reading from the indicator. Turn the cam 180 deg.; turn the same number of degrees with the plunger on the opposite side of the cam, and compare the indicator readings. Although the procedure seems somewhat complicated, it is comparatively simple when one is familiar with the principle of operation of the machine. Considerable speed of operation can be obtained. Reliable checking can be performed, as the instrument is accurate and dependable and enables the operator to determine the true condition of the camshaft.

To check the valve opening time on the camshaft, bring the plunger *C* against the base circle of the cam, set the indicator at zero, and move back the sliding block *B* until the indicator pointer drops below zero an amount equal to the lash allowed in the design of the cam. Then turn the cam until the plunger comes up on the rise of the cam and the indicator pointer comes back to zero. After loosening the handnut *G* on the dial and moving the dial until zero and the pointer are in line, turn the cam over the lift until the indicator comes to zero, and read the valve opening in degrees on the dial.

To check the relation of the cams with the No. 1 cam, bring the plunger *C* in the same position as before and the indicator pointer on zero, and turn the cam until the indicator starts to rise on the lift of the cam. Move zero on the dial to the pointer and lock, move the sliding block to the next cam, bring the indicator to the same position as on the No. 1 and check the dial reading against the cam layout. Repeat for the other cams.

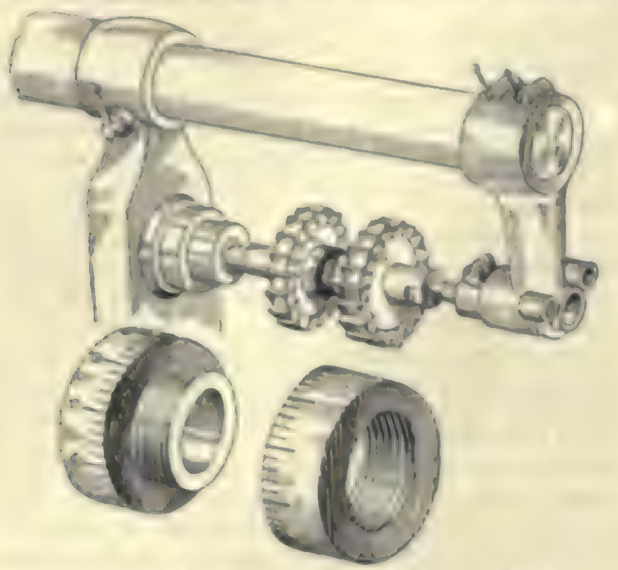
To check the closing and opening time of the exhaust and intake valves, bring the plunger *C* to position on the base circle and the indicator to zero. Turn the shaft until the exhaust cam has just reached the closed position, and set the dial to zero. Move the indicator to the intake cam and set to zero as before. Turn the cam until the indicator starts to move on the opening side of the cam and the dial reading will give the relation in degrees. Other points that can be checked are indicating the base circle, and checking the contour of the cam at any angle desired.

Adjustable Spacing Collar for Milling Machine Arbor

By O. G. Weiss

For some years I have used the adjustable spacing collar shown in the sketch for locating straddle or side milling cutters to exact position on the arbor of milling machines.

This collar is made up of a bushing, the shoulder of



ADJUSTABLE SPACING COLLAR FOR MILLING MACHINE ARBOR

which is externally threaded 20 to the inch, and a ring nut fitted to this thread. With the collar assembled and screwed up tight, the peripheries of both parts are graduated to 50 divisions, giving an increase of 0.001 in. per division in length of the collar as the ring is unscrewed.

Where solid spacing collars are used for setting up gangs of cutters the set-up must be completed and the positions of the cutters tested for error in spacing. If such error exists, the whole set-up must be dismounted in order to correct it by addition or removal of thin washers. With my device the error can be corrected by merely loosening the nut at the end of the arbor and adjusting the collar one or more divisions as may be required.

Device for Handling Lathe Chucks

By J. T. Towlson
London, England

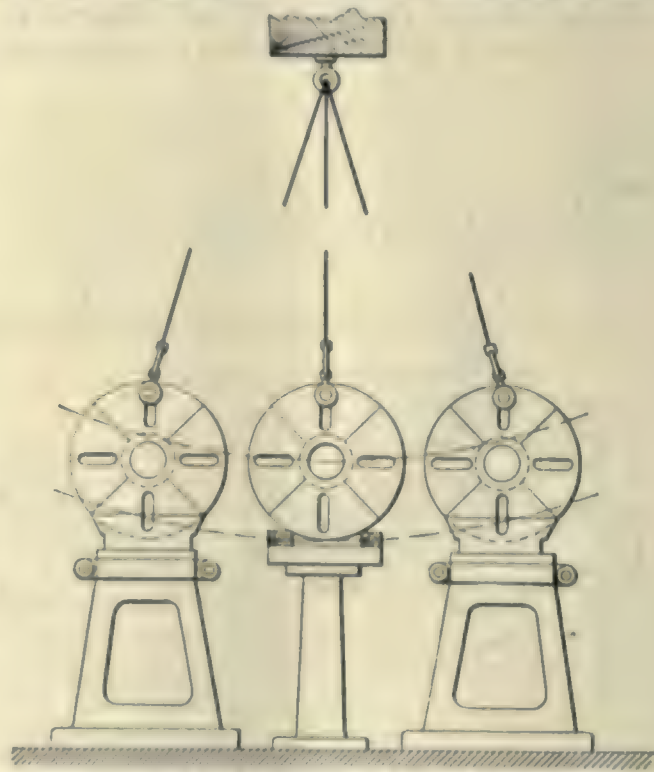
One good turn assuredly deserves another and so, as your contributors L. H. Gibbs and W. Burr Bennett have told us of useful devices for the handling of chucks on and off the lathe, it is to be hoped that a plan of my own may be of interest.

My machine shop has two rows of lathes with swings varying from 12 to 16 in., each lathe being provided with a steadyrest, a light chuck and a heavy chuck. When I say a "heavy" chuck I mean a *comparatively* heavy chuck, one weighing somewhere about 60 lb., and, anyway, too heavy for the latheman to handle conveniently with one hand while with the other he manipulates the belt to rotate the lathe spindle.

It is an old shop and has been added to again and again as new lathes and other machinery have been installed; therefore there is no remaining evidence of original design in the overhead "works." The beams are of wood and there is no room for cranes of any kind so, I have relieved the turners of the necessity of "wringing their backs" when shifting chucks, and saved them from "spelling" while waiting for a lift by making use of the following described device.

There are sixteen lathes arranged back to back in two rows, with a space of about 2 ft. between them. A plank, resting upon light columns, occupies a position midway between the two rows and, between each pair of lathes at a point about opposite the spindle nose of each pair, an eyebolt is screwed into the roof beam overhead. To each eyebolt is attached a light wire rope having a turnbuckle at the lower end.

When a turner desires to unship his chuck he attaches the turn buckle and sets it tight, then allows the lathe to run backward while holding the chuck with his hand



RIGGING FOR HANDLING LATHE CHUCKS

until it is unscrewed from the spindle, when he lets it swing by gravity to its normal position over the plank and loosens the turn buckle, leaving the tackle free to be used by the next man.

The whole device is very simple and is clearly shown by the illustration.

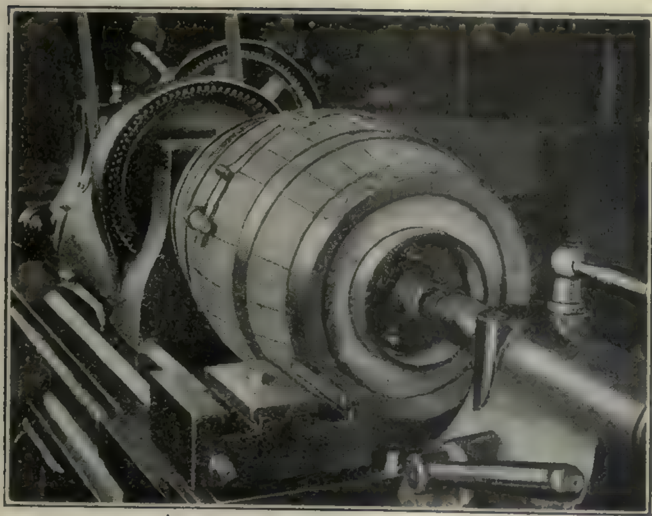
Handy Tumbling Barrel for the Small Shop

By Hiram Hicks

From time to time articles have appeared in *American Machinist* describing "home-made" tumbling barrels and other similar crude devices for polishing or burnishing work that required this treatment. Here is one that the writer saw a few days ago in a small tool and manufacturing shop.

A small keg, of the kind that has been made so popular by Mr. Volstead, was fitted with a hinged door, secured by a hasp and staple, and flanges bolted to the respective heads so that it could be placed upon centers.

When needed it is filled with work, a dog placed upon one of the hubs and mounted in any lathe that happens



HOME-MADE TUMBLING BARREL

to be idle or convenient. Any speed that could possibly be required by a tumbling barrel is immediately available through the cone belt and back gears, or the speed changing mechanism of the lathe.

If the lathe should be needed for its legitimate purpose it is but the work of a moment to dismount the barrel without disturbing its contents.

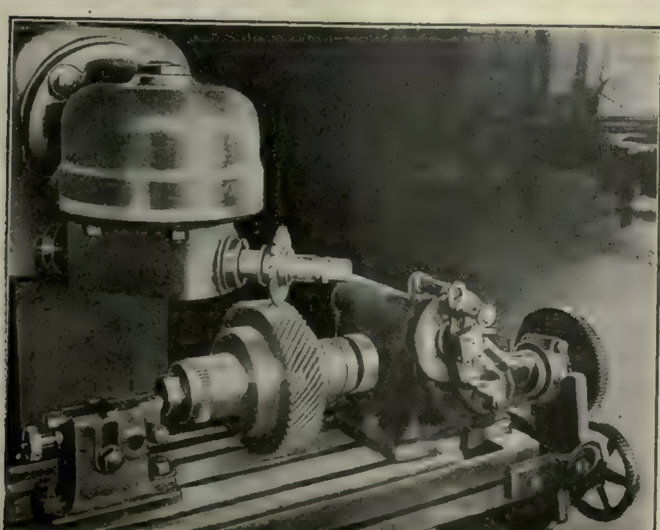
Practical Example of Helical Gear Cutting

BY MILTON WRIGHT

The illustration shows an example of spiral, or helical, gear cutting as practiced in the shops of the Persons-Arter Machine Co., Worcester, Mass. The gear is a part of the regular shop product, being the driven gear on the chuck spindle of the standard rotary surface grinding machine, and is cut without special equipment.

Two gears are cut at once. The part that appears in the picture as a single gear is actually two gears placed face to face on an arbor that is provided with means for drawing them together endwise.

The machine used is a standard Milwaukee milling machine with universal attachment and the characteristics of the gear are as follows: Material, cast iron; pitch, 0.314 in.; thickness of tooth at pitch line, 0.157 number of teeth, 58; pitch diameter, 8.203 in.; angle of helix, 45 deg. left-hand; circular pitch, 0.443 in.; normal pitch 0.314 in.; thickness of tooth at pitch line, 0.157 in.; depth of tooth, 0.216 in. The theoretical lead of the helix is one turn in 25.773 in., and the nearest actual lead that could be obtained without special gearing is one turn in 25.8 in., a difference of but 0.027 in. in a distance of approximately 25 in. The gears used are 100 on the screw, 72 and 24 on the compound stud and 86 on the indexing spindle. An idle gear is of course necessary to reverse the direction of the lead.



CUTTING A HELICAL GEAR

A No. 2, 10 pitch B & S spur gear cutter is used, somewhat larger than the standard cutter because of the increased diameter required to enable the work to clear.

Special Wrench for Making Adjustments to Valve Push Rods

BY G. A. LUERS

To make adjustments to valve push rods or tappets, three wrenches are usually required, one to hold the tappet, one to turn the adjustments and the third to handle the locknut. This invariably requires a second mechanic or helper, unless some special wrench is available which will hold on to the push rod without falling when released by the hand.

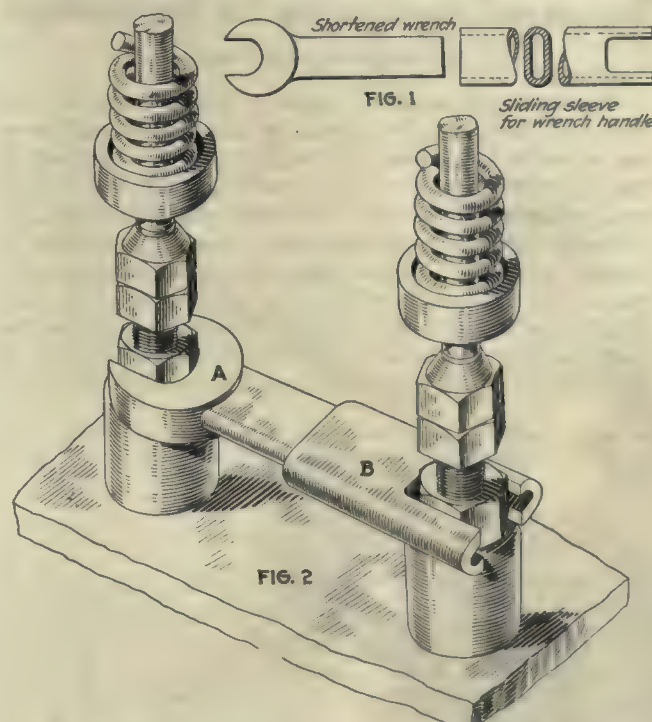


FIG. 1—DETAILS OF SPECIAL WRENCH. FIG. 2—THE WRENCH IN USE

For adjusting valves single handed, the tool shown in Fig. 1 can be made by any mechanic in spare time, from a wrench with an opening to suit the hexagon head on the push rod. Cut the length of this wrench (if too long) to swing between the valves and add a slip handle as is shown in the attached sketch. This slip handle is made from a flattened tube and is to be a snug push fit on the handle of the wrench. Cut away a portion of the end of the tube so that it will pass about the largest diameter of the nut or the distance equal to that across the corners.

To use this tool, place the wrench on the hexagon head of the push rod to be held as at *A*, Fig. 2, and swing it about until the open end of the slip handle can be pushed past the adjacent valve at *B*.

Step Bearings for a Light Jib Crane—Discussion

By S. Kelly

I have read with interest W. Burr Bennett's description of a step bearing for a light jib crane which appeared on page 528, Vol. 56, of *American Machinist*, and believe a bearing so constructed to be suited admirably to a great many uses.

On account of the cost of such a bearing, however, I cannot agree with Mr. Bennett as to its practical application to a jib crane. I am of the opinion that most superintendents and maintenance men would insist on having the step bearing of a jib crane made of a cast bracket with a cored hole having a slightly concaved bottom. The mast trunnions could be merely pieces of round stock $\frac{1}{16}$ in. smaller than the cored hole, with one end rounded to fit the bottom and the other end flattened to fit between the beam flanges of the mast.

Design and Specifications for Slip Bushings

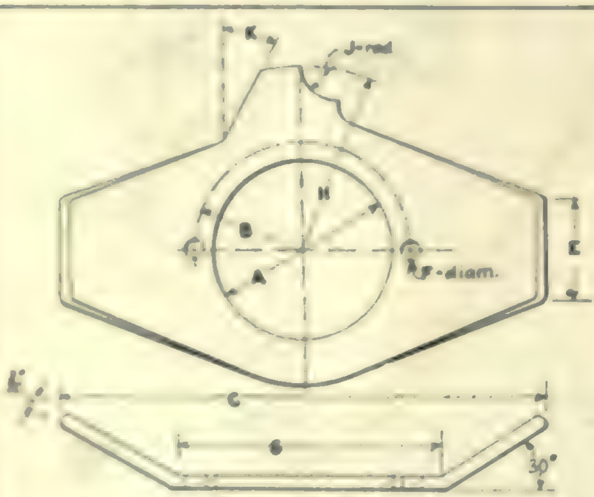
By Raymond Beckman

The drawings herewith show a type of slip bushing that has been used with entire success in our shop for more than two years. The design was prompted by the necessity for having a bushing that would lock securely in place, yet be easily and quickly removed.

To the initiated, the necessity for such a bushing is readily apparent. When used with oil or cutting compound the knurled head bushing usually used in connection with jigs and fixtures is apt to stick in the liner bushing and cause the workman endless trouble in removing it. This requires extra time and is also very trying to the workman's patience, especially if he is on piecework.

The tabulated dimensions have been worked out by trial and have been found to give excellent results. The handle allows the operator to get a much better hold on the bushing when removing it, than he would get on the knurled head.

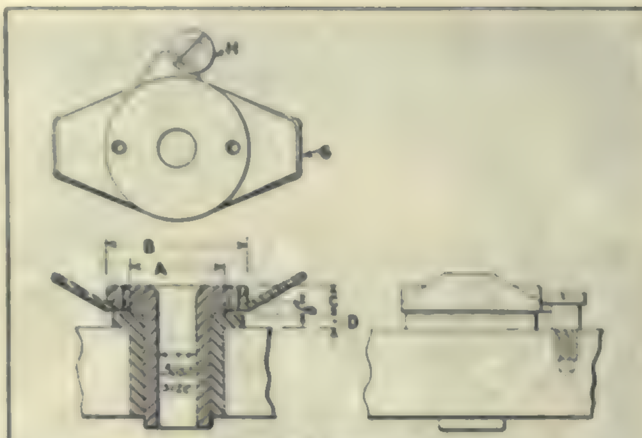
The writer believes that an important point to be considered in present day tool design is to relieve the operator's nervous system of annoying trifles and make all tools and jigs as nearly as possible 100 per cent perfect.



Bushing Handle

NO	A	B	C	D	E	F	G	H	J	K	BUSH SIZE
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55°	To ¼
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50°	" ½
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	" ¾
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	" 1
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	" 1¼
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50°	" 1½
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	45°	" 2
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	45°	" 2½
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4½	[illegible]	[illegible]	45°	" 3

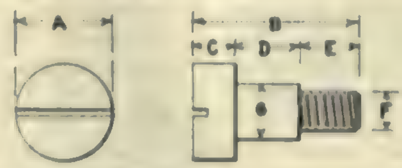
FIG. 1. HANDLE OF BUSHING



Standard Slip Bushings

BUSH SIZE	A	B	C	D	E	F	G	H
To ¼	0.748	[illegible]	[illegible]	[illegible]	[illegible]	1¼	No 1	No 1
" ½	0.998	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	2
" ¾	1.248	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	3
" 1	1.498	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	4
" 1¼	1.748	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	5
" 1½	1.998	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6	6
" 2	2.498	3½	[illegible]	[illegible]	[illegible]	3½	7	7
" 2½	3.123	4	[illegible]	[illegible]	[illegible]	4	8	8
" 3	3.623	4½	[illegible]	[illegible]	[illegible]	4½	9	9

FIG. 2. DETAILS OF BUSHING



Lock Screw

NO	A	B	C	D	E	F	G	BUSH SIZE
1	[illegible]	$\frac{25}{32}$	[illegible]	[illegible]	[illegible]	[illegible] 32	[illegible]	To ¼
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 20	[illegible]	" ½
3	½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 18	[illegible]	" ¾
4	[illegible]	1	[illegible]	[illegible]	½	[illegible] 18	$\frac{7}{16}$	" 1
5	[illegible]	[illegible]	[illegible]	[illegible]	½	[illegible] 18	½	" 1¼
6	[illegible]	[illegible]	[illegible]	[illegible]	½	[illegible] 16	[illegible]	" 1½
7	[illegible]	[illegible]	[illegible]	[illegible]	½	[illegible] 16	[illegible]	" 2
8	[illegible]	[illegible]	[illegible]	[illegible]	½	[illegible] 16	[illegible]	" 2½
9	[illegible]	[illegible]	[illegible]	[illegible]	½	[illegible] 16	¾	" 3

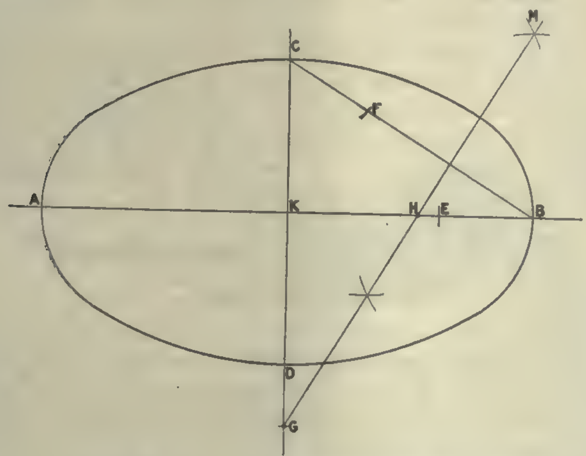
FIG. 3. SPECIFICATIONS FOR LOCK SCREW

Laying Out an Ellipse with a Compass

By James H. Yates

A useful method of laying out an approximate ellipse is shown in the accompanying diagram. The curve formed is so near to a true ellipse as to be quite accurate enough for practical purposes. A compass is the only instrument required, with the exception of a straightedge.

To lay out the ellipse proceed as follows: Mark off the major and minor axes *AB* and *CD* for any size of ellipse desired. Join *C* and *B*. With the radius *KC*, strike point *E* on line *KB*. Take the distance *EB* on a compass and mark it off from *C* as *CF*. Bisect *FB* and draw the line *MG* perpendicular to it.



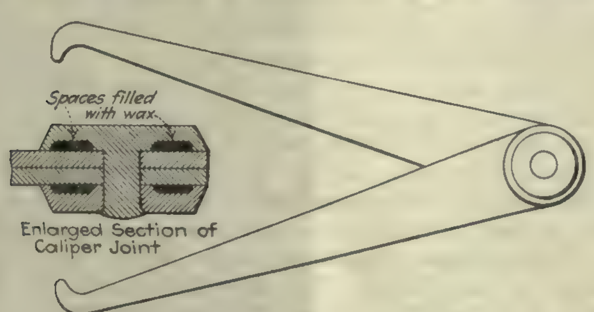
LAYING OUT AN APPROXIMATE ELLIPSE

Where this line *MG* cuts the major axis at *H* is the center for the end of the ellipse and where it cuts the minor axis at *G* is the center for the top. It is only necessary to take opposite centers to complete the ellipse.

Rivet and Washer for Firm Joint Caliper

By G. G. Spicer

Having occasion to make for myself a pair of calipers of the kind known as "firm joint," I turned both the rivet and washer with an annular recess in the under face of each where it would come against the other parts and, before riveting, filled this space with beeswax.



RIVETED JOINT FILLED WITH WAX

This tool has now been in service for several years and is still as firm and works as freely as when new. I believe this stunt could be applied with advantage to many other places where a similar joint is required.

Building Flywheels Under Difficulties

By K. Saldis

Apropos of the article under the above heading, published on page 862, Vol. 56, of *American Machinist*, the writer has seen a method of making similar wheels as a regular manufacturing proposition. This method involves the use of no large tools, yet it must be practical or it could not compete with regular machines.

The hub is cast, bored to size, keyseated, and the periphery (of the hub) drilled and tapped for the spokes, which are round rods of wrought iron. After the spokes are all screwed in, the spider is then sent to the foundry where a mold is built up to enclose it and the iron rim is cast in place around the spokes.

The wheel is then mounted on an arbor in a timber frame made purposely for the work, and the rim is trued with a grinding wheel that is mounted on a sliderest to travel back and forth across the face of the work. The grinding wheel is driven by a separate belt and is provided with an automatic traversing mechanism so timed with reference to the rotative speed of the work that the grinding wheel advances 1 in. sidewise to each revolution of the wheel to be ground. The work speed is about 150 ft. per minute. The grinding wheel is 12 in. wide.

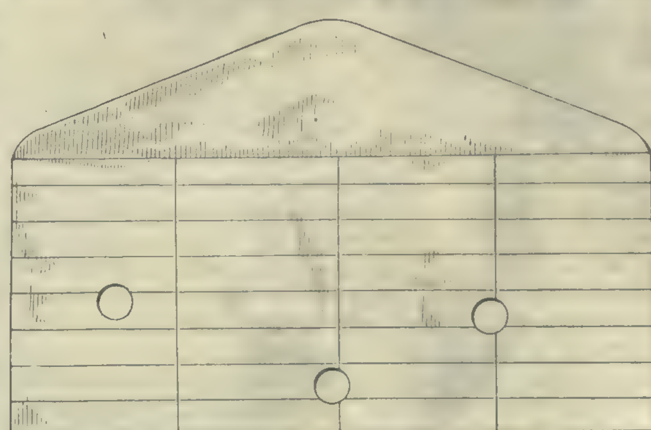
All the attention needed, after the job has been set up and started, is devoted to it by the colored gentleman who sweeps the floor. He comes around (if he happens to notice it) when the wheel stops sparking and gives the feed handle another twist. The boss, of course, decides when a wheel is "done."

If the casting is not particularly bad a wheel 16 ft. in diameter with a 20-in. face can be ground in from 10 to 12 hr. with a labor cost that is almost negligible.

An Interdepartment Envelope with Windows

By J. Madden

I recently came across what was to me a new type of interdepartment envelope, at the plant of the Cincinnati Milling Machine Co. It is shown in the accompanying line drawing, which is about one-third actual size. The unusual feature is that there are three holes punched through both front and back of the envelope. Their size and location make it practically impossible to overlook the contents even though they may consist of very small pieces of paper.


AN INTERDEPARTMENT ENVELOPE WITH WINDOWS

Editorial

Give Me All, and I'll Ask No More

IN A STATEMENT which he issued as an answer to some of President Harding's utterances regarding the coal strike, Samuel Gompers said: "The fact is that there is nobody to mine coal until the coal miners now on strike return to the mines. They will return to the mines gladly and quickly as soon as the mine owners *agree with them* (the italics are ours) on terms and conditions of employment."

Of course, they will return to work as soon as the mine owners agree with them. What more could they possibly want? Should not Mr. Gompers have said as soon as mine owners and miners agree? We can only hope that he meant to say so and that the statement, as it stands now, was merely a typographical error of the tongue. We are afraid though that this is not the case. Other utterances of Mr. Gompers have given us the impression that he either believes, or would like to make us think that he believes that the workers must necessarily be right, and that there cannot be room for mutual concessions, mutual sacrifices, mutual revisions of opinions and demands.

The stand of Mr. Gompers indicated by the paragraph quoted is the Hohenzollern stand, the stand of Germany before the war. Germany was perfectly willing to leave other nations in peace and to treat them with the greatest kindness and consideration provided they would agree to the things Germany wanted. This stand of Germany was the cause of the World War. We sincerely hope that Mr. Gompers has learned that such a stand cannot be maintained and we certainly hope that if the quoted passage was not a slip of the tongue, it was not, at least, the expression of the opinion of the majority of laboring men and labor leaders.

Are Metal Workers Hidebound?

WHY is it that so little research work is done on metal cutting? Surely this matter is of sufficient economic importance to justify the spending of much time, effort and money. An almost unlimited amount of research is justified on the ground that it produces a horsepower with one pound less of steam, possibly two ounces less of coal. Wouldn't it seem natural if more effort were spent on the reduction of power required for metal cutting? The resulting saving in power would reduce the coal consumption, the consumption of tool steel and machine tools besides, and—this is the important point—increase production.

These thoughts came to our mind after reading the article on "Cutting Fluids," by Eugene C. Bingham in our issue of June 29, 1922. The article brings out vividly how little we know about its subject, though it is of the greatest importance to every metal-working shop. And it is only one of the many machine-shop subjects about which our ignorance is monumental. We have been cutting metals for hundreds of years, in thousands of shops and by millions of people, and yet we do practically everything by rule of thumb, and our knowledge is limited to what has been gained by stumbling on some half truth, transferred from one man to the other by word of mouth.

Are metal workers more indifferent, more stupid, more hidebound than steam engineers, electricians and builders, or what?

Isn't this subject big enough to be taken up by some big society or a big university, or all universities? Why should the machine-tool trade depend on the Bureau of Standards to find some of the most elementary fundamentals of its business? Why, and again why?

Why Are There So Many Different Spindle Bearings?

THERE are certain parts of machine tools that should be standardized and others that wouldn't be a bit better if they were standardized to the last dimension. Standardizing the taper in spindles helps, but it would be of no benefit to any body if the spindles themselves were standardized. Apparently, machine tool builders were aware of the fact that they were free to indulge their tastes and fancies in respect to spindles and their bearings, for it is safe to say that there are at least as many different spindle constructions as there are machine tool shops. As we said, the public is not interested in this matter so long as they are able to exchange tools or arbors. And yet, come to think of it, is this entirely so? Does not the user of the machine have an interest in the spindle construction? Is it reasonable to expect that two different constructions used in similar machines, should be of exactly the same value? It is doubtful that this should be so and it is almost certain that there must be a difference when there are not two but an almost unlimited number of constructions in use. It is almost certain that some must be better than others and very probably that one may be the best of all.

Take the case of the front bearing of the spindle of a milling machine. It is made straight by some, taper by others. It may have a single or double taper or it may be taper with straight collar. The end thrust may be taken up at the rear of the spindle or immediately back of the front box. Then there is the box itself. It may be made of bronze, various kinds of bronze, in fact, or babbitt, or it may be hardened steel or some kind of cast iron. It may be straight or taper on the outside. It is sometimes solid, and sometimes split. It may be located directly in the column (or housing) and sometimes in another bushing which, as a rule, is taper on the outside. The same differences may be seen in rear bearings. Now, it is not likely that any one construction should be just as good as any other, and if we should have to buy a milling machine we would be interested to know which is the best. It would seem that machine tool builders should no longer be satisfied with advertising which construction they use but that they should take the public into their confidence and tell the reason why.

Shop Equipment News

Liberty Combination Planer and Slotter for Locomotive Frames

The Liberty Machine Tool Co. of Hamilton, Ohio, has recently developed a machine for completely finishing locomotive frames. The machine is really a combination of a planer and a slotter, the planer side of the machine being shown in Fig. 1 and the slotter side in Fig. 2. The principal advantages claimed for the machine are the saving of floor space, since both slotting and planing are performed on the same machine, and the reduction of the time required for moving the work from one machine to the other and setting it up. The company's standard 36-in. planer forms the major part of the machine. If desired, as many as four heads can be mounted although only one is shown in the accompanying illustrations. The bed is of the box type, and is closed at the top between the *V*s. which are provided with oiling rollers. The bed is 69 ft. long and the table 38 ft. long and 30 in. wide.

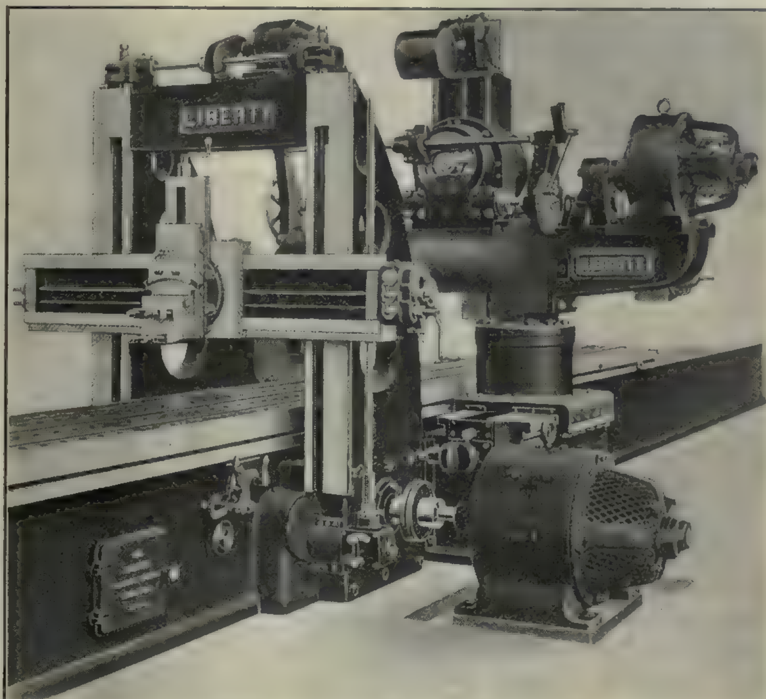


FIG. 1—LIBERTY COMBINATION PLANER AND SLOTTER

The housings are of the box type and extend to the floor. They are attached to the bed by means of large taper plugs and bolts, and are connected at the top by a heavy cross brace. The distance between them is 37 in., which also is the maximum distance between the top of the table and the bottom of the crossrail. This latter member is of box section, and is sufficiently long to accommodate two heads so that either one of them can traverse entirely across the table. The elevating screws are adjustable from the top and are supported on ball bearings.

The heads are graduated to swivel up to 90 deg., and they have automatic feeds in all directions that are operative from either end of the crossrail. When under strain, the down-feed screws are in tension. Micrometer adjustments are provided on all feed screws, and both the saddle and the slide are fitted with binder screws.

The elevating device is centrally located on the top brace. The handle at the side of the housing is employed to operate a saw-tooth clutch when it is desired to raise or lower the cross rail. This handle must be held in position while operating, as the rail stops as soon as it is released or if the rail strikes some obstruction. Side heads can be attached to the machine at any time. These heads are counter-balanced and can be moved below the table top when not in use.

Power for operating the feed is transmitted through a spur gear on the end of the bull pinion shaft, then through a pair of miter gears to the vertical splined feed shaft. The position of a small handle determines whether the feed takes place on the forward or return stroke, and the feed can be disengaged by this same handle. A pair of miter gears on the vertical feed shaft serves to operate the friction device attached to the feed gear on the end of the rail or side head. An adjustable stop operated by a knob determines the amount of feed. Reversible ratchet gears operated by small handles are used instead of trigger gears meshing with a feed gear. All handles and knobs are conveniently located, and all parts are well protected from dirt and exposure.

The operator can control and change the feed of the railheads at any time without stopping the machine or disturbing the feed of either of the side heads. Since the amount of the feed is indicated by a dial, the operator can easily set the feed to the amount suited to the work.

The running gear is placed inside the bed, and is accessible from the top. The gears are pressed on the hubs of the pinions so as to relieve the shafts of torsional strain. The journals of the shafts are supported in wick-oiled bronze bearings. The machine is shown driven by a 15-hp. reversing motor. It can, however, be driven by belt, the pulleys being aluminum with cast-iron centers. The reduction in weight obtained by the use of the aluminum reduces the inertia that becomes troublesome at high speed. The belt-shifting mechanism is entirely inclosed, so that dirt does not enter the moving parts. Shifting levers on both the front and the rear sides of machine enable the operator to control the motion of the table without walking around the machine.

The slotter part of the machine, which is best shown

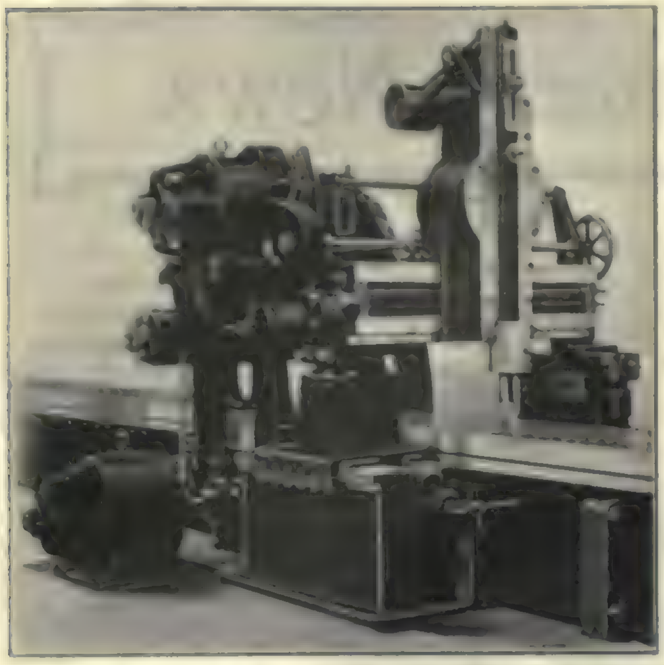


FIG. 3—SLOTTER END OF COMBINATION MACHINE

in Fig. 2, provides a clearance between the housings of 37 in., and under the yoke of 18 in. Work 30 ft. long can be accommodated. The slotter is self-contained, and furnished with a base secured to the bed that permits a travel of 24 in. lengthwise of the machine. The base carries a column upon which the crossrail can be swiveled in either direction when it is desired to slot across the bed at an angle. The slotter crossrail can be swung entirely out of the way when it is desired to use the planer for work that requires the maximum height under the planer crossrail. The left-hand end of the slotter rail rests on a housing which moves in conjunction with the right-hand housing. This left housing has a screw that is used in adjusting the angle of the rail, and also clamps for locking the rail.

The head has an independent automatic feed and rapid traverse both crosswise along the rail and lengthwise along the base. The ram is driven by means of a worm and worm wheel through a crank disk and connecting rod, and it has a stroke adjustable up to a maximum of 14 in. A 10-hp. variable-speed motor mounted on the end of the crossrail drives the ram. Two smaller motors are employed for operating the movements of the rail and head.

When slotting is being done, the table is held stationary. As soon as the cut in one position has been completed, the table can be rapidly moved to the next position by the use of a pendant switch. Attachments can be provided, such as a toolbar which is used for circular feeding or cutting fillets.

The machine has an overall height of 10 ft. 11 in., and occupies a floor space of 10 ft. 2 in. by 78 ft. It weighs 69,000 lb., and 1,000 lb. additional for each extra foot of bed length.

Hendey 1922 Model 24-Inch Crank Shaper

The Hendey Machine Co., Torrington, Conn., has added to its line the 1922 model, 24-in. shaper shown in the accompanying illustration.

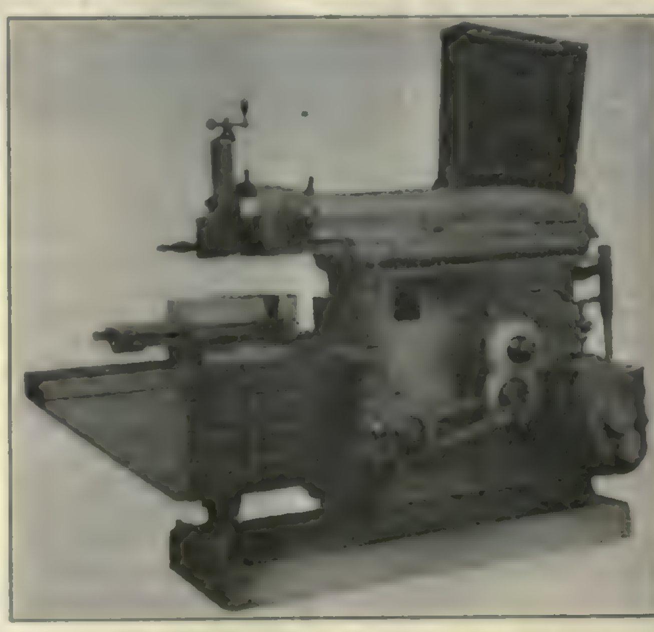
The machine is of the single-belt-drive type and may be driven from the lineshaft or from an independent motor attached to the base. It is provided with the Hendey speed-change gear box giving four speeds, which range is duplicated by throwing in the back gears, making eight speeds in all.

There are but eight gears in the speed-change train and all are of alloy steel, properly hardened, and run in oil. The starting clutch and speed-change levers are within easy reach of the operator, enabling him to make all adjustments without leaving his position.

The clutch is of the double-cone type, acting, when the lever is moved in the reverse direction, as a brake to bring the machine quickly to a stop. Conveniently located index plates show the number of strokes per minute and the approximate cutting speed in feet per minute for which the machine is set, corresponding to the several positions of the levers. There is also an index to show the length of stroke to which the ram is set, and this length may be changed with the machine in motion or idle, at the will of the operator.

The maximum stroke of the ram is 24¾ in. The vertical slide has a travel of 8 in. and may be swiveled to any angle. A single binder screw holds the head in any position. Power feed may be applied to the slide at any angular position and has a range from 0.005 to 0.060 inch.

The table travels 30 in. upon the rail and the latter has a vertical adjustment of 14¾ in. The range of power crossfeed is from 0.008 to 0.180 in. The top of the table is 17x24 in. in size and the vertical face is 17½x18 in. Jig-drilled and reamed holes are provided in both surfaces as well as the usual T-slots. The table may be removed if desired and work attached directly to the face of the saddle, which is provided with T-slots for that purpose. An extension is provided by



HENDEY 1922 MODEL, 24-INCH SHAPER

means of which the top surface of the table may be increased to nearly double its regular length.

The vise jaws are 14½x3 in. and open 16 in. The swiveling base allows the vise to be set at any angle. The driving pulley is 14 in. in diameter, takes a 4-in. belt, and should run at 440 r.p.m. The number of strokes per minute of the ram ranges from 6 to 102. A belt guard of expanded metal is furnished with the machine. The floor space occupied by the machine is 52x107 in., and the net weight is 5,680 pounds.

Betts-Bridgeford Double-Head Lathe

The illustration shows a Betts-Bridgeford 72-in. double-head engine lathe recently built for the Morse Dry Dock and Repair Co., of Brooklyn, by the Betts Machine Co., Rochester, N. Y. The lathe is intended for turning heavy crankshafts and long propeller shafts, to handle which work the bed has a length of 76 feet.

In order to utilize the machine when it is not required to work on very long shafts, and at the same time provide extra capacity for shorter work, the lathe is provided with a headstock at each end of the bed. It is also equipped with two carriages and two tailstocks. Two lead screws are provided, one on each side of the machine. One screw runs the full length, and the other one-half the length of the bed.

When the lathe is required for extremely long work, one of the tailstocks is removed and the other traversed to a position close to one of the headstocks, thus allowing the use of the full distance between the centers. When the machine is required for shorter work which can be accommodated in a little less than half the full distance between centers, the second tailstock is replaced on the bed and the other traversed to the center, so that the two tailstocks are end to end in the center of the bed. The machine is thus quickly converted into two entirely independent lathes, each swinging work 72 in. in diameter and taking a maximum distance of 27 ft. between the centers. By this arrangement economies of both shop space and first cost may be effected under certain conditions where there is not sufficient unusually long work to keep the machine busy.

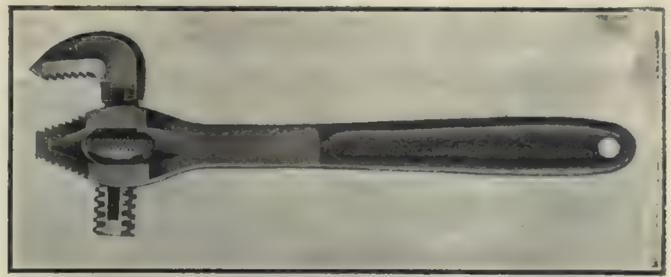
The headstocks are both alike in details of construction, being triple back-geared and having heavy bronze bearings throughout. These bearings are chain oiled from individual reservoirs. There are twelve spindle speeds controlled by levers at the front of the headstock, and obtained through sliding hardened-steel gears. A friction clutch and brake operated from the carriage or from the headstock is in the drive of each head.

Power rapid traverse controlled by levers conveniently located at the apron, is provided for both carriages. The carriages and aprons are of heavy construction and provided with compound rests and power angular feed. The aprons are of double-wall unit construction, with all gears of steel and running in oil. The machine is driven by two 50-hp. motors, mounted on the headstocks and having automatic starters.

Greenfield "Little Giant" Pipe Wrench

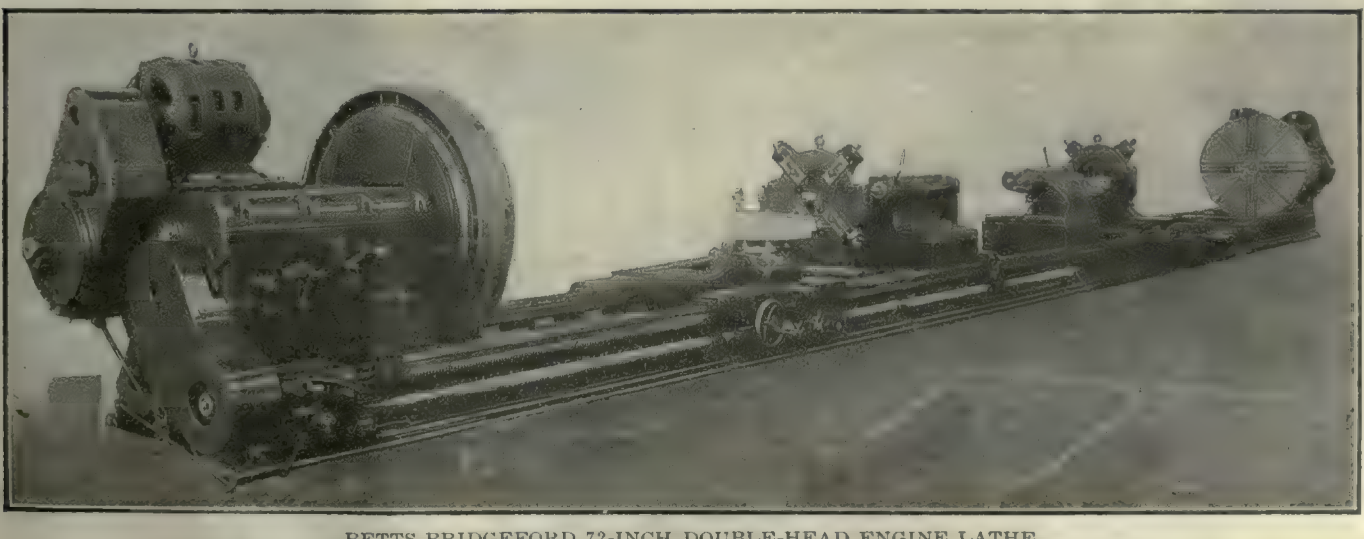
A pipe wrench in which is obtained simplicity of construction and lightness in weight, as well as great strength, has recently been placed on the market by the Greenfield Tap and Die Corporation of Greenfield, Mass. The tool, which is shown in the accompanying illustration, is known as the "Little Giant" pipe wrench. It has the end opening that is commonly employed in machinists' wrenches, which construction enables the wrench to be fitted to pipes located in corners, close to walls, or in confined positions. The operator can set the wrench on the pipe in the same manner as he would a pair of pliers, instead of having to fit the jaws on the pipe from the side of the tool.

The wrench has three parts, a drop-forged and heat-treated handle and jaw made in one piece, a drop-forged and heat-treated moveable jaw, and a hardened steel nut. Although no springs are employed, the wrench is said to grip and release quickly and easily. The main jaw is equipped with two sets of teeth, so that the moveable jaw can be engaged with either one of them, and thus lengthen the life of the tool. On the wrenches of 14-in. size and larger, two additional sets of teeth are provided back of the adjusting nut, and the moveable jaw can be reversed to engage with them. This arrangement adapts the tool to certain types of work.



GREENFIELD "LITTLE GIANT" PIPE WRENCH

The maker states that the 14-in. size has repeatedly withstood stresses in excess of 4,700 inch-pounds without slipping or bending, although the specifications of the Army and the Navy departments require a strength of only 2,800 inch-pounds for a wrench of this size. However, due to the simplicity of the construction, the wrench weighs less than a Stillson-type wrench of corresponding capacity. The tool is manufactured in 8, 10, 14, 18 and 24-in. sizes.



BETTS-BRIDGEFORD 72-INCH DOUBLE-HEAD ENGINE LATHE

Pratt & Whitney Odontometer

The Pratt & Whitney Co., Hartford, Conn., has recently added to its line of precision gages a set of instruments for testing gear teeth, known as odontometers.

The odontometer is a simple and self-contained instrument for testing the acuracy or uniformity of the gear tooth profiles and spacings of the teeth in production work. The instrument illustrated in Fig. 1 has a range of from 3 to 10 diametral pitch, may be used to check gears of any pressure angle, and can be applied to a gear while it is in place in the machine.

In effect it is composed of a section of a straight-sided rack with two parallel effective faces, one fixed and the other movable. A third face, set at an angle to the two working faces, is used to hold the fixed working face in contact with the flank of the gear tooth. The fixed registering surface is at *A*, the movable indicating surface at *B*. The third surface *C* holds surface *A* in contact with the involute surface of the gear tooth. The surfaces *B* and *C* are adjustable so that gears of various pitches can be tested with the same instrument.

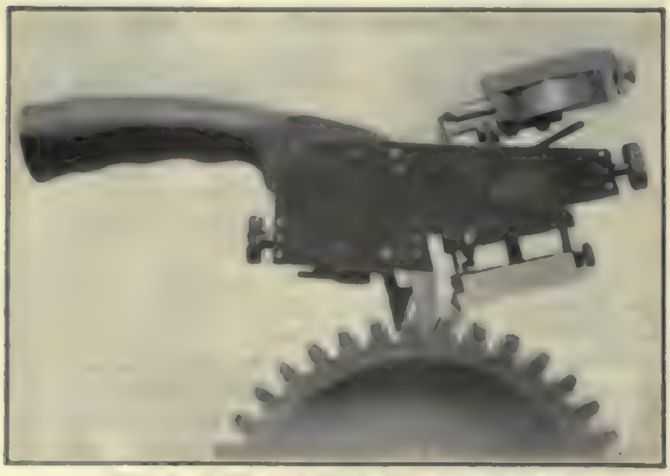


FIG. 1—3 TO 10 PITCH ODONTOMETER

The indicating surface *B* is mounted on two thin flat springs *D*, which act as pivots free from backlash. The dial indicator *E* is actuated by the lever *F*, which has a ratio of 5 to 1, so that each division of the dial represents a movement of 0.0002 in. of the indicating surface *B*.

In general the instrument is used as a comparator to test the uniformity of interchangeable and mating gears. If actual measurements are required, the distance between the two parallel working faces of the instrument can be measured.


FIG. 2—¾ TO 4 PITCH ODONTOMETER

Odontometers are made to check gears in the following range of sizes: ¾ to 4 pitch, 3 to 10 pitch and 10 to 24 pitch. The largest and smallest sizes of odontometers are shown here in Figs. 2 and 3 respectively.


FIG. 3—10 TO 24 PITCH ODONTOMETER, TESTING GEAR ON STAND

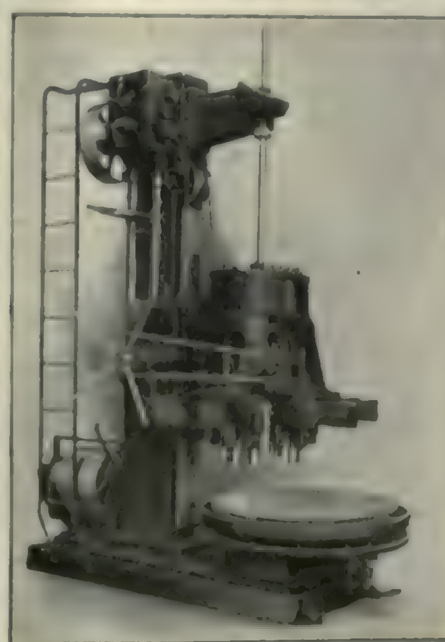
Stands are also made to hold the two smaller sizes of odontometers when gears or pinion shaper cutters are being tested. In this case the gear is placed on a surface plate and rolled by the instrument. The actual cutting edge of cutters can be tested, so that errors, of whatever nature, are detected.

Changes in Fox D-32 Multiple-Spindle Drilling Machine

The Fox Machine Co., Jackson, Mich., has made some changes in its D-32 multiple-spindle drilling machine described on page 967, Vol. 54, of *American Machinist*.

Among the changes are: An increase in weight and power; the installation of a "Little David" air motor for raising and lowering the drilling head; an interlocking device that prevents the feed from being engaged during the operation of the air control; the addition of a rotary table; base enlarged to support the table, to permit the installation of a motor in place of the clutch and driving pulley and to give more room for the accumulation of drilling compound; drilling head increased from 20 to 25 in. in diameter.

The new rotary table is now arranged for indexing when station drilling is being done. The indexing plunger is withdrawn and the table is elevated by a pedal in front of the machine. The plunger is held out of engagement until the table is brought to the next station, when it is automatically released and enters the recess in the table before the table is lowered The table is elevated on bal thrust-bearings and can be very easily revolved.


FOX D-32 MULTIPLE-SPINDLE DRILLING MACHINE

Rockford No. 3 High-Power All-Geared Milling Machine

The No. 3 high-power, all-geared, single-pulley-drive milling machine made by the Rockford Milling Machine Co. of Rockford, Ill., was described in its original design on page 377, Vol. 52, of *American Machinist*, and later as re-designed on page 585, Vol. 54. Additional changes in the design have been made, so that the machine appears as shown in Fig. 1. The general characteristics and capacity of the machine are the same as before, although there are refinements and changes in the arrangement of some of the parts.

The principal features of the machine are the rectangular overarm, the method of transmitting the drive for the feed motions to the saddle and table, the support at the side of the column for the knee and saddle, and the power-driven quick-return and rapid-traverse motions. The support at the side of the column for the knee and the saddle need be employed only when taking a cut causing unusually great strain or tending to chatter.

The mechanism for operating the quick return is housed in the small box mounted on the right side of the column. The long lever that extends to the front of the machine controls both the feed and the quick return of the table in both directions. Rapid and easy manipulation is thus possible. The feed control box operates either the longitudinal, transverse or vertical feed and quick return, depending on which machine movement is engaged with the feed gears.

The range of speed is 12 to 350 r.p.m. in 16 steps. There are 12 feed changes providing from $\frac{1}{2}$ to 16 in. per min. feed. Among the minor changes that have been made in the machine are the following: The overarm is now $4\frac{1}{2}$ x $9\frac{1}{2}$ in. in section, the distance from the center of the spindle to the bottom of the overarm is $7\frac{3}{4}$ in., and the hole through the spindle is $\frac{63}{64}$ in. in diameter.

Constant-speed drive is employed, the 16-in. pulley being ordinarily rotated at 320 r.p.m. When individual motor drive is used, a $7\frac{1}{2}$-hp. motor running at 1,200 r.p.m. is supported on the back of the column. The net weight of the machine equipped for belt drive as shown in Fig. 2 is about 8,000 lb. This view shows also the levers for changing the speeds and feeds. The speed gears are in the top compartment, the feed gears in the middle one, and a coolant tank below.

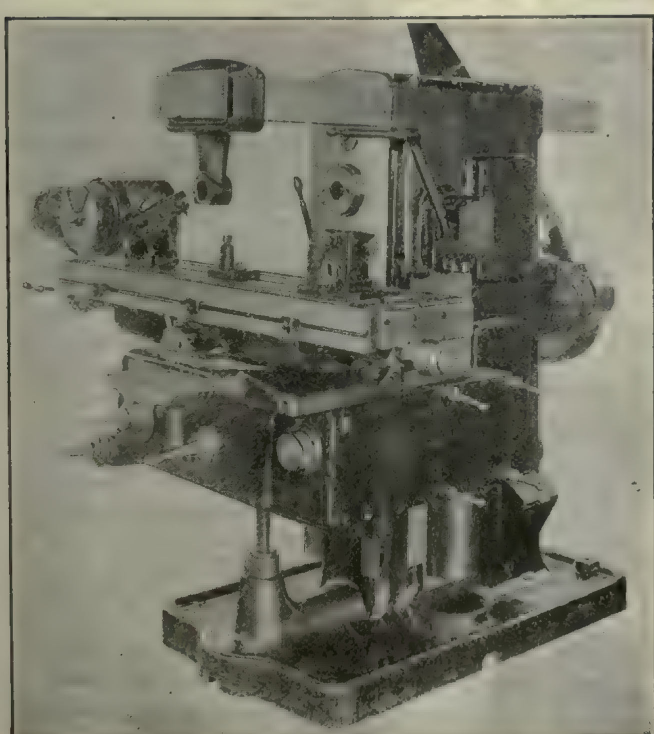


FIG. 1—ROCKFORD NO. 3 HIGH-POWER MILLING MACHINE

The machine can be fitted with a number of attachments, which have been developed to adapt it to special work. The universal milling and drilling attachment can be fastened on the face of the column. It has two heads, one at the point of junction with the machine spindle, and the other at right angles to the spindle at the end of the attachment. The spindle of the attachment has a feed of 5 inches.

The $12\frac{1}{2}$-in. dividing head shown mounted on the table of the machine is provided with two index plates that can be used in performing all the indexing formerly done with three plates. A power-driven rotary table driven from the mechanism in the knee can also be provided. The worm drive of the table has the same gear ratio as that of the dividing head, so that an index plate can be transferred to the table, and indexing done in the same manner as with the dividing head. The dial is graduated to minutes, so that the table can be accurately set.

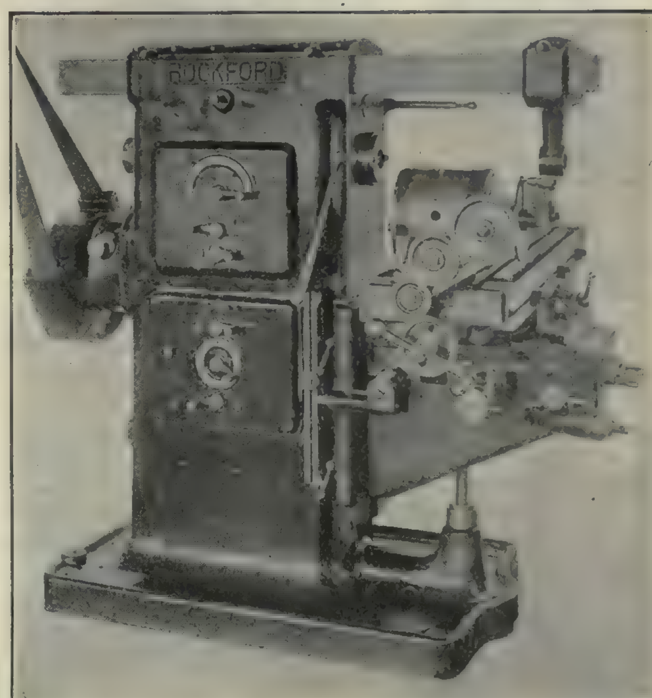
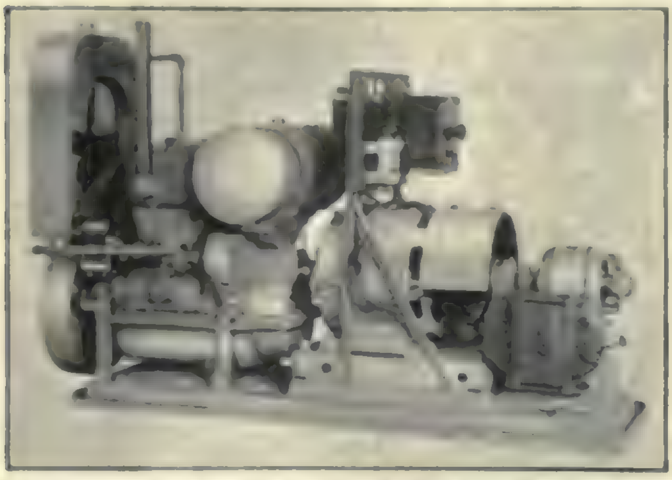


FIG. 2—GEAR SHIFTING SIDE OF ROCKFORD MILLING MACHINE

A vertical milling attachment can also be provided. It is driven from the spindle of the machine, and is secured over the end of the overarm so that it can be rigidly held. A slotting attachment can be attached in the same manner. For performing vertical work in quantities, a vertical head can be bolted to the top of the column after the overarm has been removed. In this way, a rigid vertical milling machine differing from the standard one only in the fact that it has a horizontal spindle also, is obtained. The clearance from the center of the vertical spindle to the column is normally 15 in., although it can be made $20\frac{3}{8}$ in. when additional capacity is necessary.

Westinghouse Engine-Driven Welding Equipment

The accompanying illustration shows an outfit that has recently been put on the market by the Westinghouse Electric and Manufacturing Company of East Pittsburgh, Pa., for generating the current required in electric welding, using a gasoline engine as the source of power. The equipment is applicable to use where electric power for motor drive is not available, and since it is entirely self contained, it does not require any auxiliary apparatus or connections.



WESTINGHOUSE ENGINE-DRIVEN WELDING EQUIPMENT

The equipment consists of a single-operator welding generator geared to a Doman four-cycle, two-cylinder, low-speed, marine-type gasoline engine. The generator has a rated capacity of 175 amp., and a maximum capacity of 225 amp. at 1,750 r.p.m. It is designed to operate at the arc voltage required, to stabilize the arc, and to supply a practically constant current of any value required over the working range from 90 to 225 amp. The operating characteristics of the generator adapt it especially to welding, so that it is easy for the operator to strike and maintain the arc and also to obtain the deep penetration and thorough fusion desirable for welding. The shaft of the generator extends through the pedestal bearing, and is connected by means of a flexible coupling to the exciter.

The engine is made heavy throughout, so as to withstand continuous service. The cylinder block and its removable head are made of semi-steel. The engine is provided with a force-feed system of lubrication, a Wheeler-Schebler carburetor, a Taco throttle governor, an impulse starter and a honey-comb-type radiator.

The control panel is mounted directly over the generator on an angle iron frame, and the entire equipment is mounted on a cast-iron bedplate. The outfit is made in both stationary and portable models, to adapt it to the type of service required.

Springfield 24-Inch Geared-Head Engine Lathe

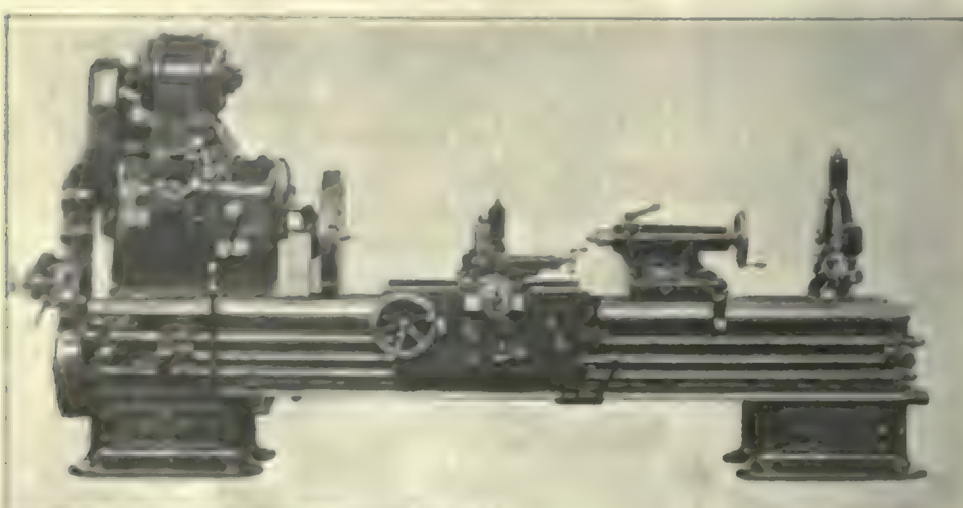
The Springfield Machine Tool Co., Springfield, Ohio, has recently placed on the market a 24-in. size of the all-geared-head engine lathe that was described in the 14, 16, 18 and 20-in. sizes on page 514, Vol. 48, of *American Machinist*. The 24-in. lathe is shown in the accompanying illustration equipped with a motor drive, cabinet legs at each end of the bed, steadyrest and other attachments.

The gears in the headstock run in oil, and all journals, excepting those on the main spindle, are equipped with ball bearings. A ball thrust bearing is employed. The head is of the selective type. It may be driven directly from the lineshaft, and it is so constructed that a motor may be mounted on top of it at any time. Fourteen gears are employed to obtain the twelve speeds.

The main drive pulley contains the friction clutch, which can be operated either from the right-hand side of the apron or from the push rod overhead. A friction drag is provided so that the spindle can be quickly stopped. All of the power-transmitting shafts in the head are short and of large diameter, so that heavy duty is possible. The operating levers are conveniently grouped at the front of the head.

The lathe may be equipped with a quick-change-gear system providing forty changes of feed, or with a system providing only six quick changes. With this latter system, which is applicable particularly where continual change of the pitch is not required, removable change gears are employed to obtain the exact feed necessary. The apron is of box construction. The half-nuts are provided with a locking mechanism to prevent their engagement when the feeds are in use.

Different types of compound, plain and turret tool posts are interchangeable with the compound rest. The countershaft furnished for the belt-driven machine is of the double friction type and has a single pulley for the down-drive to the machine. The lathe can be fitted with attachments for performing operations such as taper turning.



SPRINGFIELD 24-INCH GEARED-HEAD ENGINE LATHE

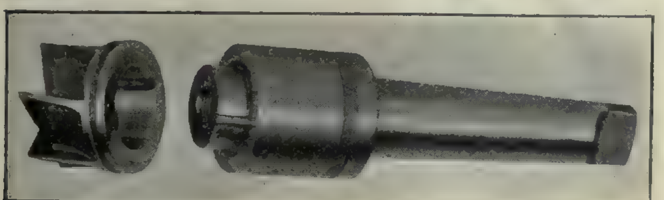
Specifications: Swing: over bed, 25½ in.; over carriage, 17 in. Distance between centers with 6-ft. bed, [illegible] in. Spindle: through hole, [illegible] in.; diameter of nose, [illegible] in.; threads on nose, Acme 4 threads per inch. Spindle speeds: number, 12; range, [illegible] to [illegible] r.p.m. Feeds: number, 40; range, [illegible] per inch. Threads, 1 to [illegible] pitch. Taper of centers, No. 5 Morse. Size of tool, [illegible] in. Taper, up to 4 in. per ft. and 27 in. long. Motor recommended: horsepower, 5; speed, [illegible] r.p.m. Weight with 10-ft. bed: net, [illegible] lb.; domestic shipping, 9,300 lb.; per additional foot, [illegible] lb. Export box, [illegible] cu.ft.

West Pin Drive for Small Tools

The West Sales Co. of Detroit, Mich., has recently placed on the market a line of small tools manufactured by the Hanson Tool and Die Co., also of Detroit. The line comprises such tools as end mills, keyway cutters, counterbores, countersinks, two- and four-fluted drills and connecting-rod tools. Special holders are provided to suit the different types of cutting tools, the accompanying illustration showing the Type B counterbore and its holder. The cutters are made of high-speed steel and the holders of an alloy steel.

The milling cutters can be furnished in a large range of sizes, to suit the work. The reamers may be either straight or helical fluted, the drills two- or four-fluted, and the countersinks of either 60- or 80-deg. angle. The drilling, reaming and counterboring tools are particularly intended for short holes. The body of the holder serves as a pilot, so that the cutting tool is required to do cutting only.

The holders can be supplied in a large range of sizes and with any type of shank needed to suit the machine. In the counterbore shown a short shank on the holder



WEST PIN DRIVE ON COUNTERBORE

slips into a hole in the counterbore itself, although for the drills, reamers and most of the tools a small tapered shank on the cutter slips into the hole in the bottom of the holder. The counterbores can be provided with the desired size of pilot at the forward end.

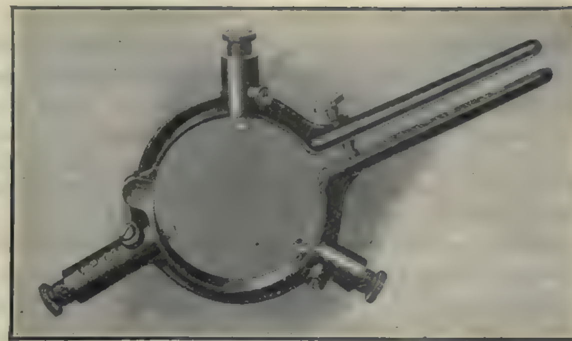
The cutter is prevented from turning in the holder by a small pin placed lengthwise in grooves in the inside and outside tapers. The construction provides a positive drive that enables the tools to run accurately and permits the use of a small shank. The tools are particularly adapted to turret work, and holders can be furnished for any style of turret.

Vedoe-Peterson Piston-Groove Cleaner

In order to facilitate the cleaning of carbon from the grooves for the compression rings in automotive pistons, the Vedoe-Peterson Co. of Norfolk Downs, Mass., has just placed on the market the "V-P" groove cleaner that is shown in the accompanying illustration. The use of a scraper for this work is thus eliminated, so that the cleaning can be performed in a very short time.

The piston which is to be cleaned is usually held on a bar passed through the piston pin hole and clamped in a vise. The hinge in the frame of the holder allows the device to be placed over the piston, so that the cutters rest in one of the ring grooves. The three cutters are adjusted to the approximate depth of the groove by means of the screws that back up each cutter. They are then locked in place by the small setscrews. The final adjustment so that the tools fit the bottom of the groove, is made by means of the knurled screw that holds the two parts of the handle together.

It is necessary to rotate the cleaner only two or three turns to completely remove the carbon. Two sets



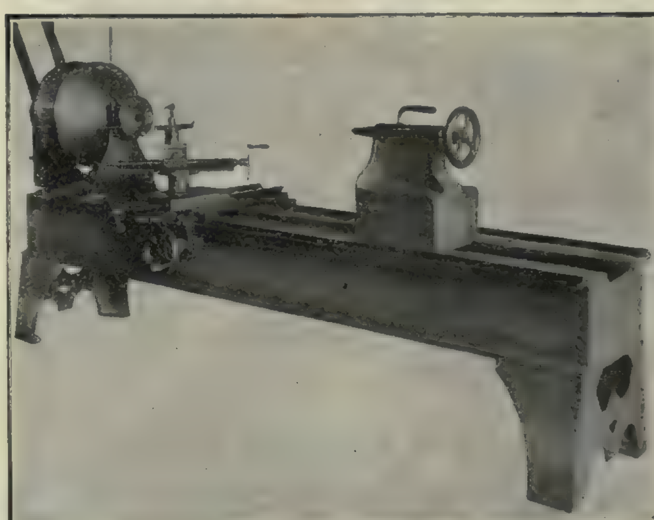
"V-P" PISTON-GROOVE CLEANER

of cutters are furnished with each cleaner, one for grooves $\frac{3}{16}$-in. and the other for grooves $\frac{1}{4}$-in. in width. The cleaner is adapted to use on pistons from 3 to 4 in. in diameter.

Buffalo Gear and Pattern Works Patternmaker's Lathe

The patternmaker's lathe illustrated herewith has recently been placed on the market by the Buffalo Gear & Pattern Works, 16 to 20 Elk St., Buffalo, N. Y.

The lathe will swing 32 in. over the shears, 24 in. over the carriage and take 6 ft. between centers. The headstock can be swiveled 90 deg., converting the machine into a face lathe, the plane of the work being parallel with the bed. When used as a face lathe, a three-legged horse is provided having a base thereon



BUFFALO GEAR AND PATTERN WORKS PATTERNMAKER'S LATHE

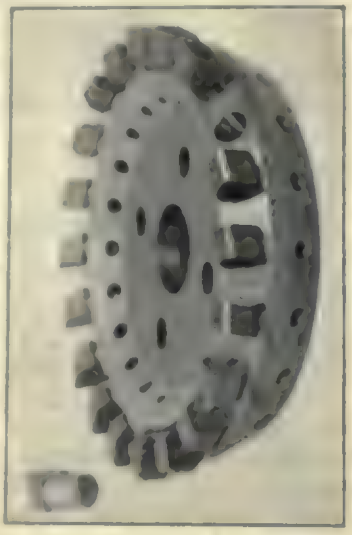
to which the compound rest can be attached, after removal from the carriage. The horse also serves as a seat for the operator.

Changes in speed are made by opening and closing two pairs of interlocking bevel-faced pulleys, one pair of which is located on the headstock and the other pair on the countershaft. Levers toggled to the shifting lever close one pair of pulleys while they open the other pair, the action being almost identical with that in the Reeves speed-changing countershaft. Closing the pulleys increases the effective diameter while opening them decreases it. A belt of triangular section is used and as the interlocking teeth of the pulleys are of wood, it is claimed that no damage results to the belt.

West Inserted-Tooth Milling Cutters

A line of inserted-tooth milling cutters made by the Hanson Tool and Die Co. of Detroit, has recently been put on the market by the West Sales Co., 1013 Ford Bldg., Detroit, Mich. The cutters are made for both light and heavy duty, and for side, face or slot milling. The bodies of the cutters are of hardened and ground tool steel, and the teeth of high-speed steel.

As can be seen in the accompanying illustration, each tooth is provided with a tapered shank that fits in a tapered hole in the body. To prevent the tooth from turning, one or more small pins fitting in grooves in both the shank and hole are employed. All types of the cutters can be furnished in a range of sizes. When desired, the size of a cutter can be permanently maintained, even after sharpening. For a plain cylindrical cutter, the outside of the body is made in spiral form with the diameter increasing slightly from one point entirely around the cutter. Thus, some of the blades are longer than others. To sharpen the cutter, the shortest blade is removed and each blade moved forward one position. One new tooth is placed in the last position that has been made vacant by the process, so that only one tooth is discarded. The cutter can then be ground to the size it was before the blades were reset.

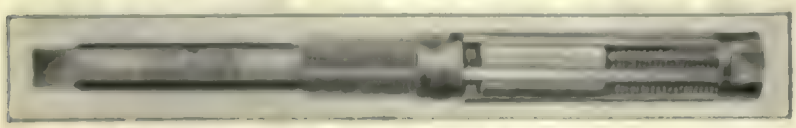


WEST INSERTED-TOOTH MILLING CUTTER

This same principle is employed on slot-milling cutters having teeth on both faces, so that the width of the slot can be kept the same after grinding the cutters. The teeth can be easily removed by inserting a wedge in the holes beneath the shanks and driving them out. No screws nor wedges are required and the blades are all of a standard type.

"Nu-Angle" Expansion Reamer

The Vedoe-Peterson Co., Norfolk Downs, Mass., has just brought out the "Nu-Angle" expansion reamer that is shown in the accompanying illustration. As the name indicates, the blades are placed at an angle to the axis of the reamer, which construction facilitates reaming holes having oil grooves and ridges. The position of the blades in the body gives a slight back rake to the front face of each blade at the forward end of the reamer. Near the center of the blades the front faces become radial, while they are slightly under-cut at the following end of the tool. The construction makes the reamer adaptable to use on either bronze, steel or cast iron, and is stated to give a smooth finish.



"NU-ANGLE" EXPANSION REAMER

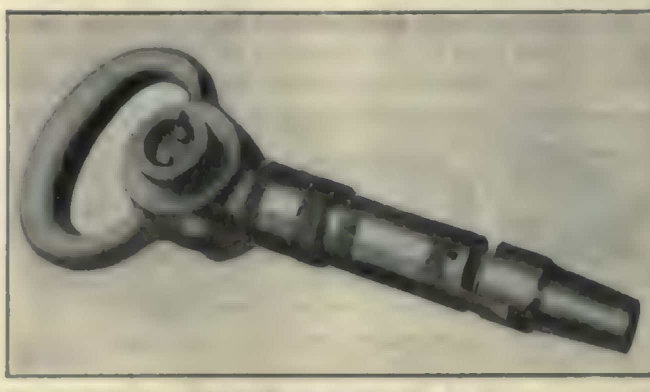
The size of the reamer is adjusted by means of the nuts at the ends of the blades. Since the blades have only straight relief, they can be sharpened on an ordinary tool grinder without taking the reamer apart.

The reamers are made in eleven sizes. The smallest has a minimum diameter of $\frac{11}{16}$ in. and a maximum diameter of $\frac{13}{16}$ in., has blades $1\frac{13}{16}$ in. long, and is $5\frac{3}{4}$ in. overall in length. The largest has a diameter adjustment from $1\frac{11}{16}$ to $1\frac{15}{16}$ in., has a $4\frac{1}{2}$ in. blade length, and is 12 in. overall in length. The reamers can be supplied singly or in sets packed in wooden cases.

Changes in "Titan" Pneumatic Tools

Since the description of "Titan" pneumatic tools on page 1015, Vol. 53, of *American Machinist*, the following changes have been made in their construction.

The valve sleeves and all port holes in the sides of the tools have been eliminated, so that instead of regulating the air by opening and closing the ports, a constant passage of free air is forced through the entire tool between the inner and outer casings.



"TITAN" PNEUMATIC TOOL

These changes greatly simplify the construction of the tool and prevent the former objectionable heating of the outside casing.

The illustration herewith shows one of the tools since the above noted changes have been made. The tools are now made and marketed by the Titan Power Hammer Corporation, 25 West Broadway, New York.

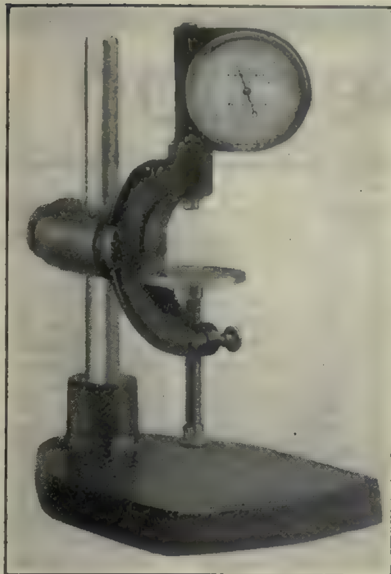
Horstmann Swivel-Head Indicating Caliper and Stand

On page 917, Vol. 50, of *American Machinist* there appeared a description of an indicating caliper made by the F. W. Horstmann Co., 196 Coit St., Irvington, N. J. A caliper of similar type but provided with a swiveling head, as shown in the accompanying illustration, has just been placed on the market by the same concern. The head swings through a complete circle about the plunger, so that its position can be adjusted to enable easy observation. The head will stay fixed in any position without the necessity of clamping it.

The instrument is used in the same manner as the caliper previously described, being set to the desired size of the work. Since the dial is graduated in thousandths of an inch, variations in the size of the pieces from standard can be easily observed. The tool is made in six sizes from 1 to 6 in. in capacity, each size having a range of 1 inch.

The stand in which the tool is shown

clamped in the accompanying illustration may be provided to facilitate gaging work of comparatively large size, so that the operator need not hold the caliper in his hand. The stand normally requires no fastenings, but for very large work it can be secured to a bench or table. The caliper may be clamped in the stand in either a straight or a tilted position, and is held perfectly rigid. Larger anvils may be furnished to use the caliper and stand.

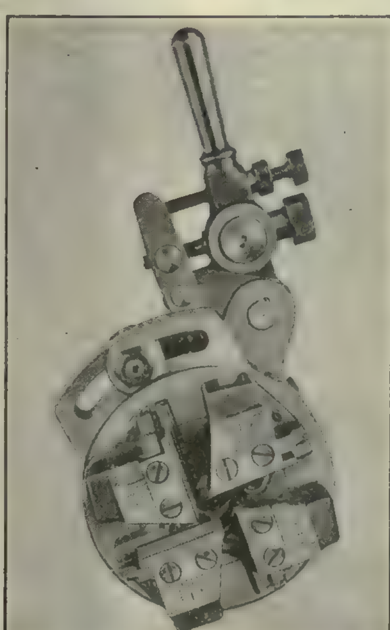


HORSTMANN SWIVEL-HEAD CALIPER AND STAND

Landis Stationary Die-Head with Micrometer Attachment

The Landis Machine Co., Waynesboro, Pa., has recently placed on the market a stationary type die-head with micrometer attachment as shown in the illustration herewith. With the micrometer attachment it is possible to set the die-head so that in taking one or more roughing cuts, the same amount of metal will be left for the finishing cut on each piece.

Graduations for all sizes of bolts and pipe within the range of the die-head are stamped on the outer surface of the closing ring. After the die-head has been adjusted to size, by means of the graduations, and locked as far as that adjustment is concerned, further and finer adjustment can be made by use of the micrometer screw. An adjustable stop screw is provided so that after the micrometer adjustment for the finishing cut has been made, finishing cuts can be taken after roughing cuts, accurately repeating the size. The die-head can be applied to lathes, hand operated screw machines and other types of machines where the work is revolved while the threading head remains stationary. For attachment to screw machines or turret lathes the die-head is equipped with a shank to conform to the dimensions of the holes in the turret. For use on engine lathes, a special bracket is required. If the work is placed on centers a special dead center is needed.

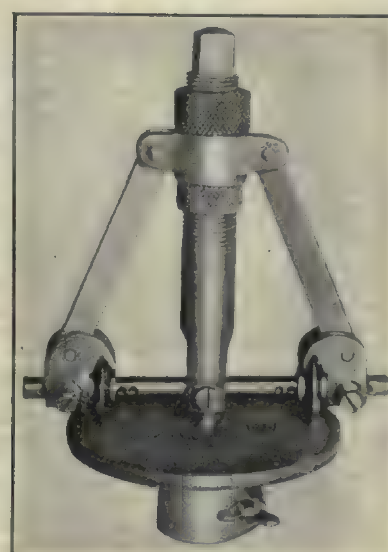


LANDIS MICROMETER DIE-HEAD

Butterfield "E-Z" Circle Cutter

The small tool shown in the accompanying illustration is intended for cutting round holes from 1 to 3¾ in in diameter in sheet material such as paper, fiber, rubber, leather and metal up to $\frac{1}{16}$ in. in thickness. It has recently been placed on the market by the M. A. Butterfield Co., 12 June St., Lowell, Mass., and is designated as the "E-Z" circle cutter.

The two cutting wheels are so mounted on a hardened spindle that the distance between them can be adjusted to the diameter of the circle that it is required to cut. The spindle and the cutters are supported by two braces, the positions of which can be moved by the knurled nut threaded to the shank so as to adjust the distance between the cutters. The feed pressure is obtained by means of a nut which engages with the supporting plate through a ball thrust bearing. The device is furnished with an extra plate and a short spindle to enable cutting holes close to a corner. This arrangement is particularly useful when enlarging openings in switch cabinets and outlet boxes. All the steel parts of the tool are hardened. The tool is ordinarily furnished with a ½-in. square shank, so that it may be driven by means of a ratchet wrench or a bit-stock attachment.



"E-Z" CIRCLE CUTTER

The device is ordinarily driven by hand, but it can be turned by power, if it is available. The tool is light in weight and compact, and can be easily carried about the shop.

The Foreman and Production

By C. E. Jensen

In dealing with a production group, we find that unless the foreman understands all the factors making up successful and profitable production, and is able to impress that fact upon his workers without apparently taking the trouble to do so, he will not make a success of his position. His workers must look up to him in technical matters. Otherwise, they will look at him out of the corners of their eyes, which means disrespect, an unwilling obedience and a disregard of advice —if not actual disobedience.

The foreman's biggest job is not the understanding and handling of the machinery, the materials or the workers. Nor does it lie in understanding the methods by which these are utilized to the best advantage of all concerned—including the community. But his biggest job is the understanding and handling of his own personal equipment for his job. It is knowing his possibilities and his limitations and how to utilize the first to the fullest and how to counteract the latter. This he may learn by self analysis and study, and sometimes by the help of "friend wife."

News Section

Turkey Needs American Machinery

From the American Chamber of Commerce for the Levant, in a special message, comes word of the opportunity awaiting American machinery manufacturers. Of vital need to Turkey at the present time, it says, is machine power. As a consequence an urgent demand exists for American-made tractors and agricultural implements of all kinds.

It is pointed out that this demand has been created as a result of the exhaustion of the available supply of animals in the recent wars, most of the draft animals having been used for cavalry and artillery purposes. American tractors, as well as other American-made farm machinery, possess a fine reputation in Turkey, it is stated.

The opportunities for the development of the Anatolian, Thracian and adjoining markets for agricultural machinery and implements are considered to be very good. Exporters here are urged to give serious thought to the entire Near East trade, as the time is now reported as being peculiarly opportune for developing this business. No duty is charged for the admittance of agricultural machinery into Turkey.

Railroads Plan Large Equipment Purchases

The Interstate Commerce Commission, according to reports from Washington, has just granted permission to the Boston and Maine Railroad Co. to carry out its plans for acquiring $3,-949,700 of new equipment, consisting of twenty-two switching engines, two road engines, sixty-five steel baggage coaches, twenty steel smoking cars, eight steel baggage and smoking cars, five steel baggage and mail cars and twenty-five milk cars, passenger-equipped. The steel cars are a start toward complete elimination of wooden or composite passenger equipment from that road.

To carry out the plan the commission authorized the company to issue $1,-[illegible] of equipment trust certificates at [illegible] per cent interest, payable semi-annually. The Government is to lend the company $1,212,500 to enable it to make the necessary cash payment on the equipment.

It is also reported that application has been made to the Commission by the Seaboard Air Line for permission to issue $2,450,000 of 6 per cent equipment trust certificates, the money to be used in part payment of 900 new steel underframe ventilated box cars, 300 new all-steel phosphate cars, 1,000 rebuilt steel underframe box cars and four all-steel dining cars.

The company has also asked permission to issue to the extent necessary of [illegible] equipment trust certificates, to obtain the release of rebuilt equipment from the lien of mortgages or equipment trust agreements now encumbering them. The arrangement for rebuilding the cars in question was approved several months ago.

Many other applications are now before the Commission in Washington from various railroads throughout the country. In the majority of cases the funds from the issues upon which authorization is being asked will be used either in road betterments or the purchase of new equipment.

Machine Tool Merger

The work of merging certain machine tool companies which has been under way for several months past was finally completed on Wednesday, July 19 and formal transfer of the individual companies to the new corporation, known as the Consolidated Machine Tool Corporation of America, was effected.

The new organization was incorporated under the laws of the State of Delaware in June, 1922, and is composed of the following individual units:—

Betts Machine Co., Rochester, N. Y.; Ingle Machine Co., Rochester, N. Y.; Hilles & Jones Co., Wilmington, Del.; Modern Tool Co., Erie, Penn.; The Newton Machine Tool Works, Inc., Philadelphia, Pa.; The Colburn Machine Tool Co., Cleveland, Ohio.

The Dale Machinery Co. of New York and Chicago of which John J. Dale is president, has also been taken over by the new combination.

The executive heads, who were also the owners of the companies forming the consolidation and who were responsible, in a great measure, for their success in the past, will remain as active executives and directors of the new company with the addition of C. K. Lassiter as president and W. H. Marshall as chairman of the board of directors.

As now made up the executive personnel and directorate is as follows:—W. H. Marshall, Chairman of the board; C. K. Lassiter, president; H. J. Bailey, H. W. Breckenridge, H. W. Champion, J. J. Dale and A. H. Ingle, vice-presidents; O. D. Miller, treasurer; R. R. Lassiter, secretary; W. H. Marshall, C. K. Lassiter, H. J. Bailey, B. J. Baker, H. W. Breckenridge, Lawrence Chamberlain, H. W. Champion, J. J. Dale, T. Allen Hilles, A. H. Ingle, F. D. Payne, directors.

The executive offices of the new corporation will be in the National City Bank Building, 17 East 42d St., New York City.

Automobile Tire Production Establishes Record

The production of rubber tires for the month of June, according to preliminary reports, indicates a new monthly record established, with an output of 3,500,000 casings. This compares with May production of 3,000,000, a production approximately 10 per cent under the record month of August, 1921.

Support for President Asked by Chamber of Commerce

Business organizations of the country within the past week have been called upon by the board of directors of the Chamber of Commerce of the United States to take such leadership as will crystallize public sentiment in upholding President Harding in the exercise of his authority for the maintenance of uninterrupted railway transportation. At the same time the Board has commended President Harding's statement making clear the issues involved in the strike, and has urged the Administration to use all the power of the agencies of the government to the end that the supremacy of the law be maintained. The President has been informed of this action of the board in a letter written by Julius H. Barnes of Duluth, president of the Chamber. Mr. Barnes has named Harry A. Wheeler, of Chicago, to deliver the letter to the President.

The declaration of the Board, as set forth in the letter, follows:

"The Board of Directors of the Chamber of Commerce of the United States commends the statement of President Harding making clear the issues involved in the Railroad Shop Crafts Strike. We believe in the peaceful settlement of controversies and due respect for agencies established by law or mutual agreement for securing just and impartial decisions. We believe in the compliance with such decisions by both parties and that the public will trust decisions so arrived at as generally fair and accord them support.

"This strike of a section of railroad employees is against a decision of the Government's own agency.

"That agency is continuously in session to carefully consider and fairly decide in the public interest controversies between railroad management and their employees relating to wages and salaries or working conditions.

"The attempt of the striking railroad employees to enforce their own views through methods of industrial war should meet the condemnation of all who believes in orderly processes of settlement.

"This country is slowly emerging from a period of unemployment and severe business depression, and cannot patiently view any unlawful interference with its transportation facilities, retarding its industrial recovery.

"We commend the President for his determination to maintain the supremacy of the law and we urge the Administration to use all the power of the agencies of the government to that end.

"We call upon the business organizations of the country to take such leadership as shall crystallize public sentiment in upholding the President in the exercise of his authority for the maintenance of uninterrupted railroad transportation and for such local protection and community public order as will secure every man his right to work without intimidation."

Business Conditions in England

By OUR LONDON CORRESPONDENT

The three months dispute with the engineering workpeople ended in an agreement which gave the employers much that they wanted. As to overtime, the employers have the right to decide when this is necessary up to a limit of 30 hours a month. In regard to any changes in shop processes or practice, where alterations mean the general displacement of workpeople of one class by people of another class, the employers undertake to give not less than 10 days notice of their intention to change, and also to provide an opportunity for discussion, unless circumstances are beyond their control. Where workpeople cannot protest until after the event and the protest is upheld, the decision, as far as payments go, is to be retrospective to the date of protest. For three weeks or so, work has been resumed in the federated shops.

Inquiries More Numerous

Not in every case has it been possible to take on as complete a complement of workmen as had been employed before the shops were shut, and this fact helped to cause, at first, somewhat of an increase in the numbers of unemployed registered officially, as men were then entitled to make claims which are not tenable if made by locked-out workers. However, since then further falls have been reported. According to the latest figures, the numbers claiming State unemployment benefit amount to 1,404,900 or, about 420,000 less than at the beginning of the year, while 105,900 are working short time and drawing benefit for intervals of unemployment.

The raw material market at the end of the dispute showed no particular additional animation, so that no immediate revival was anticipated. The same remains true now except that confidence is growing and, according to recent reports, not only are the home railway companies ordering rolling stock but Indian railways are also in the market for similar equipment.

For iron and steel, British prices are held in many respects to compare quite favorably with those of the continent, especially, as in Germany, increases in prices have been reported. The effect on the machine tool industry has yet to be seen. Certainly any improvement is but slight, and although there have been one or two complaints, more particularly from the Glasgow area, there is little evidence of the sale of German tools. In fact, those who are endeavoring to get the machine tool industry entered under part two of the Safeguarding of Industries Act, have failed so far. The fact is that though German tools are on offer very few are sold.

Tool inquiries have seemed to be more numerous or nearer to business of later but "man never is but always to be blessed," and it is now thought generally that the British engineering industry cannot revive unless the war wage bonus is removed. Some firms, at any rate, are holding off in the hope that prices will fall, and machine tools are not so urgently needed that delay is fatal.

The small tool trade has remained relatively bright, and one of the leading firms has just started to sell direct from a sort of traveling stores in the shape of a self-propelled vehicle pretty completely stocked. On the other hand, another English firm, that lately took up the manufacture of small tools will, according to rumor, be dropping them before long. One or two firms of manufacturers' agents are adopting a somewhat new method of setting apart a special room with tables on which are displayed samples of all, or at any rate many, of the small tools, etc., in which the firm deals. The idea is that the customer can come and look over the exhibition, for that is what it amounts to, and then place orders which will be filled from stock. Only one sample of each appliance is shown, so that the exhibition cannot be drawn on for direct supplies.

As was forecast in these columns some time ago, a London firm of machine tool dealers has now opened up as restaurant proprietors, and what were, until recently, show-rooms and offices are now kitchens and dining halls. Already it is the rendezvous of the machine tool people of the district. Among manufacturing firms one machine tool house is solely occupied in the machining of motor car details. Another has included equipment for the farm among its output, while a third is largely engaged on engineering repairs and the production of household utensils. Yet another is engaged on bread-cutting and buttering machines, while one well-known agent has not sold a tool since September last according to his own statement, and a certain firm of machine tool merchants is reported to have received its last order more than three months ago. These may not be fair examples, yet it must be admitted that the machine tool industry, taken as a whole, is anything but prosperous.

Serious Effect of Strike

As already indicated, not all the workpeople who were locked out were able to resume operation immediately after the dispute was ended, and the two classes of firms who, most readily, found places for their men were the textile machinery manufacturers and automobile firms, the lighter side of the latter industry having been in a good position for some time past. It is thought, however, that very few of the makers of the more expensive cars are likely to show profits. While exports may not be up to the mark, home orders for the cheaper cars are not lacking and in some instances double shifts are reported. With the trade in cycles, both ordinary and motor, appearing to be satisfactory.

As regards commercial vehicles, the decision not to hold the annual exhibition in the autumn of this year is not without significance. Aircraft and particularly the aero engine people complain of government neglect. One large firm is reported as considering the closing down of this part of its works in the near future as soon as certain foreign orders are executed, while another will probably build or arrange for building in France. Despite some orders reported, the steam locomotive building industry is in no very satisfactory condition and this applies also to the agricultural machinery side.

As to Scottish shipbuilding, a recent statement of the output on the Clyde speaks for itself. For the first six months of the present year the production of launches aggregated 167,468 tons, a decrease of more than 68,000 tons as compared with the same period of last year. The record established during the first six months of 1913 amounted to nearly 350,000 tons. In short the engineering and shipbuilding trades must be regarded as fighting for their existence. Current complaints as to excessive railway rates charges for the transportation of food and other commodities are heard here with no less frequency than is the case elsewhere.

Industries Show Losses

In many instances the effect of the recent lock-out has been to improve the relationship between employer and employee, and negotiations are starting with a view to reductions in, if not the complete elimination of, the war-time bonus. Even as it is, in some districts the wage rates of skilled workmen are below those of street cleaners.

The decline in the cost of materials was indicated recently by the chairman of John Brown & Co., Ltd., steel makers, Sheffield, when he stated that English basic pig last year was being offered at £9 a ton as compared with Belgian pig in this country at £5 a ton, whereas English pig is now down to £4 10s. Similarly, while last year basic blooms were priced at £15 English and £8-15s. Belgian, today the English price is £8-10s. Again, last year steam coal was 35s. a ton at the pit while now it is below 20s. Parenthetically we may remark that, whereas some coal distributors in the London area had been asserting their profit per ton to be no more than 5d., yet a week or two ago they managed suddenly to cut prices by 9s. a ton without, however, stimulating the hoped-for demand.

Returning to the Sheffield concern, it was pointed out that in their works the output was not more than one-third that of the previous year and, while the shops had been reconstructed to meet peace developments, the trade had not materialized. It is also pointed out that the stoppage of Admiralty orders, following the Washington conference, undoubtedly had a detrimental effect on Sheffield. For this the worst year in the history of the company as far as the chairman could remember, a dividend of 5 per cent has been paid, and little hope is held out for increased disbursements next year. Ruston and Hornsby, Ltd., builders of internal combustion engines, etc., had to transfer £100,000 from the general reserve to meet further diminution in the value of stock in trade, and W. Foster and Co., Ltd., agricultural engineers, Lincoln, reported a loss of £7,500. Vickers, Ltd., announce a dividend of 5 per cent on ordinary shares, but this, in itself, indicates an improvement as these

(Continued on page 168a)

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

The substratum of confidence and optimism which underlies American business at present is indicated by the imperturbability with which the markets received the rather unsatisfactory strike news published last week. A great many trains have been annulled because of the railway strike and at this writing it is uncertain whether President Harding's efforts to get the coal mines reopened will succeed.

The steel industry is slowing down in some localities for want of fuel. A shortage of building material is commencing to be felt because the brick kilns and tile factories are without coal and the railroads cannot move lumber and cement as rapidly as they are required.

Higher Coal Prices

The feeling is that the force of public opinion plus the moral suasion of the Government will induce the strikers to resume work under some sort of modus vivendi. This feeling is probably warranted, but it is likely nevertheless that it will be a winter of very high priced coal, for the surplus supply of bituminous has been used up and the most hopeful estimates of non-union production do not exceed six million tons a week as against a normal consumption of nearly twice that quantity.

In so far as anthracite is concerned the outlook is even graver, for the mines are tightly unionized and there is but little likelihood that they will be soon reopened. Two hundred thousand tons of English coal is on the way here, but this is but a drop in the bucket.

The plight of the railroads is less serious. There is reason to hope that most of their employees will soon return to work, but the accumulated arrears of traffic and the quantity of coal that must be hurriedly moved when mining is resumed will probably overtax many lines. The wisdom of prompt shipment when shipment can be made is therefore increasingly self evident.

But we need not emphasize the gravity of the labor troubles. They are generally understood and appreciated, and we shall no doubt muddle through them somehow. The domestic situation is otherwise almost flawless and most omens are auspicious. The Federal Reserve Bank statement shows a further gain of $10,000,000 in the gold supply and a reserve ratio of 77.8 per cent as against 77.2 at the end of the preceding week. Commercial paper is selling readily at 4 per cent and easy money seems assured for a long time ahead.

Most American bonds, including Liberties, are firm and slightly higher, but the demand for foreign obligations has not recovered from the check given it by the threat of Germany to confess bankruptcy.

European conditions are, however, improving. It is generally understood that Great Britain has offered to forgive the debt that France owes her if the French will agree that the reparations demanded of Germany shall be reduced from 132 billion to 50 billion gold marks. If the French are sensible enough to accept this proposal, which is as generous as it is wise, the way will be opened for an international loan to Germany which will greatly accelerate reconstruction throughout Europe.

Meantime it is probable that the reparation commission will accord Germany a two years moratorium during which she will have opportunity to catch her economic breath. As bearing upon the value of the mark it should be noted that at the present quotation of 20 cents a hundred the 172 billion paper marks outstanding are worth only 344 million dollars, and that the Reichsbank holds about one billion gold marks having a value of about 240 million dollars.

In the light of these figures a purchase of marks at present prices would seem to be a promising speculation at very long odds for those who are able and willing to undertake the rehabilitation of Germany's credit.

In the New York and London stock markets the tone has been almost firm. American railway shares have been conspicuous for their strength and the indications favor a sharp advance when the earnings reflect the large autumn traffic in prospect. Crop reports are good and merchants from the agricultural sections are buying more confidently in the wholesale markets.

The number of buyers registered in New York last week was the largest on record for this season of the year and trade in the dry goods district was noticeably active. The shortage of cotton goods resulting from the New England textile strike is now commencing to be felt. The American Woolen Company surprised the trade in the reductions made at its "spring opening" last Monday. The buying is said to have been general but not quite as large as it might have been if the tariff bill were not still in the air.

Staples Show Recovery

The American market for raw wool is reactionary, but at the Colonial Wool Sales held in London some advances were recorded. Here again the tariff is a factor whose influence upsets commercial calculations.

The candid minded admit an improvement in the cotton crop, but prices have changed but little as experienced traders realize that unfavorable weather in August might cause great damage.

Raw silk is rising again. Burlap and jute are also higher upon advices from India emphasizing the shortage in the jute crop.

Coffee has been quiet and easier. The fear that the Brazilian Government is selling or may sell its holdings continues to haunt the trade despite denials.

Sugar has advanced as I expected and the market is developing sensational strength. The surplus supply of last January has been all distributed. A sharp reduction in the American acreage planted to beet sugar is reported by the Agricultural Department and some statisticians now figure that the supply left available for this country will be less than the consumption. A minus stock of sugar or anything else is of course impossible, but there is every indication of a further and substantial advance before the indicated disproportion between supply and demand is readjusted.

Conditions Approaching Normalcy

Rubber, which is about the only commodity that is still subnormally low, continues to drag. The trade awaits definite news that the production will be restricted, but consumption is commencing to make some impression on the surplus stocks and it is quite possible that as in sugar we may wake up some morning to find that they have vanished.

When basic commodities are well below the cost of production they generally disappear with surprising rapidity. This statement is also partially applicable to copper, for although at the current quotation of 14 cents it is not below the cost of production, that price seems to be sufficiently low to induce a large offtake.

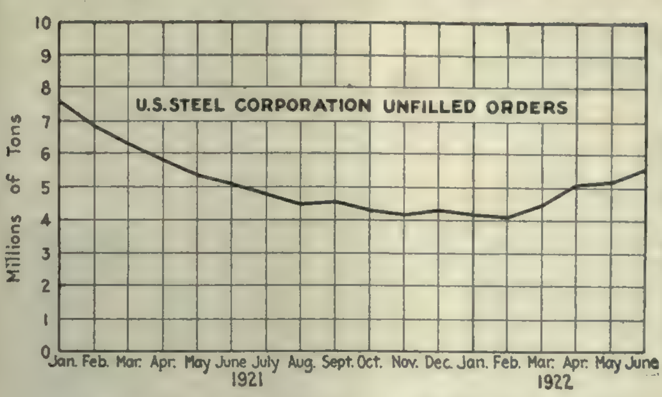
The June report of foreign trade shows merchandise exports worth 384 million dollars and imports valued at 260 millions. For the fiscal year ending June 30, 1922, the excess of exports was 1163 millions as against 2838 millions for the previous twelve months.

These figures indicate a return to normalcy in so far as our trade balance is concerned and as a generalization the other news of the week is to be similarly construed.

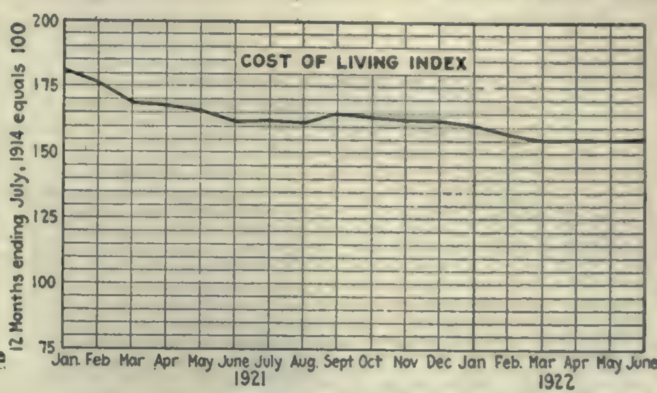
All things considered the world's business, especially in America, is recovering from the disorganization of the war with amazing rapidity, but perfection is impossible and in even the brightest skies some clouds will from time to time be seen. On the whole, the machine of civilization is running with remarkable smoothness.

Southern Exports Show Big Improvement

Indications of rapid improvement in the export business from the various southeastern ports of the United States during the past two or three months are shown in the June report for the port of Savannah. The figures available show that exports of cotton, lumber and naval stores from the port for the month were greater than in any month in more than a year. The month of July has started with unusual activity, indicating a still better record as compared with June.



Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.

DESPITE the coal and railway strikes, unmistakable signs of good, sound business prosperity are to be found on every hand. To some extent these disturbing factors temporarily may effect production and retard industrial improvement, but with the country on the eve of a big industrial revival, and with the working man sorely in need of steady employment, confidence is expressed in well-informed circles that a speedy and satisfactory solution of the troubles will be found.

Unfilled tonnage of the U. S. Steel Corporation on June 30 reached the high point of 5,635,531 tons. June production of pig iron shows an increase of 45,651 tons over May, reaching the highest point recorded since January 1921.

Early forecasts of crop yields are favorable with an indicated production of wheat, oats, barley and rye on a par with that of last year. Cotton consumed totaled 509,869 bales, with 491,097 bales exported. Stocks of cotton on hand continue to decline with 3,268,000 bales being shown as of June 30 as compared with the January 1 stock of 6,915,000 bales.

Loadings of revenue freight for the week ending July 8 totaled 718,319 cars, a reduction of 158,577 cars as compared with the week previous, but an increase of 77,784 cars over the corresponding week of 1921. Idle cars on July 1st because of business conditions totaled 405,185 or a reduction of 23,889 from the previous week. Of this total 239,225 cars were of the freight class in good repair in excess of current freight requirements while the remaining 165,960 cars were freight cars in bad order in excess of the normal number unfit for service. Of the total 2,266,045 cars on American railways, reports indicate 324,583, or 14.3 per cent to be in need of repairs, as compared with 14.6 per cent on June 15 or a reduction of 8,089.

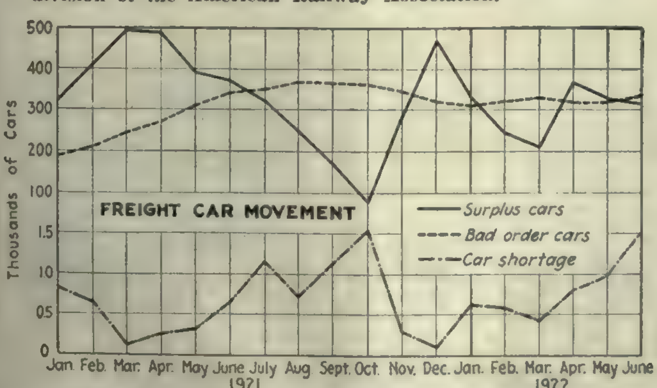
Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

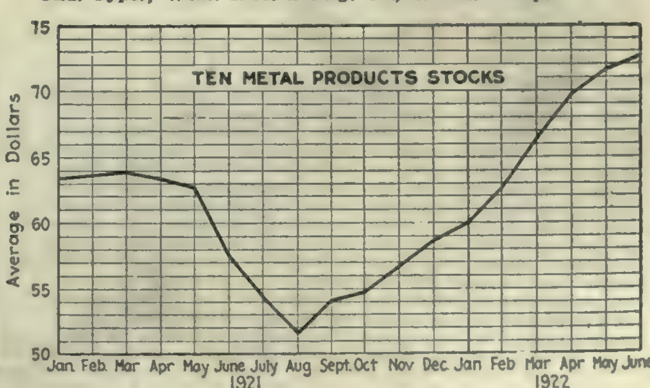
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.027	$0.0252	$0.301
Cold finished shafting	per lb.	0.0350	0.325	0.0435
Brass rods	per lb.	0.173	0.1550	0.161
Solder (½ and ½)	per lb.	0.23	0.213	0.203
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.573	....
Machine oil	per gal.	0.36	0.40	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

Foreign affairs at the moment appear brighter than has been the case for some weeks past. Berlin has agreed to accept the guarantee committee's proposal of allied supervision of her finances. This gives encouragement. It indicates, in some measure, a settlement of the reparations question, and is a matter of prime importance to American industry. The American public is more keenly interested in conditions abroad today than ever before. Evidence of this fact is had in the foreign loans offered in the United States which continue to increase in volume. Between January 1, 1921, and June 26, 1922, foreign loans offered and absorbed in the United States totaled the huge sum of $1,369,006,125. Offerings in the first half of 1922 alone total $673,801,900, and the readiness with which they have been absorbed is noteworthy, reflecting as it does the state of the public mind toward the peoples and industries in other parts of the globe. It bespeaks the faith of American investors in the future of the nations abroad.

Monthly average of car shortage, surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co., Worth. Pump.



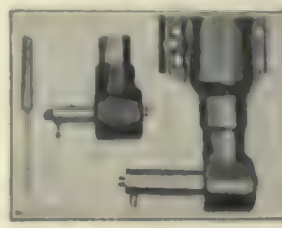
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Crib and Gage, Drill, Tap, "One-glance"
Victor R. Lawson Co., 33 Hartford St., Boston, Mass.
"American Machinist," March 30, 1922

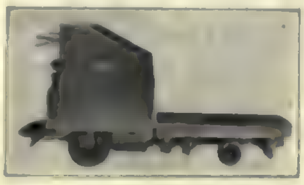
The device consisting of a drill crib with a drill gage built into it is 41 in. long by 9¼ in. wide and contains sixty [illegible] pockets [illegible] in. wide to hold drills from No. 1 to No. 60. The holes for the drill gages are located just at the ends of the pockets in hardened steel strips. Figures [illegible] in. in height on the frame give the number and diameter of drill to fit each hole. Three taps of each size from 14-20 to 1-36 are held. Each set is adjacent to the correct drill to use in drilling the hole for it in order to tap a full thread. The drills for ¾ or ⅞ depth thread are easily available

Attachment, Drilling, Offset
H. E. Harris Engineering Co., Bridgeport, Conn.
"American Machinist," March 30, 1922



The attachment is used for work where a very small clearance space is available and is intended especially for drilling, milling, countersinking and counterboring. It is made to reach into the main bore of a cylinder and drill or mill the vents or ports from the inside. The offset or horizontal arm is made as large as the bore of the air chamber and the depth of drilling or milling will permit. Drills, mills and counterbores having special shanks ground and lapped to fit the spindle in the outer end of the arm, are used.

Truck, Platform, Elevating, Gasoline
Clark Tructractor Co., Buchanan, Mich.
"American Machinist," April 6, 1922



The truck platform will elevate a load of 4,000 lb. from a minimum height of 11 in. to a maximum height of 16 in. Automatic stops control both the upper and lower limits of travel and the elevation can be stopped at any point. The lifting mechanism is operated by hydraulic pressure. Power for both locomotion and elevation is derived from a 15-hp., 4-cylinder tractor engine. Two speeds are provided in each direction. The driving and elevating controls and brake lever are mounted near the driver. The truck will climb a grade of 10 per cent with a 4,000 lb. load. Length 147 in. Width 35½ in. Height, 51 in. Platform, 36 x 45 inches

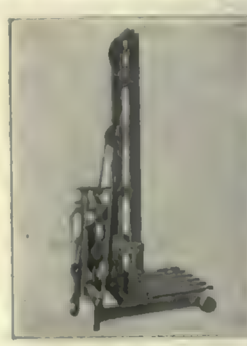
Crane, Industrial, Locomotive-type, Three-Movement
Baker R. & L. Co., 2180 West 25th St., Cleveland, O.
"American Machinist," April 6, 1922

The crane, used in both lifting and carrying work, has a capacity for lifting 2,000 lb at a radius of 4 ft. from the pivot of the crane, and 1,600 lb. at a radius of 8 ft. All controls are located on the dash in front of the platform. The machine is driven by a motor running at 1,150 r.p.m. and provided with three speeds in each direction. The lifting mechanism consists of a Sprague electric 1-ton hoist, and the boom may be raised by means of a similar hoist. A fourth motor with an electric brake swings the crane. Weight 6,600 lb.

Blower, Furnace, Electric, Motor-Driven
Clements Manufacturing Co., 601 Fulton St., Chicago, Ill.
"American Machinist," April 6, 1922

The blast is attached to small gas furnaces used in heat-treating, and consists primarily of a [illegible] universal motor projecting a small blower and operating on any specified voltage from 32 to 250. The blower is connected to the gas pipe, draws in air from the room, and delivers the mixture directly to the furnace. A damper is provided for regulating the mixture. The motor can be driven from the lighting circuit by attaching a plug to a convenient outlet. The blast delivers 210 cu.ft. of air per minute when running at 10,000 r.p.m. Weight, 13 lb.

Stacker, Lifting and Conveying
Lewis-Shepard Co., 560 E. First St., Boston, Mass.
"American Machinist," April 6, 1922



The machine is used for lifting, transporting and tiering materials in a shop or warehouse, and is mounted on three roller-bearing wheels. The front wheel can be lifted, so as to rest the two legs on the floor. The platform can be supplied with either roller or plain top, and has a minimum height of 10 or 8 in., respectively. It travels vertically on two 5-in., hinged channels, and is lowered by a lever. The height of the hinge as well as the length of the channels, can be furnished to suit the work. The machine may be operated either by hand or by electric power, and on all except the smallest size two speeds are provided. Platform, 36 x 24 in. Base, 39 x 50 inches.

Fixture, Grinding, Chaser
Geometric Tool Co., New Haven, Conn.
"American Machinist," April 6, 192?

The machine is used in grinding chamfers on the milled chasers made by the company and in grinding tapped chasers. With the fixture all chasers of a set are equally ground. Either left- or right-hand chasers may be handled. The fixture table is graduated and can be set for grinding either long or short chamfers. The [illegible] of the fixture is graduated for setting the table to the angle of chamfer clearance. The fixture may be bolted to the table of the grinding machine or mounted on a machine slide

Sawing Machine, Hack, Bench, Power-Driven, Portable
Edlund Machinery Co., Inc., Cortland, N. Y.
"American Machinist," April 6, 1922

The machine, used for fast cutting on small jobs ordinarily performed by hand, or on work usually performed by larger machines, can cut tool steel as well as softer metals. Power is supplied by a small electric motor. The saw arm has two rods on which the saw frame slides, and cutting is performed on the backward stroke. The pressure of the feed can be varied to suit the work by changing the position of the weight on the arm. The machine stops automatically when the cut is finished. A screw-operated vise holds the work.

Clip, paste on 3 x 5-in. cards and file as desired

Business Conditions in England

(Continued from page 165)

shares have received nothing since the dividend paid for 1919. The holdings in shares of this class amount to between 12 and 13 millions of pounds.

The electrical engineering concerns seem to be showing some decline. Crompton and Co., Chelmsford, has announced a decrease in net profits of £30,463. The ordinary dividend paid was 5 per cent instead of 10 per cent, while nothing was placed to the general reserve. On the other hand £10,000 has been set aside "to meet possible future taxation." This firm forms one of the concerns in which the Armstrong-Whitworth group are interested. It has been joined by C. Walmsley and Co., Ltd., Bury, manufacturer of paper-making machinery, working in conjunction with the Armstrong-Whitworth hydro-electric department, which seems to be particularly busy in connection with wood pulp. For the manufacture of newsprint the Walmsley firm recently introduced machines 232 in. wide, claimed to be the largest in the world. The first machine of this type has recently been set up in Canada.

Combinations of this kind have been reported as passing through difficult times, and the B. S. A. recently announced a loss for the year of £355,424, increased to £469,168 by interest on certain loans issued in 1920. The ordinary shares received no dividend. The company's contingent liability under guarantee in certain aircraft concerns has been reduced by about £400,000 and stands at something more than £550,000 The directors are under the impression that no charge is ultimately likely to fall on the company.

More orders are once again being placed with electrical engineering firms, largely in connection with the extension and improvement of the London tube and other railways. The combination known as the English Electric Co., has also received orders for electric locomotives for Japan amounting to half a million pounds and will electrify a section of a French railway and of a New Zealand railway also.

Meanwhile the cost of living, as officially calculated, has fallen to 80 per cent above that of 1913 but shows a tendency to rise. Money is cheaper, and the bank rate, without waiting for New York, has been reduced to 3½ per cent with a further reduction confidently anticipated. The usual assurance that this means the encouragement of industry has been given and, in fact, many fresh issues of capital are anticipated. Then again, the number of people who "whistle for the wind" by asserting that we have reached the bottom and are on the up grade, has very sensibly diminished. If we had "turned the corner" as often as was reported we should by now be a very giddy race.

In his address before the National Machine Tool Builders Association, according to report, Mr. A. H. Tuechter asserted that "in England, the Machine Tool Builders Association has arrived at a standard for milling machine spindles so that in the future, every milling machine built in England will be able to use the same face mills, arbors, etc., that are used on every other make of English milling machine. It is understood that the English standard is based on some American practice." There is perhaps some confusion of facts here, for the Machine Tool Trades Association (we have no Tool Builders Association) has done nothing in this matter. Some time ago, two rival sets of manufacturers here, namely Alfred Herbert, Ltd., and the constituent firms concerned in the Associated British Machine Tool Makers, Ltd., standardized their own practices as to spindle noses, which, however, differ. The whole matter was fully discussed in the columns of the European edition of this journal nearly three years ago, and it appeared that while the A. B. M. T. M. standard was that of the Cincinnati Milling Machine Co., the Herbert standard, on the other hand, had been adopted by Brown & Sharpe.

Swiss Automobile Industry Facing Crisis

According to a report just received from our correspondent in Switzerland, the automobile manufacturing industry of that country is facing a grave situation. All laws passed by the federal authorities imposing restrictions and prohibitions on foreign imports to aid the industry have come too late. They became effective only after the record year of 1920 showing an importation of foreign automobiles aggregating 75 million francs in value.

The official figures for the first quarter of the present year speak for themselves. While during the first quarter of 1921 the exports still reached a value of 2,020,000 francs, they amounted during the first quarter of 1922 to only 403,000 francs, a decrease of 1,617,000 francs in a period of three months. This is the worst figure recorded since Swiss automobile statistics have been published. How small and trivial the home demand has become for the Swiss automobile industry is best evidenced by the breakdown of a number of the leading factories of the country. Had the federal government not opened a great number of new automobile-postal-routes, and thus placed considerable orders with the home factories, the situation would be still more discouraging.

Imports also show large decreases. During the first quarter of 1921, automobiles brought into the country had a total value of 15,200,000 francs. During the first three months of the current year the imports were valued at but 5,200,000 francs, a decrease of 10,000,000 francs, and indicating the general crisis through which the country is passing.

The few exports which have been made have gone, chiefly, to France, England and Spain. Only one country, namely, Roumania, bought over 100,000 francs worth of Swiss automobiles. Up to the year 1921, Spain and the Dutch East Indies offered a good field for the Swiss automobile industry, but it seems that the Spanish market is definitely closed to the industry since Spain has raised her import duties to such an extent as to make them now absolutely prohibititve.

The principal countries from which automobiles were imported during the first quarter of 1922 were, in order of importance: France, 1,442,000 francs; Italy, 1,216,000 francs; Germany, 1,175,000 francs; Austria, 455,000 francs; United States, 392,000 francs; Great Britain, 278,000 francs; Belgium, 221,000 francs.

The United States in 1921 held the fourth rank in the Swiss importation but is now surpassed by Austria. Four-fifths of the cars imported were "leather covered," as the statistics say, and, therefore, exclusively new passenger cars. The reason why the German import figures are relatively small lies in the fact that German manufacturers impose a heavy extra charge on automobiles for export trade, and many orders, therefore, go to Italy and France. If Germany were to sell to home and foreign buyers at the same prices, she would no doubt control the Swiss automobile market, just as she does the bicycle trade at the present time, more than two-thirds of which come from that country.

Business Items

The Bastian Blessing Co., Chicago, Ill., manufacturers of welding and cutting apparatus, has announced that it has taken over the entire output of the line of soldering equipment, trucks, preheaters and acetylene generators produced by the St. Paul Welding and Manufacturing Co. The latter company will act as service distributors throughout the Northwest, maintaining and operating a service station at St. Paul.

The Hayes-Meserole Manufacturing Co., Inc., Milford, Conn., recently incorporated under the laws of Connecticut, with a capital stock of $100,000 to manufacture wire, wire products, etc., has taken a lease on a portion of the former plant of the United States Rubber Co., Milford, and is making arrangements to start production shortly.

The Milford Electrolytic Iron Co., Milford, Conn., recently organized, announces it has secured a lease on the factory plant of Page and Nettleton on New Haven Ave., and is having extensive alterations made to the building. The company expects to start production in the early fall.

The Hartford Foundry and Machine Co., Hartford City, Ind., has increased its capital stock to $75,000.

The J. G. Dickson Co., Pittsburgh, Pa., has recently moved its plant to 317 South Main Street, West End, in order to secure larger quarters to take care of proposed expansion.

The Mesta Machine Co., Pittsburgh, Pa., announces the removal of its Chicago office from the McCormick Building to the Peoples Gas Building, with A. B. Neuman in charge.

The Taft-Pierce Manufacturing Co., Woonsocket, R. I., manufacturers of special machinery, recently increased its capital stock from $300,000 to $1,200,000.

The Guy Steel Casting Co., West Hartford, Conn., recently incorporated to engage in the metal castings and steel treating business, with a capital of $50,000, was organized during the past week by the election of the following officers: president, John A. Guy, Hartford; vice-president, John E. Synott, Hartford; treasurer, William R. Bennett, Hartford; and secretary, George B. Kinghorn, of Southington, Conn.

Condensed-Clipping Index of Equipment

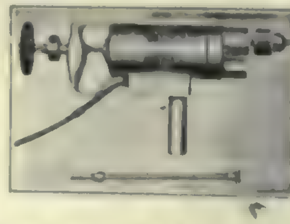
Patented Aug. 20, 1918

Hook, Crane, Safety, "Yankee"
Frank W. Trabold, 30 Church St., New York, N. Y.
"American Machinist," April 6, 1922

The hook is used on hoists and cranes when lifting loads. The load hangs directly on a curved member pivoted on the other longer member shown at the left side. The entire load must be off the hook in order to open it. When the weight carried becomes excessive, then the straight member shares in the load. The hook can fail only when the load exceeds the ultimate strength, and not when it exceeds the elastic limit. The swiveling member may be omitted. The hook is ordinarily made in sizes having capacities of 1, 3, 5, 15 and 25 tons.

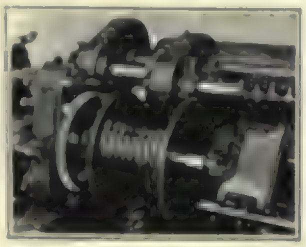
Drill, Electric, Portable, with Grinding Attachment
Louisville Electric Manufacturing Co., Louisville, Ky.
"American Machinist," April 6, 1922

The grinding attachment is placed on a Pioneer "garage special" drill to adapt the tool to such work as sharpening toolbits. The drill has the usual drilling spindle, as well as a device for oscillating the automotive valve grinding tool. The tool for driving the valve is shown below the drill. The grinding attachment fits in the rear of the armature shaft and passes through the handle; it can be quickly removed. The bearing that fits in the handle is equipped with ball bearings for the spindle, the speed of which is normally 9,000 r.p.m. The tool is furnished to operate on either alternating or direct current of either 110 or 220 volts.



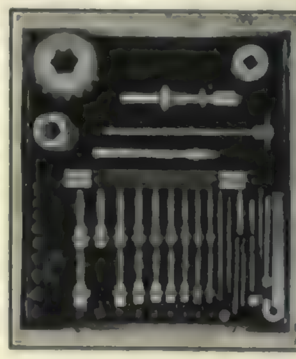
Cable Retriever, Feeder
Pawling & Harnischfeger Co., Milwaukee, Wis.
"American Machinist," April 6, 1922

The device is used for winding a cable which supplies current to a lifting magnet carried by a crane. The large, flanged drum is driven by the motor that hoists the magnet. The retriever keeps the cable taut at all times, so that no slack is allowed; but this tension is adjustable. Although the drive is through gears, the final drive is through friction members. The drum is driven only while the magnet is being hoisted. When the magnet is lowered, its weight unwinds the cable against the retarding force of the friction mechanism.



Broach, Adjustable
Edward Hollander Tool Co., 142 Miller St., Newark, N. J.
"American Machinist," April 6, 1922

The tool is used primarily in a shaper, but can be used in a drilling machine, lathe or screw machine. Type B consists of a shank on one end of which are the cutting edges, this end being slit in the center of each flat face, so that it can be expanded. Type A broach consists of a holder held in a suitable shank, with a mechanism for expanding the cutter. The tools ordinarily cut to a depth of 2½ in., but with the extension attachment provided they cut to a 5-in. depth. The cutters are sharpened by merely grinding the front face. They can be furnished either individually or in sets to suit any requirements.



Gages, Thread, Ring and Plug
Superior Thread Gauge Manufacturing Co., Brooklyn, N. Y.
"American Machinist," April 6, 1922

The principal feature of the ring gage is that the hole is eccentric to the outside diameter, so that sufficient spring is obtained at the small section of the gage in adjusting the size. Only one cut breaks the continuity of the thread. By placing the hole eccentrically a smaller outside diameter is possible than with the concentric style. The size of the ring is adjusted by tightening the set screws. In the plug gage the ends can be removed from the handle. The gages are made in U.S.S. and S.A.E. sizes for diameters from ¼ to 2 in. They can also be furnished in larger sizes to suit special work.

Gage, Amplifying,
American Gauge Co., Dayton, Ohio.
"American Machinist," April 6, 1922

The tool is similar to the larger gage made by the concern, although it is more limited in its range and does not have all of the attachments. It is used in grinding and inspection departments, and can be furnished in two sizes, one for measuring round work from ¼ to 2 in. in diameter and the other for work from 2 to 4 in. in diameter. The anvil block can be removed or its position adjusted, as can also the stop for the work. The height and position of the measuring point are adjustable by moving the entire arm. Clamping levers lock the adjustments in place.

Boring Machine, Two-Way, Motor-driven, Semi-automatic
Manufacturers' Consulting Engineers, McCarthy Bldg., Syracuse, N. Y.
"American Machinist," April 13, 1922

The machine is used for boring simultaneously both sides of the work, as when boring, bottoming and reaming both the exhaust and the intake ports of gas engine cylinders. The workholder accommodates four cylinders, and can be rotated about its central axis. The multiple heads at the two ends of the machine are fed toward the center simultaneously, where they finish the work and then return to their outer positions. The workholder is then indexed to the next position, and the feed for the heads engaged by a hand lever so that the cycle is repeated.

Grinding Machine, Wet, Bench, "Re-li-o," No. 2
Van Norman Machine Tool Co., Springfield, Mass.
"American Machinist," April 13, 1922

The machine has been adapted to wet grinding and is suitable for the use of cylinder regrinding shops and piston distributors. The wheelhead is equipped with a ½-hp. motor carrying an 8 x ¾-in abrasive wheel. The wheelslide is longer than in the dry type, and some parts of the machine are heavier. The removable toolholder mounted on the front of the wheelslide can be swung into and out of the operating position without changing the position of the set-up or dismounting the grinding wheel. The wheel is not rotated while the lathe tool is cutting. An adjustable stop is provided for the table. Weight, 600 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

JOHN A. CAMM, for several years past connected with the Kearney & Trecker Corporation, has resigned his position with that company to become president of the Western Iron Stores Co., Milwaukee, dealers in machinists' supplies and tools.

GIFFORD K. SIMONDS, president of the Simonds Manufacturing Co., Fitchburg, Mass., has recently been elected president of the Waltham Watch Co., Waltham, Mass.

A. G. CROCKER has been appointed manager of the power division of the Detroit office, Westinghouse Electric and Manufacturing Co.

W. W. SPANGLER has been appointed assistant manager of syndicate operations, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.

H. F. BOE has been appointed manager of the industrial division of the Buffalo office, Westinghouse Electric and Manufacturing Co.

W. C. KOEHLER has been appointed manager of the cost and development section, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.

M. H. SCOTT has been appointed chief clerk of the supply department, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.

C. J. MESTA, second vice-president of the Mesta Machine Co., Pittsburgh, Pa., and located in the company's Chicago office for more than a year, has returned to the home office to take charge of the sales department of the company.

T. A. MCDOWELL has been appointed executive assistant to the manager of the recently organized suply department, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.

L. C. BULLINGTON, for several years past, assistant to the manager of the power department, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., has been made assistant manager and will have charge of the general work of the power department.

Obituary

John M. Goodwin, general manager of the New Process Twist Drill Co., drill manufacturers, Taunton, Mass., died at his home in that city July 4.

Nathan Esterbrook, New Haven, Conn., formerly head of the Esterbrook Manufacturing Co., died in that city, Tuesday, July 18, at the age of eighty-six years. Mr. Esterbrook served in the Civil War as an officer, and has been prominent in business circles and civic affairs in New Haven for the past fifty years.

Book Reviews

Metric System for Engineers. By Charles B. Clapham, Hons. B.Sc. Cloth; One hundred seventy-eight 6 x 9-in. pages. Published by E. P. Dutton & Co., New York, N. Y. Prive $6.

The book furnishes a practical explanation of the metric system to meet the requirements of engineers, draftsmen, mechanics and others who deal with calculation and measurement in detail. The usual tools for measuring length, area, volume, capacity and mass, that may be graduated in metric units, are explained, and diagrams of verniers, micrometers and planimeters are given to illustrate their use. Calculations in connection with screw cutting and gear wheels are also dealt with at some length, and four pages are devoted to gear tables.

The commoner compound measures met with in engineering are taken up in Chap. VI. Moment, energy and work, velocity, acceleration, power, loads on beams, pressure, stress, density, specific volume, impurities in liquids, radius of gyration, moments of inertia, train resistance, weight of prime movers, fuel consumption of engines, temperature, heat quantities, calorific value of fuel, heat radiation and the C. G. S. system are discussed, and examples of the conversion of the formulas into metric units are given.

Chap. VII includes tables of the commoner engineering constants in both British and metric units. Chap. VIII contains examples of the alteration of numerical constants in engineering formulas.

A brief survey of the arguments advanced for and against the metric system is made in Chap. IX. The history of the system and the practicability of its adoption are told. The author treats the subject from what he considers an impartial attitude. He states: "The foregoing brief survey of the controversy on the metric system is not in any way intended as propaganda on either side. The real object of the book is *explanation* of the system, but it was thought that an attempt at a more impartial treatment of some of the points than is usually met with would be of interest."

Although in favor of the universal adoption of the system, the author admits, however, that it would be a difficult matter to change the English screw thread standards: "Furthermore, the standardization of screw threads has been carried to such lengths, and screw threads are so widely met with in all branches of engineering, that no alteration of the existing standards can be considered. Hence it appears that the present screw-thread standards would have to be retained with dimensions which, in millimetres, would be odd. This would necessitate retaining inch-pitch leading-screws on lathes to avoid complications in screw cutting."

Thirty-four tables are grouped together for easy reference in the last section, and include both exact and practical equivalents and conversion tables. An envelope on the back cover of the book holds the three detached conversion charts for office use in converting the commoner compound measures.

Trade Catalogs

Testing Machines. The Pittsburg Instrument and Machine Co., 40 Water Street, Pittsburg, Pa. A bulletin describing the various styles of Brinell testing machines for determining the hardness of materials. Surveying instruments and impact testing machines are also described.

Rust Preventors. Oil Specialties and Supply Co., 39 Cortlandt St., New York City. A bulletin on the subject of the cause and prevention of rust with information describing Rustavoid, a preservative coating material, made by this company.

Pneumatic Tools. The Chicago Pneumatic Tool Co., 6 East 44th Street, New York City. Special publications Nos. 686 and 687, issued in the form of broadsides illustrating, with numerous photographs, the application of pneumatic tools to many phases of engineering, manufacturing and construction work. Numerous novel methods of using air tools are featured, interesting and of value to engineer and contractor.

Architects' Specification Hand Book. The Truscon Laboratories, Detroit, Mich. A handbook of 108 pages, size 8½ x 11, in loose leaf form, with a complete index. This handbook has been prepared and published by the Truscon Laboratories for the purpose of furnishing to architects and engineers such information as they require in preparing specifications for waterproofing, damp proofing, oil proofing, floor hardening, and other protective finishes. Each set of specifications is accompanied by a description of the particular product, arranged logically on the reverse side of the sheet and a list of prominent users of each product is set forth. The handbook is noteworthy for the care shown in its arrangement; the clear concise manner in which each specification has been prepared, and should prove of considerable value to engineers and architects.

Ball Bearings. The New Departure Manufacturing Co., Bristol, Conn. A folder featuring the application of New Departure bearings to the record breaking cars in the Memorial Day race at Indianapolis.

Metal Cutting Saws. Henry Disston and Sons, Inc., Philadelphia, Pa. A catalog of thirty-six pages describing the Disston line of metal cutting saws of all styles, files, hack saws and swages.

Piston-Ring Groove Cleaner. The Vedoe-Peterson Co., Norfolk Downs, Mass. A leaflet describing the V-P Groove Cleaner for cleaning carbon from piston ring grooves.

Expansion Reamers. The Vedoe-Peterson Co., Norfolk Downs, Mass. A leaflet describing the Nu-Angle expansion reamers made by the company.

Metal Spraying Processes. The Metal Coating Co. of America, 495 North Third Street, Philadelphia, Pa. An eighteen page pamphlet describing the Schoop Metal Coating process and apparatus for simultaneously melting and atomizing zinc, lead, aluminum, tin, copper, bronze, brass, nickel or monel, either in wire or dust form, and impacting them on any surface. The pamphlet contains a detailed description of the process and the apparatus with numerous cuts and line drawings, showing its application.

Grindstones. The Cleveland Stone Co., Cleveland, Ohio. A sixteen-page booklet containing a talk on the art of grinding with information on strelith and sterbon wheels made by the company.

Flexible Couplings. Smith & Serrill, general sales agents, Halsey Street and Central Ave., Newark, N. J. Bulletin No. 36 describing the construction details of Francke flexible couplings as well as the Pintite rigid coupling.

Welding and Cutting Machinery. The General Welding and Equipment Co., 74 Brookline Ave., Boston, Mass. A catalog on modern welding and cutting. The various types of welding and cutting machines are described and illustrated together with examples of their application to certain work.

Pamphlets Received

Doing Business under Japanese Company Laws. Trade information bulletin No. 46, by Frank R. Rutter, American Trade Commissioner, published by the Department of Commerce.

Leather Belting Specifications. A pamphlet of twelve pages known as Standard Specification No. 37, containing the specifications for leather belting officially adopted by the Federal Specifications Board for use of the various department and independent establishments of the Government in the purchase of leather belting. The pampiet has been prepared by the Bureau of Standards, Department of Commerce, Washington, D. C.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Manufacturers Export Association annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Machine Tool Builders' Association. Annual convention, New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances—Steel shapes, plates, bars, bands, hoops and blue annealed sheets, up 12c.; cold rolled strip steel, 15c. and slight advance in coppered bessemer rods in New York warehouses. Steel shapes and bars up 15c. per 100 lb. in Cleveland. Steel mill prices showing upward tendencies, due to coal and coke shortage. Shapes, plates and bars quoted at \$1.70@\$1.80, Pittsburgh, on current business. Some sales, however, and still going through at \$1.60 on special tonnages but a maximum of \$1.85 has been reached on shapes and bars and \$1.90 per 100 lb. on plates, for immediate deliveries.

Tin quoted at 32¼c. as against 31¼c. and zinc at 6 5/16c. as compared with 6¼c. per lb. in New York, one week ago. Copper market slightly firmer. Fabricated copper and brass up ½c. per lb. in Cleveland. Zinc sheets advanced ½c. and solder 2c. per lb. in New York. Linseed oil quoted at \$1.01, as against 98c. per gal. (5 bbl. lots) in Chicago.

Declines—Dealers' purchasing prices of old metals down ½c. per lb. in Cleveland. Recent crude oil cuts causing downward tendency in lubricating oil prices; linseed oil also tending downward in several important centers. Lead market weaker.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	\$25.50
Northern Basic	26.52
Southern Ohio No. 2	26.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.66
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	28.32
Virginia No. 2	29.74
Basic	26.00
Grey Forge	26.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.50
Basic	25.50
Bessemer	25.50

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10.0	8.0	3.0
New York	9@10	6.0	3.0
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	3.75	3.25	3.63
No. 12	[illegible]	3.80	3.30	3.68
No. 14	[illegible]	3.85	3.35	3.73
No. 16	[illegible]	3.95	3.45	3.83
Black				
Nos. 17 and 21.	[illegible]	4.15	[illegible]	4.30
Nos. 22 and 24.	[illegible]	4.20	3.85	4.30
Nos. 25 and 26.	[illegible]	4.25	3.90	4.35
No. 28	[illegible]	4.35	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11.	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14.	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21.	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24.	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.85
Hoop steel	3.75	3.50	3.48
Cold rolled strip steel	6.25	8.25	6.15
Floor plates	4.80	4.66	5.08
Cold finished shafting or screw	3.50	3.30	3.40
Cold finished flats, squares	4.00	3.80	3.90
Structural shapes (base)	2.80	2.66	2.68
Soft steel bars (base)	2.70	2.56	2.58
Soft steel bar shapes (base)	2.70	2.56	2.58
Soft steel bands (base)	3.35	3.06	3.23
Tank plates (base)	2.80	2.66	2.38
Bar iron (2.20 at mill)	2.70	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{16}$	8.00		12@13
⅛	6.50		11@12
$\frac{5}{32}$ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.25
Lead (up to carlots), St. Louis, 5.50; New York	6.00
Zinc (up to carlots), St. Louis, 5.80; New York	6.30

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper rods (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.25	18.50	18.75
Brass tubing (100-lb. lots)	21.00	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	15.25	21.50	15.75
Brass wire (carlots)	17.75	17.75	.....
Zinc sheets (casks)	8.50	.....	.....
Solder (½ and ½), (caselots)	23.00	22.00	20.00
Babbitt metal (fair grade)	24.25	41.50	36.00
Babbitt metal (commercial)	11.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.50	11.50
Copper, heavy, and wire	11.75	11.00	10.50
Copper, light, and bottoms	9.75	9.50	9.75
Lead, heavy	4.75	4.50	4.75
Lead, tea	4.25	3.50	3.75
Brass, heavy	7.00	6.00	7.00
Brass, light	6.00	5.00	6.00
No. 1 yellow brass turnings	6.50	6.00	6.50
Zinc	3.00	3.00	3.00

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	5.60	7.25
IC,	14x20		7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.15	1.01
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville..per net ton		$10.50@11.00	
Coke, prompt foundry, Connellsville..per net ton		10.50@11.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	65–10%	60%
1⅛ and 1¼x3 in. up to 12 in.	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	....	$4.00 off
Button head bolts, with hex. nuts	25%	$3.90 net	.....
Hex. head and hex. nut bolts	30%	....	65-5%
Lag screws, coach screws	50%	....	60-5%
Square and hex. head cap screws	70–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60%	50-5%
Bolt ends, with hot pressed nuts	50%	....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70–10%	80%
Case-hardened nuts	60%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$4.00	$3.25	$3.10
Cone heads, ditto (net)	4.10	3.35	3.20
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.35 base
Copper rivets	55–5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	....	1.40
Cloth	3.02	....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Ansonia—Westwood Garage, Riggs St., F. K. [illegible], Purch. Agt.—one small lathe suitable for turning off commutators—ignition work.

Conn., Bridgeport—Connecticut Marine Boiler Wks., 64 Kossuth St., W. O. Wilson, Purch. Agt.—self-acting tapping device for use on drilling machine.

Conn., Bridgeport—International Silver Co., 574 Crescent Ave.—power press with balance wheel stroke 2 in. (used).

Conn., Bridgeport—Lakeview Auto Co., [illegible] Boston Ave., J. C. Bednar, Purch. Agt.—drill press, tool grinder, small lathe, and electric motor.

Conn., Bridgeport—The Sprague Meter Co., [illegible] Water St., J. McCoy, Purch. Agt.—squaring shear, about 34 in. for tin and sheet metal.

Conn., Bridgeport—A. Warren, 704 Iranistan Ave. (electric novelties)—one small lathe.

Conn., Bridgeport—J. E. Wheway, 43 [illegible] St.—small lathe for mechanical work.

Conn., Shelton—Specialty Bolt & Rivet Wks., [illegible] Hillside Ave., A. Perry, Purch. Agt.—one surface grinder, with magnetic chuck; thread chasing machine; machine for making rolled threads.

Ky., Lexington—Erd Mfg. Co., 117 Sherman Ave., address H. L. Erd, Pres.—equipment for machine shop.

Mich., Muskegon—The Shaw-Walker Co., West Western Ave.—one 36 in. power shear for 16 gage metal.

Mo., Kansas City—Schroer Bros., 1681 Delaware St.—one 18 in. lathe for power equipment.

N. Y., Buffalo—Bd. of Educ., 1401 Telephone Bldg., will receive bids until Aug. [illegible]—variety saw, grinder, lathes, motor, anvil, oven, furnace, printing shop presses and cases. Noted July 20.

N. Y., Buffalo—D. Meilin, Cherry and Hickory Sts.—small tools and equipment for proposed garage.

N. Y., Irvington-on-the-Hudson—Burnham Boiler Corp.—machinery and equipment for foundry and machine shop at Lancaster, Pa.

N. Y., Rochester — N. Sablewiski, 949 Hudson Ave.—small tools and equipment for garage repair shop, to be constructed at 976 Hudson Ave.

O., Columbus—Hamilton Engineering Co., [illegible] Bldg., manufacturers of conveyors and feeders—complete line of machine tools for new factory.

O., Lorain—Seneca Piston Ring Co., 1024 Bway., J. H. Davis, Purch. Agt.—general shop machinery, including lathe, press, grinder and shaper.

Pa., Chester—Textile Mchy. Co., 14th and [illegible] Sts.—equipment for machine shop including lathes, planers, drills, etc.

Pa., Farrell—Bd. of Educ.—machinery and equipment for machine shop and woodworking department of proposed school.

Pa., Phila.—[illegible] Machine & Tool Wks., [illegible]—one screw press with bed to take [illegible] in. work.

Pa., Phila.—C. F. Hoffman Co., 213 Cuthbert St.—[illegible] electro plating machinery, small drill press, etc.

Pa., Phila.—[illegible] & Brannen Mfg. Co., [illegible] North [illegible] St. (gas and electric fixtures)—[illegible] cut off saws, drills, presses, and plating machinery.

Pa., Phila.—M. J. Hunt Sons Co., 231 Richmond St.—one large power shear.

Pa., Phila.—H. T. Potts Iron & Steel Mfg. Co., 316 North 3rd St.—equipment for machine shop including shears, drills, presses, etc.

Pa., Phila.—Reyburn Mfg. Co., 32nd St. and Allegheny Ave. (manufacturer of metal tags)—two plane power punch presses.

Pa., Pittsburgh—Jackson-Remlinger, Manufacturers Bldg.—power punching machine.

Pa., Pittsburgh—M. G. Spaulding, 574 Union Arcade Bldg.—one 5 in. Ajax upsetter; one 5 in. Ajax roll; one 2,000 lb. single frame forge hammer; two 85 lb. cushion hammers; one 200 lb. upright hammer (steam or air); one 7 lb. Cleveland or Hillis & Jones blanking punch.

Pa., West Scranton (Scranton P. O.)—Apollo Garage, F. P. Spiegel (owner)—small machinery, tools and equipment for garage and repair shop.

Pa., Williamsport—Supply Committee, School Bd., H. A. Sterner, Secy., receives bids until Aug. 2, for following equipment for High School—

One single spindle high speed drill to be equipped with 220 volt, two phase, 60 cycle driving motor.

One metal planer 24" by 24" by 8' arranged for belt drive, or

One metal planer 24" by 24" by 8' arranged for motor drive, including a 220 volt, two phase, 60 cycle motor.

One Stewart oven furnace No 28 with pyrometer opening in the rear wall.

One electric driven center grinder for lathe center grinding, to be equipped with 220 volt, two phase, 60 cycle motor.

One universal milling attachment arranged to fit a Garvin No. 1 Universal Milling Machine

One engine lathe, back geared, arranged for belt drive, to swing 20" over the bed, with bed at least 6' long.

One No. 1½ plain milling machine with power longitudinal and power cross feeds, arranged for belt drive.

One ten inch four jaw chuck, Skinner No. 1910 or equal

Two ten inch three jaw universal chucks, Skinner No. 2410 or equal.

One low pressure acetylene generator with a capacity of one hundred feet of acetylene per hour, with back pressure valve.

One welding blowpipe 22"-24" long with five welding heads for welding work ranging from ⅛" to 1" in thickness.

One oxygen welding regulator with two gauges.

One cutting torch with 90 deg. head and four nozzles for work ranging from ⅛" to 12" in thickness.

One oxygen cutting regulator with two gauges.

Tex., Austin—Capitol Engraving Co., 901 Congress St.—power lathe.

Tex., Dallas—V. Hafner, Lobby Interurban Bldg.—jewelers lathe (small), drill press, also equipment for engraving, polishing and buffing, belting, and small motor.

Va., Keysville—J. L. Pearson—woodworking machinery, including jointer, tenoner, sander and lathe (used).

Va., Norfolk—J. E. Doherty, 2405 Granby St.—full line of machinery and equipment for garage, including lathes, drills, reamers, punches, etc.

Va., Richmond—W. P. Atkinson Co., 322 West Broad St.—complete line of machinery for auto repair shop on Meadow and Broad Sts.

Va., Richmond—F. L. Benton, 1649 West Broad St.—general repair machinery for new auto service shop.

Va., Richmond—Broad St. Service Co., 212 West Broad St.—one 6 in. bench vise and electric drill.

Va., Richmond—A. J. Fleming Co., 1622 West Broad St. (cylinder grinding and machinery repair work)—one lathe.

Va., Richmond—Franklin Motor Co., 2007 West Broad St.—one drill press, lathe and arbor press.

Va., Richmond—Fulton & Barnes, 1643 West Broad St.—combination drill press, milling machine and lathe for auto service station.

Va., Richmond—C. S. Gibson, 1811 West Broad St.—repair machinery, lathe and drill press for auto service station.

Va., Richmond—The Owens Motor Co., 2100 West Broad St.—one lathe and drill press.

Va., Richmond—Professional Auto Repair Shop, 1629 West Broad St.—one lathe, drill press and machinery for auto repair shop.

Wis., Kenosha—Buick Garage Co., 916 Salem Ave., M. Kisten, Purch. Agt.—machinery for auto repairing.

Wis., Milwaukee—G. Benning, 714 21st St.—double drum sander and 8 in. sticker.

Wis., Milwaukee—F. Grabowski, 420 Mitchell St.—sheet metal working machinery including brakes, beaders, etc.

Wis., Milwaukee—C. Kirchan, 823 47th St. (experimental tool work)—lathes, drill presses and grinders.

Wis., Milwaukee—Layton Park Motor Co., c/o H. W. Kracht, 1547 9th St.—drill press, burning-in machine, and emery wheel.

Wis., Richfield—Laubenheimer Garage Co.—lathe, drill press, air compressor, and gas storage tank.

B. C., Vancouver—Ideal Iron Wks., 123 Powell St.—equipment for proposed machine shop.

Ont., London—J. W. McLaughlin, 629 Queens Ave.—complete equipment for garage and auto repair shop.

Ont., Montrose—Canadian Axolite Co.—equipment for machine shop addition. for automobile repair shop.

Machinery Wanted

Ala., Birmingham—Gould Mfg. Co., Inc., c/o F. E. Gould—machinery for the manufacture of windshields for automobiles and motor boats.

Cal., Los Angeles—Mining & Oil Equipment Co., 2026 Santa Fe St.—reclaiming equipment.

Cal., Santa Barbara—High School Trustees, c/o School Bd.—equipment for manual training department of proposed high school.

Col., Delta—Stearns Bros.—four magazines for 3 linotype machines.

Col., Idaho Springs—Cycle Mining Co.—equipment for compressor plant (now under construction).

Conn., Hartford—Acme Bedding Co., 94 Brown St.—equipment for factory addition.

Conn., Hartford—Bd. of Contract and Supply, Municipal Bldg., W. F. O'Neill, Secy.—receiving bids until Aug. 1, laundry equipment for Isolation Hospital.

Fla., Jacksonville—Jacksonville Products Co., Pearl St., J. E. Griffith, Purch. Agt.—complete line of machinery and equipment for fruit preserving plant.

Fla., Moore Haven—Glades County Democrat & Printing Co., W. Stephens, Mgr.—printing equipment and machinery including hand and power presses, cutters, etc. (new or used).

Fla., Orlando—Fletcher & Crawford Co., West Concord St.—machinery and equipment for the manufacture of concrete building blocks (new or used).

Ill., Chicago—M. M. Rothschild, 717 Federal St.—two color press.

Ill., Rockford—Rockford Malleable Iron Co., Peoples Ave.—annealing ovens.

Ind., Huntington—The Whitlock Press, Inc., 5 North Jefferson St.—two No. 3 Meihle presses.

Kan., Wichita—J. Hill, 618 South Water St.—job printing press (power).

Kan., Wichita—Smith Clark Furniture Co., 254 North Main St.—multigraph machinery and other printing equipment.

Ky., Louisville—Kentucky Steel & Wire Co., A. H. Dillon, Pres.—machinery and equipment for the manufacture of wire nails, staples and other wire products.

La., Baton Rouge—Wright Steam Motor Mfg. Co., J. B. Wright, Genl. Mgr.—machinery and equipment for new plant.

Me., Portland—Confederated Home Abbatoir Corp.—machinery and equipment for proposed abbatoir in Bethlehem, Pa.

Md., Baltimore — McLaughlin Radio & Electric Corp., c/o G. R. Allen—machinery and equipment for the manufacture of radio apparatus and supplies.

Md., Baltimore—S. T. Williams, 223 North Calvert St.—cable way hoisting engine with winding drum and endless rope drum for electric drive, with or without motor, 35 to 40 hp., also electrically driven air compressor suitable for about 3 jack drills, with or without motor (3 phase, 60 cycle, 220 volts, A.C.).

Mich., Detroit — Four Wheel Hydraulic Brake Co., 708 Harper Ave.—miscellaneous equipment for plant expansion.

Mich., Detroit—Packard Motor Car Co., Boulevard and Belt Line Ry.—mechanical conveyor for shipping shed.

Mich., Detroit—J. Tekieli, 9201 Home St. —circular log sawmill complete (used).

Mich., Hamtramck (Detroit P. O.)—City of Hamtramck, J. J. Mitchell, Clk.—one 100 lb. portable air compressor, 4 cylinder 40 hp. gasoline motor, 20 gal. fuel tank, 12 cu.ft. air receiver.

Mich., Highland Park (Detroit P. O.)—Ford Motor Co.—equipment for the manufacture of tractor parts, also for assembly plant.

Mich., Highland Park (Detroit P. O.)—Ford Motor Co.—gyratory crusher, conveyors, elevator bins, revolving screen shaking grizzly, cyclone system, for proposed slag crusher building at River Rouge.

Minn., St. Paul—The State Bd. of Control, Capitol, D. F. Mullen, Secy.—machinery for the manufacture of butter, cheese, ice cream, etc., for dairy at College of Agriculture, University of Minnesota.

Mo., Kansas City—Erickson Garage No. 2, 3701 Main St.—air compressor, belting and pulleys.

Neb., Emerald—Emerald Motor Co., M. Luhlutz, Purch. Agt.—one 150 lb. compressor for service station.

Neb., Lincoln—J. H. Markel Motor Car Co., 12th and Q Sts., W. F. Boys, Mgr.—electric test stand suitable for work on "North East" starting motors, with attachments for other make starters.

N. Y., Buffalo—Angert Auto Parts Corp., 601 Bailey Ave., S. Angert, Pres.—equipment for wrecking automobiles and repairing parts, (for plant on Seneca St.).

N. Y., Buffalo—Barrett Bros., 628 South Park Ave.—one 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—E. P. Benner, 106 Verplanck St.—equipment for bakery at 578 South Park Ave.

N. Y., Buffalo—I. W. Dixon, 43 Briggs Ave.—machinery and equipment for curing boots and auto tires for proposed factory at 1152 Michigan Ave.

N. Y., Buffalo—J. Schaaf, 159 Willis Ave.—machinery and equipment for shoe factory at 947 Northampton St.

N. Y., Buffalo—R. Simone, 172 Terrace St. —equipment for the manufacture of confectionery and pastry.

N. Y., Dunkirk—Bd. of Educ., J. J. Madigan, Secy.—receiving bids until Aug. 14 for complete vocational equipment.

N. Y., Elmira—Elmira Water, Light & R. R. Co., F. H. Hill, Genl. Mgr.—machinery, cooling apparatus and other equipment for new gas manufacturing plant.

N. Y., Jamestown—Jamestown Malleable Products Corp., Tiffany Ave., H. E. Kies, Genl. Mgr.—annealing ovens, machinery and equipment for iron products plant.

N. Y., Newark—Marion Union Free School Dist., A. M. Croop, 6 Moore St., Supt.—vocational equipment (complete), for school.

N. Y., Ontario—Ontario Co-operative Packing Assn., R. Gates, Purch. Agt.—machinery and equipment for large packing house including grading machines.

N. Y. Wolcott—Wolcott Co-operative Assn., Inc., H. V. Wilson, Dir.—machinery and equipment for fruit packing plant.

N. C., China Grove—China Grove Cotton Mills Co.—machinery and equipment for proposed 16,000 spindle cotton mill.

N. C., Forney—Norwood Lumber Co.—trim saw for use in the manufacture of hardwood flooring, door and window casings, etc., (new or used).

N. C., Mt. Olive—B. E. Martin, (woodworking)—veneering machine and jointer (used).

N. C., Raleigh—Sanitary Laundry Co., South Blount St.—machinery for laundry on South McDougal St.

N. C., Tarboro—M. P. Williams—power job press and paper cutter.

O., Akron—International Lead Co., Betts Corners—machinery and equipment for $500,000 lead manufacturing plant now in course of construction.

O., Fremont—Safe Storm Shield Co.—machinery and equipment for proposed factory.

O., McArthur—Happy Home Washing Machine Co.—machinery and equipment for plant at Logan, O.

O., Niles—C. Bradford—equipment for bakeshop on Short St.

O., Norwalk—A. B. Chase Piano Co. (subsidiary of the United Piano Co.)—machinery and equipment for piano factory here.

O., Sebring—French China Co., O. H. Sebring (owner)—complete equipment and machinery for addition to china ware factory.

O., Sebring—Strong Enamel Mfg. Co., O. H. Sebring, Pres.—machinery and equipment for the manufacture of aluminum ware.

O., Warren—K.-W. Brick Co., (manufacturer of slag brick), R. W. Swift, Genl. Mgr.—machinery and equipment (complete) for the manufacture of bricks, including special brick presses, pulverizers, etc. (capacity 40,000 bricks per day).

O., Warren—Downs Studio, 15 West Market St.—complete steam vulcanizing outfit.

O., Zanesville—F. A. Jones Stone Co., 616 Forest Ave.—machinery and equipment for quarrying 40 acres of stone deposits at Martinsburg, W. Va.

Okla., Shawnee—F. Armstrong, 125 North Bell St.—one job press, newspaper press, linotype, belting, hangers, pulleys, beamings, metal cutter, shafting, and motors.

Okla., Supply—Republican—one 6 column folio drum cylinder press.

Pa., Clifton Heights—Caledonia Woolen Mill, J. S. Stewart, Purch. Agt.—drying machinery, vats, etc. for dyeing plant.

Pa., Lambertville—Lambertville Home Bakery—equipment for bakeshop.

Pa., New Castle—Buckeye Overall Co., M. Fisher, Purch. Agt.—machinery and equipment for factory.

Pa., New Castle—Pennsylvania Wireless Mfg. Co., Inc., R. Patch, Genl. Mgr.—machinery and equipment for the manufacture of wireless telephones, radio outfits and supplies, for factory on Florence Ave.

Pa., Oxford—Oxford Press—one 7 column Cottrell press, also newspaper folder 35 x 44 in.

Pa., Phila.—A. T. Baker & Co., Fountain and Canal Sts. (manufacturer of textiles) —steam vats, drying machines, and other dyeing machinery.

Pa., Phila.—Bureau of Water, Room 696 City Hall, C. E. Davis, Purch. Agt.—two 3 ton traveling cranes (overhead); 7 portable Pitot recording outfits; 6 Pitot rods and manometers.

Pa., Pittsburgh—Hardie Bros. Co., 1601 Liberty St.—machinery and equipment for proposed candy factory on 13th and Pike Sts.

Pa., Pittston—Howell & King Co., corner Crown and Thomas Sts., P. F. Joyce, Pres. —machinery and equipment for proposed artificial ice plant.

Pa., Wellsboro—Wellsboro Shale Brick Co., A. Wandroik, Purch. Agt.—machinery and equipment for shale brick plant including equipment for elevated railway and machinery for conveying shale to plant.

Tex., Beaumont—Neches Printing Co.—Kelly or Miller unit and other printing equipment.

Tex., Dallas—R. F. Smith, 212 West 8th St. (job printer)—power paper cutter (large).

Tex., Sweetwater—Pioneer Planing Mill Co.—woodworking machinery, sash and doors machinery, pulleys, belting, hangers, shafting; cutting off machinery, etc.

Tex., Tyler—A. Hicks—Crescent universal woodworker No. 51 and 59, belting, motor, hangers, shafting, and other equipment for woodworking plant.

Va., Clarksville—Clarksville Farmers Implement & Supply Co., H. A. Noblin, Secy.—will soon receive bids for machinery for proposed plant.

Va., Purcellville—Loudon County Milling Co.—machinery for proposed flour mill.

Va., Richmond—Stuart Fouck Co., 1611 West Broad St.—machinery for repairs (price lists).

Va., Riverton—Riverton Mills Corp., W. G. Dearing, Front Royal, Sec.—machinery for fertilizer plant.

W. Va., Fairmount—Allied Lumber Corp., A. J. Colburn, Purch. Agt.—machinery and equipment for the manufacture of lumber and mill products.

W. Va., Huntington—Huntington Candy Co., Inc., H. L. Cook, Pres.—machinery and equipment for the manufacture of candy.

W. Va., Weirton—R. L. Gates—woodworking machinery.

Wis., Eau Claire—Lange Canning Co., Mill and West Madison Sts., F. N. Herrick, Purch. Agt.—canning machinery.

Wis., Madison—The Bd. of Educ.—manual training equipment and woodworking machines.

Wis., Milwaukee—Consolidated Materials Co., 301 Caswell Blk., is receiving bids on the following equipment for gravel pit at Delafield: washing plant, crusher (25-30 hp.), pumps, screens, bucket conveyor, belt conveyor, steam engine or electric motor power.

Wis., Neenah—C. A. Douglas, 251 East Dewey Ave. (filling station and garage)—oil and gasoline pumps, storage tanks, and air pump for tires.

Wis., Oshkosh—Kuebler Grocery Co., 282 Main St., Auler & Jensen, Oshkosh, Archts. —ice machine and refrigerating apparatus (owner and architect receiving bids).

Wis., Racine—Wisconsin Cream of Corn Co., 501 6th St., J. G. Leuker, Purch. Agt.—canning machinery.

Wis., Sheboygan—Dillingham Mfg. Co., South 13th St. and Wisconsin Ave.—equipment for dry kiln.

Ont., Hamilton—Penninsula Cord Tire Co., 45 John St., S.—equipment for the manufacture of tires.

Ont., Niagara Falls—Elton Knitting Mills, c/o Chamber of Commerce—machinery and equipment for proposed woolen goods plant.

Ont., Welland—Dodds Canadian Iron Wks., Ltd.—equipment for proposed iron works.

Ont., Welland—S. L. Lambert—machinery and equipment for lumber and saw mill.

Ont., Welland—Welland Packing Co., Ltd., F. Ahman, Pres.—machinery and equipment for packing house.

Metal Working Shops

Cal., Oakland—The Starr Motor Co. of California, c/o Durant Motor Co., East 14th St., has awarded the contract for the construction of an 80 x 150 ft. administration building, and a 100 x 200 ft. warehouse, on East 14th St. Estimated cost (plant completed) $1,000,000.

Cal., San Jose—Central Improvement Co., has awarded the contract for the construction of a 2 story auto stage depot and store building on Market St. Estimated cost $41,715. Peninsula Rapid Transit Co., San Jose or 5 5th St., San Francisco, lessee.

Cal., Taft—Taft Union High School Dist. is having plans prepared for the construction of additions to its High School. Immediate building plans include a garage, and it is proposed by the first of the year to complete machine and auto shop.

Ind., Indianapolis—Zenite Metal Co., 201 North West St., has awarded the contract for the construction of a 1 story, 100 x 200 ft. factory. Estimated cost $100,000.

Ind., Michigan City—Sullivan Mchy. Co., 122 South Michigan St., Chicago, has awarded the contract for the construction of a 1 and 2 story, 400 x 550 ft. manufacturing plant and 50 x 400 ft. power and central heating plant. Estimated cost $1,000,000. Noted July 6.

Ky., Lexington—Erd Mfg. Co., 117 Sherman Ave., is having plans prepared for the construction of a 1 story, 50 x 100 ft. machine shop. R. L. Erd, Pres. F. P. Smith, Lexington, Archt.

Md., Cumberland—N. & G. Taylor Co., Inc., [illegible] St., Phila., has awarded the contract for the construction of a 1 story addition to tin house and foundry, [illegible].

Mich., River Rouge (Detroit P. O.)—Ford Motor Co., Highland Park, plans to build a 1 story, 60 x 300 ft. tractor and automobile factory addition, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

N. J., Camden—N. B. T. Rooney, 503 Market St., has awarded the contract for the construction of a 2 story, 52 x 100 ft. [illegible] station and garage on [illegible] and [illegible] Aves. Estimated cost $50,000. S. B. Gill, Law Bldg., Archt.

N. J., Trenton—The [illegible] Engraving Co., [illegible] North [illegible] St., will build a [illegible] story, [illegible] x [illegible] ft. engraving plant. [illegible] Pres.

N. Y., Buffalo—J. Schaaf, 947 Northampton St., plans to build a specialty factory and shop. Estimated cost $[illegible]. Private plans.

N. Y., Waterford—C. L. Cadle, Supt. of Pub. Wks., Capitol, Albany, will soon award the contract for the construction of shops here, and also at Baldwinsville and Pittsford. Estimated cost $[illegible].

O., Akron—International Lead Refining Co., 151st St. and McCook Ave., East Chicago, Ind., will soon receive bids for the construction of a refinery including 4 buildings on Tallmadge Ave., here. Estimated cost $[illegible].

O., Akron—M. O'Neil of the General Tire & Rubber Co., has awarded the contract for the construction of a 2 story, 95 x 163 ft. garage on West Market St., to be leased to the Cadillac Co., 1551 Bway., New York City. Estimated cost $100,000. Noted June 11.

O., Alliance—H. W. Wagner, (Ford Agency) has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost $[illegible]. Private plans.

O., Middleton—Amer. Rolling Mill Co., [illegible], plans to rebuild portion of its rolling mill which was destroyed by fire. Estimated cost $100,000. Architect not announced.

Pa., Phila.—J. Pinheiro, 1007 Race St., has awarded the contract for the construction of a 2 story, 34 x 100 ft. garage at 910 Spring St. Estimated cost $80,000.

S. C., Greenville—E. F. Bates, 109 North Main St., has awarded the contract for the construction of an automobile sales room and garage, area 8,500 sq. ft.

Tex., Waco—Missouri, Kansas & Texas R. R., plans to build a large locomotive repair shop here. Estimated cost $800,000. [illegible] Johnson, 404 Times-Herald Bldg., Waco, Supt.

Va., Clarksville—Clarksville Farmers Implement & Supply Co., plans to build a manufacturing plant. H. A. Noblin, Secy.

Wis., Beloit—J. M. Sarris, 412 Broad St., has awarded the contract for the construction of a 1 and 2 story, 100 x 120 ft. garage. Estimated cost $55,000.

Wis., Elkhorn—F. Holton & Co. has awarded the contract for the construction of a [illegible] story, [illegible] x [illegible] ft. factory for the manufacture of band instruments. Estimated cost $[illegible].

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., has awarded the contract for the construction of a 1 story, 32 x 56 ft. factory on 30th and Chambers Sts. for the development and manufacture of patented mechanical articles. Estimated cost $20,000. Noted July 13.

H. T., Pearl Harbor—The Bureau of Yards and Docks, Navy Dept., Wash., D. C., has awarded the contract for the construction of a machine shop at the Naval Base, here. Estimated cost $165,366.

Ont., London—J. W. McLaughlin, 639 Queens Ave., is having plans prepared for the construction of a garage and auto repair shop. Estimated cost $42,000.

Ont., Welland—Dodds Canadian Iron Wks. Ltd., plans to construct a large iron works. Private plans.

General Manufacturing

Cal., Merced—[illegible] Ice Cream Co., [illegible] St., plans to build a 1 story, [illegible] x [illegible] ft. ice cream distributing plant on G and [illegible] Sts. Estimated cost $[illegible]. Architect not selected.

Cal., Napa—Growers Packing and Warehouse Co., Jackson St., a subsidiary of the California Prune & Apricot Growers Assn., has awarded the contract for the construction of a 141 x 144 ft. addition to its packing plant. Estimated cost $65,000. Noted June 29.

Cal., San Francisco—L. R. Lurie, Mills Bldg., is having plans prepared for the construction of a 3 story factory on Bryant St. near 2nd St. Hockwald Chemical Co., 531 Howard St., lessee. O'Brien Bros., Inc., 240 Montgomery St., Archts.

Cal., San Francisco—The Natl. Ice Cream Co., 371 Guerrero St., has awarded the contract for the construction of a 1 story ice cream factory, in the Mission Dist. Estimated cost, $12,000. Noted April 13.

Cal., San Francisco—M. V. Politeo, Archt., 1st Natl. Bank Bldg., is receiving bids for the construction of a 1 story factory on Howard St. near 5th St., for Eames Co., 55 1st Ave., manufacturer of truck and wheel goods.

Cal., Stockton—A. S. Williams, secy. Bd. of Educ. will soon award the contract for the construction of a shop building, and other additions to high school. Estimated cost, $30,000. L. Stone, Belding Bldg., Archt.

Cal., Stockton—X-clusive Laundry, 427 East Lafayette St., to build a 1 story, 92 x 150 ft. laundry on Lafayette and California Sts. Estimated cost $50,000. Architect not selected.

Conn., Hartford—Acme Bedding Co., 94 Brown St., is having plans prepared for the construction of a 2 story, 45 x 70 ft. addition to its plant. Estimated cost $25,000. B. A. Sellew, 721 Main St., Engr. and Archt.

Fla., Bradentown—Manitee County Growers Assn. has had plans prepared for the construction of a 1½ story 50 x 150 ft. packing house adjoining both Seaboard and Atlantic Coast Line Ry. tracks. Estimated cost (excluding equipment) $15,000. Johnson & Fonda, Bradentown, Archts.

Ill., Chicago—C. W. Lampe, Archt., 155 North Clark St., will soon receive bids for the construction of a 1 and 2 story, 80 x 100 ft. factory, for the manufacture of furniture at 1666 McHenry St., for Fenske Bros., c/o Architect. Estimated cost $20,000.

La., Alexandria—The City will soon receive bids for the construction of a gas plant and distributing system. Estimated cost $110,000.

Mass., Holyoke—The Farr Alpaca Co., Jackson St., have had plans prepared for the construction of a 6 story, 100 x 500 ft. yarn mill. Estimated cost $1,000,000. S. M. Greene & Co., 292 Bridge St., Springfield, Engrs. and Archts.

Mich., River Rouge (Detroit P. O.)—Ford Motor Co., Highland Park, has had plans prepared for the construction of a 2 story, 34 x 90 ft. slag crusher building for cement mill, here. Estimated cost $25,000. A. Kahn, 1,000 Marquette Bldg., Detroit, Archt.

Minn., St. Paul—The State Bd. of Control, Capitol, will soon receive bids for the construction of a 2 story dairy (with 1 story wing) at the College of Agriculture, University of Minnesota. Estimated cost $210,000. D. F. Mullen, Secy. C. H. Johnston, 715 Capitol Bank Bldg., Archt.

Minn., South St. Paul—Katz & Horne Packing Co., South St. Paul and 352 East 6th St., has awarded the contract for the construction of a 3 story, 50 x 130 ft. packing plant. Estimated cost $130,000.

N. J., Trenton—F. A. Straus & Co., Johnston Ave., will build 2 and 3 story, 100 x 100 ft. and 80 x 187 ft. yarn factory additions. Estimated cost $150,000.

N. Y., Jamestown—Lockwood Greene & Co., Engrs., Hanna Bldg., Cleveland, O., is receiving bids for the construction of the first section of dyehouse and filter house for the Jamestown Worsted Mills, manufacturer of men's wear and women's dress goods. This will be followed later by second section of dyehouse and a 4 story manufacturing building for combing, drawing and roving mill.

N. C., Raleigh—Sanitary Laundry Co., South [illegible] St., plans to build a 2 story, 80 x 177 ft. laundry on South McDougal St. Estimated cost $50,000.

O., Cleveland—Ingraham Waste & Supply Co., 1529 Columbus Rd., is having plans prepared for the construction of a 1 story, 50 x 125 ft. warehouse and factory at 1450 Hamilton Ave. Estimated cost $50,000. W. E. Monsor, Pres.

O., Cleveland—M. Makoff, 551 Hippodrome Annex Bldg., is receiving bids and will open same about Aug. 1 for the construction of a 2 story, 32 x 64 ft. commercial and light manufacturing building. Estimated cost $40,000. A. F. Ganowitz, permanent Bldg., Archt.

O., Sandusky—Chamber of Commerce and the Ajax Rubber Co., plan to build a rubber manufacturing plant, here. Estimated cost $1,000,000. Private plans. Address Chamber of Commerce, Sandusky.

O., Sebring—Saxon China Co., South Side, plans to build additions to its pottery factory including 3 glass, 3 bisque and 4 decorating kilns. Estimated cost $100,000. Plans private.

O., Warren—K.-W. Brick Co., plans to build a factory, capacity 40,000 bricks per day. Estimated cost $50,000. R. Swift, Mgr. Architect not announced.

Pa., Philadelphia—R. R. Neely, Archt. 2126 Pine St., is receiving bids for the construction of a 3 story, 30 x 110 ft. factory for the manufacture of brushes, at 4712 Market St., for Harrison Brush Factory, 4th and Arch Sts. Estimated cost $45,000.

Pa., Pittsburgh—Atlantic Refining Co., Chamber of Commerce Bldg., has purchased a 7½ acre site adjoining its plant along the Allegheny River, and plans to extend its refinery, and erect numerous storage houses.

Pa., Stroudsburg—Nitroloid Corp. of Amer. plans to rebuild its celluloid manufacturing plant which was destroyed by fire. Estimated cost $250,000. Architect not announced.

Tenn., Knoxville—C. B. Johnson, West Main St., has awarded the contract for the construction of a 2 story, 75 x 175 ft. press and publishing house on Church St. Estimated cost $60,000.

Tenn., Knoxville—J. G. Sterchi plans to build a 3 story, 100 x 100 ft. factory for the manufacture of shirts, on Jackson Ave. Estimated cost $60,000. R. F. Graf & Sons, Arnstein Bldg., Engrs. and Archts.

Va., Purcellville—Loudon County Milling Co. plans to build a flour mill. Architect not selected. Estimated cost $30,000.

Va., Riverton—Riverton Mills Corp., is having preliminary plans prepared for the construction of a fertilizer plant. Estimated cost including machinery and equipment, from $30,000 to $40,000. W. G. Dearing, Front Royal, Secy.

W. Va., Parkersburg—General Porcelain Co. has awarded the contract for the construction of a 1 story, 65 x 225 ft. manufacturing plant.

Wis., Cazenovia—Cazenovia Creamery Co., c/o F. J. Mayes, Mgr., has selected a site and plans to build a 1 story, 60 x 150 ft. dairy. Estimated cost $40,000. Architect not selected.

Wis., Delavan—The State Bd. of Control, Capitol, Madison, has awarded the contract for the construction of a 1 story, 75 x 90 ft. laundry at State School for Deaf here. Estimated cost $50,000. M. J. Tappins, Secy. Noted July 6.

Wis., Eau Claire—Chippewa Valley Produce Co., 220 South Water St., has awarded the contract for the construction of a 2 story, 70 x 125 ft. cold storage warehouse. Estimated cost (including conveyors and cooling apparatus) $65,000.

Wis., Madison—F. Riley, Archt., Conklin Bldg., is receiving bids for the construction of a 2 story, 75 x 100 ft. manual arts building, for the Bd. of Educ.

Wis., New London—Amer. Plywood Co., has awarded the contract for the construction of a 2 story, 90 x 144 ft. unit to its veneer factory. Estimated cost $70,000. F. F. Zaug, Mgr. Private plans.

Wis., Sheboygan—Dillingham Mfg. Co., South 12th St. and Wisconsin Ave., and W. C. Weeks, Archt., 720 Ontario St., are receiving bids for the construction of a dry kiln.

Ont., Hamilton—Pennsula Cord Tire Co., 45 John St., S. plans to build a factory. Estimated cost $50,000.

Ont., Welland—S. L. Lambert plans to rebuild planing mill destroyed by fire. Estimated cost $35,000 to $40,000. Private plans.

American Machinist

Volume 57 NEW YORK, AUGUST 3, 1922 Number 5

Making Chasers for Self-Opening Dies

Milling Chaser Blocks to Form and Size—Cutting the Threads by Means of Hobs—Chasers Must Be Interchangeable—Hand and Machine Lapping Methods

SPECIAL CORRESPONDENCE

THE automatic or self-opening die, which is an indispensable tool in practically all manufacturing operations involving the cutting of screw threads in duplicate and without which no screw machine equipment would be considered complete, is the logical development of the old time "jam-plate" that might have been found in the toolkit of any toolmaker or machinist of forty years ago.

This old-fashioned jam-plate was usually in the form of a rectangular frame, with suitable handles, adapted to hold different sizes of threading dies, each die made in two parts one of which remained in a fixed position while the other was adjustable by means of a backing screw to suit various diameters of work.

The jam-plate was well named. Though each die had four cutting edges, but two of them could possibly be brought into action on any but the nominal size of the screw for which the die was intended and, owing to the wringing motion imparted to the die in conjunction with the continual advancing of the backing screw, a thread was "jammed" rather than cut into the material.

Notwithstanding its unreliability and the uncertain character of its product the jam-plate possessed two distinctive features in common with the self-opening die; it was adaptable to slightly varying diameters of screw, and it could be opened to remove the work without "unscrewing" it.

Like its predecessor, the self-opening die is usually supplied with four cutting edges, or chasers, but unlike the jam-plate the cutting edges are all advanced toward the center of the work in unison and are thus all in position to take an equal share of the cutting, regardless of the adjustment of the die.

Evolution of Self-Opening Die

In the process of evolution through which it has passed the self-opening die has developed from an uncertain, unreliable tool to a perfection that enables it to produce with unfailing regularity hundreds of thousands of duplicate threads of every known thread characteristic and in sizes from the tiny No. 0 machine screw to sturdy bars 3 in. in diameter. Thread forms from a standard V of 56 pitch to square or Acme threads of 2 per inch are regularly cut, to a degree of accuracy that compares favorably with similar threads generated by means of leadscrew and single point tool and at a rate with which no other method can be compared.

Though the die-head itself is a piece of mechanism that involves the most careful design and accurate workmanship, the practicability of the automatic die as a production tool is dependent upon the accuracy and interchangeability of the chasers which do the actual cutting and which must be renewed from time to time as they become worn in service. The chaser department of the Eastern Machine Screw Corporation, New Haven, Conn., where the material for this article was obtained, is a highly organized manufacturing establishment for the production of these chasers in large quantities, though giving to each chaser the attention ordinarily devoted to the making of a single tool.

All chasers made by this firm are of high-speed steel Though there are doubtless occasional instances where other kinds of steel might be expected to possess advantages for the purpose, this idea is probably due rather to the difficulty experienced in handling it than to any characteristic of the steel itself. Properly finished chasers of high-speed steel have been found to give superior results, regardless of the nature of the material to be threaded.

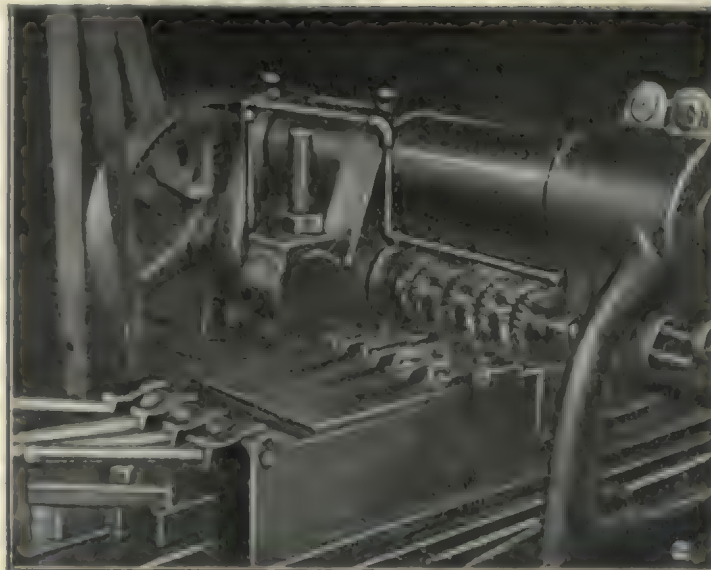
Raw Stock Is Cold Drawn Bars

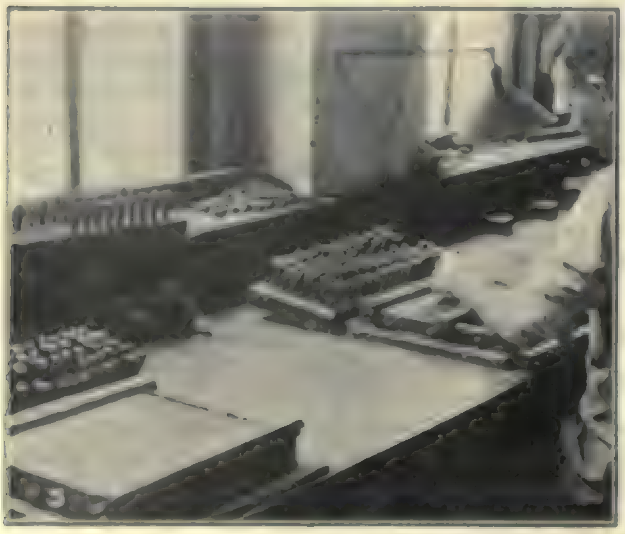
The stock is received at the factory in the form of cold-drawn bars of rectangular section, conforming in size very closely to the finished dimensions of the chasers so that no machining operations other than grinding are required to bring them to size. All chasers except specials are put through upon shop orders, the number of chasers in each lot depending upon the estimated demand for a given size.

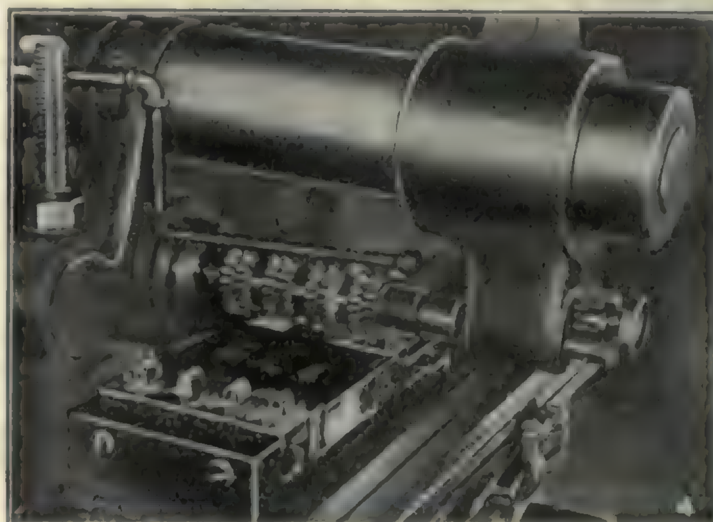
Sawing machines are arranged to handle any number of bars up to twenty-four, according to size. The blanks, as the cut sections are called, pass to the Pratt & Whitney vertical spindle grinding machine shown in Fig. 1 where a sufficient number to cover the surface is laid upon a magnetic chuck and one wide side ground to a true surface. They are then stood up edgewise between parallels and ground upon one edge. These operations are repeated upon the same machine at a later stage, at which time the chasers are practically completed and hardened.

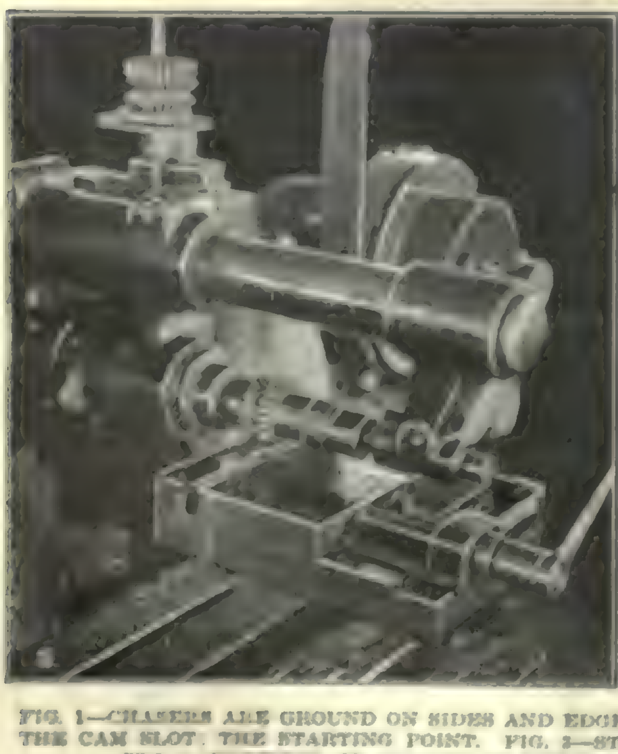
Passing next to the milling machine shown in Fig. 2, where the blanks are held four at a time in a special cam-operated vise, a square sectioned slot is milled diagonally across one of the wide faces and at the same time a part of one end is milled parallel to the slot. A gang of cutters of the proper relative diameters complete these cuts upon the four pieces at one pass.

Minor operations follow, including the drilling of a small hole in each block through which a wire is passed in the later operation of hardening to hold each set of four chasers together, milling off the corners so that no unnecessary sharp edges need be presented, removing burs that may have been thrown up by previous milling operations, etc. The blanks go thence to the stamping bench, Fig. 3, where each group of four blanks receives a serial number and each member of every group of four









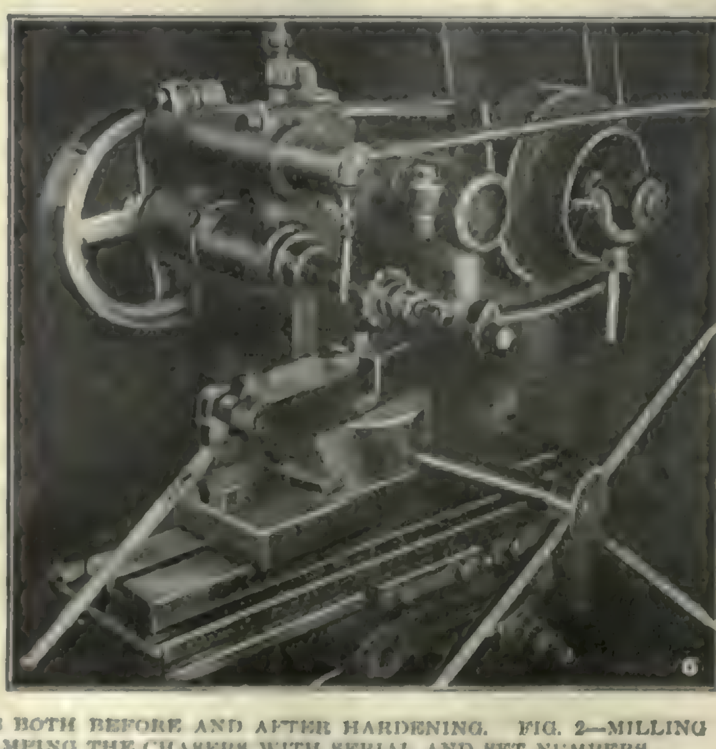


FIG. 1—CHASERS ARE GROUND ON SIDES AND EDGES BOTH BEFORE AND AFTER HARDENING. FIG. 2—MILLING THE CAM SLOT: THE STARTING POINT. FIG. 3—STAMPING THE CHASERS WITH SERIAL AND SET NUMBERS
FIG. 4—POINTING, OR MILLING TO LENGTH. FIG. 5—MILLING INDIVIDUAL CHASERS TO LENGTH
FIG. 6—MILLING THE RADIUS AT CUTTING END

is stamped 1, 2, 3 or 4, to denote the position it is to occupy in the die-head. Such a group constitutes a "set" and is handled as such in all succeeding operations having to do with the length of the chaser.

The next operation is called "milling to length," though the absolute length of the chaser is not established at this time. In this operation, as in all others involving length, the chasers are located from the diagonal slot. This is the "cam slot" that determines the radial position of the finished chaser in the die-head.

As may be seen in Fig. 4, the chasers are again held four at a time in accordance with the serial number of the group, so that each loading constitutes a "set," and as they are milled in one pass they must necessarily correspond in length, though one set may vary from another in this respect if desired.

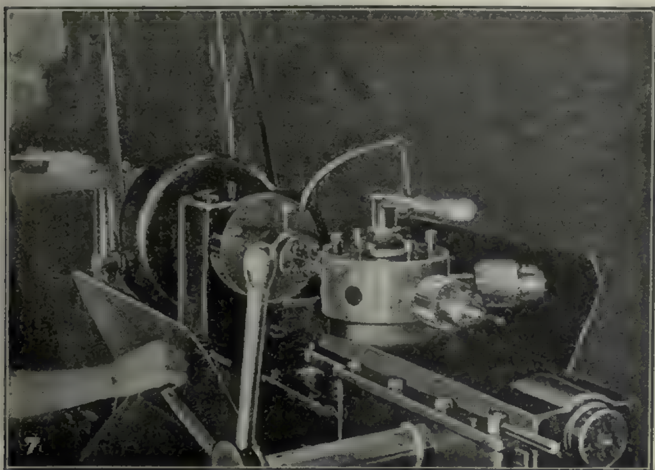
As the foregoing operation is one that must be performed upon "special" sets as well as upon the regular product an additional means of doing it, shown in Fig. 5, is provided. As it is always small lots that come to this machine no multiple holding fixture has been made but the manner of locating the piece by means of a rib upon the vise jaw fitting into the cam slot is the same as in the larger fixture.

The operation of milling the end of the chaser to a radius conforming to the root diameter of the screw to be produced by the die is shown in Fig. 6. An ingenious method of producing grooves of many different radii without the use of a corresponding number of milling cutters is here employed. Round faced cutters are used, and if the required radius is the same as that of the cutter face the work is passed under the cutter in a direction at right-angles to the axis of rotation. If a larger radius is needed the fixture is swung to pass the work obliquely under the cutter; the resulting radius increasing as the angle of departure increases.

Strictly speaking the resultant is no part of a true circle but is elliptical in shape. For the reason, however, that the final curvature of this part of the chaser is the product of the hob in a later operation, the departure from a true circular arc is so slight as to be negligible.

After passing an inspection test to make certain that no error in length has been allowed to creep in, the blanks go to the hobbing operation, of which Figs. 7 and 8 will serve to convey an idea. Before describing the manner in which the hobbing is done a word will be said as to the importance of the hobs themselves.

The cutting teeth of all chasers are the product of some form of hob. For every slight variation in diameter, in form, or in pitch, there must be a set of hobs to correspond. This is true even if but one set of chasers is to be made, and, as there must be from two to five or six hobs in a set, depending upon the size and shape of thread section and relative diameter, this will serve to explain why the cost of special chasers, however slight the departure, may seem out of all proportion to that of standard chasers.



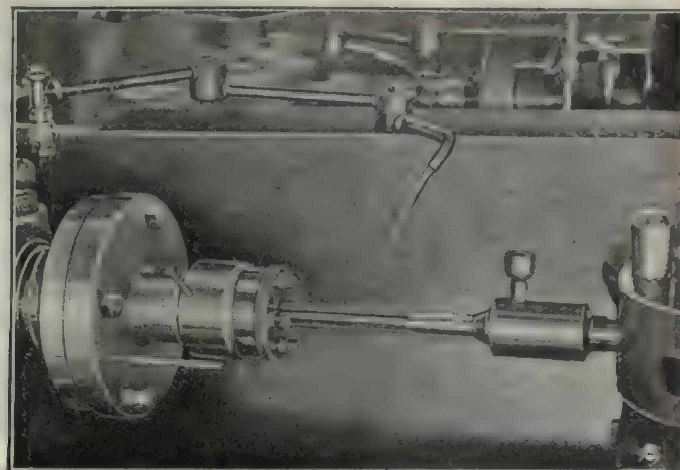


FIG. 7—HOBBING THE CHASERS. FIG. 8—THE WAY THE HOBS ARE HELD

The number of hobs required depends upon the size and shape of thread section and relative diameter of the screw to be produced. Chasers for a screw of large diameter having a fine pitched (and consequently shallow) thread of single lead could probably he cut with a single hob. On the other hand a screw of small diameter and relatively large thread section, particularly if of double or triple lead, might require half a dozen.

FIG. 9—VARIOUS SIZES AND FORMS OF HOBS

In Fig. 9 are shown some examples of the hobs required. The one at the left is of large diameter with a fine thread and is able, unassisted, to take care of all the work that comes to it. The second one is an Acme double thread of relatively small root diameter and probably requires three or four smaller hobs to precede it, as it could not possibly stand to remove the required amount of metal from the solid at a single pass.

Though the making of the hobs involves none but

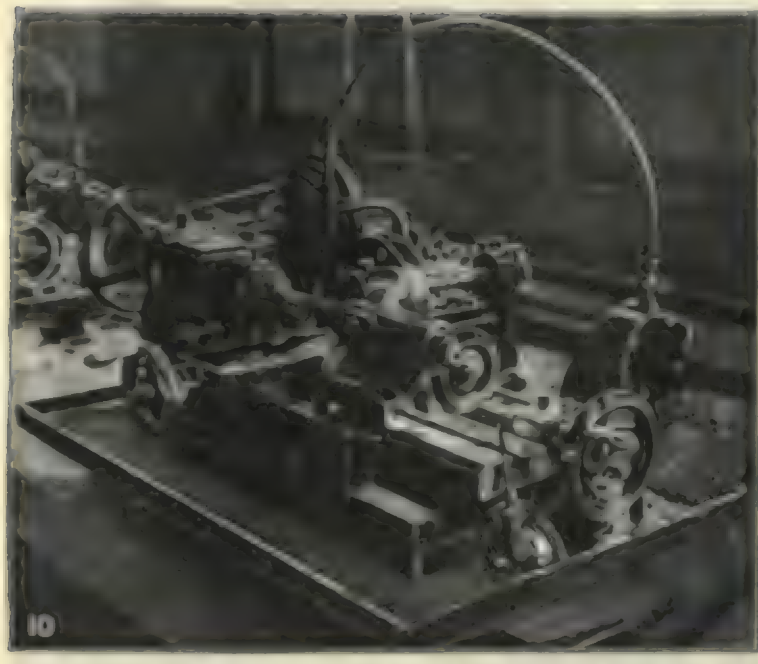


FIG. 10—MILLING THREADS ON THE HOBS

FIG. 11—GAGING AND FILING TO LENGTH

well-known machining processes, most of them being made upon Waltham thread milling machines one of which is shown in Fig. 10, the designing, particularly of special forms where the designer must make his deductions from previous experience, calls for careful study.

Returning to a consideration of the actual hobbing operations, Figs. 7 and 8 show the set up. In the turret of a hand screw machine there is a chuck with a rose reamer of a size a thousandth or two under the root diameter of the thread to be produced by the die, and a float holder to receive the squared end of the hobs. In the spindle is a special die-head of the same general construction as the die-head in which the chasers are eventually to be used.

The same cams are used to position the chasers, and the same mechanism for opening and closing the die. A slight modification of the front plate is made, as this must be removed and replaced each time a set of chasers is hobbed. The essential difference is in the slots in which the chasers lie; instead of being exactly radial they are inclined slightly backward, with the result that the heel of the chaser is brought closer by a very small amount to the center of rotation.

With a set of chasers in place, Nos. 1, 2, 3 and 4 in their respective slots, the rose reamer is run through, leaving a round true hole of the correct diameter. The operator then introduces No. 1 of the set of hobs and brings up the float holder, which serves exactly the same purpose as a tap wrench.

With the machine revolving very slowly and with a flood of oil on the hob, the latter is run through the die, the operator merely following the movement with the turret. The die is then thrown open and the hob removed, the die closed and No. 2 run through in the same manner; other hobs follow in the same way if there are more in the set.

The operation is very quickly performed and there is nothing to go wrong. Every contingency has been provided for in the design of the tools. The slight inclination of the slots in the die-head, previously referred

FIG. 12—MILLING CUTTING EDGE AND BEVELING HEEL

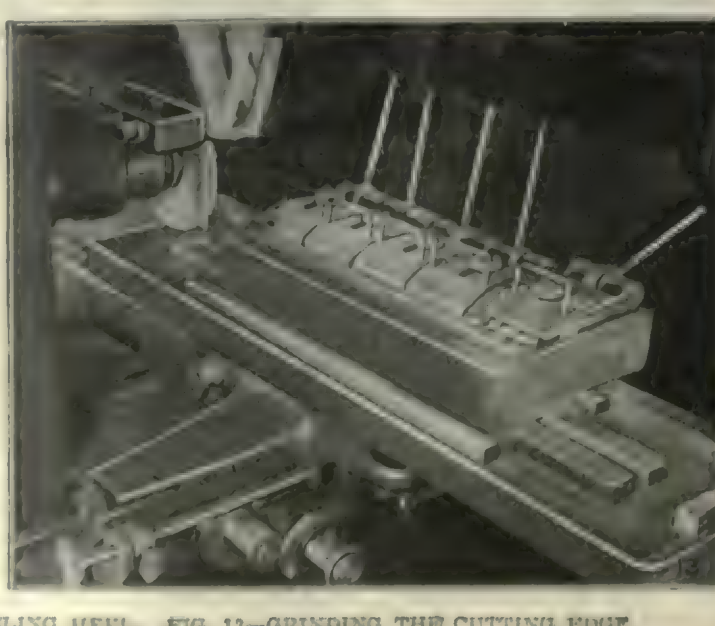


FIG. 13—GRINDING THE CUTTING EDGE

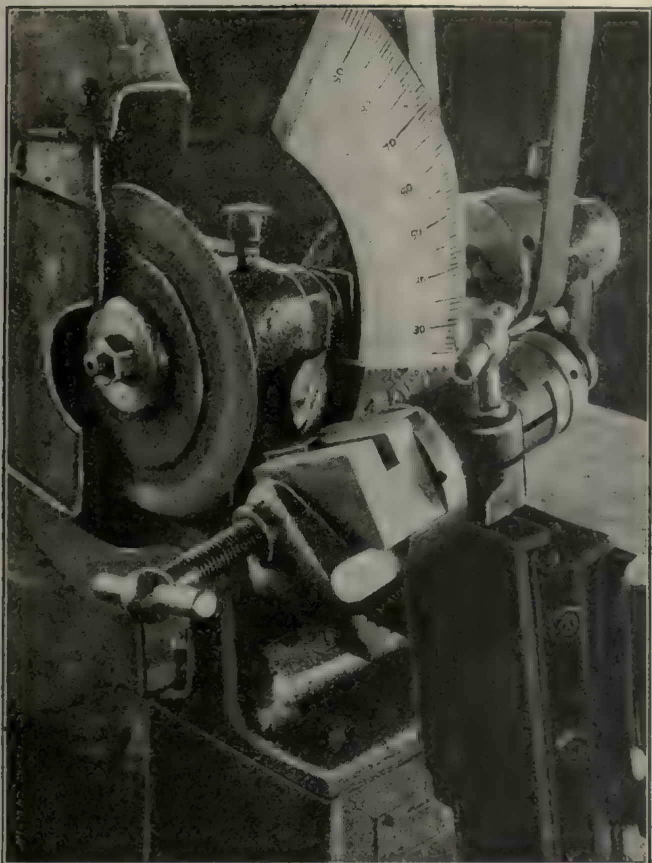


FIG. 14—GRINDING THE THROAT, AN IMPORTANT OPERATION

to, provides the necessary clearance to the die, and the manner of holding the hobs insures that they will go through correctly. As the hobs are started by the operator's fingers there is no possibility of getting a following hob in wrong. A green operator could be trained to the work in a few hours time.

After hobbing, the chasers are sent to the inspecting room where the newly formed threads are carefully scrutinized to make certain that no imperfections are getting by because of unnoticed defects in the hobs.

Testing the chasers for length, as shown in Fig. 11, is the next operation. In the device shown before the operator there is a pair of jaws so designed as to grip each chaser flatwise, locating it, as in the other fixtures, by the cam slot. The slide is then pushed forward until it contacts with a fixed stop in which position the pointed end of the measuring spindle has entered the thread and been forced back by it far enough to cause a rotation of the pointer on the dial indicator.

Holding the slide against the stop the operator turns the dial to bring the zero mark under the pointer, after which he tries the remaining three chasers of the same set. It is not essential that all sets should be alike but there must be no variation between the four chasers of any one set.

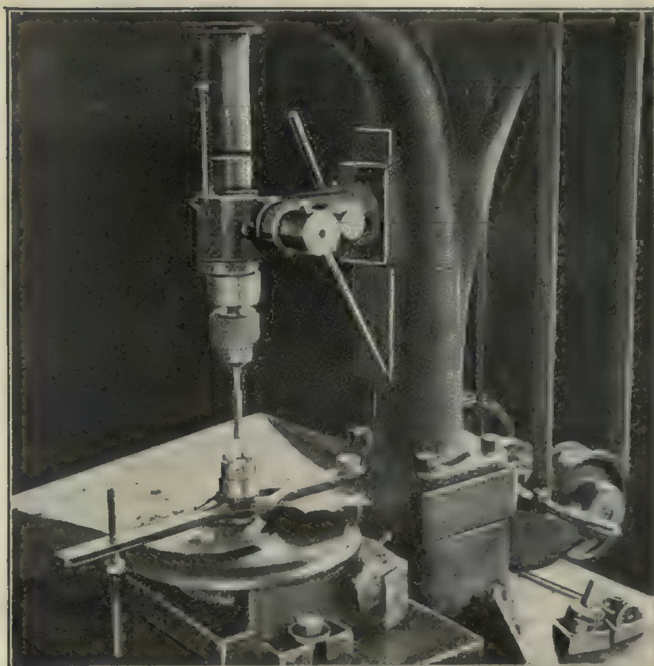


FIG. 16—MACHINE LAPPING THE SMALLER CHASERS

If the operator finds variation in this respect he picks out and lays aside the shortest one, after which he places the others successively in the little machine to his right and files a slight amount off the bearing side of the cam slot. By repeated filing and gaging he is enabled to bring a set of chasers very quickly to a uniform length.

Up to this time the cutting end of the chaser is beveled, both front and rear, this shape remaining from the pointing or "milling to length" operation shown in Fig. 4. To make a free cutting tool the edge of the chaser must be beveled slightly in the other direction to establish a certain degree of top rake. To do this they are sent back to the milling department where, as shown in Fig. 12, they are loaded into a fixture and milled to the shape that is retained in the finished chaser. To remove the burrs that are thrown into the teeth by the mills the chasers are then sent to the grinding machine shown in Fig. 13 and ground upon the edge. This operation is later repeated, using the same machine and fixture, after the chasers are hardened.

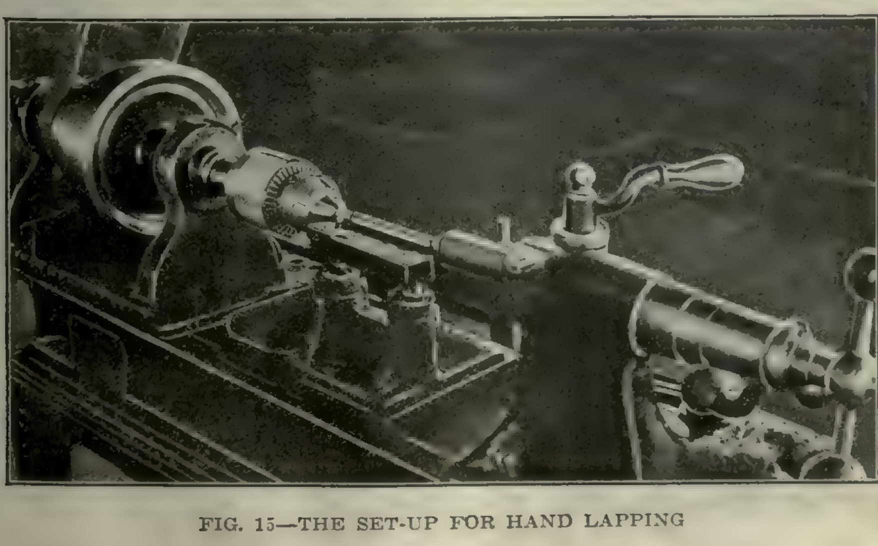


FIG. 15—THE SET-UP FOR HAND LAPPING

The chasers are now ready for the hardening operation. The utility of the small crosshole drilled in each chaser at an earlier stage is here made apparent. Chasers might be hardened without reference to their

position as members of a set and good results obtained, but if there should be any variation in treatment there would inevitably be chasers of different degrees of hardness in many of the sets. To eliminate the possibility each set is wired together and treated in its passage through the hardening room as one piece.

After hardening, the chasers are pickled, sand-blasted, inspected and tested for hardness. They are then finish ground upon flats and edges on the same machine and in the same way as was illustrated in Fig. 1. They are also reground on the cutting edge as previously mentioned in connection with Fig. 13.

Grinding the Throat

What is perhaps the most delicate operation in the manufacture of chasers is the grinding of the throat. Practically all of the work performed by a screw cutting die in removing metal falls upon the two or three more or less stubbed teeth of this beveled off portion of the die and if the angles are not just right or the teeth not properly formed the die will work badly.

The essential parts of the machine shown in Fig. 14 were designed and constructed at the factory where it is in use. By means of the various adjustable features the chaser to be ground may be presented to and swung past the grinding wheel at any predetermined angle in either plane. Though somewhat complex in design the machine is very simple in operation and when set up for the style and size of chaser in hand an ordinarily conscientious operator may grind them indefinitely with little opportunity for error.

The secret of the successful production of millions of parts necessarily so accurate as the chasers of an automatic die lies more in the machines than in the operators. Make the machines so they cannot go wrong and the desired uniformity and accuracy of product will follow.

Lapping the Finished Piece

The final operation of the chasers is the lapping. On the larger sizes this is done by hand, Fig. 15 showing the simple set-up required. A lap of the same size and thread characteristics as the screw the die is to produce is made of soft steel by the same accurate methods as are employed in making the hobs. The lap is rotated at a comparatively high speed and the chaser, laid flatwise upon a rest that is carefully adjusted to the correct height, is passed over it by hand. A fine abrasive, floated in oil, is used, being applied to the lap with a brush. This is a job requiring skill and experience to do nicely, but once having acquired the knack the production is surprisingly rapid.

To lap the smaller sizes of chaser a small drill press has been fitted up as shown in Fig. 16. In this machine a die-head, constructed in the same manner as the heads used in the hobbing operation, is mounted upon the upper end of a short vertical spindle that may be slowly rotated by means of the worm and worm wheel. The lap, rotated by the drill press spindle, is passed repeatedly through the closed die, the die-head being opened after each pass in order to permit the lap to be withdrawn.

Machinery Quotations for Our Export Trade

By Frank W. Wearin

The writer recognizes that a number of articles have been written from time to time concerning our export trade, and that various factors must be observed to maintain what trade we have and to stimulate it to a further degree. However, I think that each factor has not been emphasized sufficiently to give us a definite idea of the situation.

A concern engaged in exporting machinery to various parts of the world receives inquiries which seldom give sufficient information for it to judge what is really required. The best way out of the difficulty is for the manufacturer to quote the cost of a small or medium sized machine, and to give the full particulars regarding the number of cases, their weights, and the three dimensions of each case. The exporter may then calculate the freight charges to the prospective destination.

Descriptive circulars should be furnished, giving complete details of the construction of the machine and its production capacity for a given time under normal conditions. The machine quoted on may not be what the client requires, but he will be able to judge from the data received what he really needs, and his reply will give something tangible on which to base the next quotation.

It is practically a waste of time to forward a quotation that is incomplete in detail, more especially if it is going to a client in the middle of Africa, India, or Australia, or even to places that are nearer our shores. It must be borne in mind that very few clients have any idea of the freight rates between a port in the United States and their nearest point of delivery. These details should include also the marine and war insurance.

It is folly to quote f.o.b. at some internal point, say Chicago or Indianapolis, and expect your client in Burma to calculate freight and insurance to his port, without a knowledge of the forwarding agents' charges. Always quote "Free on Board Ship; Freight and Insurance Paid," unless a branch office on the U. S. seaboard is to handle the shipment.

The safe and substantial boxing of a shipment is vitally important for its safe carriage to its destination, and I regret to remark that this is a factor of the export business that has been shamefully neglected in the past. Many manufacturers leave the boxing of machinery to the shop foreman, or to the shipping department in which they have a very small interest. Sometimes a draftsman is sent to make a sketch of a machine crate, which is handed to the shipping department, without receiving the approval of an executive. The shipping department boxes the machine as per sketch, then hoists it in a box car labelled for New York.

If the machine arrives in New York in a broken condition the consignee ships it back to the factory for repairs. But if it is damaged at some further point in transit, there is a long argument betwen the client, the exporter and the factory, as to who is to pay the extra repair charges. The draftsman who designed the box and the shipping department that sent out the box are not to blame, but rather the careless executive who should have shouldered the responsibility. All these undesirable boxing factors can be obviated if some executive would devote a little serious thought to this important export item.

Machining and Assembling Operations on Pneumatic Tools

The Last of Four Articles—Boring and Reaming Air Motor Cylinders—Setting the Valves—"Running-in" the Motors—The Testing Brake

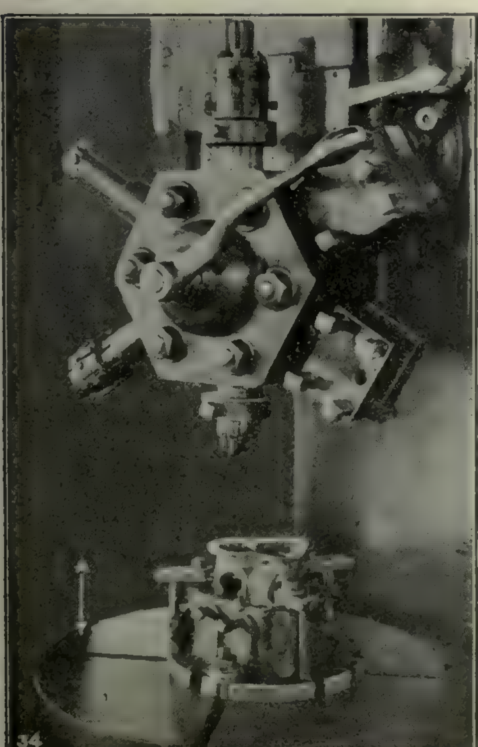
BY HOWARD CAMPBELL
Western Editor, *American Machinist*

THE operation of boring out the ends of the cylinders for a four-cylinder air motor at the Aurora plant of the Independent Pneumatic Tool Co. is shown in Fig. 34. The piece is held in a fixture that is bolted to a supplementary table *A* on the table of the machine. The supplementary table holds two dowel pins, one considerably larger than the other, and the bottom of the fixture contains eight bushed holes, four for each pin. The bottom of the fixture can be seen in Fig. 35, the two dowel pins being shown at *A*. As the different boring and facing operations are performed, the fixture is shifted, locating on one set of pins for each operation. When one of the larger holes is slipped over the large dowel pin, the corresponding small hole will fit over the small dowel pin, which brings the piece into the correct position for machining one section of the case. Four operations are performed with this fixture.

The operation of finish-reaming the cylinders of a four-cylinder air motor on a Becker-Brainerd vertical milling machine is shown in Fig. 36. The motor case is bolted to the indexing bracket *A*, that can be swung so as to bring the opposite set of cylinders in line with the spindle, using the handle *B* at the rear. Correct location is obtained by means of a pin in the back of the fixture, that slips into either one of two holes in the indexing bracket *A*, according to which set of cylinders is being reamed. The handle *C* is used to slide the whole fixture so that both front and rear cylinders of each pair can be reamed. The base to which the fixture is attached slides on ways on the sub-base, thus keeping the fixture in line with the spindle of the machine.

In Fig. 37 the same operation can be seen with the opposite pair of cylinders in line for reaming.

The valves of an air motor have to be set or timed, just as do the valves in any other kind of a motor. A very interesting device is used for this operation; it is shown in Fig. 38. The dial *A*, which is graduated by degrees, is placed over the end of the crankshaft, and the finger *B* is attached to the end of the shaft. This finger indicates the exact location of the shaft as the interior mechanism is rotated. The electrical device *C* is plugged into the cylinder head of the machine and when the piston is at the top of the cylinder, a connection is made which lights an electric bulb, thus apprising the operator of the location of the piston so that the valves can be set accordingly. The upper connection in part *C* connects with the piston and the lower connection connects with another light which apprises the operator of the opening of the valve. The connection with the air line is made while this timing process is going on, and the lower connection contains a small hole through which a blast of air rushes at the instant the valve begins to open, blowing a small copper hinge, to which one wire is connected, against the piece to which the other wire is connected, thus forming a connection and lighting the incandescent lamp. This valve has to open just a certain number of degrees before the piston is at the top of the cylinder, and if these lamps do not light at exactly the proper times the valves are adjusted.



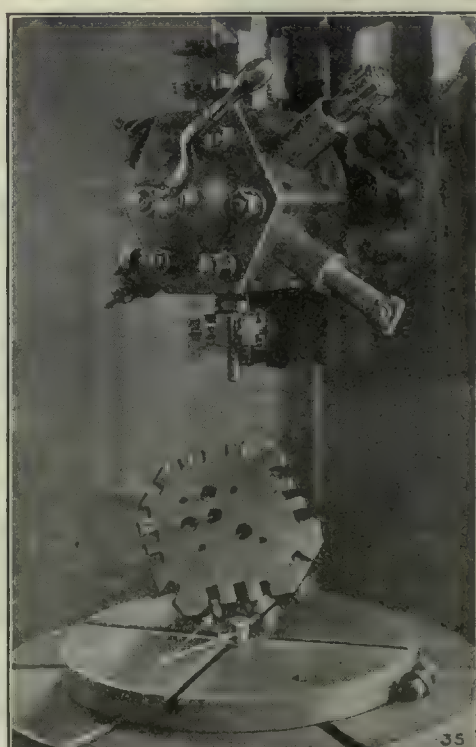
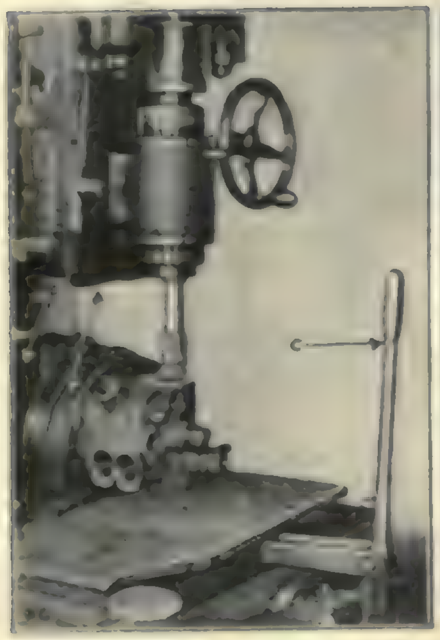


FIG. 34—BORING AIR MOTOR CYLINDERS. FIG. 35—METHOD OF LOCATING THE FIXTURE

All air motors, after they have been assembled and the valves adjusted, are subjected to a running-in operation on frames similar to those shown in the illustration, Fig. 39. This is done in order to loosen up the bearings and pistons and be sure that all parts are in a high-class operating condition. Those shown in this illustration are the "close



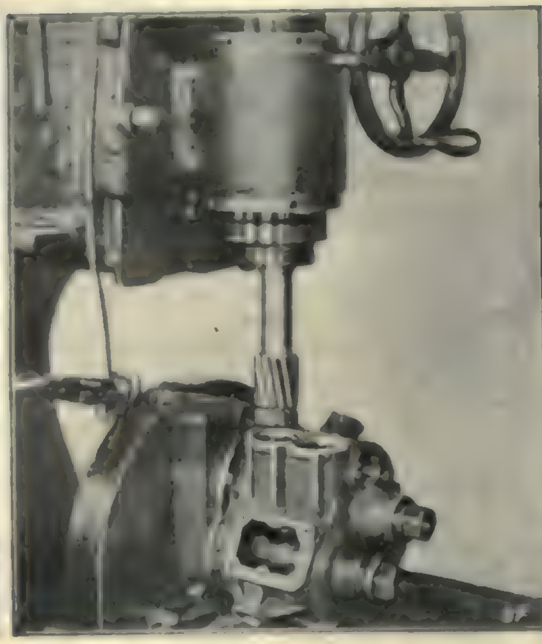


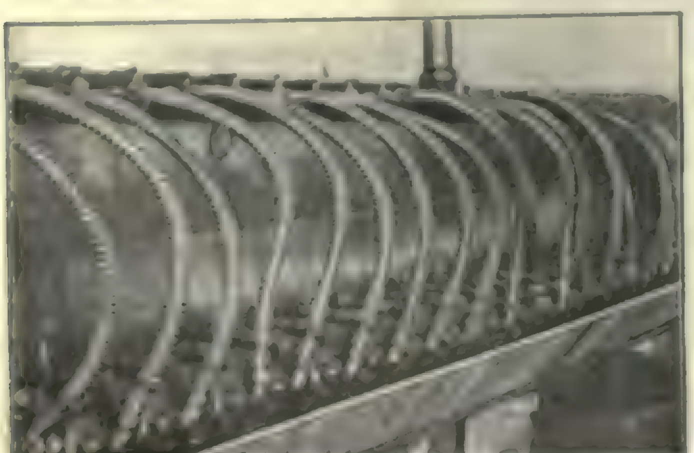
FIG. 36—FINISH REAMING AIR MOTOR CYLINDERS. FIG. 37—SHOWING OPERATION OF REAMING FIXTURE

FIG. 38—APPARATUS FOR TIMING VALVES

quarter" motors, while those shown in Fig. 40 are the more commonly known standard type. The "close quarter" motors are connected to the air line separately, while those shown in Fig. 40 are connected together through an ingenious device. Each frame carries four air motors, one of which is connected with the air supply and does the driving, while the other three are driven through chain and sprocket connections. The fact that any one of the air motors is driven instead of being the driver in this running-in test does not detract from the value of the operation. Each motor is mounted in the frame in a manner corresponding to that in which it will be used in service. In this case the sleeve is held in a bearing in the frame while the other end is supported by an "old man" as shown in the illustration. The valve heads are removed from the other three motors; otherwise they would be acting as compressors while the running-in operation was proceeding.

The torque of an air motor is a very important feature, as it indicates the ability of the motor to pull a drill at the rated capacity. The arrangement used for testing the torque of a "close quarter" air motor is shown in Fig. 41. The tank *A* supplies oil to the disk clutch *B* from the top of which projects a taper which fits into the drill spindle of the motor. A ratchet wrench is applied to the back center *C* so that pressure may be applied to the clutch. A scale *D* is now arranged between the support *E* and the air connections to the motor, and the air is turned on. As the motor is fed downward by the action of the ratchet, the oil is squeezed out from between the clutch plates and the pull on the scale becomes stronger. Any motor which fails to pull the specified capacity is sent back to the assembly room and examined for defective parts.

The apparatus shown in Fig. 42 is a testing brake, used to determine the pulling capacity of an air motor. The motor is mounted in a standard frame, as shown, with the drill socket connected with the shaft of the brake. This brake consists of a metal drum *A* about which the tension rope *B* is wound, the latter being attached at each end to a spring balance so that the



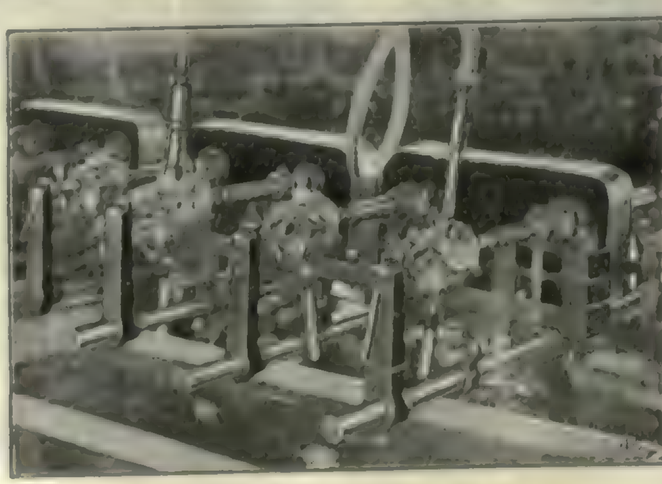


FIG. 39—RUNNING-IN STANDS FOR "CLOSE QUARTER" DRILLS. FIG. 40—ONE MOTOR DRIVING THREE OTHERS ON A RUNNING-IN STAND

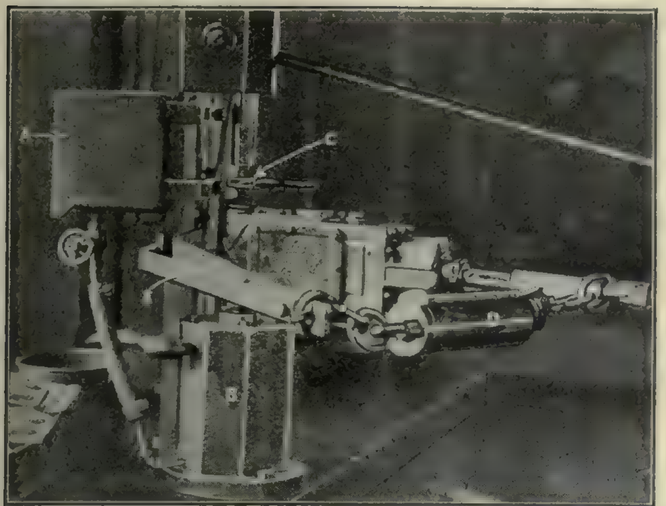


FIG. 41—TORQUE TESTING DEVICE

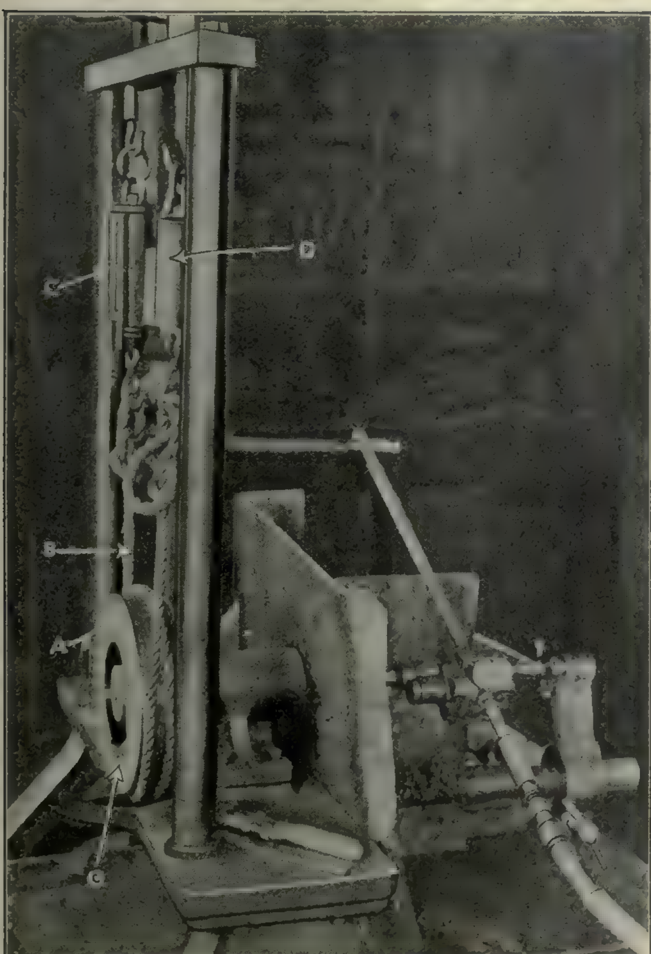


FIG. 42—USING THE TESTING BRAKE

difference in loading between the two sides can be determined by the operator. Greater or less tension can be applied to the rope by means of hand nuts on the upper end of the hook bolts from which the spring balances are suspended. The friction drum is made of brass and the outer side plate is open, as shown, so that water can be poured into the drum for cooling purposes. When the drum is standing still, the water is below the level of the bottom of this opening, but when the drum is in motion, the centrifugal force carries the water around the inside of the rim, cooling the drum and carrying off the heat.

The Encouragement of Amateur Writers

By S. Kelly

The encouraging words to embyro journalists among the machinists' craft, offered by F. P. Terry of Belfast, Ireland, on page 519, Vol. 56, of *American Machinist*, should be productive of good results.

Most of us will recognize without difficulty, the three types mentioned in Mr. Terry's letter. The "swelled head" type, the "grab-all" type, and, thirdly, the able and practical, though very modest individual, are all familiar figures to those who know the present machine shop world.

From those in the first two classes but little of real value in the shape of contributions to mechanical knowledge may ever be expected. Conceit and superficiality are the chief characteristics of the "swelled-head" type of individual. He never asks for advice nor will he take any. Seldom will he copy or follow an approved method of doing any job and, as a result, invariably leaves behind him a train of spoiled work or "jimmed" machine tools.

Selfishness is the outstanding characteristic of the "grab-all" type. He is every ready to copy from his fellow workman and even to "steal his thunder." Although he, himself, is the shop's chronic borrower, he never has been known to lend assistance of any kind to those about him. He withholds information from the struggling apprentice; he takes unkindly to improved methods or contrivances for the betterment of working conditions, and views any device installed to secure greater production as a scheme designed solely to enrich his employer.

I agree with Mr. Terry that the modest, unassuming, practical man should have encouragement and sympathy in order to bring out successfully his latent ability. He is the man who does things, who uses his brains, who is resourceful and who can be depended upon at all times to solve problems for his superiors. Cheerful readiness, whether to do a job himself or to give others the benefit of his knowledge when asked, is the chief attribute of his character.

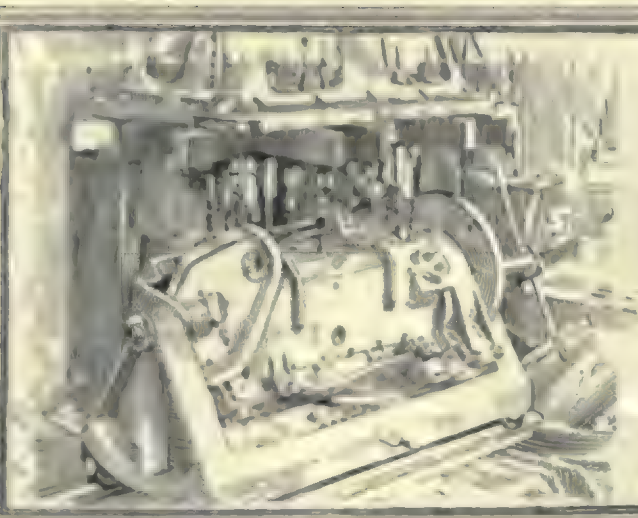
The value of men of this type among the shop's personnel is inestimable, and once he can be encouraged and persuaded to come out into the open with his ideas, his illustrations, and instructions, in his own language, for doing certain jobs, I am sure real benefit will accrue to readers of *American Machinist*.

Mr. Terry, in my opinion, should have gone one step farther in his letter of encouragement to writers by inviting criticisms from others to all published articles. This, it seems to me, would stimulate interest. Surely, Mr. Terry, Belfast man that he is, would have no objection to a more or less spirited controversy.

Increasing Interest by Instruction

By Robert Grimshaw

That no worker is going to take more interest in his job than does his employer or his foreman, is a truth which may be accepted without argument. If the former or the latter does not care enough about the manner in which the work is done to give intelligent and inspiring instructions to enable it to be done, it is idle to expect the worker to lie awake nights, thinking up the best way to perform the task. Responsibility begins at the top of the ladder.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Fixtures for Grinding Operations—Principles Involved and Points of Design—Methods of Holding for Outside Cylindrical Grinding—Use of Arbors and Steadyrests

THE process of grinding is now used as a production operation to a considerable extent, whereas a few years ago it was considered more adaptable for accurate finishing operations after work had been hardened. For the removal of metal it was considered too slow a process to be of great value; but modern practice and the development of abrasives, together with the use of specialized machinery, shows a tendency toward the use of grinding as a production process. For the removal of considerable metal, grinding is not generally used, yet it is often found profitable for surfacing rough castings or forgings when a suitable finish allowance has been made. The tool designer must become familiar with the process of grinding and the machines used in order to thoroughly understand its applications to production work.

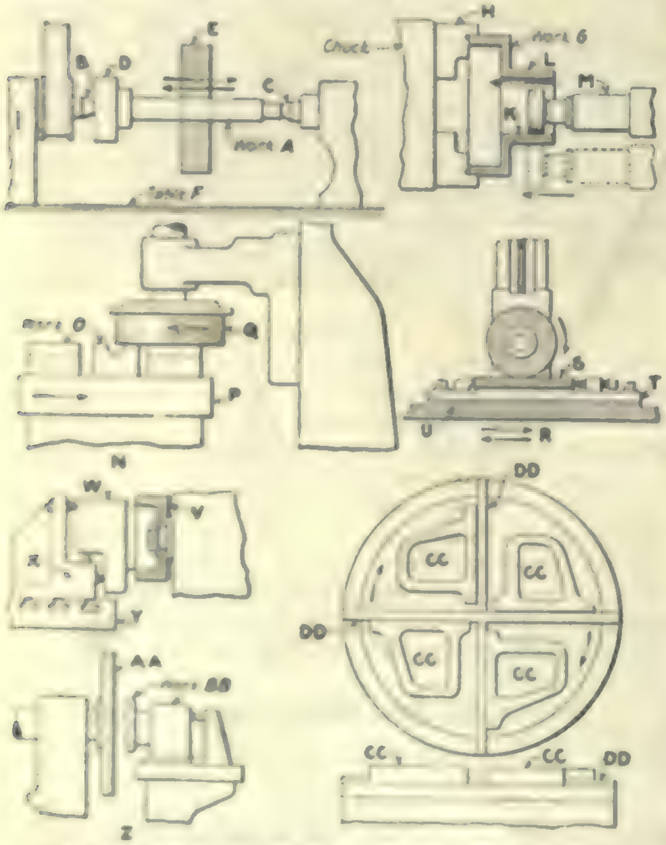


FIG. 411—EXAMPLES OF GRINDING OPERATIONS

A few examples which illustrate the application of the grinding wheel to the work in different kinds of grinding are shown in Fig. 411. The diagrams are fundamental and are intended only to illustrate the principles involved in the grinding process. In the example *A* the work is cylindrical; it is held between the centers *B* and *C* and a suitable driver provided at *D*. The wheel *E* is applied to the work as indicated and the table *F* is reciprocated backward and forward while the work is being revolved.

The wheel is fed in to the work a little at a time until the desired diameter is reached. It is customary to use comparatively heavy roughing cuts until the diameter has been reduced to a size slightly greater than that required, after which feeds are used in order to produce the required finish. The type of wheel and the quality of the abrasive are determined by the nature of the work, and it is not our purpose to go into detail in this regard. The tool engineer who is of an inquiring turn of mind can readily obtain the necessary data on grinding wheels by referring to manufacturers' catalogs.

In the example shown at *G* the work is held by the outside in chuck jaws *H*. The work to be done is grinding the inside surface *K* and the outside of the hub *L*. An internal grinding spindle *M* is applied to the machine, and suitable adjustments are made so that this spindle can take the positions shown by both the solid and dotted lines. The machine used may be a plain or an internal grinding machine.

A method used for surfacing either rough or finished work is shown at *N*. In this application the work *O* is held on a magnetic chuck *P*, which is so arranged that it revolves under the wheel *Q*. This wheel is usually of the cup variety, and it comes in contact with the work as the latter revolves. Fixtures can also be used on this type of machine if the nature of the work requires it.

Another method of grinding surfaces is shown at *R*.

*For the authors' forthcoming book.

Here the work *S* is held in a fixture *T* or on a magnetic table, as may be found desirable. The table *U* reciprocates in the direction indicated by the arrows while the work passes under the wheel. The feed, which can be operated by hand or power, causes the table to move transversely under the wheel a little at a time. This type of grinding machine is more generally used for toolroom work than for manufacturing.

Still another type of machine uses a cup wheel *V* mounted on a horizontal spindle, and the work *W* is held in a fixture *X* which is mounted on the reciprocating table Y.

Any mention of grinding processes would not be complete without an example of disk grinding, which is shown in the illustration at *Z*. Machines for this kind of grinding are made with a single spindle, which carries a faceplate *AA* on which an abrasive disk is mounted. The work *BB* is held against this surface while the disk revolves, thus removing the stock and leaving a smooth finish. Another type of disk grinder uses two spindles which are opposed to each other, and the work which is to be surfaced is passed between them so that the grinding effect takes place on both sides of the work at the same time.

Another method of disk grinding is by means of a large abrasive plate lying in a horizontal plane and revolving swiftly. Castings such as those shown at *CC* are laid on the disk, and their own weight holding them in contact with the abrasive surface is sufficient to cause removal of the stock with considerable rapidity. Suitable crossbars *DD* can be placed across the disk, and against these bars the work is thrust in the direction of rotation, as indicated by the arrows.

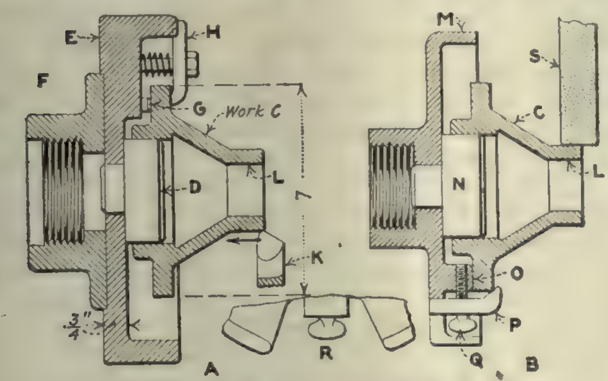


FIG. 412—TURNING AND GRINDING FIXTURES FOR A FLANGE

Turning and Grinding

Fixtures which are used for turning and grinding are quite similar in their general features of construction; but the latter type are usually considerably lighter and the work does not need to be clamped as securely, because the removal of stock by the process of grinding is slower and does not tend to throw the work out of its position. In order to illustrate this point clearly two examples are shown in Fig. 412, in which a turret lathe fixture *A* is compared with a grinding fixture *B* for the same piece of work. In the example *A* the work *C* is located on a plug *D*, which is set in the fixture *E* bolted to an adapter *F*, the latter being screwed to the spindle. The work rests on studs at *G* and is clamped down by straps *H*. The construction of this fixture is fairly heavy because tools are used for removing stock, as shown at *K*, and the hole *L* is also bored in the same operation.

In the example shown at *B* the fixture *M* is very much lighter and is screwed directly to the spindle of the machine. A locating plug *N* centralizes the work, which rests against three points *O* and is clamped in place by light clamps *P* operated by thumbscrews *Q*. Protection is afforded the operator by placing the thumbscrews in the position shown by a detailed view at *R*. The wheel *S* is used on the outside of the work and an internal grinding attachment is applied for boring the hole *L*. The general construction of this fixture is much lighter than that used for the turret lathe, and the clamping is done by finger pressure. This illustrates the difference between the types of fixtures used for turning and grinding, but it should always be remembered that any fixture used on a grinding machine must be heavy enough so that it will support the work properly and not be subject to vibration.

In the grinding of shafts or other cylindrical pieces which are located on centers, there is very little for the tool engineer to concern himself about. There are occasional cases when a little ingenuity may be required to assist the grinding machine operator in setting up the work in order to obtain maximum production.

In the example *A* shown in Fig. 413 the work is a shaft 5 in. long x $1\frac{1}{2}$ in. in diameter. If it were possible to grind this piece by employing the methods used in turning, one end would be driven positively and the other held on a center point. If the standard type of

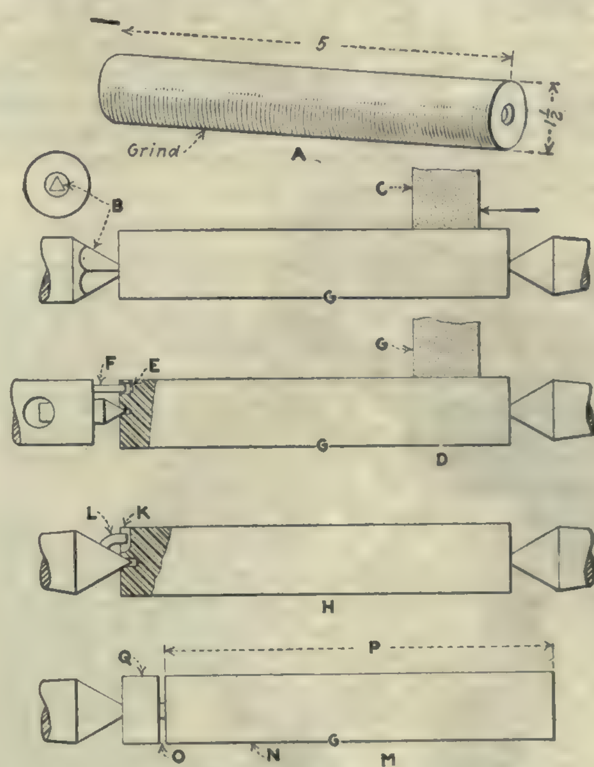


FIG. 413—HOLDING CYLINDRICAL WORK

"dog" is used, the work can be ground only up to a point close to the dog. In order to complete the shaft, the work would need to be reversed and the dog placed on the other end, after which the second grinding operation would have to be done very carefully in order that there would not be a shoulder where the second cut overlaps the first.

One method of avoiding this trouble is to use a special triangular center point like that shown at *B*. This center can be forced into the end of the work with sufficient pressure so that it will transmit torque enough to drive the shaft against the friction of the grinding wheel *C*. Another method which can be used for a similar piece of work is shown at *D*. Here the shaft is centered in the usual manner and a hole is provided at *E* in which the pin *F* enters. This pin exerts sufficient pressure to drive the work against the thrust of the grinding wheel *G*. Another method which will give good results is shown at *H*. The work is slotted at *K*, so that the pin *L* will enter the slot and act as a driver. Still another method which is quite frequently used for small pins is shown at *M*. Here the work *N* is made somewhat longer than required and grooved deeply at *O*, so that the distance *P* is the length of the piece when finished. The additional stock at *Q* provides sufficient surface so that a "dog" can be applied to it for driving purposes. After the portion *N* has been ground to size, the end *Q* is broken off.

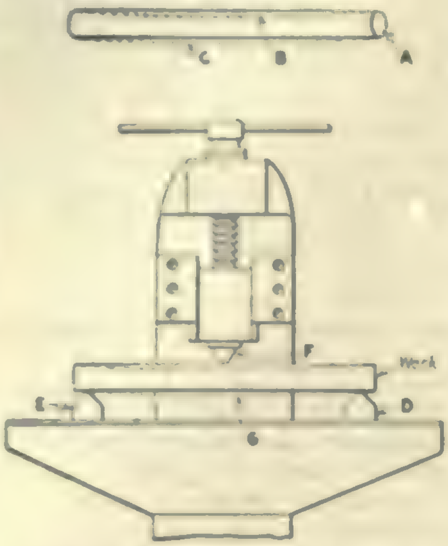


FIG. 414—STRAIGHTENING WORK BEFORE GRINDING

Straightening Work Before Grinding

When shafts are to be hardened and subsequently finished by grinding, a certain amount of stock is left on the work after the turning operation. It is quite possible that this "grinding allowance" does not take into consideration the possible warping of the work when hardening. It is seldom that a shaft of any great length can be hardened without a certain amount of distortion, and it is therefore necessary to straighten it preliminary to the grinding operation.

In order to illustrate this point clearly a diagram is shown in Fig. 414 in which the work *A* is a shaft which has been hardened, and which is found to have taken the position shown by the dotted lines at *B* and *C*. If an attempt were made to grind it in this condition, it would be impossible to reduce it to the proper size unless a very great amount of finish has been allowed for the grinding operation. In order to avoid the need for such a large allowance, the work should be straightened after hardening and before grinding. The usual method for a shaft is to place it on supports *D* and *E* and apply pressure to a block *F* by means of a suitably placed screw. The pressure can be applied by means of a handwheel or a lever, according to the requirements of the work. It will always be found necessary to depress the work considerably beyond its true center, as shown by the dotted lines at *G*, in order that it may spring back and return to a true position.

This example shows the importance of allowances for grinding. The sizes are usually determined by the engineering department, and the shaft should be marked with limits for both turning and grinding. It is essential that the tool engineer should be very careful to make all jigs and fixtures to the sizes which are produced by turning and not to the finish grinding sizes. If an occasion should arise where the grinding allowance does not appear to be sufficient, the matter should immediately be taken up with the engineering department and proper tolerances set.

Various types of steadyrests are used for supporting cylindrical work while grinding. The designs are somewhat different in their general features of construction, but the principles employed are much the same. In order to illustrate the application of steadyrests to cylindrical work, we have shown a few examples in graphic form in Fig. 415. The shaft shown in section *A* is to be ground cylindrical by the wheel *B*, which revolves in the direction indicated by the arrow. The thrust of the grinding therefore is both downward and outward from the wheel. In order to counteract this thrust and provide sufficient stability to the shaft during the grinding process, a simple steadyrest such as that shown at *C* can be used. This rest can be made of wood, if desired, and mounted so that it can be adjusted to give the necessary support.

In the example *D* the wheel *E* acts in the same manner as that previously mentioned, but two supports *F* and *G* are provided for the work. The lower support *G* obtains a contact with the work slightly ahead of the center, so that the action of the wheel has a tendency to hold the work firmly against both members *F* and *G*. These members are adjusted separately to suit the shaft diameter.

In the example *H* another type of rest *K* is used.

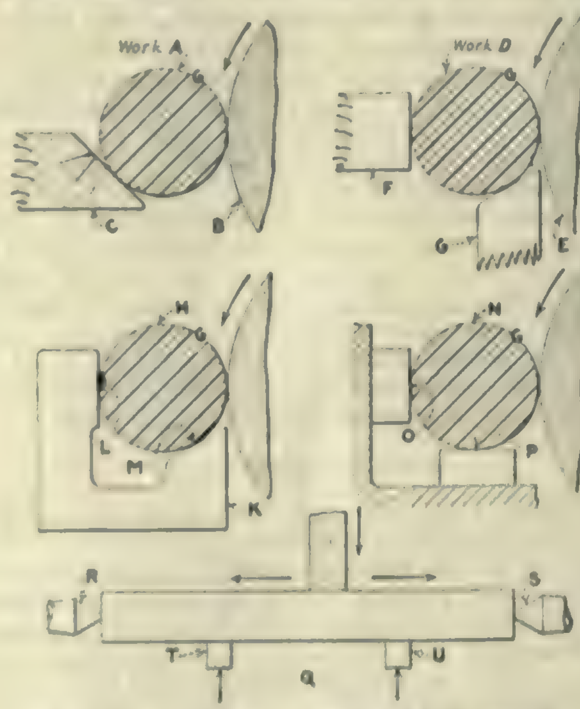


FIG. 415—SUPPORTING CYLINDRICAL WORK FOR GRINDING

The steadyrest is made in one piece and proportioned suitably to give the necessary stability. It has a contact with the work at *L* and *M* very similar to that previously mentioned. Another type, shown at *N* has two adjustable members *O* and *P* which are mounted

so that they can be very easily brought into contact with different diameters of work.

In grinding long work several steadyrests may be necessary, and in order to secure accuracy the position of the steadyrests should be as shown in the example *Q*. The work is supported on centers at *R* and *S*, and two steadyrests *T* and *U* are placed in such a position that the support is equally distributed along the length of the shaft, the distances between the steadyrests and centers being approximately the same. This is an important matter when setting up a shaft for grinding, and if considerable care is used when placing the steadyrests much better results will be obtained.

Points of Design

Many of the principles which have been previously described can be applied equally well to the design of fixtures for grinding, and many cautions which have been given in regard to other types of fixtures should be reviewed and applied here. A few additional points should be given because the action of a grinding wheel is somewhat different from that of a cutting tool.

(1) Stability of fixture and proper balance are important factors in design. Vibration causes chatter which makes it impossible to produce good work in either turning or grinding. Therefore, the greatest care must be used to make sure that fixtures are sufficiently rigid and well balanced, so that they will not set up vibrations in the work or the machine. In grinding, the fixture revolves slowly while the wheel turns rapidly, and it may seem to the designer that with such comparatively slow movement the balance of the fixture is not important. It will be found, however, that any holding device which is considerably heavier on one side than on the other will be likely to produce inaccurate work. Therefore, when such a condition

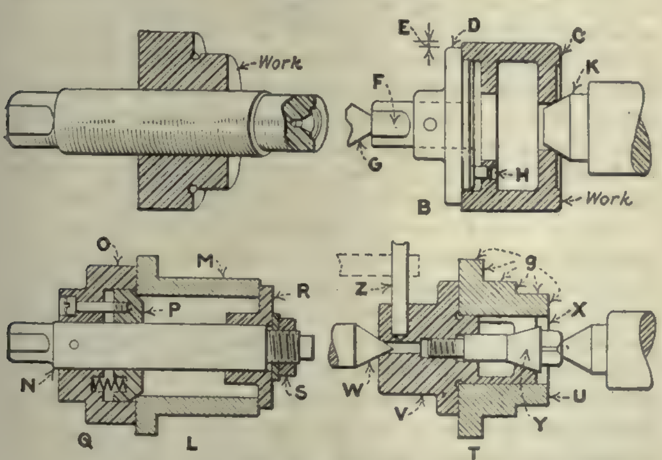


FIG. 416—PLAIN ARBORS FOR CYLINDRICAL WORK

is found, the defect should be counteracted by the use of a counterpoise.

(2) The location of the work is important, as it is in all fixtures, and due to the fact that abrasives are being used continually there is a great deal of such matter that finds its way into the fixture. Consequently, locating surfaces and plugs are likely to lose their size quite rapidly on account of the abrasive action, so that they should be made replaceable if good results are to be obtained. If indexing pins are used great care must be taken to protect them, so that they are not subject to the action of the grinding dust.

(3) The method of holding the work in grinding fixtures is the same in principle as that used for fixtures for turret lathes and other machines of a similar kind. The amount of stock removed by the grinding wheel is much less than when turning or boring, and there is consequently less pulling action which tends to displace the work. Therefore, it is often possible to use spring clamps or even springs to hold the piece

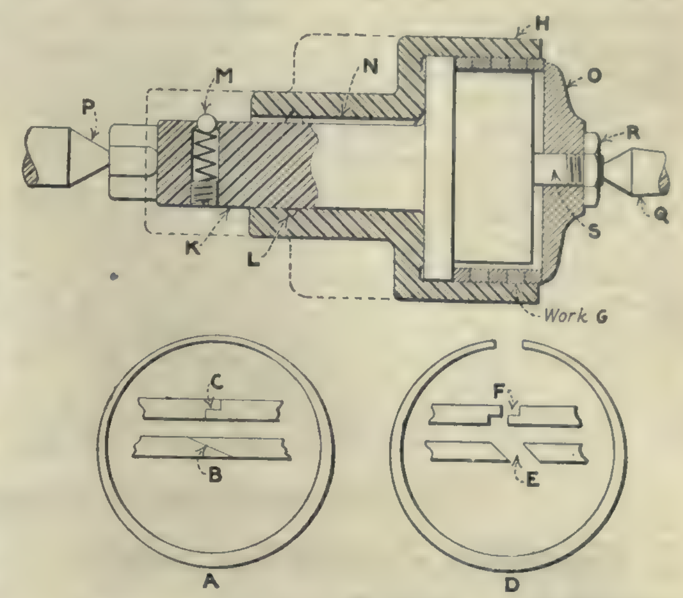


FIG. 417—ARBOR FOR GRINDING ECCENTRIC PISTON RINGS

in position. Many times magnetic chucks are used in certain kinds of grinding, the holding power of the magnets being sufficient to withstand the pressure of the grinding wheel.

(4) Work may be ground either wet or dry, depending on conditions. In the case of fixtures used for wet grinding, provision should be made so that the water can run out of the fixture freely. This is a very small matter and yet it should receive consideration when designing fixtures. There may be occasional cases where a special application will be found necessary in order to direct the stream of water into the proper position.

A few examples of simple arbors used for holding work while grinding are shown in Fig. 416. The diagram at *A* is a plain taper arbor of the standard type, such as commonly used for turning cylindrical work. The example *B* shows a piece of work *C* mounted on a shouldered collar *D*, the outside diameter of which is slightly smaller than the finished outside diameter of the work, as indicated at *E*. The collar is pinned to a short arbor *F* which locates on the center *G*. The work is driven by means of a pin *H* entering the hole as shown. The outer end of the work is supported on the center *K*.

Another method of locating and holding is shown at *L*, in which example the work *M* has been previously finished. The arbor *N* has a collar *O* pinned to it, and a taper locating plug *P* is mounted by means of springs *Q* so that it forces itself into the end of the work, thus giving the central location. The collar *R* at the other end of the piece is clamped in place by means of nuts and washers at *S*, which action draws the work back against the face of the collar *O*. The centers in each end of the arbor hold it in position for the grinding.

A simple type of expanding arbor is shown at *T*. The

work *U* requires grinding operations on the various surfaces and shoulders, as indicated by the arrows. The arbor *V* has a center *W* in one end, while the other is split at *X* in three places and expanded by means of the screw *Y*. A similar arbor to this has been described in the articles on turret lathe work. The method of driving is by means of a pin *Z* which lies against a projecting stud in the faceplate. All of the arbors shown here are of very simple type, and it will be evident that there is considerable similarity between them and arbors used for machining operations.

Eccentric piston rings such as those used in automobile and other gas-engine cylinders must be ground on the outside diameter after they have been cut apart. In the example at *A* in Fig. 417 two methods of cutting the ring are shown. The example *B* is the ordinary form, in which the edges of the ring come together on a diagonal line. The lap-joint ring shown at *C* is another form, which is not so commonly used. In machining rings of this kind, they are bored and then turned eccentrically, after which a piece of each ring is cut out, as shown at *E* and *F* in the example *D*.

When grinding the rings, they must be closed up and drawn together so that the edges meet, and they must be held in this position during the process of grinding. A method of holding frequently employed for this kind of work is shown in the same illustration. From four to six rings *G* are sprung together and placed in the shell *H*, which is mounted on an arbor *K* so that it is sliding fit. The collar *O* is brought up against the edge of the outer ring and clamped in place by the nut *R*. The stud *S* is centrally located in the body of the arbor and contains a countersunk portion in which the center *Q* locates. The other end of the arbor rests on the center *P*.

After the rings have been placed in position and the collar tightened, the operator pulls the sleeve *H* back as indicated by the dotted outline. This leaves the rings clear, so that the grinding wheel can be used to finish the outside diameter. The arbor is furnished with a ball *M*, which acts as a "detent" in the groove *L* when the sleeve is pulled back from the rings. A point of importance in connection with the design is the groove *N*, which is used solely for the purpose of relieving the air pressure when moving the sleeve backward and forward on the arbor. Unless some provision for this relief is made, great difficulty will be experienced on account of the close fit.

Recollections of an Old-Time Mechanic

By John J. Grant

After leaving Brown & Sharpe's shop I went into a woolen mill and helped the all-around man who did the repairs. I had the starch taken out of me when I encountered a job that it seemed impossible to do with the tools we had. It was done, however, and I had sense enough to see that if I was ever to become the all-round man I hoped to be, I must be able to do these jobs and others that would put me in a tight place.

I went to Northampton, Mass., and hired to a man who ran a foundry, machine shop, sash and blind shop —Old Bill Clapp. Nothing got away from him, he would take anything from cleaning a watch to building an 18 x 42-in. steam engine. I worked there for three years and laid the foundation for all the success in mechanics that has come to me.

The shop had a fair equipment of tools, as shops were supplied in those days. As far as I can remember there were three small engine lathes of 14- to 16-in. swing, wooden beds with iron V-s and chain feeds; a 16-in. lathe, a little more modern, which I remember had a curious arrangement of the speed-reducing gears, all inside of the cone pulley, and one 16-in. lathe, made by the Hadley Falls Machine Co., Holyoke, Mass. This was our star lathe and used for the best work. We had several other lathes all of the same general design, but only one with the feed in the apron.

A 24 in. x 20 ft. bed lathe was used for a shafting lathe and I have turned miles of shafting 2 to 3 in. in diameter on it, at the rate of about 30 ft. per day. We used all iron shafting in those days and when Old Bill had taken a job extremely low, he bought correspondingly bad iron for the job. This iron was full of sand streaks, so we were obliged to stop the lathe every foot or two and chip out the sand streaks.

We turned all shafting to a ring gage and it required constant watching to keep the size close enough to fill the ring, and free enough to pass through. The diameter of the ring gage was enough larger than the finished size of the shaft to allow for filing. We had standard rings bored out to inside calipers set to a scale with the corners worn off but it was a standard even though it did not match the other fellow's who made shafting. Old Bill used to chuckle when we told him about it, and say, "Well, that is all right; the people who buy this shafting will have to come to me for pulleys."

We had an 8-ft. lathe built on a stone foundation having the cast-iron ways bedded in sulphur. This lathe was not very accurate, but we did some good work on it, as it was strongly built. The spindle was of cast iron, and the bearing on the front box, which was also of cast iron, was about 8 in. in diameter and 10 in. long. After many years use the bearing had a beautiful surface. The faceplate was keyed to the spindle. While doing a job I found that the faceplate was loose, so I took off the front spindle cap, backed out the key and shimmed under it with a piece of tin. This threw it out of true nearly a quarter of an inch at the periphery, but we had to use it in that shape for at least one year before I could get permission to true it.

Our drill press was home-made, being constructed from the headstock of an old wood-turning lathe. There was no quick return to the spindle. The quill was threaded on the outside and ran through the front box. It had a handwheel at the top for feeding. The spindle was driven by a pair of cast bevel gears at the top. One of these gears was mounted on a horizontal shaft which went through a hole bored through the post to which the drill press was bolted. There was a cone pulley on this horizontal shaft, and another shaft on the bottom of the post with a cone and tight and loose pulleys.

The table was a large angle casting bolted to the post and arranged so that it could be moved up and down. The spindle had a straight hole and drills or collets were fastened in with a setscrew. We had no twist drills, reamers, taps, dies, or milling cutters except home-made ones, and some of them were fearfully and wonderfully made.

An Engineer's View of Standardization of Machine Tool Elements

BY HARRY E. HARRIS

During the writer's experience as an engineer in charge of equipment, design, purchase and installation in both large and small corporations, he has repeatedly standardized machine tool elements and equipment as well as small tools in the companies that he was connected with. Take for instance the matter of draw-in collets for lathes, milling machines, bench lathes and small grinders; he has adopted a certain collet as standard and put in new spindles or re-made the existing spindles so that this collet adopted as standard could be used interchangeably throughout. This eliminated considerable confusion in the toolroom and the necessity of having a number of sets of different styles of collets, lost time finding the proper collets and also putting collets in the wrong spindles, stripping threads and producing inaccurate work.

Another point which was standardized was the nose thread on lathe, milling machine and index head spindles, so that if machines were within a certain range, the same chucks, drivers, boring heads and faceplates could be used interchangeably. This is often of advantage when work has been strapped up on a lathe faceplate, or put into a chuck and then transferred to a milling machine for further operations. It also eliminates the duplicity and complicity of the chucks and chuck parts, faceplates, etc., in stock as the nose threads on the spindles and the internal threads in the backing plates were made to gage. They always fitted satisfactorily. In some cases, upright drills carrying lathe chucks and boring heads, were fitted with nose threads on their spindles to correspond to the above which proved to be of considerable advantage in many cases.

Eliminate Unnecessary Tapers

Another point which should be considered is the matter of centers and tapers. It is a matter of great expense and confusion in reamers and chuck shanks. It is my belief that a standard taper should be adopted and the large number of useless tapers be discarded as was undertaken and put through in regard to screw thread sizes some years ago.

Other details which might well be standardized even further than they are today, are countershaft speeds, hangers, boxes, shaft sizes, and pulleys. The speed at which cutting tools can cut or should cut is well known. A certain size lathe should have a certain range of speeds and the belt should transmit a certain horsepower at each speed and in case of cone driven lathes, the diameters of the steps of the cone pulleys, the face width for the belt and the number of steps could well be standardized for each size, as also could be the length and diameter of the bearings.

While we are on the subject of lathes, the toolposts could be standardized so that all lathes of similar size would take the same size tool. I have made it a practice when buying a new lathe, to change the toolposts to conform to a tool which was standard for that particular size of lathe, and have found quite a variation in toolposts. Where this is not done, some toolposts are found too small to fit the tool and the tool has to be ground down to fit.

Another thing which could well be standardized, and there has been some work along this line, would be T-slots of the different machine tools, so that a set of standard bolts and clamps could be used for milling machine, faceplate, shaper table and small planer work; and a set of standard clamps could be laid out and could be carried in the stock room instead of having them kick around each machine.

First Standardizers Will Reap Harvest

We are coming to a period of keen competition and the firms who are first to supply standard goods will assuredly reap the benefit, as users are well aware of the great waste that goes on in their factories due to the duplication and complication of machine tool elements and accessories, the confusion caused by not being able to find the proper part to fit and the large inventory of this kind of material each concern has to carry for each individual type of machine tool.

I, as a buyer, appreciating the large saving that this would make in my business, would consider the purchase of an inferior machine tool, if I knew that its elements were to an accepted universal standard, rather than a similar machine tool of well-known excellence of high reputation but which had everything peculiar.

I am a great enthusiast on standardization and have seen the benefits derived from it. Some years ago in one shop having 7,000 emplyees and of international renown, I carried on the work of standardizing their small tool parts for jigs, such parts as latches, clamps, bushings, feet, hinge leafs, etc. The general dimensions being standardized, saved much of the designer's and mechanics' time and allowed us to manufacture the elements and carry them in stock ready for withdrawal by the toolmaker, who simply had to suit them to the job in hand. Likewise in punches and dies, I standardized the clamps and clamping bolts and die beds, die blanks, strippers, feed fingers, punch holders, punch blanks, liner pins and liner pin bushings. We carried all these in stock in several different sizes, making it a simple matter to make a die. All the diemaker required was a sketch showing the layout of the die itself and giving the stock number of the various blanks to be withdrawn from stock.

The same standardization was carried throughout on gages, screw machine tools, etc., it being only necessary for the special job, to withdraw the blank from the stock room by its stock number and finish it to suit the special job in hand. This company is producing better tools than any other company that I know of and doing it for much less cost; this cost being approximately one-half of what they can have the same tools built by tool building concerns for them. This gives you some idea of the value of standardization.

Standardization is also of immense value in the question of replacements and reducing the cost to the manufacturer of the machine tool and its parts. A large saving would be made also to the manufacturer of machine tools in the matter of initial costs and upkeep of his special gages and tools in his designing department. He would be able to buy standard gages and tools made by gage and toolmaking concerns on a commercial quantity production basis much cheaper than he could build gages and tools himself and would require fewer of them and in the engineering department, a high priced engineer would not be compelled to give any consideration to such elements, except to select the right thing from a table of standards and have the detail draftsman specify it on the drawings.

Extracts from a letter to the Standards Secretary, A.S.M.E. Published by permission.

Methods of Machine Tool Design

Third Part of Chapter on Gear Drives—Speed Variation by Means of Sliding Gears—Arrangements of Gears—Rounding of Teeth

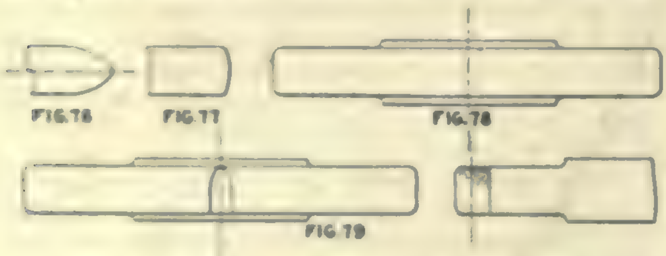
By A. L. De LEEUW
Consulting Editor, *American Machinist*

IN THE foregoing paragraphs general features were discussed, considerations which lead up to the selection of a certain design, but without considering details. We have found how much power must be transmitted, how many shifts we should make for a given number and range of speeds, etc. We must now see what means there are available to obtain the desired results.

The various desired speeds are obtained by speed variators, of which several may be used in one speed-changing device. We can make changes in one of these variators, or change over from one to another; or, what happens perhaps more often, do both, when we want a change of speeds.

Speed variators are of different types, the principle ones being: Sliding gears; cone gears and tumbler; pull pin gears; back gears; clutch arrangements; differentials; combinations of some of these devices.

Sliding gears should be made with rounded teeth on that side where they enter into mesh. Both meshing gears should have the teeth rounded. The amount of round depends on the pitch of the gears and on their circumferential speed. If the gear has several speeds, the highest should be considered. Up to 6 pitch and

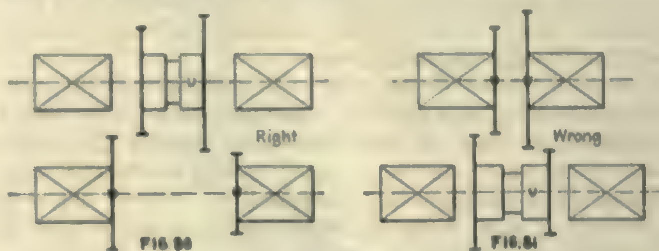


FIGS. 76 TO 79—FORMS OF ROUNDED TEETH

with a speed not exceeding 600 ft. per minute, ⅛ in. is enough for the round. Heavier pitches than 6 diametral and speeds below 600 ft., or 6 pitch or less and more than 600 ft., require $\frac{3}{16}$ in. Heavier pitches and speeds above 600 ft. require ¼ in. or more.

An excess of round does no harm, but it must be remembered that in figuring tooth pressure *the round must not be figured;* so that more round than is necessary adds to the face of gear, length of shaft, etc., without compensating features. The round should be made as in Fig. 76, and not as in Fig. 77. It is sometimes thought that the round appears as in Fig. 78. Such a round is only given to prevent the gear from being damaged in handling and a very small amount serves for this purpose. The round intended for the gear shift is shown in Fig. 79. This round is made along the face and flank of teeth. The existing machines for making the round produce one also at the top, though this is not required. Sliding gears should be close to a bearing when in mesh. Figs. 80 and 81 show the right and wrong way of arranging them. Many designs exist which ignore this requirement.

The pinion which transmits the power from a sliding gear shaft to another shaft should be placed as near as possible to the largest gear of the sliding gear system. The reason is that this gear produces the maximum torque on that shaft, and that therefore the deflection will be held to a minimum when that part of the shaft between the gear and the transmission pinion is as short as possible.

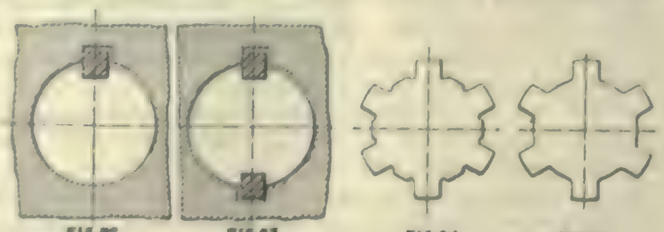


FIGS 80 AND 81—RIGHT AND WRONG WAYS OF ARRANGING SLIDING GEARS

The shaft on which the gears slide should be provided with at least two keys. If possible, these should be made larger than standard to provide more bearing surface. The reason why more than one key should be provided (and this holds good for clutches and other similar sliding parts) is that there must always be some difference in size between the bore of the gear and the diameter of the shaft, and that this causes a wedging action. This is shown in exaggerated form in Fig. 82. When two keys are used, the action is as shown in Fig. 83. The best and most modern practice is to use splined shafts for sliding gears. The number of splines in such shafts varies from four to ten. Often the shafts are hardened and the splines ground. The rather modern processes of broaching the gear and hobbing the shaft have made this construction practicable.

Cross-Sections of Hobbed Splines

When providing a splined shaft which is to be hobbed, the following should be remembered: It is not possible to hob a squared corner at the bottom of a spline. The section should therefore be made as in Fig. 84 or else as in Fig. 85, but in the latter case



FIGS. 82 AND 83—METHODS OF KEYING GEARS. FIGS. 84 AND 85—CROSS-SECTIONS OF SPLINED SHAFTS

the gear should bear on the tops of the splines only. The first-mentioned construction is to be preferred because it provides more bearing surface for the gear.

The length of the sliding gears on the shaft should

be as much as conditions will permit and should never be less than the diameter at the point where the shifting fork engages the gear. This diameter should be measured at the farthest point of engagement (see Fig. 86).

Larger gears require greater length on the shafts, because there is a tendency to cant the gear when it butts against the mating gear before the teeth enter. This canting effect may make it difficult and even impossible to complete the shift.

If it is intended to shift the gears while running,

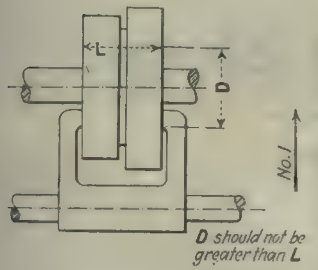


FIG.86

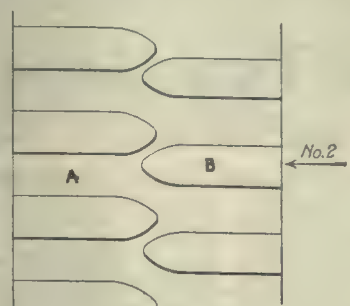


FIG.87

FIG. 86—DIAGRAM OF GEAR SHIFTING FORK. FIG. 87—DIAGRAM OF GEAR ACTION WHEN SHIFT IS TOO SLOW

care should be taken not to have much difference between the old and the new speeds. It should not be forgotten that large masses may have to be speeded up and that the load on the mechanism is proportional to the acceleration we must impart. This acceleration is necessarily very great, because the time available for the change from low to high speed is very short. This time is merely the amount of time required for the rounds of the gears to pass each other and, in addition, a few degrees of one revolution of the driven and driving shafts and possibly some other shafts besides, due to their torsional deflections.

It would seem, then, that one should shift the gears slowly, but this would cause another difficulty. Fig. 87 illustrates what happens when we try to shift slowly. While the stationary gear travels in the direction of arrow No. 1, the sliding gear moves in the direction of arrow No. 2. If the speed of *A* is high and that of *B* is low, the sliding gear will have penetrated but a very short distance between the teeth of *A* before the rounds of the two gears come in contact with one another. Gear *A* will then have a tendency to push *B* back.

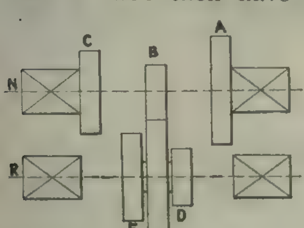


FIG.88

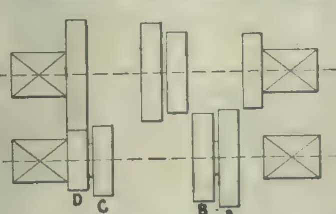


FIG.89

FIGS. 88 AND 89—THREE AND FOUR SPEED ARRANGEMENTS

This action will be repeated again and again, causing the rattling or clashing of the gears when they are not properly shifted.

Unless the speed of *B* in the direction of arrow No. 2 is great enough to bring the straight portion of its teeth opposite the straight part of the teeth of *A*, such clashing will occur. This condition is aggravated by the high speed of *A*, low speed of *B* in the direction of shift, and heavy load. When the load to be picked up is light, it may be possible to force the sliding gear into place even with a slow shift.

The sliding gear system has been taken up first because it is the most satisfactory of all speed variators in which gears are the means of obtaining the various speeds. However, its application is limited for various reasons. In the first place, it loses some of its desirable features as soon as more than two speeds are to be obtained in one shift. Fig. 88 shows a sliding gear arrangement for three speeds. As will be seen, it is no longer possible to have all of the stationary gears close to a bearing. It is further necessary to pass through one of the speeds in order to obtain one of the other two. If, for instance, in Fig. 88 *R* is the driving and *N* the driven shaft, we will obtain the high speed in the position as shown; i.e., with *B* and *E* in mesh. In order to go from the medium to low speed we have to pass through high. We also find that the length between bearings becomes rather great. If we call the face of the gears *F* and the clearance between adjoining gears, when in neutral position, *C*, the length between bearings with a two-speed arrangement would be $4F + 3C$; while with a three-speed arrangement it would be $7F + 6C$. If it were possible to make the length of the shaft proportional to the number of speeds, it would be $\frac{3}{2} \times (4F + 3C) = 6F + 4\frac{1}{2}C$, so that we have lost $F + 1\frac{1}{2}C$. Another thing to be noticed about the three-speed arrangement is that gear *F* must have at least four teeth less than gear *E* in order to slide under gear *B* without touching.

A four-speed arrangement may be constructed as

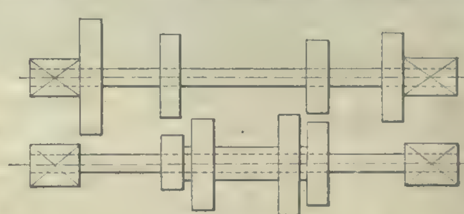


FIG. 90

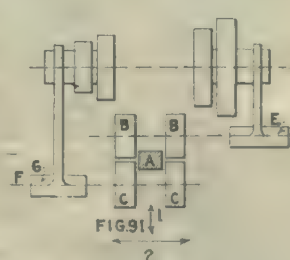


FIG.91

FIG. 90—ANOTHER FOUR SPEED ARRANGEMENT. FIG. 91—DIAGRAM OF SHIFTING COLLARS AND FORKS

in Fig. 89 or Fig. 90. The construction of Fig. 89 requires a rather complicated shifting arrangement. It is necessary to pick up gears *A* and *B* while *C* and *D* are being held in a locked position. When it is necessary to shift *C* and *D*, gears *A* and *B* must first be brought to the neutral position and there secured against sidewise movement, after which *C* and *D* may be picked up and shifted. The way in which this is ordinarily accomplished is shown in Fig. 91 in diagrammatic form. The lever *A*, shown here in section, can swing in the direction of arrows Nos. 1 and 2, and is thus able to engage either collars *B-B* or *C-C* and move them sideways, thus moving either rod *D* and fork *E* or rod *F* and fork *G*. To lock the inactive fork, spring plungers are sometimes used, or a positive lock may be pushed out of the way by the lever itself. This matter will be more fully treated in the chapter on interlocking devices. Many other shifting devices are possible operated by cams and other mechanisms.

It is, of course, possible to have more than two sets

of sliding gears on one shaft and operate them with two, three or more forks, all operated by one lever, but such devices become complicated and are not much used. Besides, the gears would become too large if the range of speeds is considerable. With two even belt cones we found that, if the largest step had a diameter D and the small step a diameter d, the range of speeds was $\frac{D^2}{d^2}$. The same would be the case with sliding gears if we were willing to have a large gear drive a small one. This, however, is not desirable. We aim to slow down as we go further, so that the range of speeds is much less than the value expressed by $\frac{D^2}{d^2}$.

The four-speed arrangement shown in Fig. 90 requires a length of shaft of 12F + 11C and is therefore not to be recommended except, perhaps, for light loads. It has various other disadvantages besides the great length of shaft, such, for instance, as the fact that there is no regular increase or decrease of speeds when going from right to left.

Making Camshafts in Two Motor Shops

Methods Used in Turning and Grinding Camshafts for Four- and Six-Cylinder Motors—Operations and Their Sequence

By FRED H. COLVIN

Editor, *American Machinist*

THE method used in machining the Pierce-Arrow camshaft may be of interest and is given in considerable detail herewith. The list of the various operations and the allowance for grinding is as follows:

(1) Grind flash on ends for centering.
(2) Center both ends.
(3) Straighten.
(4) Rough-turn Nos. 1, 2 and 3 bearing diameters for steady-rests; allow 0.062 to 0.065 in. for finishing.
(5) Finish-turn large flange; allow 0.018 to 0.020 in.; face both sides of large flange and inside of small flange; allow 0.015 to 0.020 in. between large and small flanges and 0.014 to 0.016 in. on outside face of large flange.
(6) Finish-face cams Nos. 1 and 2; turn and face back of small flange at No. 1 bearing and front flange at No. 2 bearing.
(7) Finish-face cams Nos. 3 and 4; turn and face back of rear flange at No. 2 bearing and front flange at No. 3 bearing.
(8) Finish-face cams Nos. 5 and 6; turn and face back of rear flange at No. 3 bearing and face back of No. 4 bearing.
(9) Finish-face and neck flanges at No. 2 bearing; turn Nos. 1 and 2 bearing diameters; allow 0.020 to 0.025 in. and neck No. 1 bearing.
(10) Finish-face and neck both flanges of No. 3 bearing; turn Nos. 3 and 4 bearing diameters; allow 0.020 to 0.025 in. and face counterbored end.
(11) Rough-turn between cams.
(12) Face front end and re-center.
(13) Counterbore and re-center rear end.
(14) Rough-grind cams; allow 0.025 to 0.028 in. on diameter for final grind.
(15) Grind dip in cams; allow 0.025 to 0.028 in. for finish-grind.
(16) Drill, countersink, burr and tap flange.
(17) Straighten.
(18) Carburize.
(19) Straighten.
(20) Harden and anneal flange.
(21) Sand blast.
(22) Polish centers and straighten.
(23) Grind all bearing diameters and grind joint face of large flange and inside faces of both collars for front bearing.
(24) Test bearings and straighten if necessary.
(25) Final-grind cams.
(26) Stone high points of cams and break sharp corners around edges of cams.
(27) Test for truth and straighten if necessary.

The rough-turning of the bearings is shown in Fig. 1, a Lo-Swing lathe being used for this purpose. The facing of the shoulders and cams is shown in Fig. 2 and the rough-turning between them in Fig. 3. The method of driving the camshaft can be seen in the various operations. In the first a bent tail dog is used on the large flange; in the second, a three-jawed chuck grips the flange after it has been turned; and in the third operation a special form of driving clamp can be seen. The camshaft is then carburized and hardened, after which the flange is annealed. The shaft is then straightened on centers as shown in Fig. 4, the dial indicator testing the concentricity of the various bearings. The indicator can be slid along the splined bar to any desired position. A straightening press can be seen just to the right of the operator. The finish grinding of the camshaft is shown in Fig. 5, and requires no special explanation.

The cam testing fixture used by the Peerless Motor Car Co., of Cleveland, Ohio, is shown in Fig. 6; it resembles in many ways the type of machine shown in a previous article, but has an indexing mechanism on

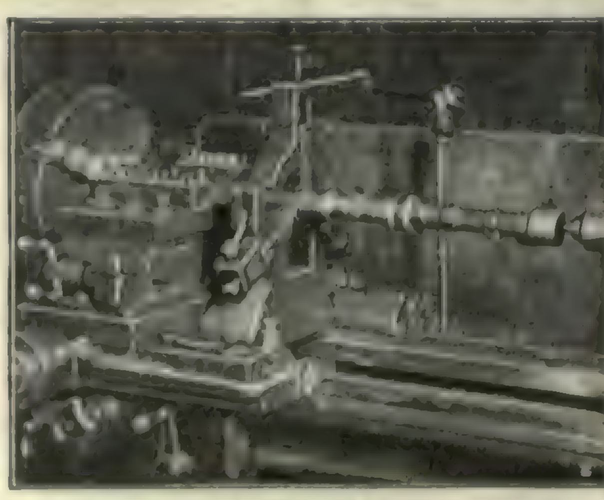
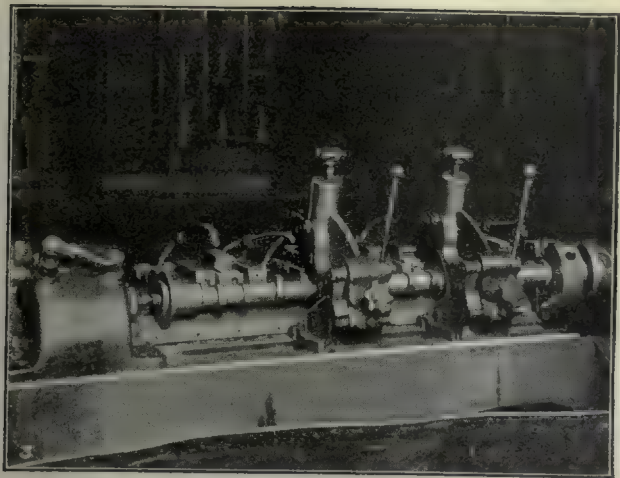
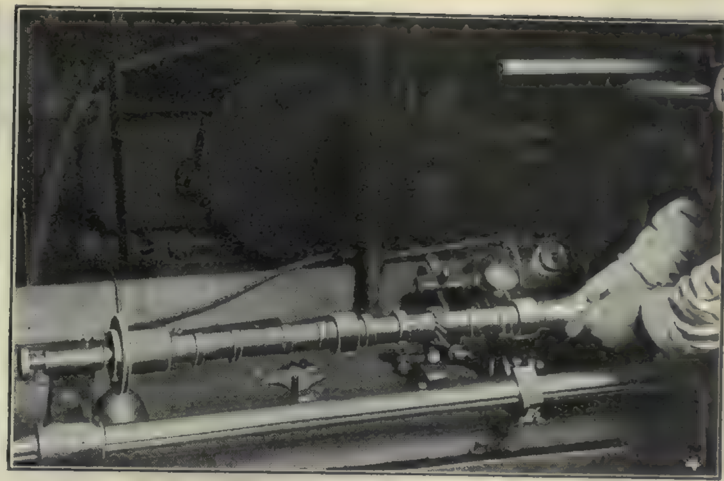
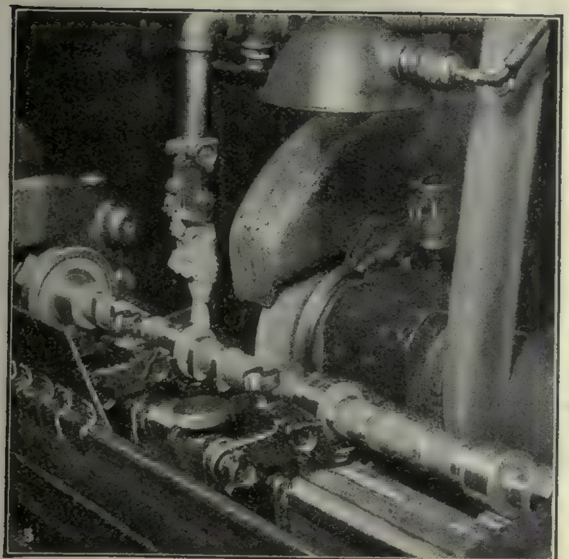


FIG. 1. FIRST OPERATION IN LO-SWING. FIG. 2. FACING THE SHOULDERS







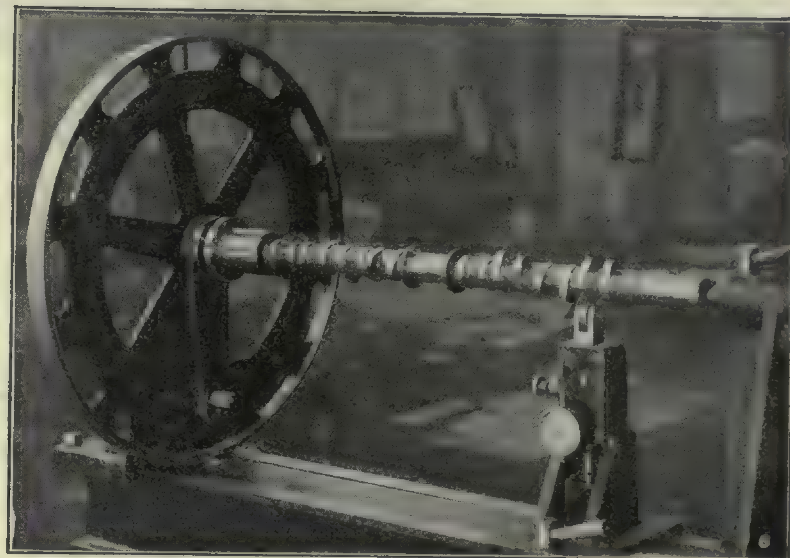
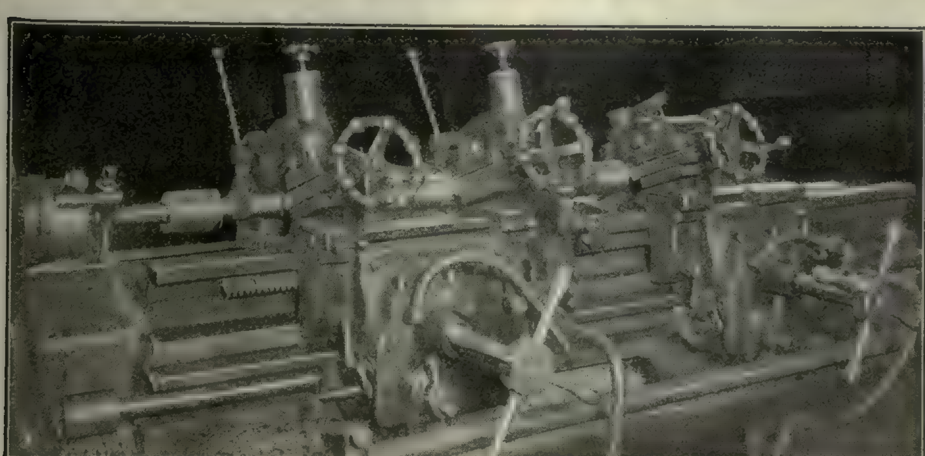


FIG. 3. FINISH TURNING CAMSHAFT. FIG. 4. STRAIGHTENING AFTER HARDENING
FIG. 5. FINISH-GRINDING THE CAMS. FIG. 6. PEERLESS TESTING FIXTURE

the large wheel in addition to an outside pointer, showing the angularity of the cams in degrees. This camshaft is for an eight-cylinder motor, while the Pierce-Arrow camshaft handles only the inlet valves for a six-cylinder motor. The Pierce-Arrow is a dual valve motor, having two inlet and two exhaust valves to each cylinder, hence the twelve cams on the shaft in Fig. 4.

The camshaft for the Mack motor, like the crankshaft, is made of carbon steel and then carburized so as to secure an extremely hard bearing surface. The ends of the forgings are ground, if necessary, and the camshaft is centered, after which a preliminary straightening takes place. Then the center bearing is rough-turned, the shaft turned between the cams and the other rough-turning operations completed. The shaft is then ready for another straightening, followed by three finish-turning operations, one being shown in Fig. 7, utilizing a Lo-swing lathe with three toolposts. The



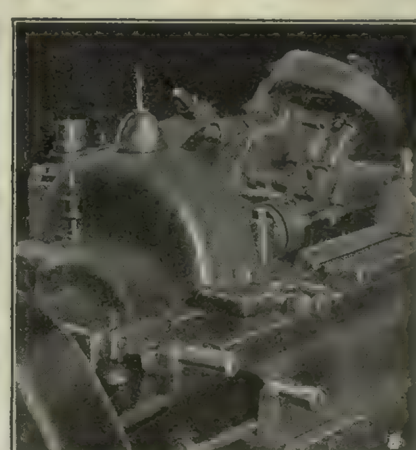


FIG. 7. TURNING THE CAMSHAFT. FIG. 8. HOBBING THE SPIRAL GEAR

FIG. 9. THE FINAL STRAIGHTENING. FIG. 10. FINAL INSPECTION

large diameters of the three bearings should be noted.

The milling of the spiral gear for driving the oil pump on a Lees-Bradner machine is shown in Fig. 8.

The sides of the cams are then faced, the small diameters undercut and the shaft cut to the proper length and re-centered. Then the fillet radius is cut on the gear, two keyways milled and cotter-pin holes drilled and countersunk. The end threads are cut and the cams rough-ground.

All burrs are then removed with a file, all machine operations inspected and the camshaft is ready to be carburized and hardened, the threaded portions being afterwards annealed. Sand blasting comes next, after which the final straightening takes place as shown in Fig. 9, a convenient hand press being provided for this purpose.

The center bearing is then finish-ground, after which the eight hardened cams are both rough- and finish-ground. The end main bearings and the several diameters that form gear seats are finish-ground. This is followed by a final inspection as in Fig. 10, including scleroscope hardness tests. These tests include the bearings and the cam throws, as can be seen from the apparatus in the same illustration.

How Shall We Designate Tolerances?—Discussion

By J. A. Roy

Referring to the article by F. C. Hudson on page 794, Vol. 56, of *American Machinist*, entitled "How Shall We Designate Tolerances?" this is a subject which might well be thrashed out and some standard system adopted. The average engineer and draftsman may have (more often he has not) a conception of the uses of tolerances and their expression on working drawings. A tolerance is simply an indication as to the variation from a certain size that is serviceable in the assembled unit, making allowance for the errors which cannot be disassociated from any type of human performance.

The accepted and almost universal method of indicating tolerances, let us say for a hole and shaft is thus: $2.000 {}^{+0.002}_{-0.000}$ in. and $1.997 {}^{+0.000}_{-0.002}$ in., that is, the basic dimension is actually indicated, and nothing smaller than 2.0 in. in the case of the hole, nor anything larger than 1.997 in. in the case of the shaft will be accepted. The workman will naturally have the dimension shown, basic in this case, fixed in his mind and he will work to it and make allowance in only *one* direction. This often results in scrapping or rerouting of work, and always in loss of time.

Let us now consider the results if we indicate the mean dimension and give a bidirectional tolerance. The dimensions given above would become 2.001 ± 0.001 and 1.996 ± 0.001 in. The machinist now has an indicated dimension midway between the allowable limits. He consequently works to that dimension and a slight error either way will not cause rejection. If his "mike" or gage should be out a trifle the chances are he will get by. Also the natural wear of the tool point and machine bed and parts, faulty but almost imperceptible alignment of centers, and settling of the machine foundation will, to some extent be taken care of automatically.

This system of indicating tolerances is especially useful in a shop where piecework and time study are in vogue, and where a complete system of working and inspection gages cannot be had, or where only a few pieces are required. The writer speaks from experience when he says he always took the *mean*, and not the *basic* dimension as standard. Any change in dimension could be immediately corrected without repassing the piece through the operation, a most unsatisfactory method where a fairly heavy cut to a close tolerance is required.

And, why in Sam Hill does a draftsman put down ± 0.001 when ± 0.010 would be plenty good enough? And how many were ever guilty of putting down ± 0.500 or even ± 0.250? And why, when ± 0.010 is given will a machinist work to ± 0.0005? I have known some to work to ± 0.0001. It might make a good subject for a psychological investigation, but it has no place in these days of efficiency and maximum production.

Factory Storekeeping and Material Control

The Seventh Article—Storeroom Stowage Rules—Protection of Stores from Fire, Pilfering and Deterioration—Charging and Issuing Maintenance Stores

By HENRY H. FARQUHAR

IN COMPLETING the discussion of storeroom requirements, the methods of stowage, the protection of materials and the handling of maintenance stores must be dealt with. The five general rules given for the physical arrangement and the removal of goods in the storeroom will facilitate the handling and taking of inventory, if strictly observed.

A few definitions of the terms illustrated in Fig. 13 and used in the rules for stowage are as follows:

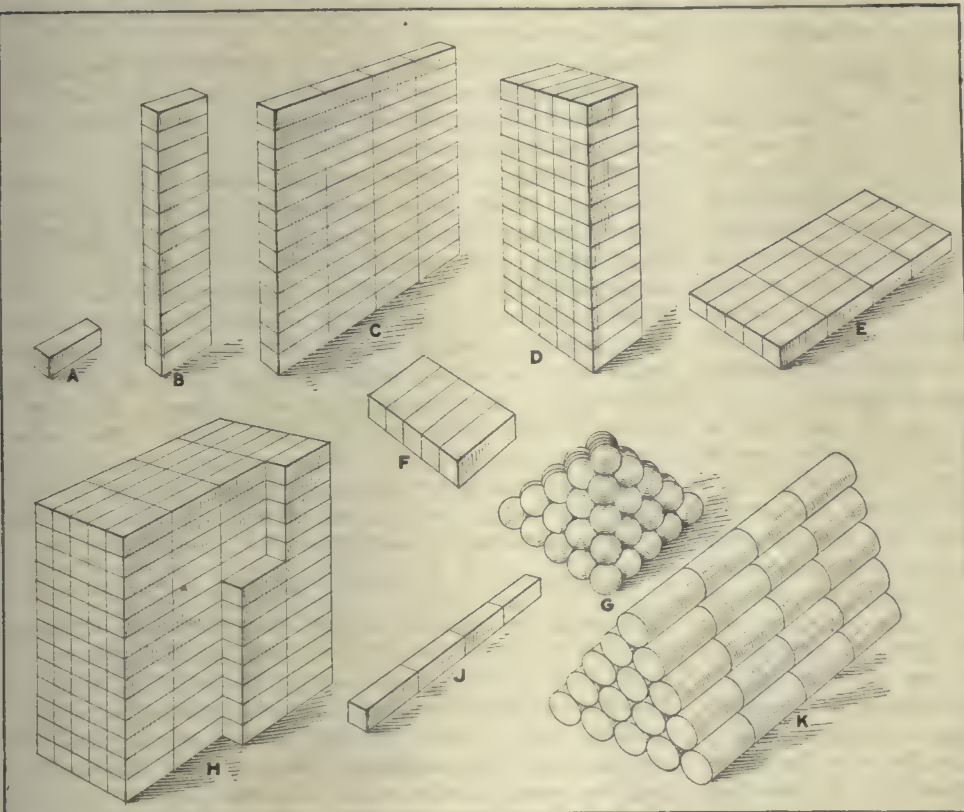


FIG. 13—STOWAGE UNITS

An article is any one kind of material, as machine bolts.

An item is any one size or variety of an article, as hex head machine bolts, U. S. Standard, $\frac{1}{2}$ x $3\frac{1}{2}$ in.

A unit or piece is any single piece, as one bolt, shown at *A*.

A package is a quantity in the original container, as one box of bolts, twelve in a box, shown at *A*.

A lot is a quantity received and stored at any time, as one gross bolts, twelve boxes, twelve in a box.

A standard lot is a quantity determined upon as most suitable for a given condition of use, as fifty bolts.

A column is a number of units or packages in vertical arrangement, one wide, two or more high, one deep, shown at *B*.

A row is a number of units in fore and aft arrangement, one wide, one high, two or more deep, shown at *J*.

A course is a number of units in left and right arrangement, two or more wide, one high, one deep, shown at *F*.

A section is a number of rows in vertical arrangement, one wide, two or more high, two or more deep, shown at *C*.

A tier is a number of rows in left and right arrangement, two or more wide, one high, two or more deep, shown at *E*.

A block is a number of courses in vertical arrangement, two or more wide, two or more high, one deep, shown at *D*.

A stack is a number of tiers in vertical arrangement, two or more wide, two or more high, two or more deep, shown at *H*.

A wedge stack is an arrangement of units in the form of a wedge, as illustrated by the storing of shells, cans and other cylindrical bodies, and as shown at *K*.

A pyramidal stack is an arrangement of units in the form of a pyramid, as illustrated by the storing of cannon balls, and other spherical bodies, and as shown at *G*.

A pile or heap is an irregular mass of pieces, such as a pile of coal.

Instructions for stowage are as follows:

(1) Have a designated stowage place for each item, and so far as possible keep all of that item and no other in that place, properly stowed. When it becomes necessary to place different articles or items, or different lots of the same item, in the same stowage space, separate the piles or stacks by at least 2 in., if in bins, and by at least 5 in., if on platforms or in piles on the floor between the aisles. Be sure that this arrangement is such that it never becomes necessary to remove one item to get at another.

(2) Arrange the items for a maximum facility in taking inventory. In other words, as you face the stowage area from the aisle, commence piling at the back left-hand corner and complete this column to the top; then in front of this build the next column and so on, completing the left-hand section. Similarly, complete the next section to the right, each column being completed so that no vacant spaces will remain hidden, before a new column is started. Only the last column should remain incomplete as shown at *H* in Fig. 13. Place all labels facing the aisle wherever possible.

In taking inventory, multiply the number of packages

For the author's forthcoming book.

or units per block by the number of full blocks, and add to this the number of packages in the incomplete section. For a wedge stack:

Number in a block = number on bottom tier × (number of tiers + 1) ÷ 2.

In some cases stowage may be arranged so that the taking of inventory is accomplished in even less time than this. It is often possible with articles which occupy space in direct proportion to quantity, to establish a scale or gage at the side of the stack, bin, carboy or other container, which, at a glance, indicates with sufficient accuracy the quantity on hand. Familiar examples of such scales of quantity are found in coal pockets and in lumber sheds. The general method is applicable to the measurement of many other materials if a suitable means be devised.

(3) Provide for securing a turnover of stock. The methods of doing this will vary somewhat as between single and double binning, stacking or piling.

Single and Double Stacking Systems

In single stacking always issue from the right-hand side of the stack. Starting with the incomplete section, as shown at *H* in Fig. 13, work in the opposite direction (to the left) from that in which the stack was built up. Remove each column and section completely before another is disturbed. If stacks tend to topple over, it may be necessary to remove the items by tiers, leaving the top of the stack instead of the right-hand section incomplete. The procedure should be modified accordingly. This, however, is more wasteful of stowage space and should not be done unless necessary.

When a new lot of the same item is received, as directed in Rule No. 2, pile it to the left of the present lot, removing the left-hand sections of the latter and putting these packages on the right-hand side as it becomes necessary to provide room. The new lot may be placed flush with the old one in single stacking, unless it is desired for identification purposes to keep the two lots physically separate. Leave odd packages on the right-hand section of the new lot where the separation of lots is necessary, or use more of the old lot to fill in the new stack where stacks are to be flush throughout. Where it is impracticable or too expensive to move the old lot to make way for the new, the latter may be piled to the right of the present lot as described in the next paragraph.

Where double stacking is practiced, it is necessary always to have space for two stacks, one from which all issues are made, the other to which all receipts are added. Each stack is built up as explained in Rule No. 2, and between the two, a vacant space of not less than 5 in. should ordinarily be left. Withdrawals are made from right to left of the issuing stack as explained, and when the issuing stack is exhausted, issuing should start from the previous incoming stack, and future receipts should be put in the space just left vacant. Where it is desired to keep each lot separate, here again the procedure must be modified as suggested for single stacking. Which stack or lot is outgoing and which is incoming at any particular time is indicated by the difference in bin tags, or by a marker, if desired.

(4) Establish standard lots for the stowage and issue of materials wherever practicable. Unfortunately, it is seldom possible to make the trade container, box, keg, or carton, at once our unit of purchase, stowage and issue throughout, although this should be done wherever possible. In such cases, the container need not be opened until it reaches the point of use, except for inspection and for possible treatment against rust. Clerical work in such cases is much simplified, since the transactions relate to a few packages containing many units.

Where the use of the original container is not possible, however, it will facilitate issuing and quick service if, instead of putting the units back in the original containers or storing them loose in bins at the time of inspection, they are divided off when being counted into predetermined standard amounts which, as separate lots, are suitable for delivery to the point of use. Such items as bolts and nuts, screws, special castings and so on may always be needed in certain definite quantities for the assembly of a standard product. This quantity should be sorted into suitable boxes or put into strong bags and stored as a standard lot ready for issue without further counting.

Again, the method of storing in bulk and issuing by units described below under "Maintenance Stores" will cut down the clerical work incident to book entries and to the taking of inventory.

(5) Utilize available stowage space to the utmost capacity. Study your requirements in each material and try to have just enough and not too much space for each article. By providing standard racks and interchangeable bins, by leaving vacancies every so often at the start, and by providing overflow bins when necessary, one may afford to be very miserly in allotting space for the various items without the fear of later confusion in case his estimate was wrong. Readjustments in such cases may be readily made. The great obstacle to more effective space utilization is the lack of data showing how much space a given number of any item will occupy, or how many may be stored in the given space which is available.

Precautions Against Fire and Explosion

Since in the normal factory the equivalent of much more money is held within the four walls of the storeroom than in any other part of the establishment, it follows that every precaution should be taken to insure against loss. The storeroom should be of fireproof construction, if practicable. In any event, certain precautions must be observed to prevent loss through explosion or fire.

No inflammable material, such as gasoline, powder or dynamite should ever be allowed in the storeroom itself. Such material should be stored in an isolated position away from all buildings.

Within the storeroom, cleanliness should be absolutely insisted upon. Oily waste, paper, burlap, and all materials which are subject to spontaneous combustion, or which would readily serve to feed an incipient blaze, should be rigorously excluded from the storeroom, except as they may be brought there, or as they may accumulate temporarily, pending prompt disposal.

All aisles must be kept absolutely clear of permanent obstructions. The only obstruction which should be permitted in any aisle is that caused by men and trucks actually in the process of delivering goods. When a truck has been emptied or filled, it must not be allowed to clog up the aisle, but should be taken immediately to the designated position. The possibility of controlling a fire should not be lessened through unusual obstructions.

It goes without saying that the most modern overhead

sprinkler system should be installed. Particular care must be taken, furthermore, to see that the sprinkler has a chance to perform properly through having plenty of room between sprinkler head and piles of material. Having determined the minimum head room which should be left, constant vigilance through systematic inspection is necessary to prevent storeroom attendants from encroaching upon this space.

An ample supply of hand fire extinguishers should be provided at convenient points. An incipient blaze may be put out through the use of such extinguishers before it has become sufficient to start the sprinkler heads. As an extra precaution, a hose should be provided, which is connected to a head other than that to which the sprinkler system is attached.

As to the use of wood instead of steel storage racks and bins, little can be said as regards insurance rates because conditions vary so widely, making individual appraisals necessary in each case. For instance the difference in rates in any given case between sprinklered and unsprinklered storerooms is very much in favor of sprinklers, and this holds true in general regardless of what kind of storage equipment is used. In unsprinklered storerooms the use of metal equipment might amount to as much as a 20 per cent saving in rates over wood equipment in some cases, whereas in others the saving would be negligible. With the use of sprinklers, however, which is the only safe method, there appears to be little choice between metal and wood equipment as far as the insurance rates go.

How Deterioration and Pilfering Are Avoided

All material subject to deterioration through rust must be treated by some one of the numerous preparations available for this purpose. It must be remembered that the chemical decomposition of metals takes place much more rapidly during the warm, humid days of summer, and particular attention is necessary at this time. Parts which are to be held in storage more than a week should be given a coating of a rust preventative.

Specifications, tests and prices of the various rust preventing agents may be obtained from the vendors, as may also the machines and solutions by which these agents may be easily removed. Care must be taken to secure an agent which does not readily evaporate and which does not corrode or otherwise injure the surface of the metal.

In the discussion of double binning methods, it was emphasized that one of the prime advantages to be derived through this method was the insurance of a turnover of stock. Even with double binning, however, the turnover may be insufficient to prevent rust and this method must be looked upon as a supplement to, and not as a substitute for, the use of rust-preventing agents.

In the case of materials such as rubber, which harden and become useless with age, and in the case of certain oils which solidify if left standing too long, the double binning principle comes fully into its own. As explained in the previous installment under the discussion of double binning, the provision of one bin or aisle for all incoming material with the use of the adjoining one for all issuing, is the only sure way to provide automatically and systematically for a regular turnover of stock. Since double binning requires somewhat more space than single binning, the principle may be used, of course, for the storage of this kind of goods, while those not subject to rapid deterioration may be single binned. The only loss in the latter case is the loss of accuracy of inventory, a sufficiently important consideration, however, in all cases.

The prime prerequisite to prevent deterioration from dust is to keep the storeroom thoroughly cleaned and to provide dustproof racks for such articles as stationery, which would be ruined should they become the least bit dirty. The standard racks and bins described and illustrated previously are entirely adaptable to closed cabinets and many such racks are in use today for the dustproof storage of many different articles.

The success with which so many plant activities may be controlled hinges at many points on the accuracy of the inventory. Consequences have at times been very distressing when we thought we had one hundred pieces on hand and found there were actually only eighty-five. Our accounting statements, furthermore, are misleading unless our inventory of materials and work in process is correct. Primarily, in order that we may maintain any semblance of control and only secondarily because some among us have the habit of pocketing that which does not belong to us, we must have a locked storeroom. The psychological effect, furthermore, is excellent.

The temptation to petty theft is particularly strong in the case of such handy household articles as tacks and hammers, electric light globes, ink, paper, mucilage, and similar items. If such articles are left where they may be easily slipped into one's pocket for home consumption, it is inevitable that that is what will happen to many of them. Such temptations should be removed.

This does not mean, however, that we are to be parsimonious in furnishing supplies, or even that we may not adopt a liberal policy in supplying at cost such articles as the individual employees may desire. With the locked storeroom and a tight rein generally, accompanied by a judicious amount of what workmen are usually pleased to regard as "red tape," most of the needless requests and petty takings will disappear of themselves. A liberal policy in these respects may neutralize what might otherwise be called an irksome system. It simply means that we must know at all times where we stand and that insistence must be placed upon the locked storeroom, the written requests, and the approval of some responsible official before articles are furnished for private consumption.

Handling Maintenance Stores

The adequate handling of the supplies used in the upkeep of a plant offers peculiar problems and difficulties because of the emergency nature of much of the maintenance work. Some factories have made great strides in standardizing current inspection and repairs, and in planning and even in paying bonus on the operations performed by this department. But there is an irreducible minimum of hurry-up jobs which constantly places the retention of a system in the maintenance storeroom to severe tests.

On one hand, to maintain any semblance of control of inventory and of issue, a certain amount of systematic routine must be insisted upon. On the other hand, a few seconds delay when a steam pipe or water main bursts, is not to be tolerated. The question is how to secure control and avoid delay. Reference is made to preceding discussions of such matters as organization, layout, the provision of adequate equipment, including standard interchangeable racks and bins properly indexed with cross references, and operated by double

keeping methods. These are all features of good storeroom management, doubly important in this case.

In addition to these matters, I wish to suggest briefly the means by which the work of the maintenance department may be speeded up, and yet may be controlled in two features of its work, which ordinarily cause the most concern, namely, the handling of supplies and spare parts, and the checking in and out of tools.

It is needless to emphasize the fact that the regulation of replenishment, follow-up, inspection, storing, and balance sheet control previously described is doubly important in the case of items which have such a potential possibility of causing disaster through an insufficient or unsuitable supply, as have most of the articles carried in the maintenance storeroom. Because of the nature of the supplies, it also follows that a liberal policy as regards the amount of inventory must be adopted. This policy must be reflected in the setting of low limits and amounts to order, and to such a plentiful allowance must be added constant vigilance.

In a previous installment, under departmental supplies, two alternatives in charging or allocating the cost of the materials issued to the proper account, were indicated as follows:

(1) Departmental supplies may be charged to departmental expense, to be taken up in the overhead.

(2) Departmental supplies may be charged to specific jobs when desirable from a cost-finding standpoint.

In the case of the maintenance department supplies, both methods are usually desirable—the first for small inexpensive items, the second for expensive or special materials which the particular job served should carry. In cases where the reserve supply of stocked items is kept in a central storeroom from which small, current supplies are issued, the above procedure is applicable.

Where this is not the case, but where the whole supply of parts needed for maintenance is stored in the maintenance storeroom, a slightly different procedure is necessary, in order that the best results as a whole may be obtained and that the desired charges may be made between those to be charged to departmental expense and those to be charged to special expense.

The following procedure will be found effective for those supplies to be charged to departmental expense when issued to the workman. A reserve supply will be kept in one bin, in original packages or in other bulk lot as is desirable. On this supply the regular procedure described for the central storeroom will operate. In other words, for each item there will be a balance sheet that controls replenishment and records all transactions, and a bin tag on the bin will be operated as described. Back to back or alongside of this main bin will be another smaller bin which is used for direct issue to the workman. When the latter becomes empty, a transfer in bulk will be made from the main bin, and at that time a stores issue will be made for the quantity transferred, charging the amount to the departmental supplies. The articles will be placed loose in the issuing bin, from which the issues may be made without a further record.

For materials to be charged to a specific job number, either those materials purchased specially, or those of considerable value, the proper charge is unknown until the use is known. Where this use may be ascertained previous to issue, the stores issue may be filled out and placed aside with the article until it is called for, which will expedite action in delivery. But on a hurry-up job there is nothing to do but give out the material as called for and attend to the issues later. By following the procedure indicated, however, the paper work at the time of issue may be reduced solely to rush jobs—a small proportion of the work in well-run departments.

A similarly simple procedure covering tools will give the speed and definiteness essential for effective work. Each tool, of course, must have its own location, which must be so indexed and cross-indexed as to make it possible for a stranger to find any tool in a very few moments, no matter whether it is in its rack or in the hands of some mechanic in one of the departments of the plant.

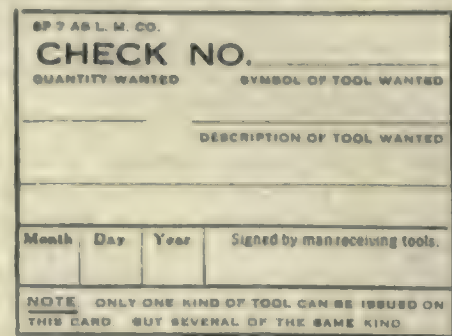


FIG. 14—CHECK FOR TOOLS AND FIXTURES

The tool racks must be plainly lettered according to a systematic scheme. A card index of each tool refers to the rack where it is stored. When a mechanic desires a tool he comes to the window and fills out and signs the tool check shown in Fig. 14. The attendant issues him the tool, files the check by the tool symbol and in the compartment with the mechanic's number on it files a tag on which this tool's symbol is stamped. The whole transaction should take but a moment. Looking at the files of checks, one may see just who has any particular tool and where he has gone with it, in case a hurried recall is desired. Looking at the man's compartment, one may see just what tools are now in his possession.

As Told by the 1919 Census of Manufactures

The table below gives some facts of more than passing interest that were gathered from the 1919 census of manufactures. After eliminating the wages and material, the amounts left per wage earner for profit and overhead are as follows:

	Wages per Wage Earner	Profit and Overhead
Machine tools	1,250.00	1,643.00
Automobiles	1,486.00	2,367.00
Railroad cars	1,505.00	1,998.00
Cash registers and adding machines	1,366.00	3,063.00
Locomotives	1,436.00	1,771.00
Power pumps	1,351.00	1,437.00
Crude iron, steel and rolled products	1,705.00	1,464.00
Engines	1,359.00	1,826.00
Safety razors		3,139.00
Saws		2,434.00
Shovels, spades and scoops		2,360.00
Machinists' tools		1,598.00
Machine shops without foundries	1,292.00	1,683.00
Machine shops and foundries combined	1,257.00	1,534.00
Foundries alone	1,343.00	998.00

From the above it would seem that it pays better in the matter of tools to make shovels and scoops and saws than it does machinists' tools. Also, that it is an expensive luxury to run a foundry. Likewise that a machine-tool shop does not afford as much for profit and overhead as just a plain machine shop, and certainly not as much as an engine shop; nor an automobile shop; nor a railroad car shop; nor a locomotive shop; and that many other metal-working industries seem to be able to pay more than the machine-tool shop can pay for wages, and still have a lot more left for profit and overhead. Evidently the machine-tool shops have been more modest in their demands on their customers.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Three Methods of Storing Material

By Herbert Crawford

There are many methods of handling and storing material, each adapted for some particular place, and from which we can select the most suitable for other similar conditions. The illustrations herewith show three methods used in different parts of the plant of the Peerless Motor Car Co., Cleveland, Ohio.

The first, Fig. 1, shows a very substantial rack of structural steel for storing bar steel for the screw machine and other departments. This rack needs no special description. It is simply well built of shapes and sizes suitable for the loads to be carried. It is located in the center of the building, beneath the first floor, both to secure a firm foundation and to avoid obstructing light from other departments.

FIG. 1—SUBSTANTIAL STEEL BAR STORAGE RACK

In Fig. 2 is shown a storage room for finished and semi-finished parts, large steel tote boxes being used as containers. The boxes are handled by means of a suitable sling and an electrically operated overhead crane. The stacking of the boxes is carefully kept inside the painted lines designating the aisles. This keeps a clear passage for men and trucks and also makes a path for the load on the crane in carrying boxes from one point to another, or in delivering them to some other department as the work progresses. These boxes can be piled seven deep so that a large amount of material can be stored in a small floor space without presenting a crowded appearance.

An entirely different type of storage and handling apparatus is shown in Fig. 3. This is for handling and storing frames in any one of three rows. The gantry crane has a runway which overhangs the legs at each end so that stacks of frames can be piled either in rows *A*, *B* or *C* as desired. As the track on which the crane runs extends to the building behind it, a great many frames can be piled in each of the three locations. The frames are handled in lots of seven and are usually piled fourteen deep. The three lines of storage can easily take care of a thousand or more frames without exceeding the height of piling shown, and this can even be doubled if necessary to take care of an emergency or other condition.

The storage yard is adjacent to the chassis assembling shop so that a stack of frames is simply picked up from the storage piles, lowered on to the small truck *D* and pushed into the assembling shop at the right. This makes a very compact and convenient storage arrangement and saves space in the stockroom.

FIG. 2—TOTE BOX STORAGE. FIG. 3—CONVENIENT FRAME STORAGE

A Double Collet Chuck

By Milton Wright

An adaptation of the collet chuck principle to the holding of quill gears is shown in the accompanying illustrations. The piece to which it is adapted is familiar to all who have had occasion to "look into" the transmission of an automobile, and consists of three gears of different diameters cut upon a single piece of metal.

These quill gears are heat-treated and, in the better class of machines, ground after hardening. The grinding operations include the teeth of the large gear but because of the smaller diameter and close proximity to the large one, the teeth of the small gears cannot be reached by the grinding wheel.

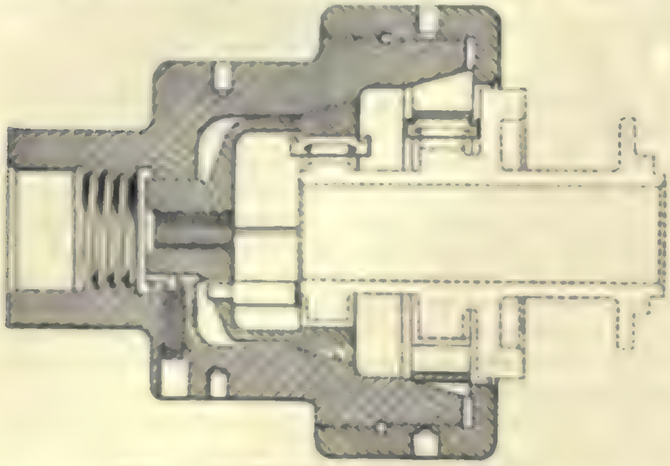


FIG. 1—SECTIONAL VIEW OF CHUCK

The chuck, shown in section in Fig. 1, was designed for the purpose of locating this piece from the pitch circles of both the smaller gears and thus compensate for any slight error, caused by distortion in hardening, that might exist in either. For this purpose two collets are provided, one to be closed by means of a draw bar and handwheel upon the rear end of the spindle in the usual way and the other by the outer ring, which screws upon the body of the chuck and is turned by means of a bar. The piece, set up ready to go in the chuck, is shown in Fig. 2. The plugs, or pins, by means of which the chuck is enabled to reach the pitch circles of the gears, are first made as round pieces of the proper diameter and are then wired in place upon a finished gear (before the latter is hardened), and a part of their surface ground away to conform to the circles presented by the inner surfaces of the respective collets.

FIG. 2—THE WORK READY TO GO IN THE CHUCK

Notches are made in both ends of each pin so that in setting up for the final grinding of the bore of the piece the pins are placed in their respective positions and held by means of two rubber bands snapped around each set. The work can then be handled into and out of the chuck as a unit.

FIG. 3—THE CHUCK UPON THE GRINDING MACHINE

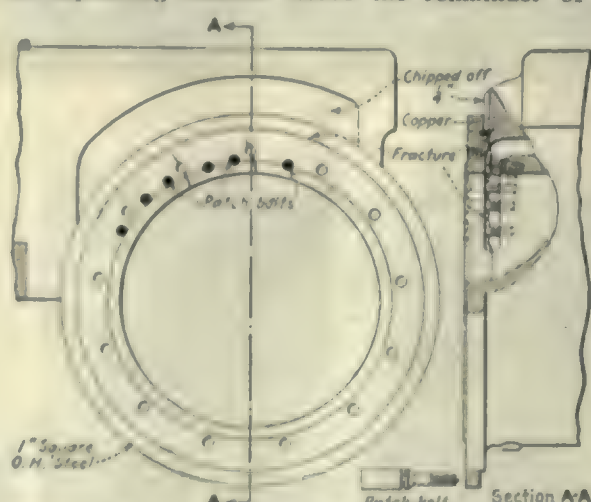
The chuck is used upon the work spindle of an internal grinding machine as may be seen in Fig. 3. Though in this picture the large gear appears to be within the chuck, it does not actually touch it, the piece being held entirely by the grip of the collets upon the pins.

The chuck was designed by G. E. Peterson, superintendent of the grinding department for the Pratt & Whitney Co., of Hartford.

Repairing a Broken Locomotive Cylinder

By F. M. A'Hearn

A broken piston rod on a passenger locomotive resulted in forcing out a front cylinder head and cracking the end of the cylinder for a distance of some 15 in. circumferentially, the crack commencing in the front steam port and extending outwardly to the vertical surface above the port, terminating in a line almost concentric with the cylinder flange. The radius of the crack was from $\frac{1}{8}$ to $\frac{1}{4}$ in. larger than that of the flange and extended approximately the entire length of the port. The crack was opened $\frac{1}{8}$ in. at the inside which brought the cylinder-head seat through the broken zone a corresponding amount above the remainder of the joint. The section was also cracked radially at two stud holes, all of the fracture appearing as shown in the accompanying sketch.



HOW THE CYLINDER WAS REPAIRED

There appeared to be a possibility of drawing the broken section back into its original position and making a satisfactory job, the saving of time the locomotive would otherwise be out of service being the

point that decided the matter, although it would be necessary to reinforce the cylinder flange by the use of a band shrunk around it which would cover the fracture in such a manner as to make any method of caulking a difficult matter. It was found that if the vertical surface was chipped away a small amount the crack would terminate on the extension of the cylinder flange thus formed.

A row of patch bolt holes was drilled at an angle with the bore of the cylinder, the object being to have the heads of the patch bolts outside of the cylinder-head joint and to screw the bolts into the cylinder body between the steam port and the bore of the cylinder. With the patch bolts screwed in, the broken section was drawn back very nearly to its original position. The vertical surface along the line of the break was chipped back $\frac{1}{4}$ in. and a groove $\frac{5}{16}$ x $\frac{5}{16}$ in. was chipped the length of the crack, care being taken that the crack terminated in the groove so made. A piece of square copper was fitted into the groove and fullered tight, the band was shrunk on and the patch bolts again tightened to take up any slack gained by shrinking the band. The shanks of the bolts were next cut off and the heads caulked tight. The cylinder joint was found to project slightly along the broken zone necessitating some scraping and grinding.

When tested under working pressure the copper strip leaked in several places but was easily caulked, the space between the band and vertical face of the casting being sufficient to permit the use of a thin fuller. The radial cracks were not visible after the band was applied and did not leak when tested.

When consideration is given to the value of a new locomotive cylinder, it is apparent that a study of the various methods of repairs is time well spent. It requires no skill or intelligence to scrap a broken piece but often requires good judgment to make repairs.

Testing Gears by Micrometer Measurement

By S. O. Gordon

The accompanying formulas may prove useful to the reader for checking the pitch diameter of gears. It may be well to note that this method is also useful for finding the distance from the center of the gear, and for calculating the sizes of pins for locating the gear in a chuck.

Two plugs with centers B and L, are placed in opposite or nearly opposite tooth spaces as shown in the accompanying illustration, and are of such a diameter that they touch the teeth at the pitch line. A micrometer measurement is taken over these plugs and from the accompanying formulas the error in the actual pitch diameter of the gear is figured. It is necessary to calculate the size of the plug for each size of gear, even though the diametral pitch is the same.

Referring to the accompanying illustration, C is the center of the gear, CB the center line of the tooth space, F the point where the tooth curve cuts the pitch circle. The line of action, BFE is tangent to the base circle at E. A part of this line, BF is also the radius of the plug. The angle FCE or α is equal to the pressure angle.

D = pitch diameter; N = number of teeth;

M = micrometer measurement for an even number of teeth;

X = micrometer measurement for an odd number of teeth;

A = distance between plug centers for an odd number of teeth;

Z = diameter of plug;

$$\delta = \frac{360°}{4N} = \frac{90°}{N} \qquad \gamma = \alpha + \delta$$

The triangles CEF and CEB are right triangles.

$$CF = \frac{D}{2} \qquad CB = V$$

$$CE = \frac{D}{2}\cos\alpha \qquad V = \frac{CE}{\cos\gamma}$$

$$V = \frac{\frac{D}{2}\cos\alpha}{\cos\gamma} = \frac{D}{2}\cos\alpha\sec\gamma$$

$$W = V\sin\gamma$$

$$Y = \frac{D}{2}\sin\alpha$$

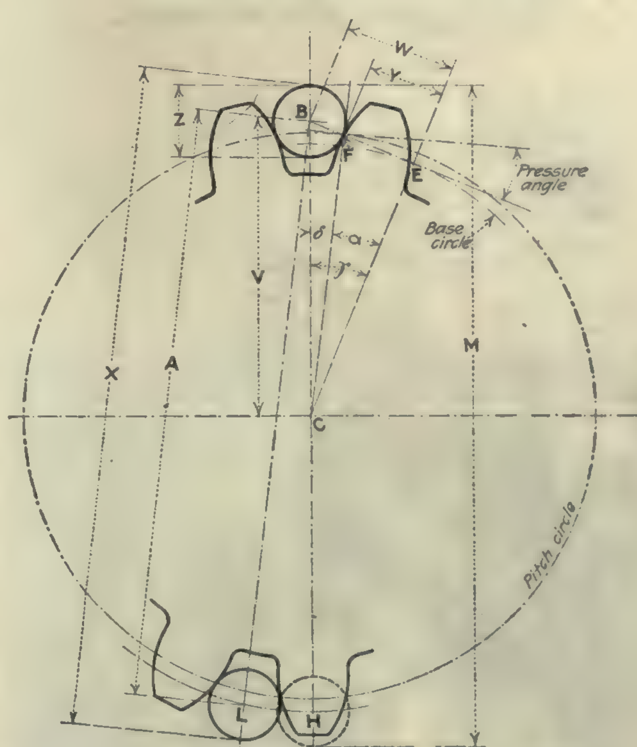
$$Z = 2\,(W - Y) = 2\,V\sin\gamma - D\sin\alpha$$

$$Z = D\,(\tan\gamma\cos\alpha - \sin\alpha)$$

$$M = 2\,V + Z$$

$$M = D\cos\alpha\sec\gamma + Z$$

The illustration is made for an odd number of teeth, but when the gear has an even number of teeth, the tooth spaces and, therefore, the pins, are directly opposite each other. The center of the pin opposite to B is at H which, in this case would be on the center of a tooth space instead of a tooth as shown.



GEAR MEASURING PLUGS IN POSITION

$$M = 2\,V + Z \qquad M = D\cos\alpha\sec\gamma + Z$$

For an odd number of teeth a little further calculation is necessary.

$$BH = 2\,V$$

The triangle BLH is a right triangle, being inscribed in a semicircle.

$$\text{Angle } HBL = \frac{90°}{N} = \text{angle } \delta.$$

$$A = BH \times \cos\frac{90°}{N} = 2\,V\cos\delta$$

$$X = A + Z.$$

$$X = D\cos\alpha\sec\gamma\cos\delta + Z$$

For example, to find the diameter of the plug and the micrometer measurement for a gear with 20 teeth, 8 diametral pitch, 2½-in. pitch diameter, 14½ deg. pressure angle:

$$\alpha = 14\tfrac{1}{2}^\circ \qquad N = 20 \qquad D = 2.5$$

$$\delta = \frac{90^\circ}{N} = 4\tfrac{1}{2}^\circ$$

$$\gamma = \alpha + \delta, \qquad \gamma = 14\tfrac{1}{2}^\circ + 4\tfrac{1}{2}^\circ = 19^\circ$$

$$Z = D\,(\tan\gamma\cos\alpha - \sin\alpha)$$

$$Z = 2.5\,(0.34433 \times 0.96815 - 0.25038) = 0.20745 \text{ in.}$$

$$M = D\cos\alpha\sec\gamma + Z$$

$$M = \frac{2.5 \times 0.96815}{0.94552} + 0.20745 = 2.76727 \text{ in.}$$

For example, to find the diameter of the plug and the micrometer measurement for a gear with 25 teeth, 10 diametral pitch, 2½-in. pitch diameter, 14½-deg. pressure angle:

$$\alpha = 14\tfrac{1}{2}^\circ \qquad N = 25 \qquad D = 2.5$$

$$\delta = \frac{90^\circ}{N} = 3^\circ\,36'$$

$$\gamma = \alpha + \delta = 14\tfrac{1}{2}^\circ + 3^\circ\,36' = 18^\circ\,6'$$

$$Z = D\,(\tan\gamma\cos\alpha - \sin\alpha)$$

$$Z = 2.5\,(0.32685 \times 0.96815 - 0.25038) = 0.16514 \text{ in.}$$

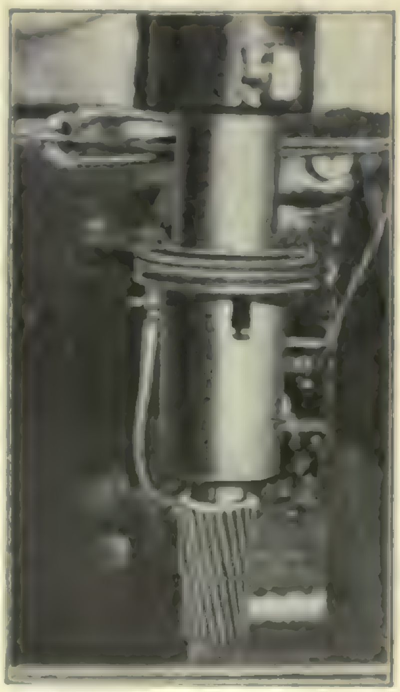
$$X = \frac{D\cos\alpha\cos\delta}{\cos\gamma} + Z$$

$$X = \frac{2.5 \times 0.96815 \times 0.99803}{0.95051} + 0.16514 = 2.7064 \text{ in.}$$

Carrying the Lubricant Around with the Tool

By Henry M. Clary

The foreman having decided that the boring and reaming tools used for boring out some large work on a heavy two-spindle drilling machine were not getting enough oil, he had the tinsmith make up the arrangement shown in the photograph. A band of sheet metal was cut to a length that would just go around the spindle of the machine, and of a width of about 1½ in. Then a similar band was cut, except that it was made enough longer so that it would be about 3 in. greater in circumference, and a disk was cut out and soldered in for the bottom. The center was cut out, of course, so that the spindle could pass through. Then this cup, or pan, was cut through one side so that it could be placed around the spindle, and the ends were soldered together again. This was necessary because it could not be slipped over the spindle nose, due to the fact that the nose is larger than the other part of the spindle.



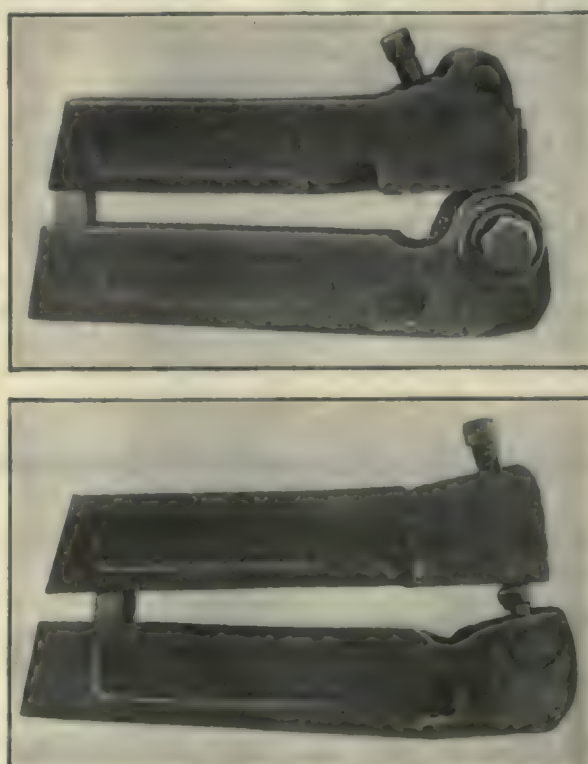
LUBRICANT-CARRYING PAN ATTACHED TO MACHINE-SPINDLE

A petcock, to which a long spout had been soldered as shown, was soldered into the bottom of the pan, and the lower end of the pipe through which the lubricant flows from the tank was placed so that the lubricant could run into the pan. As the spindle of the machine turns, the pan turns with it, feeding lubricant to the point of the tool. Or if a reamer is used, as shown in the photograph, there is no doubt that the lubricant reaches every part of the hole.

Salvaging Toolholders by Brazing

By George Wilson

In an effort to improve the ordinary setscrew type of toolholder and at the same time secure one that might use the toolbits to shorter lengths, it was decided to try different makes and designs selected from the catalogs. The shop was not long in rendering a most emphatic opinion, with the result that a considerable number of socalled "improved" toolholders were relegated to the scrap pile in favor of the old standby, the plain setscrew.



TOOLHOLDERS BEFORE AND AFTER BRAZING

As the toolholders represented a considerable cash outlay it was decided to try salvaging by brazing up the "works," shaping off the protuberances and putting in setscrews in the usual manner. After this was done and the surplus brass cleaned off so that the steel was exposed, the pieces were reheated to a low red, just hot enough so that the brass would not run out of the cracks, smeared with cyanide and quenched.

A good many toolholders have the habit of breaking the bits under pressure of the screw, due to a hollow under the screw. Before casehardening these tools the bottom of the hole was filed, to insure straightness. The illustration shows the toolholders before and after brazing.

Finish Boring Connecting Rods and Crankcase

By Herbert Crawford

The device used by the Peerless Motor Car Co., Cleveland, Ohio, for finish-boring the connecting rod so as to leave 0.001 in. for the final scraping and fitting is shown in Fig. 1, and in detail in Fig. 2. It consists

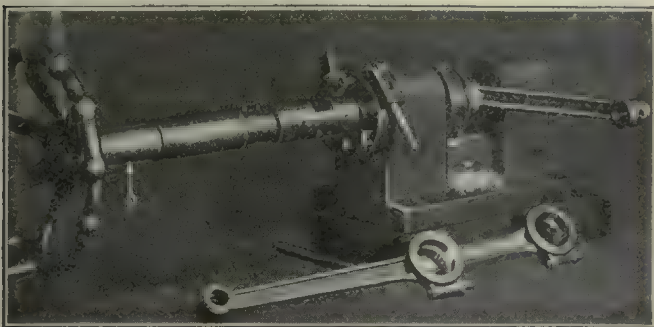


FIG. 1. FIXTURE FOR FINAL BORING

of a substantial block with a bearing on each side of the rod, each bearing being fitted with a steel sleeve which guides the boring bar. The nut *A*, which is threaded on the end of one sleeve, is first used to clamp

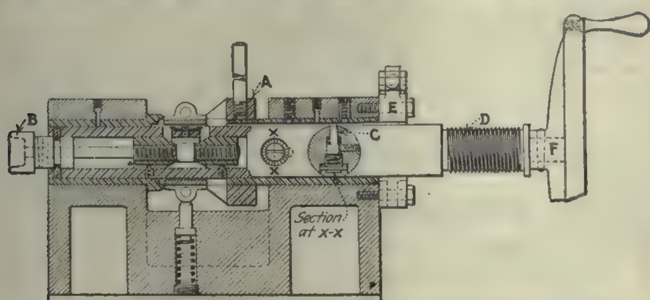


FIG. 2. DETAILS OF BORING FIXTURE

the rod lightly in place. The bar is then slipped through so that the six centering plungers are inside the bearing as in Fig. 2. They are forced out by the knob *B*, centering the bearing with the bar. The connecting rod is then clamped tightly in position by nut *A* and the centering plungers withdrawn by knob *B*.

The boring bar is then moved forward so as to bring the cutting tool *C* in position to bore the bearing. This brings the threaded portion of the bar *D* in position to be engaged by the split nut *E*, providing a feed of 32 per inch to the boring tool. The bar is then fed through by hand with the wheel *F*. The cutting tool has micrometer graduations for feeding it into the work.

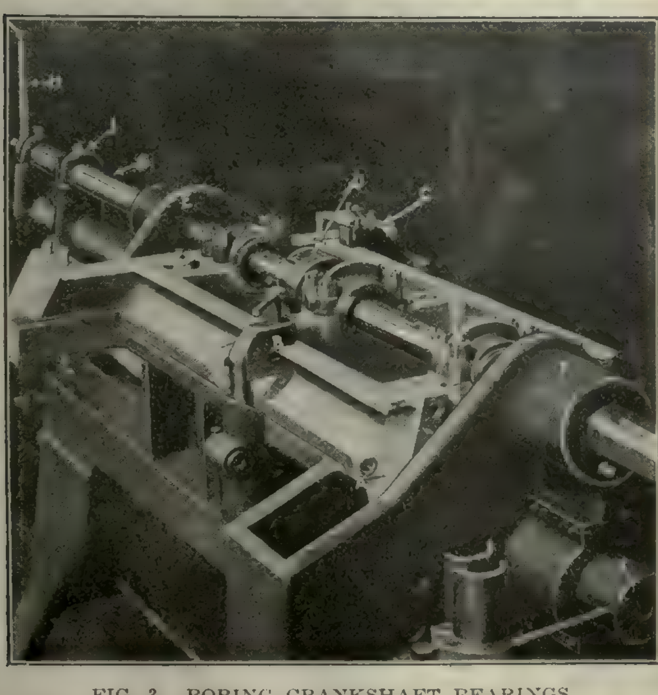


FIG. 3. BORING CRANKSHAFT BEARINGS

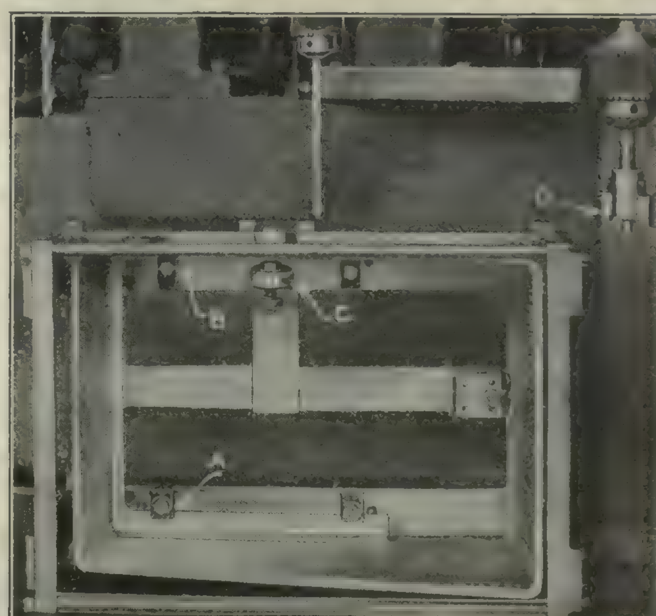
A somewhat similar device is used for finish-boring the crankshaft bearings as shown in Fig. 3. The cylinder block rests on one cylinder face in the fixture at *A*, and the plug *X* fits into the camshaft hole being held by clamps *B* and *C*. A center-bearing *D* projects up from the base to support the bar, in addition to the end supports *E* and *F*. The bar has disappearing cutters as shown in the bar in Fig. 2, and is also fed by a screw at *G* having 20 threads per inch, using the crank handle *H* for turning. A split nut at *I* allows for a quick return of the bar, also for rapid movement between the bearings.

Drilling a Large Die-Casting

By R. E. Marks

The illustration shows one of a lot of very large die-castings used by the Monroe Calculating Machine Co., Orange, N. J. The reason for die-casting this part was not to eliminate machine operations but to insure a solid and reliable aluminum casting of thin section.

This casting forms the case of a calculating machine and measures 15 x 12¼ x 4½ in. and weighs 2 lb. 6 oz. As shown it is being drilled in a fixture of very light con-



DRILLING A LARGE DIE-CASTING

struction so as to secure easy handling. The skeleton construction is of interest as an example in fixture design. In addition to being supported on the outside, the flange is clamped on the inside as at *A* and *B*. The side of the case is also supported against the thrust of the drill by the arm *C*. A large hole in one position, for the crank operating-handle to go through, is cut by the trepanning tools shown at D, a pilot hole being first drilled as usual.

Editorial

Shop Economies Aside from Cutting Speeds and Feeds

IT IS a common failing when attempting to reduce costs to consider only the time required for machining a piece of work. Increased cutting speeds and feeds are not to be overlooked, but in many cases the time taken in handling work exceeds that of cutting.

The keeping of sufficient material ahead for the constant operation of machines is also a vital factor in economic production. This involves not only ordering in ample time from concerns with a reputation for prompt delivery, but in storing the material where it can be readily found, starting it out of the stockroom on time and having a system which moves it promptly to the machine.

When it comes to the machines themselves we are confronted with the problems of easy handling from the floor or bench, and the designing of fixtures whereby the work can be accurately, easily and quickly clamped ready to be machined. Ease of cleaning out chips, which prevent accuracy, is an important matter. If the time taken in loading keeps the machine idle, the advisability of using duplicate fixtures, or of reducing the idle time in other ways, should be considered.

Nor should the inspection and assembly be overlooked as both can very frequently be speeded up more than many realize. Some of our best shops are using piece-rate and bonus very effectively in the inspection of parts. They claim not only a greater output but a much more careful inspection. For a super-inspection penalizes both the passing of poor work and the rejection of work which should have been passed as O. K.

Cutting speeds and feeds should of course be looked into and it will frequently be found that a stiffer machine with a better feed mechanism will prove a paying investment. The kind of tools being used may also prove a factor in securing increased production. But study the other factors as well, they are frequently sources of leaks which are unsuspected and yet count up to a wasteful total that is amazing.

Wages Should Not Depend on Profits

WE QUOTE from an editorial in the *New York Tribune* of July 20 the following:

"Thomas Kennedy, chairman of the Anthracite Miners Scale Committee, complains that 'It seems that interest lies in only one direction, and that is to put wages on the arbitration table and permit the profits of the operators to go unchallenged.' If things are so, if the strike settlement committee asked for by the president is not to consider profits as well as wages, Chairman Kennedy has just cause to complain."

It is perfectly proper that the question of wages should be looked into. It is also perfectly correct that the question of profits should be looked into. But, we wish to state our conviction most emphatically that the one has nothing to do with the other. If it should be found that the profits are unreasonably high, this would not be a reason why wages should be raised. Nor should wages be lowered because profits are low.

This idea that profits and wages have some relation, one to the other, is so common that it may not be amiss to call attention to the fact that there may be two companies in the same industry, one of which makes large profits while the other one is barely keeping alive. If there were such a relation between wages and profits, as many people seem to think, then the employees of the first company should receive unusually high wages while those of the second company would have to be put on starvation diet.

The worker is entitled to a living wage or to a saving wage and he may be entitled to more than that, but his title to these things is not based on the fact that his employer is making money, but rather on the fact that he is giving his energy and contributes to production. His work is part of the world's work and for that reason alone he is entitled to his reward. The amount of his compensation should be based on the value of his work and to a certain extent on the preparation necessary to bring him to that point where he can perform his work successfully.

If he and his employer are partners, that is if he shares in the losses as well as in the profits, then the amount of profits would be a measure for the amount of his wages, but not until then. Simple as this idea is, it seems to be overlooked by many people many times.

An Achievement in Safe Aviation

THE Air Mail has added another record to its list of creditable achievements, achievements which have no equal in aviation the world over. During the year ending June 30, 1922, the air mail planes flew 1,750,000 miles, or seventy times the distance around the globe, and without a single fatality. This record is all the more remarkable when we consider that much of the flying was over such rugged country as the Rocky and Sierra Madre Mountains, where safe forced landings are almost impossible.

Those who still look at the airplane as a highly dangerous toy will have to revise their ideas, as it is doubtful if any other method of transportation can show a better record. The freedom from accidents speaks volumes for the painstaking work of those in charge of the planes and the service in general. The motors and planes must have been kept in excellent condition and the pilots must have exercised great care to achieve such a result. Every mechanic must have given wholehearted service and worked harmoniously.

This performance is all the more noteworthy when we recall that the appropriation for the service was sadly inadequate and required curtailment in every direction. Congressional doubters as to the practicability of the air mail service should take warning and loosen the purse strings for a service which bears directly on the development of commercial aviation in this country.

The country as a whole is to be congratulated on having a corps of men in the Post Office Department who can accomplish such remarkable results. They deserve the highest commendation and should be rewarded by being allowed to further develop the Air Mail Service along safe and sane lines.

Shop Equipment News

Automatic Multiple Die-Casting Machine

The machine shown in Fig. 1 is a multiple automatic die-casting machine that has been developed by the Automatic Die Casting Co., 1120 Marshall Field Annex, Chicago, Ill. The machine is of rotary type, consisting principally of a table carrying four dies rotating about a central vertical shaft. The four dies can be of the same or different patterns, as the machine works at a given rate of speed and the same amount of time is required for any casting. Two castings are made at the same time, eight castings being delivered at each complete revolution of the table. Any of the metals now used in die casting can be used in the machine.

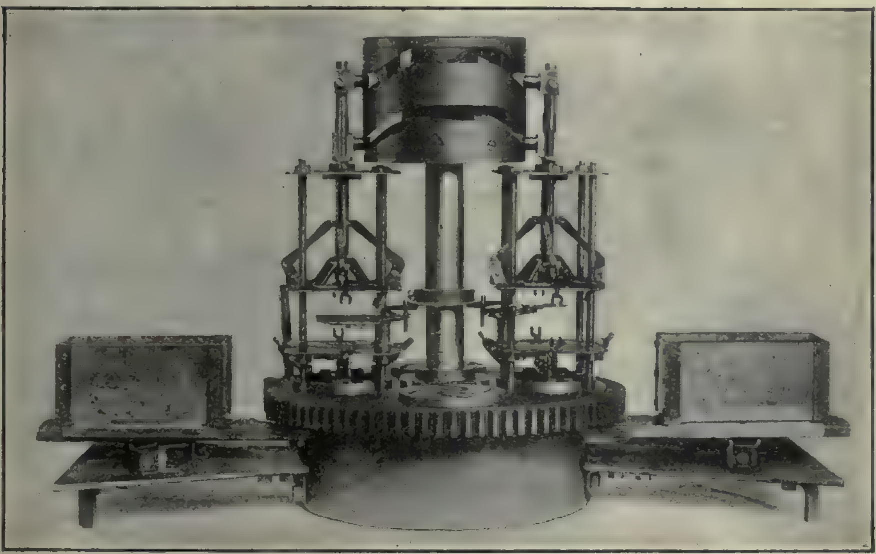


FIG. 1—AUTOMATIC MULTIPLE DIE-CASTING MACHINE

The four dies, which are placed at equi-distant points near the edge of the machine table, are enclosed in die-cages which support the operating mechanism. (Two of the die-cages have been removed from the machine shown in the illustration so that the mechanism may be seen more clearly.) Through the center of each die-cage is a vertical shaft, enclosed in a sleeve made of steel tubing. The shaft is attached to the upper half of the die, and the tubing is attached to the mechanism that controls the core pins.

To the upper end of the shaft is attached a follower that rides in the upper one of the two grooves in the large cam attached to the main shaft. A follower attached to the sleeve rides in the lower groove. As the table revolves, the shaft and sleeve are raised and lowered by the action of the cams, thus opening and closing the die and setting or withdrawing the upper core pins. The cam grooves are so made that the core pins are placed in position just before the dies are closed, and withdrawn just after the dies are opened.

The lower core pins are held by four short levers that ride in four curved slots in a round plate resting on the table of the machine and centrally located between the four posts of the die-cage. The plate is made to turn first in one direction and then in the other as the table revolves, thus causing the core pins to converge and separate as desired.

On opposite sides of the table are located two metal boxes, mounted on the ends of a long arm that passes through the base of the machine. This arm is pivoted in the center, so that it can swing approximately 60 deg. in a horizontal plane. Each box is lined with firebrick and contains a pot for the metal. The pot, a cross-section of which is shown in Fig. 2, resembles a tea kettle with a vertical cylinder in the center in which a piston is operated by a cam on a horizontal shaft. When the piston is raised, the metal flows into the cylinder through a number of small holes; and when the piston is forced downward, the metal is forced into the bottom of the pot, out through the spout and into the die. A second cam operates a lever attached to the top of the piston so as to raise it. The machine is so designed that the piston cannot operate if the spout of the pot is not in the correct position in the die-opening, thus precluding the possibility of danger to the operator.

A series of gas jets inside the box melts the metal and keeps it at the desired temperature while the machine is in operation. As the table revolves to bring two of the dies in line with the two pots, the metal boxes slide toward the table with the spout of the pot entering the gate in the die. The arm swings with the table while the pistons are forcing the metal into the dies, then the boxes are withdrawn and the arm swings back in time for the next set of dies. Directly

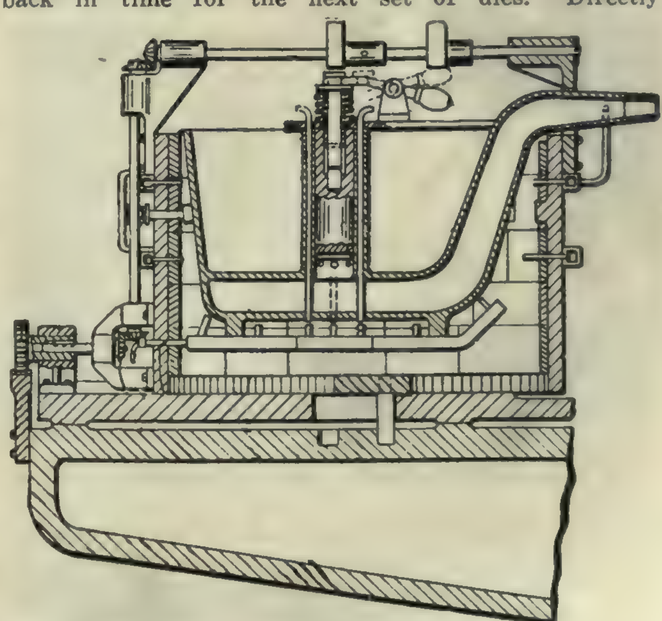


FIG. 2—CROSS-SECTION OF POT

after the two dies have received their charges of metal, they are automatically opened, the core pins are pulled out, the castings are ejected, the dies cleaned and closed, the core pins are pushed in, and the dies are ready for another charge. In the meantime, the other two dies are passing through the same cycle of operations.

As the upper half of the die is raised to the maximum height, carrying the casting with it, a pin knocks the casting loose and causes it to fall onto the plate which can be seen suspended between the upper and lower halves of the dies. The plate is then withdrawn and at the proper time a tripping mechanism causes the plate to turn and dump the casting.

After the castings have been removed from the dies, a rotary brush attached to a rack is fed forward across the face of each die, revolving as it goes and cleaning the die. Then the brushes are returned to their places and a powerful jet of air is blown upon the face of each die for the purpose of removing any particles that may have clung to the die.

A complete water circulation system keeps the dies at the proper temperature at all times, the water being introduced through a swivel overhead pipe at the center of the machine, then passing through four radiating pipes that connect with both the upper and lower halves of each set of dies and eventually discharging through the base of the machine.

The pots can be operated by either the plunger method or compressed air, depending upon the kind of metal being used and the preference of the operator. When the compressed air method is used, the air is preheated so that no further expansion will take place when the air comes in contact with the metal. A system of burners surrounding the cylinder keeps the cylinder and piston at the correct temperature, in order to prevent the piston from sticking in the cylinder and to prevent any metal from adhering to the wall of the cylinder.

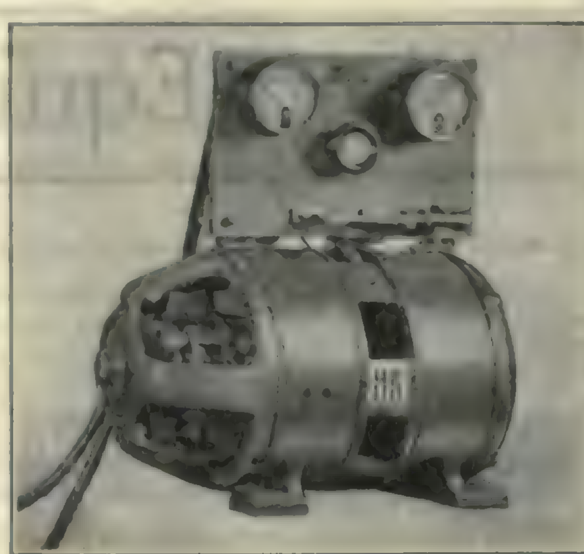
Hobart HB Constant-Potential Battery Charging Outfit

The accompanying illustration shows a storage-battery charging outfit that has recently been placed on the market by the Hobart Brothers Co., Troy, Ohio. The chief feature of the machine is that it charges at constant potential, so that batteries of the type ordinarily employed in electric automobiles can be completely charged in from six to eight hours.

When the batteries are first placed in the circuit, they draw a large amperage. As the charge builds up, the resistance of the battery increases, so that the amperage decreases. When the battery is fully charged, it can be left connected to the line without danger of injury, as no current flows. It is stated that with the constant-potential method of charging, the charge occurs very rapidly, the greater part of it taking place within three hours after connection. Also, since the battery does not heat appreciably and practically no gassing occurs, the life of the battery is said to be prolonged.

Any number of batteries may be connected to the machine, provided that the full load does not exceed the amperage capacity. The short time in which batteries can be charged is said to reduce the cost of current and the number of rental batteries that a charging station must have on hand.

The outfit consists of a 5-hp. ball-bearing motor built in one unit with a 7½-volt, 200-ampere constant-



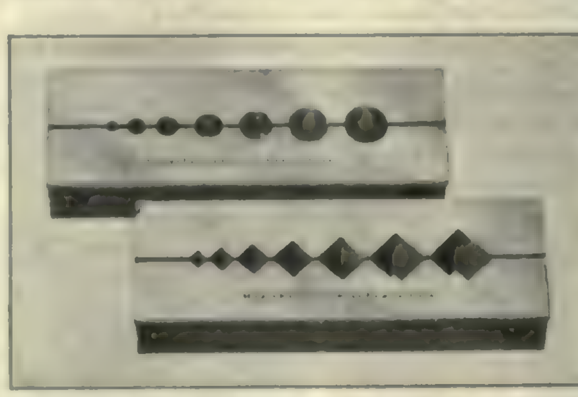
HB CONSTANT-POTENTIAL CHARGING OUTFIT

potential generator. Combining the motor and the generator in one unit eliminates trouble that may arise from lack of alignment of two units. The outfit is intended primarily for charging 6-volt batteries, although it can be adapted to use for 12- or 24-volt batteries. The outfit is completely equipped with all necessary parts such as bus bars, terminals, instruments, switchboard and 12 ft. of connecting cable.

The machine is 17 in. in height, 33 in. long and 16 in. wide. The switchboard is 12 x 18 in. in size. The total height of the machine and switchboard is 30 in. and the net weight 575 pounds.

Milliken Spring Vise Jaw Clamps

The accompanying illustration shows the vise jaw clamps that have recently been placed on the market by the Milliken Machine Co., West Newton, Mass. The devices are intended for use in a bench vise or in vise jaws or clamps mounted on milling machines, surface grinding machines and similar tools. Each pair has different



MILLIKEN SPRING VISE JAW CLAMPS

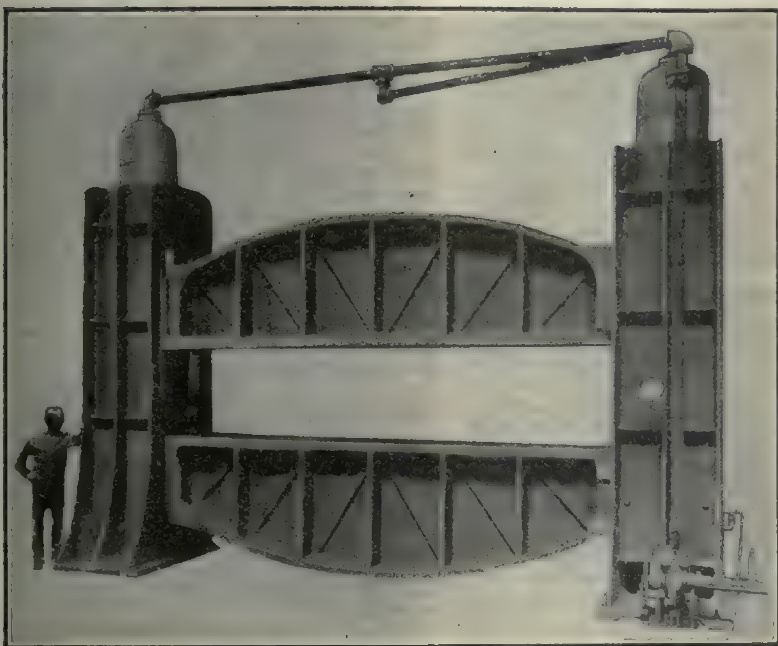
sizes of holes, for either square or round stock, so that rods, pins or screws can be securely gripped. Either rough or finished stock can thus be held without marring or bruising it when performing machining operations such as slotting, milling, grinding or threading.

When the jaws of the vise are released, two springs cause the jaws of the clamp to automatically open, so that the work is released. The clamps are hardened and finished all over. They are made to take stock from ⅛ to ½ in. in size.

Large Hydraulic Flanging Press

A very large hydraulic flanging press has recently been built by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio, for the Merchants Dispatch Transportation Co., Rochester, N. Y. The machine, which is shown in the accompanying illustration, is used for flanging the plates for Murphy car ends. Its principal feature is its size, as it will flange cold steel $\frac{5}{16}$ in. thick by 10 ft. long.

The press is equipped with two 20-in. diameter rams.



LARGE HYDRAULIC FLANGING PRESS

Two auxiliary cylinders $5\frac{1}{2}$ in. in diameter are used for returning the platen to the upper position. The stroke is 24 in. and the maximum distance between the platens is 36 in. The press is capable of exerting a pressure of 435 tons. The strength required to withstand this pressure is obtained by the use of cast steel for all cylinders, platens and housings. The total weight of the machine is 42 tons.

Valves and fittings made by the Hydraulic Press Manufacturing Co. are used in connecting the press to the hydraulic line. A three-way, poppet-type, high-pressure valve is used to control all the movements of the press by the manipulation of one hand lever.

Marvin & Casler Castellating and Hexing Machine

On page 36 of *American Machinist* there appeared a description of a nut castellating and hexing machine that has recently been placed on the market by the Manufacturers' Consulting Engineers, Syracuse, N. Y. The Marvin & Casler Co., Canastota, N. Y., has just taken over the manufacture and sale of this machine.

The machine is intended especially for the castellation of nuts and for milling the hex form on spark plugs or such articles. The work is held in six collets carried on a revolving turret, the pieces in every alternate collet being operated on simultaneously. The turret is automatically oscillated to and from the cutters. The operation of the machine is continuous, six pieces being completed at each revolution of the turret. The capacity is 1,000 nuts per hour.

Leinert "Rotex" Dimension Calculator

A device to enable the rapid mechanical addition and subtraction of fractions of an inch, inches and feet, has recently been placed on the market by W. Leinert, 410 West 23rd St., New York, N. Y. This device is shown in the accompanying illustration and is designated as the "Rotex" rapid calculator. It consists of a front plate carrying two circular scales, one divided into forty-eight equal parts and the other into sixty-four parts. The former scale is used for operations involving integers of feet and inches, and the latter scale for those involving fractions of an inch. The divisions of the scale are indicated with black figures in clockwise sequence for addition, and red figures in counter-clockwise sequence for subtraction.

Mounted within each of these scales is a circular rotatable disk graduated at its periphery with divisions and figures corresponding to those on the scale. A pinion on the shaft of each disk meshes with a gear carrying the circular scale at the top of the device. The perforations on the rotatable disks provide for the insertion of a stylus that is furnished with the device. The celluloid pointers serve to indicate the last item in case of interruption.

When starting to use the device, the dials are set to zero by first disengaging the gears, turning the dials, and then bringing the gears into engagement. The disks are turned consecutively to the different values that it is desired to add or subtract, the motion being clockwise using the black figures when adding, and counter-clockwise using the red figures when subtracting. The calculations are always started with the zero mark of the disk placed opposite that of the scale, and the zero on the disk is moved either way necessary for the operation. A buzzer signals at each complete revolution of the upper gear showing feet.

When reading the results, the number of feet is indicated on the upper gear on the left-hand side, and the integers of inches on the lower disk on the left-hand

LEINERT "ROTEX" DIMENSION CALCULATOR FOR ADDITION AND SUBTRACTION

side and on the upper gear on the right-hand side, while the fractions of inches are read on the lower disk at the right. The device should prove of especial use when adding and checking a series of dimensions on a drawing to obtain the overall dimensions, although it can be adapted to many other uses of a similar nature.

News Section

Auto Production Makes New Record

According to reports just issued by the National Automobile Chamber of Commerce, the June production of motor vehicles was slightly in excess of 288,000 cars, including both passenger vehicles and trucks. This establishes a new high record for motor car production in the American industry. It is 12 per cent. higher than the May production figures, which were 256,000, and indicates a total production for 1922 of more than 2,000,000 motor vehicles. For the second quarter of the year, 763,000 motor cars were manufactured, and the total for the first six months was 1,137,000. This compares with a production of 1,668,000 for 1921 and the record production in 1920 of 2,205,197.

Steel Companies Show Increased Earnings

According to Dow, Jones & Co., an improvement in steel demand, together with ascending prices for steel products, is reflected in earnings statements of steel companies to hand thus far. Republic Iron & Steel for the first time since the beginning of 1921, showed a profit for stock. Lackawanna, while reporting a deficit for the second quarter, did much better than in the first; Gulf States Steel's second quarter profits were equal to $1.70 a share on common stock against 40 cents in January-March period. Vanadium, which although not a steel company proper depends for its business on the steel trade, showed a small balance for stock in the half year due to profitable business in second quarter offsetting loss in first.

A similar improvement may be expected in United States Steel's report, to be made public July 25. In first quarter U. S. Steel had net of $19,339,285, and net for stock of $5,909,232, not quite enough to cover the $6,304,919 preferred dividend for the period. It would not be surprising if the big company reported net of over $30,000,000 in period ended June 30, or its common dividend earned with ample margin. About $26,000,000 is needed to cover all dividend requirements.

Operations of steel companies gained steadily through year up to close of June. The coal and railroad strikes, combined, have affected operations to some extent in July, but there is every indication that as soon as these troublesome factors are out of the way operations will be brought to a level approximating demand.

U. S. Steel began the year with operations around 60 per cent capacity. At close of first quarter they were close to 70 per cent. Between April and June they ranged from 71 per cent to 78 per cent capacity. Broadly speaking, a similar gain in operations was shown.

Prospects for the remainder of the year in steel trade are good. Pending the settlement of the labor controversies, consumers are more concerned about deliveries than about placing forward business, but demand is still satisfactory. Canners and automobile makers have been heavy consumers of steel for some time. There are signs of a revival in railroad demand, and steel men estimate that several million tons will be needed for new cars and locomotives, and to put the constantly increasing number of bad order cars into first class running order.

Alabama District Shows Increased Production

A survey of industrial conditions in the iron and steel business of the Alabama district during the latter part of July, shows that production has been steadily increasing from week to week during the past two months, and that there is promise of steady activity throughout the district during the remainder of the year, according to the Atlanta office of the Southern Metal Trades Association.

The Tennessee Coal, Iron and Railroad Co. has blown in another furnace at Bessemer, Ala., giving that company now nine active stacks. The Central Iron and Coal Co. has also blown in another furnace and that company now has all of its stacks going. The Republic Iron Co. is expected to start up another stack in the near future. The present total of active stacks in Alabama is twenty-two as compared with five at this time in 1921, not including the stacks referred to above.

The concrete bar mill of the Southern Steel and Rolling Mills Co., known as the Gerson Rolling Mills, has begun operations, while the larger 16-inch bar mill being constructed by this company is expected to be finished and ready to start up within the next thirty days. Nearly all departments of the steel mill at Ensley, Fairfield and Bessemer are in steady operation.

Resumption of operations at the North Birmingham plant of the United States Cast Iron Pipe and Foundry Co., has served to increase the district's pipe production. Practically all of the pipe plants at Bessemer and Anniston are now operating at capacity.

While the iron market of late has been somewhat listless Birmingham base is still at $18.50 to $20, though very little business is reported at the new price as yet. Pressure base pipe is at $37 and $38, with sanitary base at $55, $60 and $65, the cast-iron pipe market continuing strong.

Official figures on pig-iron production in Alabama during June show an increase of more than 100 per cent over June of 1921. Production is officially given at 189,101 tons as compared with 93,000 tons in June, 1921. The output during July is expected to exceed that of June as there have been four additional furnaces started up since the first of the month.

S. A. E. Production Men to Meet in Detroit

A national meeting of the Society of Automotive Engineers will be held in Detroit, Oct. 26 and 27, for the purpose of discussing problems of automotive production. The meeting is to be known as the S.A.E. Automotive Production Meeting.

Papers treating current production problems in a simple and practical way will be read and fully discussed in morning meetings on each of the two days. The afternoons will be devoted to factory inspection trips especially arranged for the purpose of viewing new and advanced production methods that will particularly interest the tool, inspection and production men. The principal object of this meeting is the promotion of an interchange of experience between practical factory men on automotive production problems which are troubling them in their daily work.

An S.A.E. Production dinner will be held Thursday evening, Oct. 26, where social friendships between production men will be promoted. Announcement of the locations of the meetings and dinner will be made in the near future.

Special committees of Detroit S.A.E. members are in charge of the arrangements for this national meeting. K. L. Herrmann, a Studebaker production engineer, is chairman of the committee which is selecting the papers and topics for discussion. Suggestions or requests to present papers should be addressed to the S.A.E. New York office.

Engineers of Steel Industry Will Hold Convention

The engineers in the iron and steel industry will meet in convention during the week of September 11th to 15th, 1922, at Cleveland Public Hall, Cleveland, Ohio, at which time there will be presented and discussed subjects dealing particularly with steel mill problems.

The papers have been written with a view of giving to the engineers as much practical data as is possible, feeling that this class of information is far more beneficial than the theoretical side when dealing with steel mill problems.

Some of those who will present and discuss the subjects are Dr. C. P. Steinmetz, Messrs. B. G. Lamme, Wilfred Sykes, A. G. Witting, F. C. Watson, D. M. Petty, L. W. Heller, R. B. Gerhardt, D. B. Rushmore, J. B. Crane, E. R. Fish, R. M. Rush, R. E. Butler, F. Hodson, Prof. Edgar Kidwell, F. W. Cramer, A. R. Leavitt, E. T. Moore, R. H. Bauer, F. A. Wiley, L. F. Galbraith, R. S. Shoemaker.

Representatives from practically every steel mill in the United States are expected at this convention for it will interest practically every class of engineer.

Railroad Shopmen Better Paid Than in Private Industry

A comparison of the wages of railroad shopmen with the wages paid to employees in foundries and machine shops in other industries, given out today by the National Industrial Conference Board, 10 East 39th Street, New York City, shows that the average hourly earnings of the railroad employees stand at least 25 per cent and weekly earnings at least 32 per cent above those paid to men performing practically identical work in privately controlled plants. Railroad skilled shop mechanics include machinists, boiler makers, blacksmiths, sheet metal workers, and electrical workers, whose duties in the railroad shops are practically identical with the duties of men employed in commercial foundries and machine shops.

The National Industrial Conference Board has just completed a survey of the wages of employees of foundry and machine shops other than railroad, which shows that the average earnings of skilled labor stood at 56.1 cents on January 1, 1922. In a statement given out by the Conference Board on July 2, the average hourly earnings of railroad skilled shop labor were shown to be 70.1 cents under the new wage rates, this being based on the hourly rate of 70 cents laid down by the U. S. Railroad Labor Board, and a working week of 48.06 hours.

Wages Are Higher

The hourly wages of skilled mechanics employed by the railroads are therefore 25 per cent higher than those paid skilled mechanical employees of other industries in the country at the first of the year. Wage rates in private industry, moreover, have declined in the past six months, so that the comparative position of railroad shopmen and other shop workers in private industry is probably at present more marked than here shown. The National Industrial Conference Board's report covers the wages of 388,560 men employed in 1,338 plants, or 73 per cent of all the wage earners in foundries and machine shops as shown by the United States Census of Manufactures in 1919, and can therefore be regarded as thoroughly representative of the conditions existing in foundries and machine shops throughout the country.

Studies by the Conference Board show that the average hourly earnings of skilled shop labor in privately controlled plants rose from 30.4 cents per hour in 1914 to 71.3 cents in September, 1920. On January 1 of the present year, these wages had declined to 56.1 cents per hour. The railroad shopmen's wages rose during the war period from 29.8 cents per hour in 1914 to 86.4 cents per hour at the peak in November, 1920, and despite two wage cuts ordered by the Railroad Labor Board, the wages of the striking shopmen have been reduced to a point which is only 1.2 cents per hour below the rates paid to shopmen in other industries at the peak of the industrial inflation.

A comparison of the weekly wages of the two classes of employees shows a situation which is even more favorable to the railroad shopmen than in the case of hourly earnings. This aspect of the matter is important, as weekly earnings constitute a much better basis for judging the comparative status of the two groups of workers than do hourly earnings. The statement of the National Industrial Conference Board referred to above, estimated the average weekly earnings of skilled railroad mechanics to be $33.67 under the reduced rates recently established by the Railroad Labor Board. The weekly wages of foundry and machine shop employees, however, on Jan. 1, 1922, were $25.08, giving the railroad employees a clear advantage of 32 per cent in weekly earnings over the earnings of men performing work identical with their own, but in the shops of privately controlled companies. Since a decline in wages of outside shop workers has taken place since the first of the year, the position of the railroad shopmen is even more favorable.

The employees of the foundry and machine shop industry are shown to have been working an average of 44.7 hours per week on January 1, while it is estimated that on the basis of the average number of hours worked per week since September, 1919, the railroad shopmen will average 48.06 hours. Statements have recently appeared which purport to show that any comparison of the estimated earnings of railroad employees for 1922 with the actual earnings of 1914 are unfavorable to the employees because of the fewer hours of work performed in 1914 on account of the severe industrial depression of that year. The figures published by the Interstate Commerce Commission, however, show that in 1914 the average number of hours of work per week for railroad shopmen was 51.4 or nearly 3 hours per week more than the estimate of 48.06 hours for 1922.

In 1914, moreover, the average working day of railroad shopmen was nominally ten hours but fell to the lower figure by reason of lack of business. Since that time the nominal week has been reduced by the insistence of the unions to 48 hours or 8 hours per day, with a 6-day week, and the attempt is now being made to use this fact to make the real earnings of railroad employees appear to be less than in 1914.

The result is, therefore, that railroad shopmen are in a more advantageous position than they were in 1914, in three ways: First, that their hours of employment have been reduced, giving them more time for leisure and receation; second, that their economic status, even under the new wage cuts, is 10 per cent higher than eight years ago; and third, that the average weekly wages of railroad shopmen are at least 32 per cent higher than those of men doing the same work but employed by other industries, where wages are regulated as a general rule, by the supply and demand for labor.

"Made-in-Atlanta" Exhibition

Several hundred Atlanta manufacturers will co-operate in a "Made-in-Atlanta" exhibition to be held at the Atlanta Auditorium Sept. 18 to 23, at which time the products of all Atlanta factories will be on display. Among the foundries and machine shops already listed is the Atlanta Stove Works, Hanson Motor Co., Atlantic Steel Co., Butters-Camp Co., Nick Heater Corporation.

Gerard Swope Elected a Fellow of the A.I.E.E.

Gerard Swope, president of the General Electric Company, has just been elected a Fellow of the American Institute of Electrical Engineers. Fellowship is the highest grade of membership as is characterized by the stipulation that the president of the Institute is to be chosen only from among the Fellows.

Mr. Swope, although an electrical engineer by training, has developed into a conspicuous business executive as well, one whose career has revealed an ability for continual accomplishment. He was graduated in 1895 from the Massachusetts Institute of Technology as an electrical engineer, and after his graduation found work in the shops of the Western Electric Company, forging ahead rapidly until he became general manager of power apparatus business, making that department extremely successful.

In 1908, he became general sales manager of the Western Electric Company and in 1913 was made a vice-president and director, in charge of all commercial work in the United States and of all manufacturing, engineering and commercial work outside of this country. This necessitated traveling abroad, and while in Japan he was decorated by the Emperor with the Order of the Rising Sun.

During the period of America's participation in the war, Mr. Swope served as assistant director of purchase, storage and traffic, receiving the Distinguished Service Medal. He was made a Chevalier of the Legion of Honor by the French government.

In 1919 he was made president of the International General Electric Company, serving in that position until chosen president of the General Electric Company last spring.

Gasoline Consumption Shows Big Increase

Of particular interest to consumers of gasoline, kerosene and fuel oil whether for automobile or any other purpose, is the recent announcement from the Bureau of Mines.

Due chiefly to the record breaking output of automobiles, the gasoline stocks, which have been mounting steadily to new high records, are now on the decline. On June 1, stocks on hand at the refineries amounted to 856,607,102 gallons, which is 35,661,000 gallons below the record figure of 892,267,766 gallons atained at the beginning of May. The fact that the billion-gallon mark, forecasted in some quarters, was not reached seems due to the tremendous increase in domestic consumption of gasoline, which amounted to 499,242,343 gallons in May. This figure represents an increase in domestic consumption of gasoline of 113,000,000 gallons over the month of April and 145,000,000 gallons over the month of May, 1921. Gasoline consumption figures for May constitute a record for that month, and are within four million gallons of the record-setting figure attained in August, 1921, although occurring three months before the customary month of largest consumption.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

PRESIDENT HARDING is trying valiantly to hold the shield of governmental protection impartially over the Constitutional rights of the strikers and their employers as well as to protect those who may be willing to do the work that the strikers have abandoned.

As usual in such cases each of the parties in interest feels that favoritism is being shown to the others, but the vast majority of the public recognize the fairness of the President's attitude. Some, it is true, advocate measures that would be more coercive or Rooseveltian, but it is plain that most people are satisfied with Mr. Harding's punctilious respect for the Constitution and believe that his policy will be successful. It is only upon this theory that the tranquility of the markets can be explained for it must be admitted that the winter will be one of genuine discontent and distress unless the strikes are soon settled.

Money in Demand

The non-union production of bituminous coal is disappointing and far below current requirements. Little or no anthracite is being mined and while the railroads bravely claim that they are functioning normally it is undeniably true that many are seriously handicapped and that we may have a vexatious freight blockade in the autumn unless relief is soon found. This will not only delay the distribution of goods but tie up the capital invested in them.

The result may be an increased demand for money as it is estimated that merchandise worth at least a billion dollars is normally in the hands of the railroad companies and any delay in its delivery would of course retard the liquidation of commercial credits.

There is already some indication of this, for according to the reports of 795 of the more important banks, commercial loans are now increasing for the first time in more than a year. The increase for the two weeks ending July 19 was $25,000,000, but as the total is still $1,276,000,000 below the figures of May 25, 1921, and the weekly statement of the Federal Reserve System shows a reserve ratio of 79.2 per cent there is abundant room for further expansion.

This high reserve ratio, which compares with 77.8 at the end of the previous week, is in part due to an increase of nearly $10,000,000 in the gold held and in part to a decrease in deposits and earning assets, which suggests that a reduction in the rediscount rate will soon be necessary if the Federal Reserve Banks are to keep their resources remuneratively employed.

Taking advantage of the plethora of bank credit Secretary Mellon has announced that one billion of the 4¾ per cent Victory notes will be called for payment on December 15 and that of the obligations so called $300,000,000 will be exchangeable on August 1 for an equal amount of four year Treasury certificates bearing interest at 4¼ per cent. As on the present money market these Treasury certificates are worth a premium, the effect has been to advance the Victory notes called and to pave the way for successfully refunding the 4½ billions of short dated debt that matures during the fiscal year ending June 30, 1923. All of which serves to emphasize afresh the ease of money due to the continued gain in our gold supply and the possibility of inflation as a consequence.

The resiliency of the security markets in the face of the strikes is perhaps due to a subconscious recognition of this possibility. Under the leadership of the Government issues most domestic bonds have been in good demand at advancing prices and while stocks have been from time to time attacked by the bears they have rallied sharply upon the slightest intimation of good news. On these rallies the railroad shares have been the leaders and a boom in railroad stocks is quite possible when the labor troubles are ended. Eliminating the coal traffic the car loadings indicate that the railroads are now handling a record tonnage of other freight.

Of the commodity markets there is nothing novel or sensational to report. Raw cotton has been rather easier on a generally admitted improvement in the crop. During the critical month of August deterioration is normal and it will be strange if the month passes without a crop scare and a sharp advance in the market. But in the long run an increase in European consumption must be relied upon to sustain prices and it is to be expected if the arrangements for the rehabilitation of German credit now under discussion are consummated.

Activity in All Industries

Our domestic trade in cotton goods and nearly everything else is satisfactory and will be better when the strikes are settled. A broad speculation in sugar is developing but the market hesitates a little as Cuban raws approach four cents. Once that rubicon is passed the upward progress will probably be more rapid for it is becoming plain that there will be active competition for the small remnant of the much exploited surplus that remains.

The demand for hides and leather is also better and shoe manufacturers report an active trade. The market for wool and woolen goods is somewhat disarranged by the quarrel over the wool schedule of the tariff bill but the minor textiles, silk, linen, jute and burlaps are all tending upward. The petroleum production is now the largest on record. The increase is perhaps due to the coal shortage.

Pig iron is a dollar higher in anticipation of the activity that is expected when the steel mills can get the coal that they require. Tin and zinc have also advanced. Copper still hangs around 13¾ to 14 cents. It must be a price that pays producers for the supply seems equal to the demand, which is large because of the boom in building and construction activity generally. In greater New York alone the new buildings now under way will house 38,363 families and in New York and New Jersey some $256,528,000 was invested in new residences during the six months ending June 30, last.

The automobile production for June was the largest on record for that month and there has been a correspondingly large demand for tires. As a result America now uses 65 per cent of all the world's rubber production and as new tires are required and new uses for rubber are found an advance in that article may come even though the English and the Dutch do not agree to reduce production. Coffee is dull and dragging. The market is paralyzed by the fear that the Brazilian Government is quietly selling its valorized holdings.

The news from abroad is not sensational or important. The London stock market is firm on easy money and coal is higher in England on American purchases totaling over 700,000 tons. Many close observers believe that the British Government is sending gold here at the rate of ten million dollars a week with the purpose of raising the reserve ratio of our Reserve banks to a point that will insure an acceptance of our quota of the inevitable German loan. I continue to believe that when and if it is issued the German mark will be worth more than 20 cents a hundred.

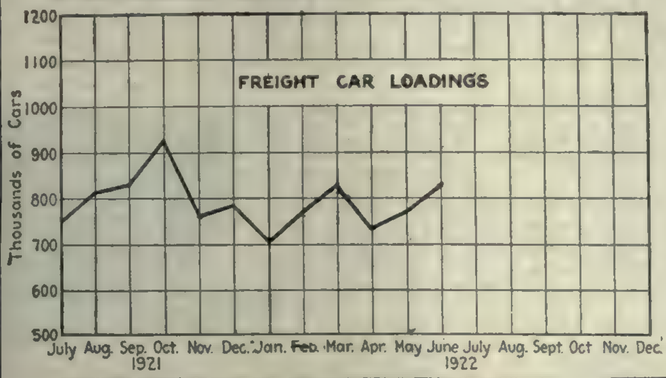
Apart from the coal and railway strikes which must be settled and may be settled when this is printed the low price of wheat is the only adverse factor of importance in the commercial complex of this country.

That it is not more generally complained of is surprising and it may be that I overestimate its seriousness. If so I shall be glad for, if the purchasing power of the farmer is not impaired, this fall will be a period of great prosperity despite the probability of high priced coal.

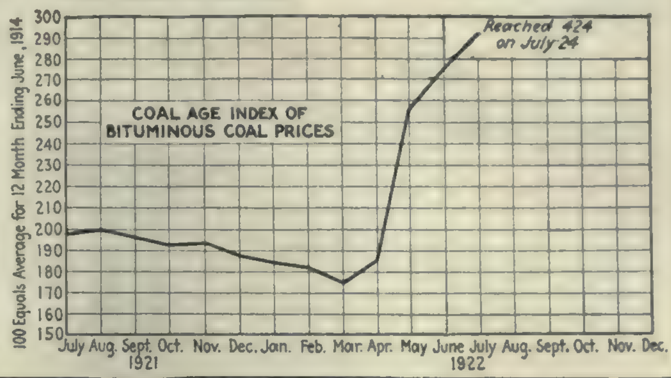
Southern Pig Iron Output Shows Increase

Pig iron production continues to pick up in the Alabama district, with inquiries and sales getting steadily better. Prices prevailing are $19 and $20 per ton base for No. 2 foundry iron. During June a total of four furnaces were blown in, and production for the month was 189,008 tons, bringing the six-month total to 945,117 tons, as compared with 630,343 tons the first six months of 1921. Since March production each month has increased steadily by several thousand tons, and the outlook gives promise of close to normalcy before the end of the year.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base



AMERICAN foreign trade has just closed its fiscal year. For the twelve months ending June 30, 1922, exports show a total value of $3,770,220,971. Imports in the corresponding period were valued at $2,607,618,110. By way of comparison the fiscal year ending June 30, 1920, showed exports having a total value of $6,516,510,033 and imports having a total valued at $3,654,459,346. In other words, the so-called "favorable" trade balance of the United States, that is, the excess of exports over imports standing at nearly 3 billions of dollars on June 20, 1921, has declined until on June 30th of this year it is just a little over one billion dollars. While the position of the United States is shifting slowly toward an excess of imports over exports, it does not appear that this point will be reached in the very near future.

The country's excess of exports has declined to an average only slightly higher than pre-war levels, yet it is still being maintained by the new loans and investments abroad.

"It is worthy of note that although the total value of foreign trade is still more than 60 per cent above the prewar total," says a local bank, "the current average monthly net balance of exports is only moderately above the prewar level.

"This substantial reduction in the excess of exports does not, however, indicate that an excess of imports is a probable development of the near future. The expectation of a net balance of imports is based on the fact that eventually the obligations of other countries to the United States can be liquidated only by payments in goods and services. But as regards the largest item in this indebtedness—the advances made by the Government to the Allies—interest payments have thus far been deferred and consequently have exercised no influence on the trade balance. Moreover, general negotiations regarding funding and interest payments on the Allied indebtedness have hardly more than begun, so that for some months at least the influence of this factor on the trade balance will be slight.

Comparative Prices of Shop Supplies

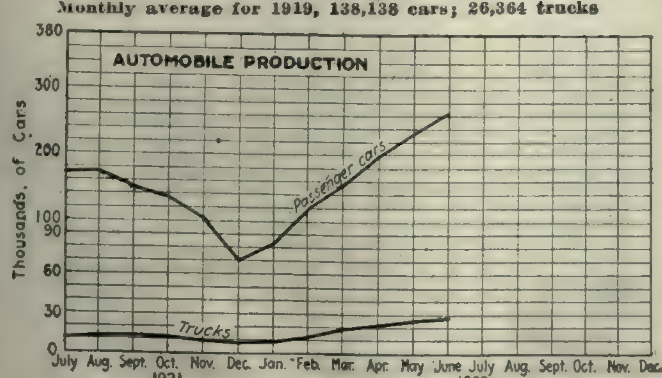
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.027	$0.0252	$0.0283
Cold finished shafting	per lb.	0.0335	0.0335	0.0435
Brass rods	per lb.	0.162	0.1550	0.159
Solder (½ and ½)	per lb.	0.21	0.213	0.203
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

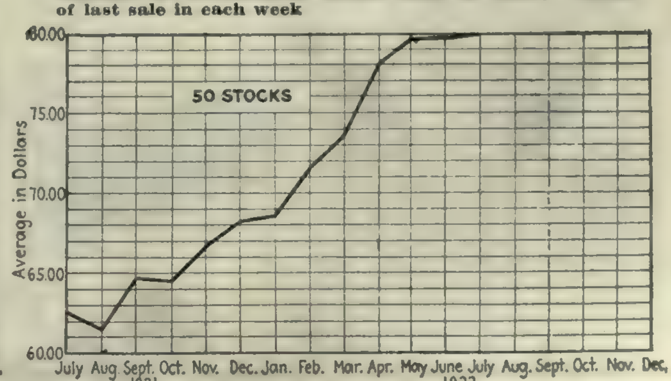
Freight cars loaded with revenue freight during the week ending July 15th totaled 860,907, an increase over the week previous of 142,588 cars. As compared with the corresponding period in 1921, an increase of 86,023 cars is shown. Idle cars on July 8 totaled 405,120 as compared with 405,180 on July 1. Of this total 239,160 were surplus freight cars in good repair in excess of current freight requirements, while the remaining 165,960 were freight cars in bad order in excess of the normal number unfit for service.

The Steel Corporation's report for the second quarter which shows a gain of more than $7,000,000 over the first three months, created an optimistic feeling. The net earnings for the second quarter amounted to $27,286,945 as compared with a net of $19,339,983 in the first three months of the current year and $21,892,026 in the second quarter.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Monthly average for 1919, 138,138 cars; 26,364 trucks



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week



Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Saw, Bench, Portable, Universal
Union Machine Co., Grand Rapids, Mich.
"American Machinist," April 13, 1922

The machine, adapted to use in pattern and woodworking shops for cutting stock up to 2 in. in thickness, can be mounted on a bench or furnished with a base. A ½-hp. motor drives the 7-in. saw, and is controlled by a switch at the front. The table can be tilted to any angle up to 45 deg. and locked in place, and has graduations for setting. The saw may be furnished for either ripping, cross cutting, or combination work. The arbor of the saw runs in ball bearings at a speed of [illegible] r.p.m. Table, 20 x 15 in. Bench style: height, 10 in.; weight, [illegible] lb. Mounted on base: height, 36 in.; weight, 130 pounds.

Saw, Bench, Universal
State Pattern & Machine Co., 2524 West Lake St., Chicago, Ill.
"American Machinist," April 13, 1922

The saw is used in pattern, cabinet and carpenter shops, in shipping rooms and [illegible] for cutting wood, [illegible], asbestos, fiber and even soft metal. The machine can be supplied with either a tilting or stationary table. The motor is of ½ hp., 110 or 220-volt, and for either a.c. or d.c. The saw can be raised or lowered, and provides a maximum depth of cut of 2½ in. The speed is 3,600 r.p.m. A guide is furnished to be used on either side of the saw. Height, 34 in. Diameter of the saw, 8 inches.

Lathes, Screw Cutting and Turning, "Handy," 9- to 12-in.
Seneca Falls Manufacturing Co., Inc., Seneca Falls, N. Y.
"American Machinist," April 20, 1922

The screw-cutting lathe can be arranged for either motor or belt drive. It has a large hollow spindle, power-driven longitudinal and cross feeds, graduated crossfeed screw, and a set-over tailstock. A plain or compound rest, and a double friction countershaft having a cone belt shifter can be furnished. The plain turning lathe has a [illegible]-in. swing and 3-ft. bed, and a maximum space of 12 in. between centers. It is equipped with a plain rest, feeds from 0.002 to [illegible] in. per revolution of the spindle, [illegible], three step cone and self-oiling spindle.

Truck, Platform, Hand, Non-Elevating, Heavy-Duty
Plimpton Truck Co., Elm Court, Stamford, Conn.
"American Machinist," April 20, 1922

The truck is used especially in foundries and machine shops where heavy, compact loads are handled. It has a wide wheel base and steering [illegible] of the [illegible]. The handle is normally held in a vertical position by a spring-[illegible]. The truck may be [illegible] to steer on [illegible] or four wheels. It is made with load capacities of [illegible] lb. It may be equipped with [illegible] wheels, which can be used either on rails or directly on the pavement.

Punch, Center-Locating, Prick, Scriber
Bernard F. Johnson, 3476 Boulevard, Jersey City, N. J.
"American Machinist," April 13, 1922

The punch is used for precision work in laying out centers for holes in jigs and dies, and in outlining cams. As it is not necessary to employ buttons in laying out holes, holes can thus be placed very close together. The tool can be used in conjunction with a shaper, milling machine or other machine tool. The work is attached to the machine table, and is moved by means of the machine controls. After each adjustment, a prick mark can be made on the work by tapping the rear end of the punch with a hammer. Springs permit the motion of the punch in either direction.

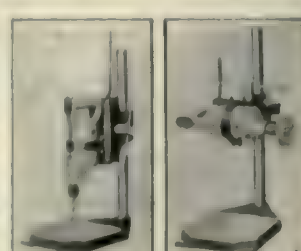
Filing Machines, Die, Enclosed, Nos. 3 and 4
W. D. Rearwin, 716 Monroe Ave., Grand Rapids, Mich.
"American Machinist," April 20, 1922

Although smaller in size, the machines are similar in principle to the No. 6 model, and can be mounted on a bench or on short columns. The No. 4 machine has a maximum stroke of 3 in. and a 12-in. square table, arranged to tilt to all four sides, with a swiveling mechanism graduated to 7 deg. on each side. An adjustable hold-down clamp moves with the table. The position of the file slide and the length of stroke are adjustable. Speeds of 200, 300 and 400 r.p.m. are provided. The No. 3 machine is smaller and has a 1½-in. stroke and an 8-in. square table.

Truck, Elevating, Industrial, Hand, Model-E
Plimpton Truck Co., Elm Court, Stamford, Conn.
"American Machinist," April 20, 1922

The front end-plate of the truck is a combined step and thrust bracket, against which the operator may press the handle to force the truck backward. The platform is released by pressing a pedal. The handle is automatically retained in the vertical position when not in use. Steel or wooden platforms can be employed. The steel platforms can be furnished for any truck length in standard widths of 24, 30, 36, 42 and 48 in. The truck is made in capacities of 3,000 and 4,000 lb., with platform sizes of 7 x 18 x 36 to 9 x 20 x 52 inches.

Stand, Drill, Portable, "Hole Shooter"
A. H. Petersen Manufacturing Co., Milwaukee, Wis.
"American Machinist," April 20, 1922



The stand is used with the "Hole Shooter" electric drill. With the drill vertical, the combination serves as a bench drill and, with the motor swung to the horizontal position, it can be used as an electric grinding machine or for buffing or polishing. The spindle of the machine can be set to operate at any angle. The range of travel of the slide is 12 in., and the range of travel of the rack in any one position is 3½ in. Base, 8 x 8 in. Weight, 30 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

Washington Notes

By Paul Wooton

Service orders extending drastic priority privileges in the transportation of coal were issued by the Interstate Commerce Commission on July 25. Under one of the orders the railroads are given authority to move coal by the most available route. Under another, the railroads are instructed to move coal, coke and fuel oil in preference to all other freight, excepting food for human consumption, food for livestock, livestock and perishable products.

Cars for coal loading are to be furnished first for fuel intended for railroads and for the bunkering of ships; next for public utilities which directly serve the general public under a franchise. This includes street and interurban railways, electric power, light, gas, water and sewer works and ice plants. Hospitals come next in the priority list. Other consumers then are listed in the following order: federal state, county and municipal governments. The order points out that the intention is that all common carriers, public utilities, quasi-public utilities and governments may be kept supplied with coal for current use, "but not for storage, exchange or sale."

Priority also is given to coal for shipment to the Northwest by way of the Lakes and to the commercial sizes of coal for domestic use. The order provides also that no coal is to be subject to reconsignment or diversion, except for some purpose in the same class or in a superior class. Mines producing coal are to be given first call on cars suitable for transportation of their output. The President has submitted a plan to the operators and mineworkers providing for a minimum wage for 280 days each year. The plan has as its object the elimination of those mines not in a position to furnish 280 days' work and thereby meet the evil of overdevelopment in the industry.

The use of machinery in the manufacture of knit fabrics was discussed in the Senate during the tariff debate on July 21. A duty of 60 per cent advalorem, was adopted on knit fabric in the piece, composed wholly or in chief value of cotton or other vegetable fiber, made on a warp knitting machine. A duty of 35 per cent was placed on such articles made on other than a warp knitting machine. A duty of 50 per cent advalorem was placed on gloves of cotton or other vegetable fiber made of fabric knit on a warp knitting machine and 25 per cent on those made on other than a warp knitting machine.

The Union Electric Welding Co., has requested the Supreme Court to review the decision of the Circuit Court of Appeals for the 6th Circuit which decided in favor of J. P. Curry and C. L. Miller in a patent infringement case. Curry and Miller brought the suit originally in the Northern District of Ohio Court, seeking an injunction and an accounting from the welding company for an alleged infringement of patent. The lower courts held that the patent was infringed and awarded Curry and Miller $45,000, representing profits on the infringement. The welding Company has asked the court to set aside the verdict of the lower court. The case will not be considered by the court, however, until it reconvenes in October.

Large Special Broaching Machine Installed

The J. N. LaPointe Co., New London, Conn., has recently shipped to the Schenectady Works of the General Electric Co., an extra large broaching machine of their No. 5 type, which is to be directly driven by a reversing motor.

The machine is designed to cut twelve 0.375 in. slots simultaneously in a stator frame. The jig or fixture attached to the machine for holding and centering the stator frame weighs 1,800 pounds. The weight of the complete machine is 1,200 pounds. The twelve cutter bars are each 1⅞ in. in section by 156 in. long.

Penn State College Will Enlarge Engineering School

In a report made during the past week by the industrial conference committee of engineers making a study of the School of Engineering of the Pennsylvania State College, it is recommended that the Pennsylvania legislature provide for the next biennium new buildings, equipment, and salary increases totalling nearly $2,000,000. The committee endorsed the work being done by the school and stated that of its 2,500 graduates in engineering, over half are in Pennsylvania occupying positions of service to the railways, industries, cities, and the various departments of the State.

The committee making the report was composed of M. I. Kast, architect; Elbert A. Gibbs, chief engineer of the McClintock-Marshall Company; C. B. Keiser, superintendent of motive power of the Pennsylvania Railroad; Carl W. Davis, of the J. H. McFarland Company; C. S. Coler, manager of the educational department of the Westinghouse Electric and Manufacturing Company; and P. C. Haldeman, master mechanic of the Luckens Iron and Steel Company.

Among the new buildings recommended by the committee were a main engineering building to replace one destroyed by fire in 1918, a building for the Department of Electrical Engineering; and a new foundry and transportation building.

To provide for the accommodation of a larger number of students in the Engineering School of the college as well as in the other schools, the raising of a fund of $2,000,000 is now planned. Health and welfare buildings will be erected as the initial step in the college's program for development into the state university when it will be able to admit 10,000 students.

American and Lima Receive Locomotive Orders

It is reported that the New York Central Lines have placed orders for 150 locomotives, half with the American Locomotive Co. and half with Lima Locomotive Works.

Earlier this year the same system placed orders for 75 switching locomotives at an approximate total cost of $2,500,000. The orders just placed will involve expenditure of about $7,000,000.

A National Engineering Museum

After the DeLamater-Ericsson Commemoration on March 9th, the 60th anniversary of the Battle between the Monitor and Merrimac, the American Society of Mechanical Engineers appointed a committee to co-operate with the committee in charge in making a collection of historical material connected with Mr. Cornelius H. DeLamater and Capt. John Ericsson during their 50 years' association (1840-1890) as the leading factors in the DeLamater Iron Works, at the foot of West 13th St., New York City. These works were the largest institution of their kind in their day and there during the period mentioned developments took place in Naval, Merchant-Marine, Ordnance and Industrial Engineering which helped materially to raise this nation from comparative unimportance to its recognition as the leading nation of the world, and yet of the details of this accomplishment there is no record. In fact there is nowhere a tangible record of any of the steps whereby this country has attained its present commanding position in the world.

In seeking for a permanent depository for the DeLamater-Ericsson Historical Collection the committee conferred with the Smithsonian Institution at Washington and its secretary sent with his reply his latest report on the National Museum which is under his custody.

The Smithsonian Institution then not only solicited the placing of the DeLamater-Ericsson Historical Collection in its National Museum but proposed the co-operation of the committee in establishing the nucleus there of a great National Engineering Museum comparable to the foreign museums to record the accomplishments, in the upbuilding of this nation, of its engineers who are only now beginning to secure a recognition of obligations too long deferred.

At the annual meeting of the American Society of Mechanical Engineers, there will be exhibited a part of the historical collection in the Engineering Societies' Building. Such of it as would be appropriate as representing the work of Capt. Ericsson will be sent as requested to the tercentenary of the City of Gothenburg, Sweden, to be held there next summer. On its return it will go with the rest of the collection to the National Museum at Washington.

Lima Locomotive Plans New Financing

The refinancing plan of the Lima Locomotive Works, proposed recently by the Directors, has been approved at a special meeting of the stockholders in Richmond, Va. The plan provides that 48,590 shares of $100 par common stock shall be converted into no par common at the rate of two shares of new stock for one of old. The shareholders likewise will have the right to subscribe, at $50 a share, for 1⅓ additional shares of no par common stock for each share of existing common stock.

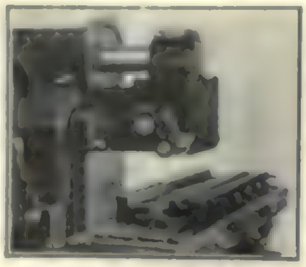
The preferred stockholders may also obtain the right of subscribing to the new common stock by converting their stock into new common.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

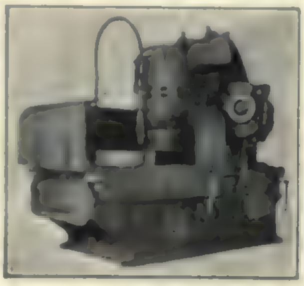
Attachment, Rack-Cutting, Milling Machine
Rockford Milling Machine Co., Rockford, Ill.
"American Machinist," April 20, 1922

The attachment is used primarily for cutting racks and is intended especially for use on the heavy-duty milling machine, but can also be furnished to fit the No. 1½ machine. It clamps to the face of the column of the machine and is driven from the main spindle. A rack vise and indexing attachment can also be furnished. Racks of different pitches can be indexed by various gear combinations. Eighteen change gears provide for cutting diametral pitches from 3 to 6 by half pitches, all pitches from 7 to 16 and all even pitches from 16 to 32; also circular pitches from [illegible] to 1 in., varying by [illegible] in. The rack vise has jaws 36 in. long that open 1½ inches.



Grinding Machine, Surface, Vertical, High-Power, No. 27-R
Blanchard Machine Co., Cambridge, Mass.
"American Machinist," April 27, 1922

The work is carried on a rotary magnetic chuck and both chuck and table are traversed by power. The annular grinding wheel is 27 in. in diameter and 7 in. deep. A 60-hp., 600 r.p.m. induction motor built into the wheelhead drives the wheel at 530 r.p.m. Power for other purposes is supplied by a 5-hp. motor. A wheel dresser attached to the head provides for dressing the face of the wheel while grinding. The head slides vertically on a massive column. Both hand and power feeds are provided, the power feed giving from 0.0005 to 0.005 in. per revolution of the chuck. Length, 12 ft. 6 in. Width, 7 ft. 6 in. Height, 10 ft. Floor space, 12 ft. 6 in. x 7 ft. Weight, 30,000 pounds.



Reamer, Piston-Pin Bushing, "X-Cel"
Alvord Reamer and Tool Co., Millersburg, Pa.
"American Machinist," April 27, 1922

The cutter and adjustment of this tool are much the same as in the regular Alvord adjustable reamer, but the shank and pilot stem are ground to an accurate sliding fit with the taper plug, and are parallel and concentric with the cutting edges. By passing the pilot stem through the piston-pin bushings, slipping the taper plug on the pilot and pressing it into the bushing, the reamer is centralized and supported, so that it reams the bushings in correct alignment with no chatter. No adjustment is necessary on the taper plug. The reamers are made in eight different sizes, and cover a range from ⅜ to 1 15/32 in. Set No. [illegible] consists of four reamers and will ream standard and oversize holes for practically all of the leading cars on the market.

Micrometer, No. 55
Brown & Sharpe Manufacturing Co., Providence, R. I.
"American Machinist," April 27, 1922

By means of four detachable anvils the range of the tool is increased, making it adaptable to measurements from 2 to 6 in., instead of from 2 to 5 in. as formerly. The anvils can be quickly changed and are held securely in place by a knurled nut. One anvil is for measurements from 2 to 3 in., another from 3 to 4 in., and so on. The tool is especially useful in garages and service stations where small pistons, many under 3 in. in diameter, and also large pistons for trucks and tractors, require accurate measurement. It can measure all ordinary sizes of pistons.

Stop, Safety, "Simplex"
Atlantic Co., 452 Classon Ave., Brooklyn, N. Y.
"American Machinist," April 20, 1922

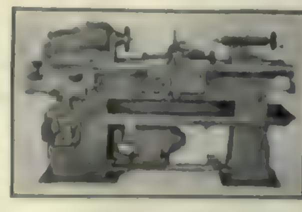
The device is intended for attachment to automatic machines and is used as a stop in case of irregularity or breakage of the work, or change in tension, size, or speed. It is operated by current from either a battery, generator, or regular lighting circuit. It is wired in series with a Mazda lamp, which remains unlighted normally because the circuit is open. The contact points are left without current again when the stop has acted. A latch in the stop holds a notched shifter rod that keeps the belt in the running position. If the contact points close the circuit the latch is released, and the spring in the rod immediately moves the belt to the loose pulley or disengages the clutch. A spring providing any force up to 75 lb. can be utilized, so that it is possible to shift a 6-in. belt. The stop itself is 3¼ x 2⅝ x 2¼ in. in size.

Grinding Machine, Crankshaft, Automotive, Universal, No. 4
Brown & Sharpe Mfg. Co., Providence, R. I.
"American Machinist," April 27, 1922

The machine is used in service shops for grinding automotive parts. With an internal grinding attachment and chuck, it does internal and face grinding, and with a toothrest, it will grind line reamers, milling cutters, and other tools. The throw-blocks are adjustable to different shaft diameters. With the piston arbor, time is saved in mounting pistons. The automatic crossfeed will move the wheel from 0.00025 to 0.004 in. at each reversal of the table. The speeds and feeds of the wheel, work and table are entirely independent. The grinding wheel, 24 in. in diameter, 1 in. thick, has a 5-in. hole, and is protected by a heavy guard. Swing, 22¾ in., 15¼ in. over the water guards. Maximum work length, 60 in.

Lathe, Toolroom, 14-Inch
Hendey Machine Co., Torrington, Conn.
"American Machinist," April 27, 1922

The motor is mounted on a shelf beneath the oil pan. It is controlled by push buttons and drives the speed-box through an Oldham coupling. Nine changes of speed are controlled by the two levers on the front, while the ratio of the back gearing makes nine additional speeds available, giving eighteen speeds in all. The complete range of threads and feeds provided is controlled by the two upper levers. The spindle end thrust bearing distributes the load evenly over the wearing surfaces and makes adjustment easy. The crossfeed and carriage traverse give accurate tapers or bevels when the two are used together. The tail spindle is graduated. The treadle along the front of the base serves to stop the lathe, without stopping the motor.



Bench Machine, Combination, "Reeves"
Ster-O-Lock Manufacturing Co., 417 So. Dearborn St., Chicago, Ill.
"American Machinist," April 27, 1922

This machine is a combination tool intended for use in the garage or service station, and can be used for drilling either wood or metal, for surfacing or sanding, disk grinding, polishing, buffing, rough or tool grinding, or for rip-sawing wood. The table through which the rip-saw protrudes can be entirely removed, or tilted for sawing at an angle. The horizontal disk at the upper end of the spindle is for disk grinding or surfacing. The vertical spindle has a range of 3¼ in. without adjustment, and is supplied with a Jacobs chuck that will take drills up to ⅜ in. The drilling table is adjustable.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The United States Pipe & Foundry Co. is installing four machines for the manufacture of cast iron pipe by the de Lavaud method at its North Birmingham plant.

The Wright Aeronautical Corporation, for the quarter ending June 30, 1922, reports net sales of $667,037 and net profits after $136,340.

The Chicago & Eastern Illinois Railway, for four months ended April 30, 1922, reports a net income of $325,856, after taxes and charges.

The Norfolk and Western Railway Co. reports gross earnings for June of $9,474,614, an increase of $2,417,224 over the corresponding month of 1921.

The Southern Pacific Co., for the six months ending June 30th, reports a net revenue from railway operations of $27,958,826, an increase of $5,014,210, over the same period of last year.

The National Tool Co., Cleveland, Ohio, has purchased the business of the SaveAll Tool Co., Waltham, Mass., manufacturers of the SaveAll Chuck. J. C. Dufresne will remain in the capacity of manager of the SaveAll department.

The Herberts Machinery and Supply Company, Los Angeles, Calif., announces that it has acquired the exclusive sales rights of the Gisholt Machine Co., Madison, Wis., for the states of Arizona, California and Nevada.

The American Refrigerating Machine Co., Inc., Hartford, Conn., has been incorporated under the laws of Connecticut to engage in the refrigerating machinery and tools of all kinds. The capital stock of the company is $50,000, and the incorporators are: Edward Carlson, Samuel Gilbert, and Gustaf Bernston, all of Hartford.

The Coppus Engineering Corporation, Worcester, Mass., industrial engineering and equipment, has recently been incorporated with a capital of $500,000, succeeding the Coppus Engineering and Equipment Co., incorporated in 1912, The concern manufactures steam turbines, pumps, turbine blowers, etc. The incorporators are: Frans H. C. Coppus, president; Otto Wachsberg, and Linwood M. Erskine, all of Worcester.

The C. G. Garrigus Co., Haddam, Conn., recently incorporated to manufacture and deal in machinery, tools, hardware, etc., with a capital of $50,000, organized last week with the election of Clarence G. Garrigus, president and treasurer; Howard L. Webster, vice-president; Alfred C. Garrigus, assistant treasurer and secretary; and Harold I. Arms, assistant secretary.

The Hi-Power Tool Corporation, Jackson, Mich., recently incorporated with a capital of $75,000, has taken possession of the plant formerly occupied by the Jackson Machine Co. and production is expected to start within the next thirty days. The officers of the new company are: M. C. Townley, president; Watson R. Smith, treasurer and general manager; Thomas Woodfield, vice-president, all of the city of Jackson. Richard W. Hansen, formerly with the Illinois Tool Co., Chicago, has been retained in the capacity of engineer to develop a line of hobs, reamers and milling cutters. Arthur Knapp, formerly of the Goddard Tool Co., will be sales manager and T. G. Trocke, also formerly with the Goddard Co., will be production manager.

The Penn Seaboard Steel Corporation, for the six months ended June 30, 1922, reports a deficit of $571,687, after charges and inventory adjustments.

The American Metal Co., Ltd., and subsidiary companies for quarter ended March 31, 1922, reports a net income of $508,304 before depreciation but after interest charges.

The Hercules Powder Co. reports net earnings for the first six months of the current year of $717,326, equivalent to $5.50 per share on the $7,150,000 common stock.

The American La France Fire Engine Co., for the six months ending June 30, 1922, reports operating profits of $456,-970 as compared with $452,653 in the corresponding period of 1921.

The Delaware, Lackawanna and Western Railroad Co., in its report for June, 1922, shows gross earnings of $5,-501,267 as compared with $7,566,132 in June, 1921. The decrease in earnings is attributed to heavy losses in traffic due to the coal strike.

The Otis Steel Co., Cleveland, has just issued $5,000,000 first mortgage, twenty-five year 7½ per cent gold bonds, the proceeds of their sale to be used in the construction of four open-hearth furnaces, a blooming mill, a sheet bar mill and a strip mill of 84,000 tons annual capacity.

The Ontario Steel Products Co., Ltd., Toronto, for year ended June 30, 1922, reports a profit of $141,083 compared with $223,446 in previous year. After deduction of interest, depreciation, dividends and inventory reserve, deficit was $150,987 against surplus of $32,946 in preceding year.

The B. F. Goodrich Co., for six months ended June 30, last, before interest and depreciation charges, reports net earnings of $3,877,000. After interest of $1,527,483 and depreciation of $1,037,836, net profits before federal taxes were $1,312,000, about equal to preferred dividend requirements for the period.

The Smith & Furbush Machine Co., and Proctor & Schwartz, Inc., both of Philadelphia, manufacturers of textile machinery, have been merged into a new company to be known as Procter & Schwartz, Inc., with a capitalization of $2,500,000. The officers of the new consolidation will be: Walter M. Schwartz, president; E. B. Ayers, Frederick Kershaw and Thomas W. Allen, vice-presidents; and Frank E. Schermerhorn, secretary and treasurer.

The Studebaker Corporation, for the second quarter of the current year, reports net profits of $7,086,552, after deducting for federal tax reserve. This is equivalent to $11.52 per share on the $60,000,000 common stock after preferred dividends and compares with $4,069,848 in the first quarter, equivalent to $6.49 per share on the same issue.

The Ford Motor Co. is reported to have produced 141,941 cars and trucks during the month of June in its American and foreign plants, an increase of 13,698 over May. This brings the half year total to 551,382 cars and trucks as against 442,142 in the corresponding period of 1921.

The Stewart Warner Speedometer Corp. for quarter ended June 30, 1922, reports profits before taxes of $1,605,-267, the largest in the history of the company, comparing with $601,945 in second quarter of 1921. For first half 1922 profits totaled $2,121,686, against $652,872 in same period of 1921.

The Roach-Appleton Manufacturing Co., 2446 North Crawford Ave., Chicago, has been recently incorporated for $100,000 for the purpose of manufacturing electrical specialties, such as protecting materials and also special stampings and assemblies. The officers of the company are: Ernest G. Appleton, president and treasurer; Walter O. Roach, vice-president and general manager, John N. Wilson, secretary, all of whom were formerly connected with the Chicago Fuse Mfg. Company.

Personals

James C. Potter, president of the Potter and Johnston Machine Co., manufacturer of machine tools, Pawtucket, R. I., recently returned from his business trip to Europe.

H. Wales Lines, president of the Meriden Machine Tool Co., forming turret and spinning lathes, Meriden, Conn., was elected a vice-president of the Meriden Savings Bank at its recent annual meeting.

W. C. Durant, president of the Durant Motors, Inc., New York, has become president of the Locomobile Company of America, makers of the well-known Locomobile pleasure automobile, and the Riker trucks, Bridgeport, Conn.

Fred W. Howe, vice-president of the Crompton and Knowles Loom Works, Providence, R. I., returned home last week after a three months' trip in China and Japan.

E. V. Swangren, formerly vice-president and superintenedent of the F. J. Littell Machine Co., Chicago, and W. N. Stevenson, formerly secretary and chief engineer of the same company, announce the formation of a partnership to be known as the S. & S. Machine Works, 4522 Lexington Street, Chicago.

Charles L. Harold, secretary of the Birmingham Civic Association, and also of the Southern Association of Rolled Steel Consumers, has resigned his position and will shortly enter upon a new line of activity.

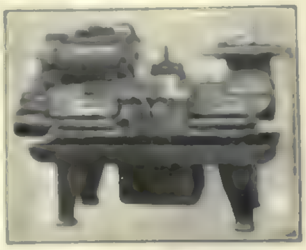
H. F. Barrus, who, for a number of years past, has been identified with the Union Twist Drill Co., Athol, Mass., will sail for England early in September where he will take up his new duties as general manager of Barrus & Cullen, of London.

A. A. Murphy, for many years past connected with Du Pont sales activities, has been appointed resident sales manager of the industrial and railway paint and varnish division of E. I. du Pont de Nemours and Co., with headquarters at 30 Church Street, New York City,

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Lathe, Manufacturing, "Sundstrand," 11-in.
Rockford Tool Co., Rockford, Ill.
"American Machinist," April 27, 1922

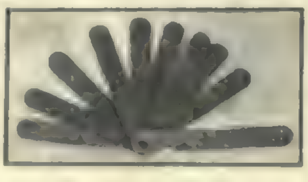


The machine is constructed on the same general principle as the 9-in. lathe but has a greater swing and adaptability. It is equipped with crossfeed, quick-change feed and reverse to the carriage, and is adaptable also to thread cutting. The drive is of the single-pulley type. An extension is provided at the outer end of the spindle for attaching air cylinders, draw-in attachments and expansion chucking devices. Swing: over carriage 12 in.; over cross-slide, 10 in. Distance between centers, 18 in. Speed of drive pulley, [illegible] r.p.m. Number of feeds, [illegible]. Number of spindle speeds, 9. Floor space, [illegible] in. Weight, [illegible] lb.

Reamer Holder
Marvin & Casler Co., Canastota, N. Y.
"American Machinist," April 27, 1922

The holder is used on screw machines or lathes and is not intended to float. The bushing or adapter sleeve is mounted on the turret of the lathe. After the work has been bored, the cone-shaped centering plug in the holder faceplate enters the hole to make the faceplate concentric with the lathe spindle. Capscrews are tightened to secure the faceplate. The plug is removed and the reamer holding sleeve is inserted. This sleeve holds the center line of the reamer on the center line of the work and of the machine spindle. Faceplates, holder sleeves and center plugs are interchangeable, and the sleeves can be supplied in sizes to suit the reamers used.

Gage, Thickness, Feeler, Locking
Lufkin Rule Co., Saginaw, Mich.
"American Machinist," April 27, 1922



The thickness or feeler gage is adapted particularly to the use of automobile mechanics and repair men, and is provided with a lock which consists merely of a knurled head nut that clamps the leaves tightly together. Fits can be gaged in places difficult of access. The gage is made in several styles with from six to nine leaves. The No. 109 tool shown has a case in which the blades fold. On all styles the leaves are $\frac{1}{2}$ in. wide and 3 in. long and can be easily removed. If two leaves are separated from the others and locked in position, they may be used as the upper and lower limits for a fit. When the gage is closed and locked, the blades are protected.

Sand-Cutting Machine, Power, Type HP
American Foundry Equipment Co., 336 Madison Ave., New York, N. Y.
"American Machinist," April 27, 1922

The machine is for use in foundries for cutting and tempering sand. It is similar in general construction to the former model. [illegible] and tempering may be accomplished without any [illegible], and sand may be piled or thrown into windrows. The drive wheels are driven by a motor running in either direction at two speeds of [illegible] and [illegible] ft. per minute. By tilting the frame by means of the handwheel at the front, the cutting cylinder can be lowered into the sand. This cylinder is driven by a [illegible] motor. Length, 91 in. Width, [illegible] in. Cutting cylinder length, 44 in. Weight, [illegible] pounds.

Punching and Shearing Machine, Combination, Triple, Ocking
Amplex, Inc., 6 West 32d St., New York, N. Y.
"American Machinist," April 27, 1922

The machine does not occupy much floor space, and can be adapted to different types of work without changing tools. On the operator's side it is clear of encumbrances such as flywheels and driving gears. It has a slanting centering slide. The plate shear has longer knives than in the former models. The frame is cast steel. The smallest size machine is the No. 13, which will split $\frac{3}{8}$-in. plates and cut $3\frac{1}{2}$ in. angles, with a punching capacity of $\frac{5}{8}$-in. holes in $\frac{3}{8}$-in. material. The largest size machine is the No. 32, which will split $1\frac{1}{4}$-in. plates, cut 8 x 8 x $\frac{7}{8}$ in. angles and punch $1\frac{5}{8}$-in. holes in 1-in. material.

Staybolt Machines, Horizontal, Styles A and B
Dale Machinery Co., Inc., New York, N. Y.
"American Machinist," April 27, 1922

The style B machine illustrated is used for turning simultaneously taper and straight diameters on staybolt forgings and for threading continuously and simultaneously both the straight and taper ends. The front head has an adjustable taper attachment. Both dieheads are automatically tripped at the end of the cut, and are automatically closed. The style A machine is used to make side stays from the bar and turns the relieved portion in the center of the bolt and threads both ends in uniform pitch and continuous lead. A hexagonal turret is mounted on a slide, moving directly on the ways of the machine. The stock is fed through the spindle and automatic chuck by the bar feed.

Etching Pencil Outfit, Electric
Luma Electric Equipment Co., 405 Spitzer Bldg., Toledo, Ohio
"American Machinist," April 27, 1922

The device, consisting of a magnetic table and the pencil itself, is adaptable to etching or writing on hardened steel, demagnetizing steel, annealing and soldering. By using the magnetic table, work that has been placed on a magnetic chuck can be easily demagnetized, or tools may be magnetized. When used in annealing, the cord of the pencil is attached to the top connection on the side of the instrument, and the point is replaced by one of carbon. The outfit is operated from an ordinary lighting circuit of 110-volt, 60-cycle, alternating current.

Furnace, Forging and Rivet-Heating, Oil-Burning, Portable
Wayne Oil Tank and Pump Co., Ft. Wayne, Ind.
"American Machinist," April 27, 1922

The forging and welding furnace is used in shops where it is necessary that the equipment be moved about. The tank will withstand a working pressure of 100 lb. per square inch and is fitted with a safety valve. The 2-in. air-tight filling opening is conveniently located. The fireclay shapes can be quickly renewed. Air pressure is obtained by connecting the furnace to the compressed-air line which supplies the riveting hammers. Work opening: Width, 6 in.; height, 3 to 4 in. Height, 51 in. Depth, 25 in. Width, 31 in. Weight, 600 lb.

Clip, paste on 3 x 5-in. cards and file as desired

where the company's paint and varnish division has recently opened new offices.

ROBERT W. APPLETON, production engineer of the Pierce Arrow Motor Car Co., Buffalo, N. Y., has been appointed manager of purchases of the company. Mr. Appleton, who will also continue his duties as production engineer, has been identified with the Pierce Arrow factory for more than twenty years.

CHARLES F. GOEDKE of the William Ganschow Co., Chicago, Ill., has been elected treasurer of the American Gear Manufacturers' Association.

A. J. WURTZ, professor of electrical engineering at the Carnegie Institute of Technology has retired from the staff of that department to devote his entire attention to research work in that subject for the division of co-operative research.

E. B. PHILLIPS, for the past two years instructor in electrical engineering at the U. S. Naval Academy, has been appointed instructor in the same branch of study at the Carnegie Institute of Technology, Pittsburg.

R. E. CAROTHERS, formerly manager of the turbine section, Westinghouse Electric and Manufacturing Co., Pittsburgh, has been appointed manager of the steam turbine division of that company.

JAMES A. BEAUBIEN has been appointed manager of the New York office of the Pennsylvania Pump and Compressor Co., Easton, Pa., and will be located at 30 Church Street, New York City.

CHARLES F. LLOYD, formerly manager of the Substation Section, Westinghouse Electric and Manufacturing Co., Pittsburgh, has been made manager of the electric division of the company.

WENDELL E. WHIPP, manager of the Monarch Machine Tool Co. and president of the Whipp Machine Tool Co., Sidney, Ohio, addressed the Kiwanis Club of that city on business conditions at its recent meeting.

BRUCE H. LYTLE has been promoted to the position of manager of the substation section, Westinghouse Electric and Manufacturing Co., Pittsburgh.

A. B. NEUMAN, for a number of years past engaged in consulting engineering work in Chicago, has been appointed manager of the branch sales office in that city of the Mesta Machine Co., Pittsburgh, Pa.

Obituary

CHARLES E. THWING, sales manager of the Worcester Lathe Co., Worcester, Mass., died at his home in that city, July 9, after five months' illness at the age of 61 years. He was one of the best known lathe salesman in the country, and began his career as a bookkeeper for the Lathe and Morse Tool Co., Worcester, of which his father, Edwin A. Thwing was for many years agent. At one time Mr. Thwing was sales manager for the Whitcomb-Blaisdell Machine Tool Co., Worcester, leaving that company to become treasurer of the Draper Machine Tool Co., Worcester. This company later was taken over by the Whitcomb-Blaisdell Machine Tool Co. and Mr. Thwing went with it. When Alonzo W. Whitcomb, president, left the company some years ago and started the Worcester Lathe Co., Mr. Thwing joined him in his old capacity.

EDWARD R. CALDWELL, founder of the E. R. Caldwell and Son Brass Co., Syracuse, N. Y., died at his home in that city recently at the age of 58 years after a long illness. He organized the Central Brass Co. here 31 years ago, and later the Caldwell & Ward Brass Co., both still in operation.

PETER ECKEL, president of the Eckel-Nye Steel Co., Syracuse, N. Y., died recently at the Memorial Hospital in that city following an operation, at the age of 67 years. Mr. Eckel was at one time superintendent of the Sweet Manufacturing Co. and later was with the re-organized Sweet Steel Co. of Syracuse. With his brothers he founded the Eckel-Nye company about twenty-five years ago.

Book Reviews

The Gantt Chart. By Wallace Clark. Published by the Ronald Press Co., New York City, N. Y.

Mr. Clark writes as the acknowledged literary executor and disciple of Henry L. Gantt among whose contributions to the science of more intelligent management were undoubtedly the control and progress charts which have come to bear his name. This book is eloquent testimony to the truth that all big and good ideas are essentially simple. The idea that it is good business to utilize a method of charting the amount of idle time of machines, of recording the actual as against the expected production of individual workers, of showing by simple bar charts the progress of work within departments and by departments—this does not sound profound, nor yet strikingly ingenious. Yet it took Mr. Gantt and his co-workers to develop a technique of chart design and procedure which had never before been worked out, which has given effective results in practice, which has applications to many types of control problems not yet fully realized.

Mr. Clark's is deliberately a book of elementary exposition. It is most useful too, and the industrial statistician, administrative accountant and co-ordinating executive will find suggestions in the text which can be turned to good account. Administrators will find here a practical statement of how one group of engineers applied a sound principle of management. The literature of scientific methods of business control is definitely enriched by this contribution, well deserving of a place on the desk of every executive.

Production Engineering and Cost Keeping for Machine Shops. By Wm. R. Basset and Johnson Heywood. 311 pages, 6 x 9 in., 115 illustrations. Published by the McGraw-Hill Book Co., New York. Price $3.50.

Having as its basis the articles which appeared in *American Machinist* under the title of "Modern Production Methods," this book takes up many subjects which are of vital interest to all who have to do with the economical production of machinery or machine parts. The twenty-six chapters include planning, purchasing, stockkeeping, engineering, tools, shop layout, central control of production and the control of work in the shop. Planning work in a jobbing shop will appeal to many, as most shops have more or less work which comes under this head. Time study fundamentals, setting standards and piece rates as well as special cases of each are given careful attention, while time study on automatic machines has a short chapter of its own.

The fundamentals of cost systems are taken up and the authors point out just what benefit they can be expected to confer. Fixed charges, the various phases of overhead expense, analyzing labor costs, accounting for supplies and getting the overhead into the finished product, are treated in considerable detail. The last five chapters deal with the handling of abnormal expense, the gathering of final costs; statements, both of conditions and operating; the cost of selling and graphic methods of control. These give just the points which are needed by many shop managers, and not always in small shops either.

The various subjects are handled in clear and easily understandable language and the many examples help to make them plain in every way. The authors are evidently students of shop psychology as well as systems, which adds materially to the value of the book. The effect of certain methods on men is discussed from a broad viewpoint which will aid managers who have not been through the shop in understanding the men's reaction on various matters. It is a thoroughly practical book and one which can be heartily recommended to managers and to shop executives who wish to go up the ladder.

Trade Catalogs

Self-Opening Die Heads and Collapsible Taps. The Victor Tool Co., Waynesboro, Pa. A booklet showing installations of the Victor self opening die heads and collapsible taps in machine shop work. The booklet also describes the nut facing machines and the floating reamer holders made by this company.

Automatic Electric Furnaces. Automatic and Electric Furnaces Limited, 281 Grays Inn Road, London, W. C. 1, England. A twenty-page catalog describing the Wild-Barfield automatic electric furnaces for steel hardening. The catalog contains a general description of the product, a theoretical and practical discussion of the pyroscopic detector data on vertical hardening and flat furnaces and information relative to oil tempering and salt tempering baths. Illustrative and descriptive matter on air tempering muffles, maturing ovens, pyrometers, and magnetic sclerometers is also given.

Rapid Production Lathes. The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. A special bulletin of eleven pages, just issued, giving a detailed description with numerous illustrations of the LeBlond 11 inch heavy duty rapid production lathe. The bulletin also contans complete specifications covering the machine.

Multi-Cut Lathes. The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. A new general catalog containing complete descriptive matter on and illustrations of the LeBlond multi-cut lathe. Set forth in the catalog are detailed descriptions on the special features of construction with numerous halftones and line cuts. Typical multi-cut tool layouts are featured and setting table for the machine is given. On page 29, by means of line drawings, are shown samples of parts of various styles on which the machine has effected time saving in machining.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., October 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Machine Tool Builders' Association. Annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

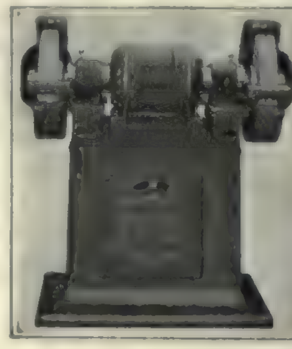
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Hoist Operator, Chain, "Handiman"
New Jersey Foundry and Machine Co., New York, N. Y.
"American Machinist," April 27, 1922

The device is for operating hand-power hoists of [illegible] of larger capacity and is an electrically driven machine that may be suspended in the bight of the operating chain. It has a capacity to overhaul 135 ft. of chain per minute, with a chain pull of 150 lb. It is driven by a [illegible]-hp. motor attached to the frame and running in either direction. The worm-wheel shaft carries a grooved sheave with a V-shaped rubber tread to fit any size and pitch of operating chain and to prevent slipping. The machine is [illegible]. Current may be supplied from a lamp socket. Weight, [illegible] pounds.

Grinder, Heavy-Duty, A. C. Motor
J. G. Blount Co., Everett, Mass.
"American Machinist," April 27, 1922

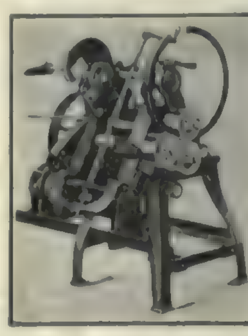


The grinder has a 5-hp. heavy-duty motor and is made for wheels 18 x 3 x 1½ in., or 16 x 3 x 1½ in. The end shields are of cast iron, turned with a recess and bolted directly to the motor frame. Adjustable wheel guards are furnished either plain or of the exhaust type. The work supports are adjustable. The safety starting switch is mounted within the column on a separate panel. The machine is furnished with an a. c. motor either for 220- or 440-volt, 60-cycle, 2- or 3-phase, or for 550-volt, 60-cycle, 3-phase current. Weight, 1,200 pounds.

Gear-Tooth Rounding Machine
Cross Gear and Engine Co., Detroit, Mich.
"American Machinist," May 4, 1922

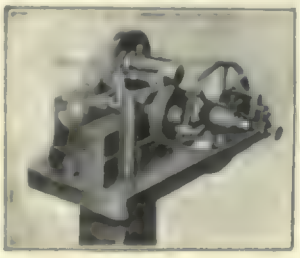
The machine is for accurately rounding at high speed the tooth corners of straight and helical spur gears and of spiral bevel gears and pinions. The cutter is rotated by a pulley on the head. To suit the tooth thickness, the eccentricity of the cutter spindle housing can be varied by means of an adjusting screw. The machine is made in three sizes, can be furnished with special heads for carrying the gears, and can be equipped for motor drive. Capacities: No. 1, up to 4-pitch, 24-in. diameter and up to 2-pitch, 16-in. diameter. No. 2, up to 4-pitch, 36-in. diameter, and 2-pitch, 30-in. diameter. No. 3, 1- to 4-pitch, up to 60-in. diameter.

Bending Machine, Angle, No. 14
Excelsior Tool and Machine Co., East St. Louis, Ill.
"American Machinist," May 4, 1922



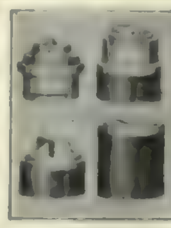
The machine is used for bending angle iron into circular form. Bar and T-iron can also be formed with the same rolls, but special rolls are required for pipe and channel iron. All three roll shafts are driven, so that small circles can be rolled by one pass through the machine with the flange on either the inside or the outside. The machine, which may be furnished either with or without the cutting attachment or the motor drive, requires 3 hp. to operate. Capacity, angle iron up to 2 x 2 x ¼ in. Height, 5 ft. Floor space, 4 x 5 ft. Weight, 1,800 pounds.

Sharpening Machine, Saw, Automatic, No. 2
George Scherr, 126 Liberty St., New York, N. Y.
"American Machinist," May 4, 1922



The machine is larger than the No. 1 model, and is intended for sharpening circular saws from 1½ to 8 in. in diameter. It is used on all types of circular metal saws, screw slotting cutters and jewelers' and slitting saws. Saws up to ⅛-in. thick with holes from ⅜ to 1 in. in diameter can be handled. Indexing is done by means of the saw being sharpened, although saws with broken teeth can be handled. The machine measures 12 x 24 x 36 in., the column being 30 in. high. Wheel, 4½ x ⅜ in. Weight, 135 pounds.

Furniture, Machine, Jack, Blocks and T-Slot Nut
Marvin & Casler Co., Canastota, N. Y.
"American Machinist," May 4, 1922




The equipment is used on the tables of machine tools when setting up work. The T-slot nut shown at the right is generally used when an additional clamp is placed on work secured to a machine table. Diameter, ⅝ to 1 in.; length, 1⅝ to 3 in.; width of head, 1$\frac{1}{16}$ to 2 in. At the left are shown jacks used on machine tables for leveling work. The jack screw is of fine pitch, has a point at one end and a flat surface on the other, and can be extended ⅝ in. The tubular extension blocks are placed under the jack to increase the height. Minimum height of jack: to top of point, 1⅞ in.; to top of surface, 1⅝ in. Extension blocks: outside diameter, 2⅜ in.; lengths, 1, 2¼, 4⅞, 9½ inches.

Planer and Jointer, Hand, Portable, Motor-Driven, 4- and 6-In., No. 133
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," May 4, 1922

The machine is intended to replace the hand plane when planing and fitting wood. The 4-in. machine has a [illegible]-hp. motor and planes 4½ in. wide, while the 6-in. machine has a [illegible]-hp. motor and planes 6½ in. wide. Both sizes rabbet up to ½ in. The tables are raised and lowered by means of hand-wheels and screws. The cutter head is fitted with three knives, and is directly connected to the electric motor operating at 3,600 r.p.m. on either a. c. or d. c. of 110 or 220 volts. An attachment for setting and sharpening the knives and a floor column can be furnished.

Trestle, Steel, Demountable, "Eureka"
Reinhold Bettermann, Johnstown, Pa.
"American Machinist," May 4, 1922

The trestle is for use in an industrial plant to support work. Each stool has four legs braced together to form a pyramid. The stools can be used individually for supporting automobile rear axles; and they can be supplied with a special slot at the top, for use under axles fitted with truss rods. To form the trestle, two stools support the T-bar. Notches in the bar allow the distance between the stools to be varied. Height, from 13½ to 30 in. Weight, from 11 to 30 lb. Trestles with the legs riveted to the T-bar can also be supplied with a standard height of 30 in. and a length of 42 inches.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Ala., Birmingham—East Pratt Coal Co., 621 Chamber of Commerce Bldg., T. W. Morgan, Pres.—one vertical drill press up to 3½ in. drill.

Fla., Buena Vista—Buena Vista Automobile Works—complete garage machinery and equipment, including lathe, drill press, reamer, and small tools (new or used).

Mass., Fitchburg—Fitchburg Pumping Mchy. Co., H. Gordon, Dir.—additional machinery and tools for proposed $125,000 plant at East Akron, O.

Mass., Woburn—Massachusetts Gear & Tool Co., E. R. Lyman, Mgr.—one Universal grinder, No. 1 Brown and Sharpe or equivalent, with complete equipment including internal grinding attachment, also Cincinnati No. 1½ cutter and tool grinder, or equivalent.

Mich., Saginaw—Miles Mchy. Co., 205 Bearinger Bldg.—cut-off machines, drills, key seaters, milling machines and other tools.

Miss., Jackson—Lauchley Fdry. Machine Co., B. W. Lauchley, Pres.—equipment for foundry and machine shop.

N. J., Patterson—The Sipp Machine Co., Erie R.R., Keen and Warren Sts., W. Toll, Asst. Secy.—one automatic threading lathe (used).

N. Y., Buffalo—C. F. Dunning, 1480 Jefferson Ave.—equipment for automobile repair shop.

N. Y., New York—The New York Central R.R., Grand Central Station, Purch. Dept.—one motor driven improved 6 spindle vertical bolt threading and turning machine, capacity up to 36 in. long.

O., Cleveland—The Bd. of Educ., East 6th St. and Rockwell Ave.—one motor drive wood lathe, No. 20C, complete with 220 v., d.c. motor, with starting box. Also the following equipment for Patrick Henry, Rawlings and Audubon Schools, (previous bids have been rescinded)—two hollow chisel mortiser, block sander, 4 bar folding machines, 4 punch and shear machines, 4 forming rollers, 4 burring machines, 4 turning machines, 2 wiring machines, 2 hand forges, 2 variety saw benches, 2 cabinet planers, 2 combined oil stone grinders, 4 lathes, 4 10 in. bench drills, 4 two-wheel grinders, 4 squaring shears.

O., Columbus—White Machine Co., 240 North High St., C. White Pres.—machine tools, including drill press, lathe, 24 in. grinders, etc.

Okla., Tulsa—McCann Motor Co., 633 North Main St.—one 16 in. power lathe.

Pa., Phila.—Roberts & Manders Stove Co., 11th St. and Washington Ave.—foundry machinery including cranes, boring machines, drills, etc.

Wis., Appleton—Herman Motor Co., 680 College Ave.—machinery for auto repair shop.

Wis., Black Earth—R. A. Hermann—equipment for auto repair shop.

Wis., Milwaukee—General Battery & Motor Service, 1008 29th St., A. Ebener, Purch. Agt.—machinery for auto repair shop.

Wis., Milwaukee—Heller Elevator Co., 250 Milwaukee St.—planer and lathe.

Wis., Milwaukee—J. Kokotez, 511 National Ave., (auto repairs)—repair machinery including drill press.

Wis., Milwaukee—A. A. Magritz, 1078 25th St.—sheet metal working machinery.

Wis., Watertown—Klinger & Mayer, 200 1st St.—machinery for automobile repairing, including crane and power press.

Que., Montreal—H. Rayment, 412 1st Ave. Rosemont—complete equipment for garage and automobile repairs.

Que., Montreal—O. Roberts, 340 Hingston Ave.—complete equipment for automobile repair shop.

Que., Westmount—F. S. Cape, 460 Wood Ave.—equipment for garage.

Machinery Wanted

Fla., Brooksville—Florida Veneer & Grate Co., J. Coogler, Purch. Agt.—one mortiser, tenoner, rounding and nailing machines and other miscellaneous machinery for the manufacture of boxes (new or used).

Fla., Lake Eustis—Lake Eustis Fruit Co., B. Dillard, mgr.—machinery for proposed fruit canning factory.

Fla., Ocala—Smoak & Goni—woodworking machinery for the manufacture of automobile and truck bodies, including various saws, jointer, tenoner, sander, etc., also small tools for automobile and tire repairs (used or new).

Fla., Tampa—Consumers Ice Co., Polk and Marion Sts.—will receive bids until Oct. 1 for ice machinery for proposed plant, 30 ton daily capacity.

Ga., Mt. Airy—W. A. Smith—cotton mill machinery, capacity 5,000 spindles.

Ind., Goshen—News Printing Co.—linotype machine, model K.

Kan., Wichita—R. W. Parks, 1832 South Wichita Ave.—one 18 in. planer for cabinet work.

Ky., Ashland—Pittsburgh Brick & Tile Co., c/o S. S. Willis—machinery and equipment for brick manufacturing plant at Summit.

Mass., Worcester — Ettrick Finishing Wks., Box 445—two Woonsocket nappers, 90 in. long, double action.

Minn., Duluth—McDougall Terminal Warehouse Co., 510 Alworth Bldg.,—equipment for refrigerating and artificial ice plant on Railroad St. and 9th Ave. W.

Minn., Frazee — Frazee Co-operative Creamery Co., F. O. Anorison, Mgr.—one 10 ton ice machine, 2 cream vats, and one 30 hp. boiler.

Miss., Hattiesburg — Hattiesburg Pine Oils Co., V. M. Scanlon, Pres.—machinery and equipment for the manufacture of turpentine, oil and various pine oil products.

Neb., Lincoln—Lincoln Rug Factory, 2373 O St., D. O. Pettit, Pres.—power cutting and fraying machine; power or hand looms for making rugs; machinery for rug cleaning.

N. J., Hammonton—Littlefield Ice & Coal Co.—complete refrigeration machinery and equipment for proposed ice plant.

N. Y., Buffalo—O. E. Bray, 1009 Mutual Life Bldg.—special machinery and equipment for the manufacture of patented Plankstone (concrete blocks treated with other materials), for several factories in western New York.

N. Y., Buffalo—H. S. Lockwood, 220 Triangle St.—printing equipment for proposed plant on South Park Ave. and Reading St.

N. Y., Jamestown—Lindbeck Lumber & Mfg. Co., 16 River St. (manufacturers of wood work, trim and dealers in lumber)—conveying and woodworking machinery for new addition to factory.

N. Y., North Tonowanda—Transfer Lumber & Shingle Co., Main St., C. Betz, Purch. Agt.—machinery and equipment for the manufacture of stained shingles, for proposed plant at Minneapolis, Minn.

N. Y., Owego—Gotham Shoe Co., Church St.—machinery and equipment for proposed shoe factory on Church St.

N. Y., Rochester—Vacuum Oil Co., 926 Exchange St.—machinery and equipment for proposed barrel washing plant.

N. Y., Tonowanda—The Transfer Lumber & Shingle Co.—machinery and equipment for stained shingle plant in Minneapolis, Minn.

N. C., Newton—S. D. Houk, c/o Newton Oil & Fertilizer Co.—machinery for proposed fertilizer mill.

N. C., Winston-Salem—Fogle Furniture Co., F. A. Fogle, Pres. and mgr.—woodworking machinery for furniture factory.

O., Columbus—Clark Show Case Co., 31 West Chestnut St.—wood and metal working machinery.

O., Dennison—Dennison Lumber Co., J. C. Roby, genl. mgr.—woodworking machinery for planing mill.

O., Niles—Atlas China Co., A. H. Ahrendt, Pres.—machinery and equipment for proposed addition to plant.

O., South Akron (Akron P. O.)—Washington Rubber Co., (manufacturer of rubber specialties)—equipment to replace that which was destroyed by fire.

Pa., Ellwood City—Consolidated Stone & Mining Co.—complete equipment and machinery for proposed cement block factory on Wampum Rd., capacity 21 blocks per minute.

Pa., Grove City—McKays Carriage Wks., Brie Ave.—machinery for 1-story factory addition.

Pa., Phila.—Apex Hosiery Co., Lawrence and Luzerne Sts., W. Meyer, Purch. Agt.—full fashion knitting machines including latch needle machine and dyeing machinery.

Pa., Phila.—Huges & Bradley Co., 10th St. and Washington Ave., J. C. Wollman, Purch. Agt.—circular and flat knitting machines, and hand frame looms, for textile manufacturing plants.

Pa., Phila.—E. L. Mansure & Co.—1415 North St.—looms for new textile manufacturing mill.

Pa., Phila.—Motor Exchange, 327 North 3rd St.—chain hoist, 40 ft. lift.

Pa., Phila.—Wilson & Co., 10 South 18th St.—additional presses and equipment for print shop.

Pa., Pittsburgh—H. C. Frick Coke Co., Carnegie Bldg.—mammoth belt in 20 separate lengths of rubberized fabric, length over all about 9 miles, 4 ft. wide, ⅜ of an in. thick 350 tons, for use in coal mines for carrying coal through a four mile tunnel.

Pa., Reading—E. R. Meinig, McKnight St. bet. Greenwich and Oley Sts.—complete machinery and equipment for proposed 7 story hosiery factory.

Pa., Scranton—E. H. Schlesser, 1006 Scranton St.—paint shop machinery and spraying apparatus and complete mechanical equipment for large addition to garage and paint shop.

Pa., Vandergrift—Bd. of Educ.—equipment for vocational department of proposed High School.

Pa., Warren—Crescent Furniture Co.—machinery for furniture factory, including planers, saws, stickers, etc.

S. C., Beaufort—Beaufort Gazette, S. F. Sherman, Mgr.—$10,000 worth printing machinery for proposed publishing plant.

S. C., Sumter—Sumter Ice & Fuel Co., E. H. Moses, Mgr.—machinery for proposed creamery and ice plant.

Tenn., Waverly—J. P. Cowe Co. (cotton mill)—knitting mill machinery for the manufacture of hosiery.

Va., Rich Creek—Ace Lumber Co., T. E. Ballard, Secy.—mill and woodworking machinery (used or new).

Va., Wytheville—R. P. Johnson—one 4 side planer and matcher to handle lumber up to 20 in., also self feed rip saw, (used).

Wis., Bavaria (Gleason P. O.)—H. Brei, Route 1—cheese making machinery and vats.

Wis., Hartford—Hillside Co-operative Dairy Co., Route 4, E. C. Retzlaff, Purch. Agt.—power churns, separators and belting.

Wis., Madison—J. Feldman Paper Box Co., 515 Regent St.—special machinery for box factory.

Wis., Madison—Madison Gas & Electric Co., 120 East Main St., Mead & Seastone, Engrs., State Journal Bldg.—Engineers are receiving bids for ash handling equipment for power house.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances.—Recent mill rise in blue annealed sheets reflected in advance of 12c. in Chicago and 25c. per 100 lb. in Cleveland warehouses. Floor plates up 25c. in Cleveland; steel bars and shapes, 2c. and bands, 12c. in Chicago. Steel shapes, plates and bars quoted at $1.70@$1.80 per 100 lb., Pittsburgh. Quotations at the lower figure, however, difficult to obtain even on large tonnages. On current business, as high as $1.90@$2 has been quoted on plates and $2 per 100 lb. on shapes.

Tin quoted at 33½c. as against 32½c. and zinc at 6⅞c. as compared with 6⁷⁄₁₆c. per lb., last week. Brass sheets and tubing up ½c.; brass wire and rods, 1c. and babbitt metal, ½c. per lb. in New York warehouses. Babbitt metal up ½c. in Cleveland. Copper market slightly firmer. Lead prices steady; sales heavier. Dealers' purchasing prices of old copper and zinc advanced slightly in Cleveland and Chicago.

Declines.—Drop of ½c. per lb. in dealers' purchasing prices of old lead, in Cleveland. Raw linseed oil down 2c. per gal. (5 bbl. lots) in New York.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.50
Northern Basic	26.52
Southern Ohio No. 2	26.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.66
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	28.32
Virginia No. 2	29.74
Basic	26.00
Grey Forge	26.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.50
Basic	25.50
Bessemer	25.50

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.40@2.60	3.78	3.50	3.75
No. 12	2.45@2.65	[illegible]	3.55	3.80
No. 14	2.50@2.70	3.88	3.60	3.85
No. 16	2.70@2.90	3.98	3.70	3.95
Black				
Nos. 17 and 21	3.00@3.25	4.15	3.80	4.30
Nos. 22 and 24	3.05@3.30	4.20	[illegible]	4.30
Nos. 25 and 26	3.10@3.35	4.25	3.90	4.35
No. 28	3.15@3.40	4.35	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.85
Hoop steel	3.78	3.50	3.48
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	4.80	4.91	5.08
Cold finished shafting or screw	3.50	3.30	3.40
Cold finished flats, squares	4.00	3.80	3.90
Structural shapes (base)	2.83	2.66	2.70
Soft steel bars (base)	2.73	2.56	2.60
Soft steel bar shapes (base)	2.73	2.56	2.60
Soft steel bands (base)	3.38	3.06	3.35
Tank plates (base)	2.83	2.66	2.38
Bar iron (2.20 at mill)	2.70	2.21	2.28
Drill rod (from list)	55@60%	55%	50%

Electric welding wire:

³⁄₃₂	8.00	12@13
⅛	6.50	11@12
³⁄₁₆ to ¼	6.25	10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	33.12½
Lead (up to carlots), St. Louis, 5.40; New York	6.00
Zinc (up to carlots), St. Louis, 6.00; New York	6.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	18.50	18.75
Brass tubing (100-lb. lots)	21.50	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	16.25	21.50	15.75
Brass wire (carlots)	18.25	17.75	.....
Zinc sheets (casks)	8.50	.....	.....
Solder (½ and ½), (caselots)	23.00	22.00	20.00
Babbitt metal (fair grade)	24.50	42.00	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	12.00
Copper, heavy, and wire	11.75	11.50	11.25
Copper, light, and bottoms	9.75	9.75	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6 25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.25	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.15	1.01
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville..per net ton		$10.50@11.00	
Coke, prompt foundry, Connellsville..per net ton		10.50@11.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	50%	65–10%	60%
1¼ and 1¼x3 in. up to 12 in	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	....	$4.00 off
Button head bolts, with hex. nuts	25%	$3.90 net	.....
Hex. head and hex. nut bolts	30%	....	65-5%
Lag screws, coach screws	50%	....	60-5%
Square and hex. head cap screws	70–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60%	50-5%
Bolt ends, with hot pressed nuts	50%	....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70–10%	80%
Case-hardened nuts	60%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$4.00	$3.25	$3.25
Cone heads, ditto (net)	4.10	3.35	3.35
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.35 base
Copper rivets	55–5%	50%	50-%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40 10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

Wis., Milwaukee—M. L. Buck, 3719 Grand Ave., (garage)—chain hoist similar to [illegible] and for machine shop work.

Wis., Milwaukee—New Way Service Co., 1827 North Ave., B. Adelman, Purch. Agt.—[illegible] machinery.

Wis., Oshkosh—[illegible] Co., W. C. [illegible], Purch. Agt.—power [illegible] machines and electric motors.

Wis., Waukesha—Manitowoc Church Furniture Co., [illegible] Lincoln Ave., wood-working machinery for the manufacture of church furniture.

Wis., Waukesha—The Spring City Auto Co., [illegible] Main St., W.—gas storage tank and pump.

Wyo., Casper—The Texas Co., J. A. Wall, Purch. Agt.—equipment for 6,000 bbl. oil refinery.

N. B., St. Johns—Nasgwak Paper Mills Ltd.—machinery and equipment for paper mill [illegible].

Ont., Chatham—[illegible] Oil & Gas Co., L. A. [illegible]—machinery and equipment for proposed gasoline absorption plants in Western Canada, Northern Alberta.

Ont., Fort William—Fort William Paper Mills—machinery and equipment for proposed paper mill.

Ont., London—[illegible] Egg Ltd., 372 [illegible] St.—manufacturer of egg sterilizing equipment—A. R. Routledge, Pres.—wood and metal working machinery for making special parts.

Ont., St. Thomas—[illegible] Tractors, Ltd., H. [illegible], West Lorne, Engr.—wood and metal working machinery, tools and gasoline engines for tractors and parts.

Ont., Toronto—Durant Motors of Canada, [illegible] Royal Bank Bldg.—equipment for machine shop and for proposed automobile factory at Leaside.

Ont., Toronto—Taylor Rubber Co., 37 [illegible] St. E.—[illegible] moulds and [illegible] for auto tire factory in Aurora.

Ont., Welland—Maple Leaf Milling Co., R. [illegible], Mgr.—flour milling machinery and equipment.

Ont., Windsor—Windsor Steam Motors, Ltd.—complete machinery and equipment for proposed steam automobile plant.

Mex., Tampico—Pierce Oil Corp.—equipment for refinery partially destroyed by fire.

Metal Working Shops

Cal., San Francisco—W. P. Fuller Co., [illegible] and Mission Sts., has awarded the contract for the construction of a garage. Estimated cost [illegible].

Conn., Hartford—Greenwood & Noerr, Engrs. and Archts., 847 Main St., are receiving bids for the construction of a 4 story, 52 x 131 ft. factory, for the manufacture of electric specialties, for Hart & [illegible] Mfg. Co., Capitol Ave. Estimated cost $125,000.

Conn., Stamford—Frankel & Warshaw, 262 Atlantic St., are receiving bids for the construction of a 2 story, 85 x 90 ft. garage on State St. Estimated cost $40,000. S. Z. Levine, Gurley Bldg., Archt.

Ill., Evanston—C. C. Henderson, Archt., 105 South La Salle St., is receiving bids for the construction of a 1 and 2 story, 66 x 204 ft. garage at 1622-24 Chicago Ave., for J. E. [illegible], 1707 Ridge Ave. Estimated cost $40,000.

Ind., Indianapolis—Olin Sales Co., 515 [illegible] plans to build a 2 story, [illegible] ft. [illegible] sales and service station at [illegible] North Meridian St. Estimated cost $150,000. Architect not selected.

Mass., South Boston (Boston P. O.)—National Can Co., 36 Washington St., will soon award the contract for the construction of a 2 story, 92 x 160 ft. factory, a 2 story, 20 x 40 ft. storehouse, and a 1 story, [illegible] ft. garage on [illegible] St. Estimated cost $125,000. Noted Apr. 12.

O., Cleveland—Cleveland Heater Co., 1906 West 112th St., is receiving bids for the construction of a 1 story, 80 x 240 ft. factory on West 112th St. and Locust Ave. Estimated cost $100,000. L. Friedman, [illegible] & Co., Century Bldg., Engrs. and Archts.

O., Cleveland—D. [illegible] & Son, Stop 2, [illegible], had plans prepared for the construction of a 1 story, 42 x 275 ft. foundry and shop. Estimated cost [illegible]. H. W. [illegible], [illegible] Bldg., Archt.

O., Cleveland—F. P. Screw Co., 2921 East 79th St., has awarded the contract for the construction of a 1 story, 25 x 160 ft. factory, at 2921 East 79th St. Estimated cost $40,000.

O., Cleveland Heights (Warrensville P. O.)—W. Van Bergan, Stop 14, Mayfield Rd., plans to build a 1 story, 74 x 109 ft. garage at 2204 Lee Rd. Estimated cost $45,000. Private plans.

Pa., Butler—Hinman Bros., 1017 7th Ave., have awarded the contract for the construction of a 2 story, 100 x 150 ft. garage on Green Ave. and 8th St. Estimated cost $60,000.

Pa., Freedom—Freedom Oil Wks. is having plans prepared for the construction of a 2 story, 48 x 75 ft. garage and repair shop addition. J. E. Martsolf, 513 3rd Ave., New Brighton, Archt.

Pa., Grove City—McKays Carriage Wks., Erie St., manufacturer of automobile bus bodies and other carriages, has awarded the contract for the construction of a 1 story factory addition.—Estimated cost $10,000.

Pa., Hatboro—Roberts & Manders Stove Co., 11th and Washington Sts., has awarded the contract for the construction of a 2 story, 16 x 60 ft. and a 1 story, 125 x 185 ft. factory. Estimated cost $50,000. Private plans.

Pa., New Kensington—National Auto Service Co. has awarded the contract for the construction of a 1 story, 25 x 60 ft. and 60 x 70 ft. garage, at 1030 5th Ave. Estimated cost $40,00.

Pa., Osgood—Du Roth Steel Truck & Car Wheel Co., 611 Keystone Bldg., Pittsburgh, plans to build a manufacturing plant here, the first unit to be 100 x 200 ft. Estimated cost $1,500,000. C. E. Long, 1202 Peoples Bank Bldg., Engr.

Pa., Phila.—National Biscuit Co., 10th Ave. and 15th St., New York City, has awarded the contract for the construction of a 1 story, 130 x 184 ft. garage on 12th and Glenwood Sts., here. Estimated cost $50,000. A. G. Zimmerman, 85 9th Ave., New York City, Archt.

Pa., Pitcairn—Pennsylvania R. R., Broad St. Sta., Phila., is having plans prepared and will soon receive bids for the superstructure of a steel car repair shop, here. Estimated cost $300,000. A. C. Shand, Ch. Engr.

Pa., Pittsburgh—Commercial Land Co. c/o F. M. Love, 235 Water St., is receiving bids for the construction of a 4 story garage on Rebecca St. and Baum Blvd. Estimated cost $175,000. Private plans. Buick Motor Co., Baum Blvd. and Euclid Ave., lessees.

Pa., Pittsburgh—Hunting Davis Co., archts., Century Bldg., is receiving bids for the construction of a 1 story, 41 x 108 ft. garage addition for T. Donaldson, c/o Donaldson McAleer Motor Co., 1100 Western Ave.

Pa., Pittsburgh—W. H. Stulen, Archt., 101 Market St., is receiving bids for the construction of a 2 story, 34 x 115 ft. factory addition, for the manufacture of toys, for D. N. Carlin Co., 125 Denniston Ave. Estimated cost $20,000.

Pa., Warren—Warren Tank Car Co. will rebuild its tank car factory and repair plant destroyed by fire. Estimated cost $75,000. Private plans. Noted June 22.

Pa., Waynesboro—The Frick Co., (steam engine and boiler works), will build a 1 story, 200 x 600 ft. addition to its plant. Private plans. Noted Mar. 24.

Tenn., Knoxville—Iddens Mchy. Co. will soon receive bids for the construction of a 1 story plant. Estimated cost $50,000. Architect not announced.

W. Va., Beckley—The Raleigh Motor Co. is having plans prepared for the construction of a 2 story, 49 x 146 ft. garage on East Main St. Estimated cost $60,000. H. M. Miller, Roanoke, Va., Archt.

W. Va., Wheeling—The McGraw Co. (Ford Agency), Bellaire, O., is having plans prepared for the construction of a 2 story, 98 x 125 ft. garage at 2011 Main St., here. Estimated cost $40,000. Architectural Dept. of Ford Motor Co., Detroit, Mich., Engrs.

Wis., Appleton—Hermann Motor Co., 680 College Ave., plans to build a 2 story, 80 x 80 ft. garage and repair shop on College Ave. Estimated cost $40,000. Architect not selected.

Wis., Black Earth—R. A. Hermann plans to build a 1 story, 50 x 70 ft. garage on Main St. Estimated cost $40,000. Architect not selected.

Wis., Nekoosa—Nekoosa Iron Wks. will build a 1 story, 50 x 75 ft. machine shop and foundry. Estimated cost $40,000. M. J. Powers, Pres.

Wis., Waukesha—The Spring City Auto Co., 220 Main St., W., is receiving bids for the construction of a 1 and 2 story, 50 x 132 ft. garage. Estimated cost $40,000. M. H. Blake, Andrews Blk., Archt. Noted June 8.

Ont., Leaside—Durant Motors of Canada, 909 Royal Bank Bldg., Toronto, is receiving bids for the construction of an auto factory including a 1 story 40 x 100 ft., 3 story 80 x 401 ft., 3 story 100 x 401 ft., 1 story 20 x 200 ft. and 1 story 130 x 500 ft. buildings, here. Estimated cost $500,000. Private plans.

General Manufacturing

Cal., Oakland—General Electric Co., Rialto Bldg., San Francisco, has awarded the contract for the construction of a 132 x 236 ft. factory on 14th and 54th Sts., here. Estimated cost $100,000.

Conn., Essex—E. E. Dickenson & Co. has awarded the contract for the construction of a 3 story, 40 x 100 ft. addition to its witch hazel plant. Estimated cost $40,000. Noted June 29.

Conn., Hartford—The Hartford Ice Cream Co., 380 Windsor Ave., is receiving bids for the construction of a 2 story, 40 x 80 ice cream plant.—Estimated cost $30,000. Private plans.

Fla., Auburndale—Auburndale Citrus Growers Assn. has awarded the contract for the construction of a 1 story 80 x 125 ft. packing plant. Estimated cost $18,000. E. B. Sands, Mgr.

Ill., Chicago—W. F. Hall Co., Chicago and Kingsbury Sts., plans to build a printing plant, (in units), on Kilpatrick between Diverse and Wellington Sts. Estimated cost $8,000000. Architect not announced.

Ill., Chicago—Henschien & McLaren, Archts., 1637 Prairie Ave., will soon receive bids for the construction of a 4 story, 75 x 150 ft. packing plant near the Union stock yards, for the Western Packing & Provision Co., 3854 South Morgan St. Estimated cost $170,000.

Ind., Anderson—National Tile Co., 25th and Pitts Sts., has awarded the contract for the construction of a 1 story, 86 x 435 ft. tile plant. Estimated cost $50,000.

Me., Lewiston—The Lewiston Bleachery & Dye Wks., Lisbon St., has awarded the contract for the construction of a 3 story, 40 x 110 ft. addition to its sheeting department.—Estimated cost $40,000. Private plans.

Minn., Duluth—McDougall Terminal Warehouse Co., 510 Alworth Bldg., has awarded the contract for the construction of a 6 story 200 x 500 ft. refrigerating plant and terminal warehouse on Railroad St. and 9th Ave., W.—Estimated cost $1,000,000. A. M. McDougall Pres.

Minn., Minneapolis—Western Newspaper Union, 200 North 3rd St., has awarded the contract for the construction of a 2 story, 46 x 134 ft. printing plant and office building at 316 8th Ave. S. Estimated cost $125,000.

O., Cleveland—Glenville Hospital c/o A. White, Supt., 701 Parkwood Dr., will soon award the contract for the construction of a 1 story, 36 x 50 ft. laundry. Estimated cost $50,000. J. W. C. Corbusier, 1038 Keith Bldg., Archt.

O., Zanesville—Kerns Gersuch Bottle Co. has awarded the contract for the construction of a 1 story, 24 x 40 ft. factory. Estimated cost $100,000.

Pa., Phila.—Apex Hosiery Co., Lawrence & Luzerne St.—has awarded the contract for the construction of a 6 story, 90 x 155 ft. factory.—Estimated cost $150,000. Private plans. Noted Jan. 20, 1921.

Pa., Phila.—E. I. DuPont Paint Co., 35th St., and Grays Ferry Rd., will build a 1 story, 63 x 113 ft. factory.—Estimated cost $12,000. Private plans.

Pa., Pittsburgh—The Pittsburgh Forge & Iron Co., Chamber of Commerce Bldg., plans to build a 1 story, 26 x 64 ft. carpenter shop on 26th St. W. G. Wilkins Co., Westinghouse Bldg., Archts.

Pa., West Hickory—H. H. Smith & Co., will rebuild its 2 story, 68 x 72 ft., and 50 x 140 ft. tannery and bleach house which was destroyed by fire. Estimated cost $50,000. Noted June 29.

American Machinist

Volume 57 NEW YORK, AUGUST 10, 1922 Number 6

Compulsory Unemployment Insurance and its Effect on the Machinery Industry

Manufacturers in Two States Facing Compulsory Unemployment Insurance—Humanitarianism Ignores Economic Laws—Inelastic Demand a Factor in Machinery Industry

BY ERNEST F. DUBRUL
General Manager, National Machine Tool Builders' Association

THE industries of Massachusetts and Wisconsin face agitation advocated by people who have a very worthy desire to improve the conditions of wage earners. Unfortunately, such sentiment often takes on an impractical character, as in the advocacy of unemployment insurance in the two states named. No doubt such legislation will be presented in other states during the coming year. It is well, therefore, for manufacturers to be fortified with arguments against such legislation, and the following is submitted for your information to be used whenever the occasion arises.

The bills now being agitated in the states of Wisconsin and Massachusetts would be absolutely disastrous to the machinery industries of those states for a very fundamental economic reason: That is, that the demand for machinery is of a most inelastic character. These bills in effect provide that, if, after a workman has been employed for a given length of time, he be laid off through no fault of his own, an unemployment dole or compensation shall be paid to him for another period of time.

Let us see how this affects the machine building industries. Machines have absolutely no demand in and of themselves. Theirs is a derived demand, that arises only when there is a market for the products of the machines, though increased material comfort obtained by increased consumption of material goods is possible only by the increased use of machinery. No industry can, for very long, produce more goods than it can sell, whether its force be 5 or 5,000 men, and whether its product be special and made on contract, or be of such a nature that it can be made for stock. A shop working on special or contract machinery gives the clearest illustration of the principle involved.

Unemployment is mostly due to the operations of the economic cycle, and the evils of unemployment are more apparent in times of depression than at any other time. This accounts for the attempts in such periods to mitigate the evils by legislation. Such times of depression are also financially the most dangerous for the employer. Therefore, the proponents of unemployment insurance propose to compel the employer to pay out unemployment doles just when he can least afford to do so, and when such doles would further drain his cash resources, already more than sufficiently burdened from various other causes.

> UNEMPLOYMENT is mostly due to the operations of the economic cycle and the evils of unemployment are more apparent in times of depression than at any other time.
>
> Bradstreet's statistics of failures show that the metal working industries have had the worst experience of all the manufacturing industries. To add unemployment doles to their other burdens would put more concerns out of business than the present bad conditions have done.
>
> Insurance as a science can never insure things that lie so much in the domain of politics, so influenced byfeelings and emotions as the unemployment problem.
>
> To ask the individual to do what cannot be done by scientific insurance is asking the impossible.

An employer making contract machine work has no alternative when general business slumps but to lay off his men. He cannot possibly find employment in such times for all the men he had used when his business was good. He does not lay them off for caprice; he wants to get work for them and for his shop as well. To compel such an employer to pay wages or any percentage of wages to the men previously employed, would compel him to pay out money without any possibility of receiving any return therefor. Could he possibly make his price on the product sold during active times high enough to include the paying of unemployment doles to the men who might be discharged immediately on completion of a certain job? The tremendous addition in cost that would have to be made in all estimates to cover these contingencies would result in such inflation in prices as to prevent exchange. Could any employer possibly get any mathematical basis of experience on which to base any such estimates?

A favorite argument of the proponents of unemployment compensation is that it would compel the employer to continue employment and make goods for stock. Consider two machine builders making an equivalent line of machinery.

In one case as the demand falls off after a boom has passed, the management ceases production as order-

are filled. Even so, there will surely be some outstanding orders for materials, orders that had to be placed far ahead, in anticipation of delays in delivery of materials, to permit a continuing schedule of manufacturing. These "Impending Inventories" so-called, are always of larger dollar value than the current requirements of a dull period. The orders must be placed ahead for larger quantities than would be the case were deliveries prompt. Then, as soon as deliveries improve with the fall in demand, these inventories come in on the manufacturer. Often the rush is great enough to swamp many concerns who have not been sufficiently careful to avoid over-ordering of this sort. Even the best forecaster is sure to get stuck with some inventories of that kind, and they are always high priced. Even though the cash position is very sound and provides enough to carry the key organization over the slump with the reduced demand, the fall in price on the components of the material inventory is a dead loss on what has to be carried.

Adding to his natural and unavoidable burdens, the unemployment insurance law would compel this employer to pay out additional amounts of cash as unemployment compensation to the men laid off. No concern could do so unless it had charged enough more for its product during the boom to provide that cash when it was needed, the amount depending on the provisions of the law, of course. And if it did so it would be called a profiteer by the uninformed sentimentalists.

Working Up Large Inventories

Now, suppose that a direct competitor of this concern were to continue production and work up these inventories in order to give his men employment. He would deplete his bank account of the cash he would invest in the additional labor, of course. As he continued, his warehouses would fill up with machines built at high costs for labor and material, machines that would later on find themselves in competition with low cost machines built by the wiser competitor who had shut down when the boom passed. If the depression lasts long enough even this employer must shut down for lack of cash, for due to the nature of demand for machinery his stock is very slow moving.

If, in addition to what he spent for labor in working up stock, his cash account is to be drained by the additional unemployment dole his position is still further weakened. More than that, the competitor who first shut down will be in better position to re-employ good men at lower wages as soon as demand shows signs of revival. He then will get the pick of the labor market, including the best men laid off by the man who overstocked. All this will make for lower costs and lower prices, and still greater loss to the one who continued employment.

As it would be doubly disastrous to continue employment for that reason, there is no sane basis for the argument that by compelling employers to pay unemployment insurance they will be compelled to keep men employed.

Effect of Obsolescence of Product

The history of every depression shows that precisely in such times are improvements mostly made in machine designs. This is perfectly natural, for two reasons: First, because the machine builder has more time to think in periods of that sort, when the pressure of production is relieved; and second, because the pressure of competition and the necessity of getting business drives him to coax every possible bit of business his way by bringing out newer and better machines.

The competitor who was wise enough to shut off his production early is probably fully fortified with new designs, ready to be brought out when the market is down. If a design is very far in advance of previous practice, that new design simply wipes out the potential value of the stock of older types of machines left on the hands of any producer. This makes over-stocking particularly disastrous to the machine builder. The relative value of old types of machines will not be at all in accordance even with the replacement cost. It will accord with the relative utility of such machines in production of the goods they were designed to make. Obsolescence loss due to over-stocking is an ever present and very large danger to machine builders in every depression. This danger makes it all the more imperative for them to shut down until cost conditions are stabilized at lower levels.

Machine builders naturally have a bad "load factor" and the effect of their load factor must be carefully considered before legislation of this sort is allowed to pass.

Consumer and Producer Goods

Some advocates of unemployment doles are college professors, not producers of physical goods. As consumers they seem to view production as mainly the production of consumer goods. As a matter of fact, the great mass of production is production of producer goods; that is, goods used for further production, or processing.

Only a very small part of the production of any one year goes into consumption that year. The most elastic demands are those for consumer goods of perishable nature. Even the perishable consumer articles have a varying elasticity in their demand according to the varying conditions of the purchasing power of the country and according to the psychological attitude which in some cyclical stages diminishes the will-to-buy even though the power-to-buy is present.

Relatively small reductions in price of some commodities would correspondingly widen the market and restore the unit demand. But even in such cases it is necessary for the manufacturer to keep his costs going down in line with reduced prices, if he is to make a profit. That means that he must get more output per dollar of wages paid, either by getting more production per dollar or by reducing wage rates.

Theoretically he might sell the market short from day to day or week to week and get his costs down below the sale price—if he cannot increase output.

Evil Effects of Unemployment Insurance Laws

If his shop is full of orders his workmen will not accept a reduction of wages. In his present stage of economic education the wage earner cannot recognize the necessity and desirability of accepting progressive cuts in wages that would bring down costs in conformity with prices. The inevitable consequence of wage cuts so made is to breed strikes, with their usual manifestations, without reducing wages. He finds it difficult to reduce wages without stopping production.

If unemployment insurance laws were in effect, and an employer sought to reduce cost by reducing wages, and keeping the shop full of orders taken at lower

prices, such an employer would surely be accused of cutting wages to bring on a strike and thereby avoid the payment of unemployment compensation. For this reason also, the unemployment dole would not work out in practice to continue employment, even in industries having an elastic demand, that would respond to lower prices.

In England experience with unemployment doles shows that many workers preferred to lie idle and amuse themselves, as long as the small dole was forthcoming, rather than to hunt a fresh demand for their services at reduced pay on the new job. In such cases, the unemployment dole increased unemployment and did not reduce it.

If, through misguided sentiment, the states of Wisconsin and Massachusetts should be burdened with this sort of legislation, the machine industries of those states will experience many relative difficulties in competition with employers of other states, unless and until similar economic fallacies and misguided sentiment would procure the passage of similar bills in other states. Meanwhile, the machine builders in Wisconsin and Massachusetts would be greatly weakened and many of them no doubt would be put out of business by the conditions created by the worthy desire to mitigate the evils of unemployment.

Bradstreet's statistics of failures show that the metal working industries have had the worst experience of all the manufacturing industries. Certainly to add unemployment doles to their other burdens would put more concerns out of business than the present bad conditions have done. Could the social loss and wastage of capital caused by the wrecking of businesses that offer employment, offset the doles that would be paid to the employees that would be supposed to be protected by the unemployment insurance?

Scientific Insurance Impossible

The worst thing about some of these bills is that they seek to put the burden of the unemployment dole directly on each employer, instead of providing some scientific insurance basis on which to calculate the risks. These bills are general, and apply to all industries alike, regardless of the fact that the demand for the product of each industry is entirely different in its nature and in the effect its elasticity must exercise on wise managerial policy. To provide scientific insurance, on an actuarial basis, that would make each industry carry its fair share of burden would be an almost impossible task. No man can possibly vision a fair basis of that sort, because human caprice shifts demand over night. There have been times when factories making articles of wearing apparel like bustles, beads, and hoop-skirts, have found the decrees of fashion to wipe out their demand over night, and the workers had to hunt for other jobs, and so did the factory. How could any actuary devise a formula that would furnish a scientific insurance basis for unemployment compensation in such cases?

Nearly every producer must gamble more or less on his judgment of the consumer's taste, to tempt the consumer to part with money in exchange for his own commodity. This is a heavy enough risk without adding to it the additional burden of paying out doles that in England encouraged idleness, while the employer himself has to hunt a job through change in demand, and may face bankruptcy besides.

An Economic "Sport"

No legislator, no social reformer, no matter how sincere, can afford to make the burdens of industry more than they are now. Advocates of all sorts of social legislation are indulging in the favorite economic sport of hounding the manufacturer. They cannot believe that the hated employer must conform to the operations of the business cycle if he would stay *in* business and give employment and produce goods to supply the wants even of the reformers, to say nothing of paying taxes, like the Excess Profits Tax, that penalized progress. Many such people cannot be made to realize that employment can be continuous only as business is healthy. Too many, through ignorance or envy, look on profit as an exploitation of the manual worker. They cannot believe that after all the losses of all industry are taken up over a long period of time, the final remainder left, if proportionately distributed to all the business men in the industry, would be a small per capita reward for their organizing ability and their courage in taking the risks out of which the small net profit arose.

True, some men do get big rewards, but they are very few and far between—"For many run, indeed, but only one gains the prize." It is precisely that human hope or optimism that tempts so many to run in spite of the fact that only a few can and do succeed. Kill that hope, and society will never progress. Russia's example should be enough for memory. Each individual, whether worker or employer, has his own part to look after in earning the world's living, and he can only exchange his own commodities or services for those of others.

Insurance as a science can never insure things that lie so much in the domain of politics, so influenced by feelings and emotions, as the unemployment question.

To ask the individual to do what cannot be done by scientific insurance is asking the impossible.

Unemployment—A Management Problem

Basis for Public Insurance Not Yet Developed in United States—European Systems Grew Out of Private Efforts

THE basis for applying public insurance to the relief or prevention of unemployment in the United States without enormous cost does not exist as yet, according to a study of the question just issued by the National Industrial Conference Board, under the title "Unemployment Insurance in Theory and Practice." This basis has been provided in European countries where such insurance is in use, by fairly definite knowledge of the rate of unemployment and its stabilization and reduction through the efforts of workers and employers. In the United States, where the rate of unemployment is normally more than twice as high as in Europe, where little accurate knowledge exists regarding it, where private organization and activities in relation to unemployment have not developed to any great degree, and where the great extent and political organization of the country would make the administration of legislation difficult and costly, the problem invites the voluntary co-operative effort of industry and the public before compulsory legislation is resorted to.

Summary of the Report

According to the theory of insurance, the economic application of the insurance principle to unemployment requires: (1) That the risk of unemployment for the group covered be relatively constant, definitely determinable and reduced to a minimum; (2) that the cost, when determined on the basis of a constant risk arising from causes beyond the control of the worker, be distributed so as to give an incentive for its further reduction.

The problem of unemployment insurance from a practical point of view, therefore, is one of deciding whether the unemployment contingency may be more definitely prevented and provided for at less cost and with more equitable distribution of the burden by means of public insurance than through some other form of co-operative effort toward prevention or relief. This involves the specific questions regarding the extent to which other forms of co-operative relief or prevention are available; to what extent it is possible to determine, stabilize and reduce the average risk; and to what extent the direct costs and benefits can be distributed so as to be equitable and so as to tend toward a reduction of the contingency.

The development of co-operative unemployment relief and prevention measures in all countries where such measures have been tried indicate: (1) That they have grown up in correspondence with an increase in the frequency and seriousness of unemployment, with the recognition of the inadequacy of individual provision for relief and an increasing sense of social responsibility; (2) that the private co-operative measures have served as a basis for social measures; (3) that these private measures have become insurance measures to the extent that the cost could be diminished, through reducing, stabilizing and determining the risk; (4) that public or social insurance systems have been developed out of private insurance measures so far as the latter have proven inadequate or excessively costly from the insurance point of view and so far as the sense of social responsibility has led society to assume part or all of the burden and distribute it over certain groups; and (5) that, finally, these social insurance measures have proven successful from the insurance point of view to the extent that their cost has been diminished by limiting their scope and determining, stabilizing and reducing the risk through assisting private co-operative efforts, through basing their actuarial features on the experience with these private efforts and supplementing them by special measures such as labor exchanges.

Co-operative Benefit Funds

The voluntary co-operative measures such as trade union benefit funds and friendly society aid have been accepted for many years in England and certain other countries of Europe as a means of meeting unemployment contingencies, but they have not developed to any great extent in the United States. The advantages of such systems of mutual aid are that they spring from the voluntary initiative of groups of workers, whose risk of unemployment is approximately equal, and that within a narrow area they may serve to reduce unemployment and malingering. They fail generally because of the relatively small number of workmen reached, because they afford no incentive to industrial forces which might assist in improving employment conditions, because the field for placing members out of work is limited, and finally, because their cost is relatively high and their financial or contractual basis insecure.

The municipal funds subscribed either by public or private organizations to relieve the distress from unemployment among workers who also contribute to the same fund have not been a success because they have attracted unfavorable risks, the cost has been very high and the solvency of the funds insecure. They have not enlisted the co-operation of the employing group and have afforded relief to only a small proportion of local workmen in seasonal trades.

Public subsidies to workmen's benefit funds have overcome some of these difficulties because they have been based on a more calculable risk and the solvency of the funds has been maintained through the assistance of the public treasury. The weakness of this system is that unorganized workmen have received little or no benefit from it and that the position of the union workers has been correspondingly strengthened. This system has not taken into account the employer as a factor in the unemployment situation, but relied only on such efforts as the labor organization could make to secure employment for their members. These defects led to the introduction of a form of universal compulsory insurance through a state fund.

Compulsory insurance against unemployment exists in Great Britain, Russia, Austria and Italy, and is under consideration in Belgium and Germany. The British system, put into operation in 1912, was the result of careful study of the subsidized voluntary plans and developed out of earlier attempts to meet the problem of unemployment through Poor Law Relief and through labor exchanges. The British system, in con-

trast to continental unemployment insurance systems, was devised primarily to provide relief for regular unemployment instead of abnormal unemployment in emergencies. It was designed to protect organized and unorganized workers alike and so to distribute the risk among as large a group as possible as to make the cost small in relation to potential benefits. It was established on an actuarial basis afforded by trade union employment records and was designed to promote the accumulation of a reserve to tide over bad years.

Failure of the British Fund

The British Unemployment Insurance Fund became exhausted in 1921 and has involved a large drain on the public treasury since that time, largely because of three circumstances: (1) The acute business depression which caused sudden and long unemployment of large numbers, (2) the inclusion immediately prior to the beginning of the industrial depression of eight million workers not previously insured who drew benefits after making only a few contributions, and (3) the provision for payment to insured workers of special benefits without corresponding contributions, in order to relieve the distress of those who had exhausted their rights to benefits. The system, though possibly financially sound in relation to normal unemployment, proved inadequate under the stress of extreme emergency; it has done practically nothing to stimulate efforts for reduction of unemployment by employers, employees and the state, and the administrative machinery has been found extremely costly. Improvements in the administration of the system, particularly as related to the labor exchanges and the payment of benefits, are under consideration. It is doubtful, however, how much the system could have reduced unemployment because it was adopted after practically every other method of meeting the problem of unemployment had been tried and because unemployment in normal years had probably nearly reached a minimum.

The question of the adoption of a system of public unemployment insurance in the United States involves two specific questions: Is there need for such a system here, and does an adequate basis for the economical application of the insurance principle to unemployment exist in this country?

The studies of the board show that there is in the United States in normal times a considerable body of wage earners without employment, a large proportion of whom may be presumed to be in need of relief. This proportion of wage earners without work is considerably higher in the United States than in the industrial countries of Europe and the available means of relief by voluntary effort are much fewer than abroad. Accurate knowledge of the volume of unemployment and of the extent to which unemployed workers are able to provide for themselves in individual or co-operative ways is, however, lacking here and the extent of the need for systematic relief cannot be fully known until more adequate information exists in regard to unemployment, wage conditions, standards and cost of living, differences in seasonality of industries and savings.

Studies by the board have shown that much can be done by individual employers, and co-ordinated industrial effort to reduce unemployment and some progress in this direction has been made. Although the plans inaugurated in particular establishments cover as yet so small a percentage of the industrial workers of the country as not to have greatly affected the general unemployment contingency, they suggest the possibilities of bringing private initiative to bear on the problems in a variety of ways suited to the special requirements of different groups of workers in industry. They indicate that there exists an increasing sense of industrial responsibility in relation to unemployment and that as technical methods of providing relief and preventive devices are worked out, the cost may be reduced and the worker in time bear some part of it. The private measures so far used to meet the unemployment problem are for the most part relief measures and appear to have been successful as the cost has been reduced through the development of preventive features and the systematization of relief.

The private efforts of employers, trade unions, and other organizations to provide for or prevent unemployment have not as yet, however, developed to an extent sufficient to afford an adequate basis upon which to build a system of public insurance in the United States. The unemployment risk among American wage earners is not known with any degree of definiteness, but available figures indicate that compared with industrial countries in Europe the rate is very high and has not been reduced to a working minimum. The financial basis which would be required for an actuarially safe insurance system in the United States would involve an enormous expense. Furthermore, the political organization of the United States would make the adoption of a national system of unemployment insurance impossible without constitutional changes, and the country's vast extent, diversified industries and social composition would create under such a system an administrative problem of gigantic proportions and cost. If, on the other hand, a system of unemployment insurance were to be built up by the separate states, the complications arising from attempting co-operation between the states in the placement of workers and adjustment of compensation would likewise present administrative problems of difficulty, especially in view of the probability that the legislation in the separate states would differ widely. In addition to these difficulties is the fact that there does not exist in most states either a system of labor exchanges or comprehensive organizations of wage earners, either one of which European experiences indicates as a necessary basis for a public insurance scheme.

Not Ready for Public Insurance

Such legislation for public unemployment insurance as that projected in the Wisconsin Bill of 1921 and others modelled on it, is based on the recognition of the necessity of promoting individual effort to determine, stabilize and reduce the unemployment risk. On its actual success in achieving this end in practice, depends its cost and effectiveness in the relief of unemployment. This is dependent on better knowledge regarding unemployment and on the extent to which similar methods are adopted in other states and over the country as a whole. Such extensive adoption would require nation-wide legislation which would be of great practical difficulty and great cost. The final question raised by such legislation is whether the stimulation of private co-operative efforts to reduce unemployment which are necessary to meet the need for unemployment relief and serve as a basis for any extended system, can be more economically and effectively achieved by compulsory legislation than by some other means? The problem is, therefore, put squarely to industrial management in the United States to devise such other means.

Forced and Shrink Fits in Machine Construction and Repair

By W. S. Standiford

The holding of wheels on shafts by means of forced or shrink fits, instead of the usual method of securing the parts by means of keys, does not seem to be used to the extent that it should, considering the excellent results that are obtained with such parts as gear wheels that are subjected to heavy vibration. Pinions held on shafts by keys will not stand jarring for any length of time, and sooner or later they become loose. In case the pressure exerted upon a pinion is continuous, the latter will remain fast upon its shaft for a much longer time than where the motion is intermittent and jerky.

Two keys a quarter-circle from each other will enable a pinion to remain solid longer on its shaft; but the writer has found by experience that, when continuously running machinery is desired, it is much better to force a gear wheel on a shaft by hydraulic pressure, no key being needed. A pinion or gear wheel pressed on in this manner will remain until it requires to be removed because of worn teeth, removal often being quickly effected by cutting a slot in the bottom of a tooth, forcing a wedge in the slot and knocking the wheel off with a hammer. In making pressed or forced fits, the difference in diameter of the members is not great, as all that is needed is to have the grip sufficiently tight to prevent the parts from slipping and coming off. Any heavier pressure puts a strain upon the metal around the hole and may cause a cast-iron pinion to break while in action.

The usual practice among mechanics in fitting work of this kind is to judge the amount of oversize for the internal member by the feel of a caliper; but this is a very uncertain method, as errors are likely to be made in judging sizes. The right way of taking such measurements is by means of an inside micrometer in the hole, and an outside micrometer on the shaft. This puts all measurements upon an exact basis, the worker knowing just what allowance has been given in thousandths of an inch. A mechanic always gains by doing all such work as carefully as possible, as bad habits once formed are hard to break and often lead to spoiled work.

There is a limit to the size of fits that can be forced or pressed. This is due to the fact that as the diameter of the fit increases, more powerful apparatus is required to press the parts together, so that a point is soon reached where it does not pay to keep an expensive and powerful machine for only occasional use. Force fits are generally made on such comparatively small objects as crankpins, car-wheel axles and machine parts.

Allowances for Fits

In judging the proper allowance for a press fit, several factors have to be taken into consideration; namely, the thickness of metal surrounding the hole, the kind and quality of the material of which the parts are made, the size of the work, and also the smoothness and accuracy of the bore and shaft that are to be fitted together. As a general rule, to make a press fit of the greatest possible strength, there should be a difference in the sizes of the parts to be fitted together of from 0.002 to 0.003 in. for each inch of diameter.

The following rule will serve to give an idea of the pressure needed for making forced fits for different shaft diameters: The required pressure in tons will be the fit allowance in thousandths of an inch, multiplied by the diameter of the shaft in inches and also by the factor of $1\frac{1}{2}$. As an example, suppose that a gear wheel is to be forced on a 4-in. shaft, the allowance being 0.002 in. for each inch of diameter.

$$4 \times 0.002 = 0.008 \text{ in. allowance.}$$

The pressure in tons will be $8 \times 4 \times 1\frac{1}{2} = 48$ tons.

On smaller diameters of shafts where a very strong grip between the parts is desired, the larger allowance of 0.003 in. can be used.

It will be apparent that, if the allowance figures given were adhered to for very large sized shafts, the required pressure would be very great and beyond the capacity of the appliances found in most shops. To show this clearly, we will suppose that a 14-in. crankpin is to be fitted into its disk.

Then, $0.002 \times 14 = 0.028$ in.,

And, $28 \times 14 \times 1\frac{1}{2} = 588$

tons pressure needed to do the work. Very few factories possess the facilities for obtaining such heavy pressure. However, the extra-tight fits are usually unnecessary. In practice, for a shaft of 14-in. size, it will be found that a 0.012 in. total allowance will hold tightly, the tonnage necessary to force the parts together being very much less.

Some mechanics taper the sections to be fitted, thinking that tighter fits will result. This is bad practice, because the tendency of taper-fitted parts to become loose under vibration is always present. On the other hand, a taper fit does not abrade the contacting surfaces to the extent that a parallel fit does. In order to prevent abrasion in work of this kind, it is advisable to lubricate the surfaces with white lead mixed with a little lard oil, or else rub a piece of ordinary soap over the surfaces. It is best to keep the members as smooth as possible, so as to allow for putting new gears on the shaft, should they be needed later.

Shrink Fits

Shrink fits are employed in cases where the greatest possible binding effects are desired, being used extensively by machinery manufacturers, and also in railway locomotive shops for putting tires on the driving wheels of engines. Repair forces also use shrink fits to hold parts of machines together in emergency, as well as in permanent work.

As in force fits, the allowance for a shrink fit depends to a great extent upon the thickness and amount of metal around the hole, as this has a great influence upon the stresses in the hub at the bore of the wheel. The higher the heat of the outer member, naturally the greater the expansion and the subsequent shrinkage. By properly sizing the parts, it is possible by the shrinkage method to control definitely the amount of pressure between a wheel and its shaft. In actual practice there are limits beyond which it is not safe to go, on account of the mechanical stresses set up when the metal is cold. Should the final pressure exceed the elastic limit of the steel, a permanent set will occur, the metal around the hub being under a strain and likely to develop a crack. Should the pressure on the hub be so great that its ultimate strength is exceeded, it will burst when the parts become cold.

For the general run of machine work, an allowance of about 0.004 in. for each inch of diameter of the fit will give satisfactory results. On account of their large diameters, railroad locomotive tires are shrunk on with an allowance of from $\frac{1}{64}$ to $\frac{1}{32}$ in. per foot, of diameter, and they give effective service in withstanding shocks.

Scientific Selection of Materials for Forgings

Selecting Steels to Suit the Job—Specimens Subjected to Exhaustive Tests—Importance of Heat-Treatment—Work Supervised by Laboratory

SPECIAL CORRESPONDENCE

THERE is probably no piece of metal entering into machine construction that is subjected to more severe usage than the crankshaft of the high-speed internal combustion engines of automobiles and aircraft. From the moment the engine is put into service this shaft is called upon to withstand a rapid succession of hammerlike blows to the number of thousands per minute that, aside from the wringing and twisting strains to which it is at the same time subjected, would soon disintegrate any but the most carefully designed and structurally perfect forging.

It is not enough merely to say that such a forging must be sound and of good material. In order to be certain that the crankshaft will render continuous and satisfactory service it is necessary for the manufacturer to know by actual test that the steel from which the forging is made is free from structural defects; that it is sufficiently strong to absorb the shocks and convert them into useful work; and that it possesses the property of resilience to a degree that will enable it to endure the continued hammering of the pistons and their connections and preserve its structure.

It thus devolves upon the manufacturer of high-grade crankshaft forgings, who would jealously guard his reputation as a supplier of strictly first-class material, to subject the steels from which his product is made to a most careful scrutiny, not only for visible defects in its structure but in the matter of chemical composition and the more intimate physical properties that can be determined only by the application of tests.

The Wyman-Gordon Co., operates extensive forging plants at Worcester, Mass., and Harvey, Ill., specializing in the production of forgings for automobiles, where there are maintained complete laboratory systems for determining the properties, both chemical and physical, of each lot of steel received from the steel mills, establishing a permanent record thereof and supervising the progress of the stock through the forge and heat-treating departments. This article is based upon a trip through the Worcester works.

The suitability of a steel for a definite forging—as a crankshaft for an automobile engine—is determined by its ability to resist the peculiar shocks and strains to which such a shaft is subjected in service and as this ability follows to some extent the chemical composition of the steel the chemical analysis must necessarily be the basis upon which the stock is selected.

FIG. 1—THE STEEL YARD

All orders to the steel mills, therefore, specify the chemical content of the required material, and this content is the basis upon which a consignment is accepted or rejected. To meet the specifications the mill prepares a "melt" of steel in accordance therewith. When the melt is rolled into bars each bar is stamped with a number that designates that particular melt and nothing else. This is the "heat number" to which further reference will be made in this article, and it remains the identifying symbol of a given lot of steel up to the time that the consignment is analyzed by the purchaser.

To the layman it would seem that, given a definite chemical content, all steels conforming to that analysis should be reasonably uniform regardless of their origin. But this is far from the case. So many factors enter into the making and rolling of steel that two heats, even from the same mill, though they may be identical in so

FIG. 2—BORING FOR SAMPLES FOR THE CHEMICAL ANALYSIS

far as the chemical laboratory is able to determine, may exhibit widely differing physical properties.

Because of this condition it is necessary to consider each melt, or "heat," of steel individually, determine its characteristics separately, and segregate the forgings made from it in their progress through the shop so that each lot will receive the treatment best calculated to bring out its wear- and shock-resisting properties.

In Fig. 1 may be seen a part of the receiving yard of the plant under discussion, and from this view the reader may discern how each heat of steel is stacked separately in accordance with its number. As the mill heat number signifies nothing apart from the records of the mill that produced it, and as it is quite possible for the same number to designate two or more very different kinds of steel if they come from different mills, the first step in the process of segregation is to assign to each stack in the yard an identifying symbol that must not under any circumstances be duplicated. This symbol is the "analysis number," and in Fig. 1 it may be seen conspicuously painted in several places upon each stack.

In the office of the laboratory there is a file of 5 x 8-in. cards, and as each consignment of steel is laid down in the yard the name of the supplying mill and the mill heat number are entered upon one of the cards, to which is assigned a consecutive analysis number. This number is immediately painted upon the stack in the yard and thus is established a record to which later will be added the actual chemical content of the steel as determined by the laboratory, the results obtained from the physical tests, and finally, the disposition of every bar in the consignment.

To complete the segregation and make certain that not a single bar shall be used for any purpose to which it is not adapted, or receive any treatment other than that indicated by the requirements of its composition, each bar in the stack is stamped with an individual number running consecutively from 1 up to the number of bars in the stack.

Borings are taken, as shown in Fig. 2, from the ends of the bars for the purpose of analysis. The bars are sampled in two places; at the center of the section and at a point midway between the center and the outer surface. These samples are placed in stout envelopes each marked with analysis number, the bar number, and "outside" or "center" according to the boring.

As the purpose of this article is to cover in a general way the system of supervisory control exercised by the laboratory over the selection of material and such operations as affect its properties in subsequent handling, no attempt will be made to describe in detail the actual tests. To give the reader an idea of the complete equipment provided, Figs. 3 and 4 are presented, showing parts of the chemical laboratory.

Though the result of the chemical analysis establishes the status of a consignment of steel it is by no means conclusive as an index to what the steel may be expected to endure in service. Though it may with comparative safety be assumed that, given a uniform showing by several bars in the same heat, all the bars in that heat will display similar characteristics, it does not follow that bars from different heats, though having exactly the same chemical content, will behave in similar manner under the physical tests. Indeed, wide variation may be expected in the latter case.

At the same time that the borings are taken for the chemical analysis, short sections are cut from several bars of each heat, and these "coupons" are forged to a round section of 2½ in. diameter, regardless of the size or shape of the bar from which they are taken. These coupons are then subjected in the laboratory to a tentative heat-treatment based upon the chemical content and in accordance with the judgment of the engineer in charge. After heat-treating, the coupon is sawed apart lengthwise and one of the resulting half-round

FIG. 3—THE BALANCES IN THE CHEMICAL LABORATORY

FIG. 4—TESTING AND ANALYZING SPECIMENS

by chemical content and those actually exhibited under actual physical test are manifested. Though the same temperatures and methods of handling may have been employed upon this as upon previous samples of like nature, the specimen may prove to be too hard or too soft. If the Brinell test indicates a variation in this respect that puts the sample outside the allowable limits of hardness, the coupon may be retreated or other coupons taken from the same or other bars and subjected to treatment at different temperatures, until the proper treatment has been found to give the sample the requisite physical properties.

From one of the quarter sections of the finally selected coupon a test piece as shown at *A* in Fig. 5 is made up for the tensile test. The small diameter at the center is 0.505 in., giving a cross-sectional area of $\frac{1}{5}$ sq.in. This test piece is put in the testing machine shown in Fig. 6,

pieces is again split, reducing it to quarter sections.

The half-round piece is preserved and to it are applied Brinell tests for hardness, both upon the outer surface and also upon the surface exposed by the saw.

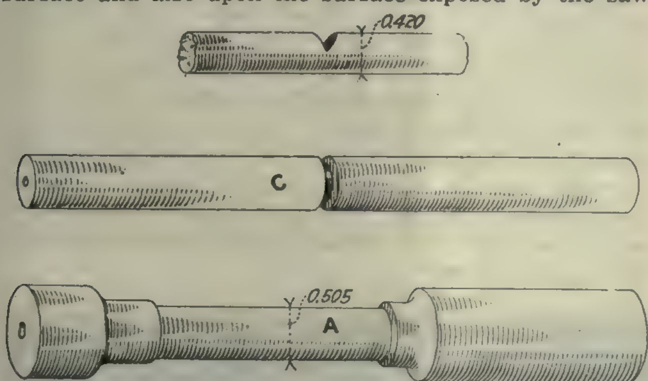


FIG. 5—SAMPLES PREPARED FOR THE PHYSICAL TESTS

In the first heat-treatment of a specimen the only guide is the result obtained upon previous specimens of similar analysis, and is in the nature of an experiment. It is here that discrepancy between qualities indicated

FIG. 6—THE TENSILE TESTING MACHINE

where it is pulled apart and the "yield point," or limit of elasticity and the ultimate strength, are automatically recorded upon the chart of the machine. This test also indicates the ductility of the steel.

The property of resilience which gages the ability of the material to stand up under long continued shocks, is

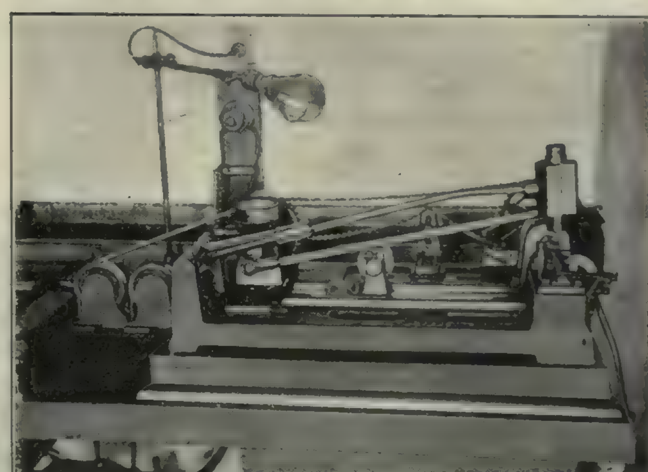


FIG. 7—THE STANTON ALTERNATE IMPACT MACHINE

tested in two ways. The machine shown in Fig. 7, called the Stanton alternate impact testing machine, is a device for delivering continuous blows of definite moment upon a specimen that is turned half way over after each successive blow so that the hammer tends to bend it first in one direction and then in the other until it breaks. The weight of the hammer, the distance through which it falls, and the rapidity with which the blows are delivered may be changed to suit the conditions. For this work the hammer weighs ten pounds and falls through a distance of 2 in. 90 times per minute. When the specimen breaks the machine automatically stops and the total number of blows that have been delivered is registered on a counter.

An entirely different method of testing the resistance of the specimen is provided by the Izod impact testing

FIG. 8—THE IZOD MACHINE

machine, shown in Fig. 8. This machine breaks the sample the first time the hammer strikes it, but the distance that the hammer swings beyond the point where it contacts with the sample is a resultant of the height of fall and the resistance of the test piece. A movable pointer is pushed by the forward swinging hammer over the scale at the top of the machine, but the pointer is not attached to the hammer and so remains to indicate the point of greatest amplitude of swing.

A specimen is prepared from one of the broken pieces from the tensile testing machine as shown at *B* Fig. 5. The test piece may be seen in the machine in Fig. 8, where it is gripped in a vise directly in the path of the swinging hammer with the groove at the level of the vise jaws and toward the hammer. The piece at *C*, Fig. 5, has been prepared for the Stanton machine where it is held by both ends and is unsupported in the middle where the hammer falls. This specimen is ½ in. in diameter and the square sectioned groove has a diameter at the bottom of 0.40 inch.

Samples from every heat of steel received at the yard are passed through the above outlined series of tests and the results are tabulated upon the cards in the file. The laboratory is therefore in a position to assign to each order for forgings a steel that can be guaranteed to meet the conditions specified upon the order, and to attach instructions for heat-treating the forged pieces in accordance with their requirements.

To further insure the segregation of certain kinds of steel and to make it impossible for even one bar to be subjected to improper heat-treatment, each forging is stamped while at the forging heat with a symbol that denotes the analysis number and thus furnishes a means of identifying single forgings in case they are removed from the regular progression for any purpose.

The manufacture of crankshafts is done so far as is practicable in one heat; including breakdown, forging, trimming, and indexing. In Fig. 9 may be seen a large steam hammer used for producing crankshafts. If the design calls for a flange to be forged upon the shaft an extra heat is necessary at that end of the forging for the operation.

As the bars from the yard are sheared to forging length the pieces are stacked upon racks, one of which may be seen in Fig. 10, of such design that they may readily be handled by either crane or floor truck and, each rack is ticketed with a card bearing the job number, the analysis number and instructions to the furnace men for heat-treating. As the work progresses through the shop each lot remains in its respective rack or racks and the tickets present a quick means of identifying any job, an identification that is easily verified at any time by comparing with symbol stamped upon each forging.

FIG. 9—A 9,000-LB FORGING UNIT

In making up the forgings a definite proportion of each lot (usually one in six) is left with an extra piece of metal or "coupon" attached, so that tests of the metal may be taken from the forgings at any stage.

The heat-treatment of the finished forgings is an operation of prime importance and it is here that the knowledge of the properties of the steel gained by the laboratory in its preliminary tests is demonstrated to its full advantage. The index card shows the exact temperatures that must be attained to bring out the qualities of the steel.

In this department oil fired furnaces are used exclusively. They are each fitted with an electrically operated automatic regulating device that is under control of the pyrometers and may be set in advance to bring the furnace to any desired temperature and hold it within a total variation of not more than 5 degrees.

Various grades of carbon, chrome-nickel, chrome-vanadium, and other alloy steels go into the forgings and each requires its own particular heat-treatment. Hardening heats are fairly uniform; ranging from 1,450 to 1,650 deg. depending upon the grade of the steel to be treated. Draw heats may range from 1,000 to 1,200 deg. Fahrenheit.

From the draw heats the crankshaft forgings go directly to the special straightening presses while hot, where they are straightened to bring the journals and crankpins into alignment and insure sufficient material to "clean up" in the subsequent machining operations.

Besides the tests outlined above a constant watch must be maintained upon the structure of the steel by means of the microscope. Though a lot of steel may show a uniform analysis and the coupon under test may demonstrate that it possesses all the necessary qualifications in the way of strength, ductility, etc., local structural defects may creep in and, if allowed to escape the vigilant eyes of the laboratory inspectors, prove to be a prolific cause of mysterious failures.

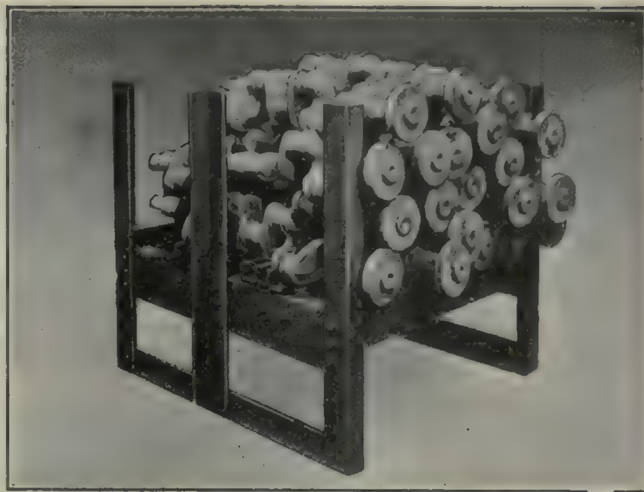
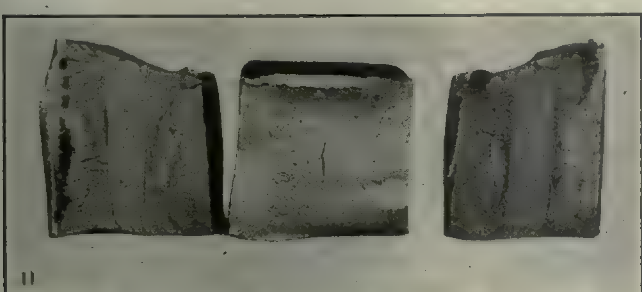
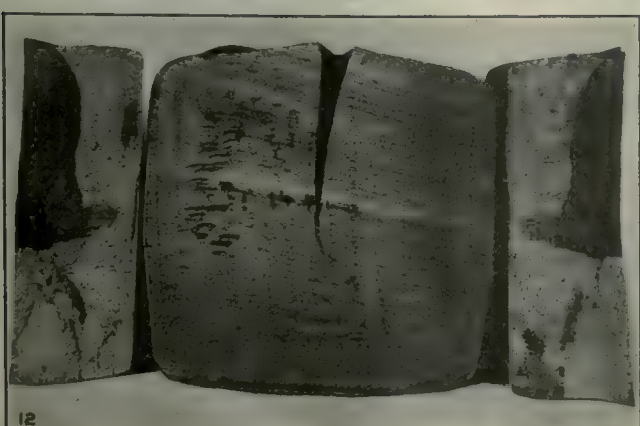


FIG. 10—RACK UPON WHICH THE WORK IS HANDLED IN THE FORGE SHOP

Though no microscope is needed to show the defective structures displayed in Figs. 11 and 12, they may be accepted as evidence of what may be expected in more minute degree in any lot of steel, even though all tests have proved it to be of good quality as a whole.





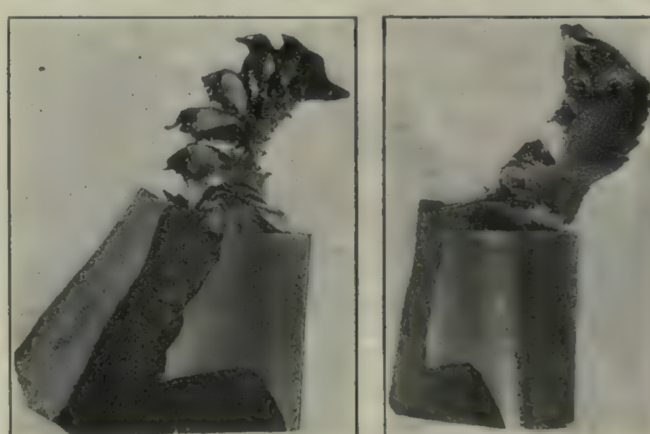
FIGS. 11 AND 12—LOCAL STRUCTURAL DEFECTS IN STEEL

An Unusual Break in a Tire Turning Tool

Special Correspondence

The illustrations show a remarkable break in a tool used for turning locomotive driving wheels on a 90-in. wheel-lathe in the plant of William Sellers & Co., Inc., Philadelphia, Pa. The tool section at the break is 3 x 1½ inches. The cutting edge is unimpaired.

At the time of the break the lathe was turning the tires on a pair of drivers 82½ in. in diameter with a cut varying from $\frac{5}{16}$ to $\frac{3}{8}$ in. in depth on each toolrest. The feed was $\frac{3}{8}$ in. per revolution and the cutting speed 14½ ft. per minute, consuming 52 horsepower.



BROKEN TOOL WITH CUTTING EDGE STILL SHARP

The tools had been reground for this pair of wheels. As there were other interruptions during the turning of this pair of wheels no record was made of the time, but just previous thereto a pair of 80-in. wheels was turned in 42½ minutes; also a pair 56 in. in diameter in 47 minutes; another pair 76 in. in diameter in 44 minutes; a pair 67 in. in diameter in 39 minutes, and a pair 54 in. in diameter in 38 minutes, all times given being from floor to floor.

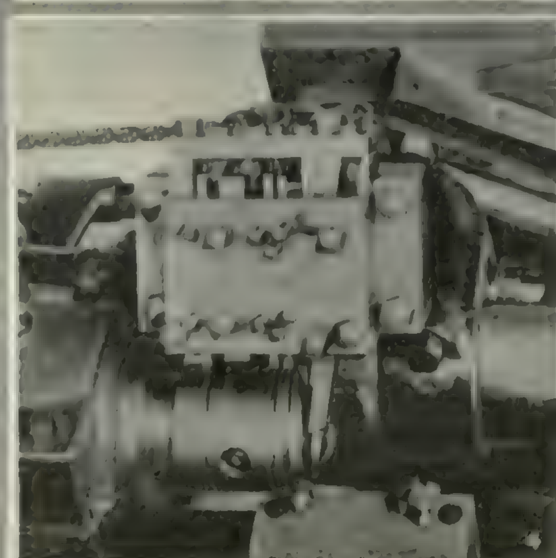
SPECIAL AUTOMOTIVE

Fig. 1—Libby lathe machining a Duesenberg forged steel brake drum. The tooling is very simple and the work of boring, turning and facing is completed in 12 minutes

Fig. 2—A similar piece of work for the Rolls-Royce, except that the face of the drum is slightly conical. A taper attachment bolted to the turret, guides the toolblock

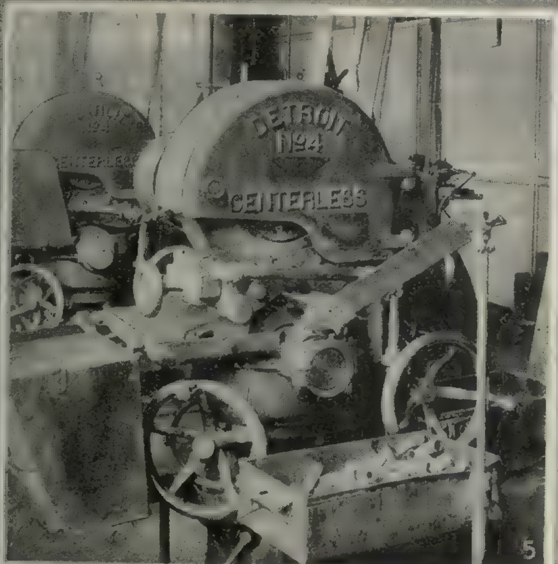
Fig. 3—Reed-Prentice piston lathe. Roughing tools in *A*. Semi-finish tool at *B*. Facing and chamfering at *C*. Grooving at *D*. Time 1 min. 20 seconds

Fig. 4—Reed-Prentice lathe for finishing. Front tools finish three diameters. Back tools finish groove, relieve center, face and chamfer end. Time 2 minutes



MACHINING METHODS

Fig. 5—Detroit centerless grinding machine. About 250 ft. of work runs through machine per hour. Average handling rate 1,200 pieces per hour



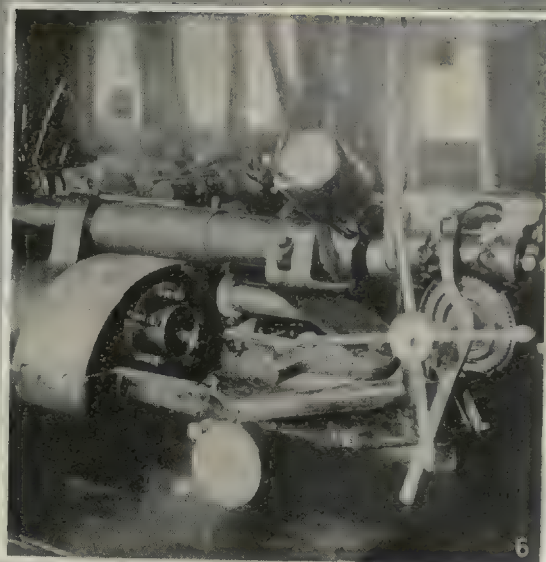
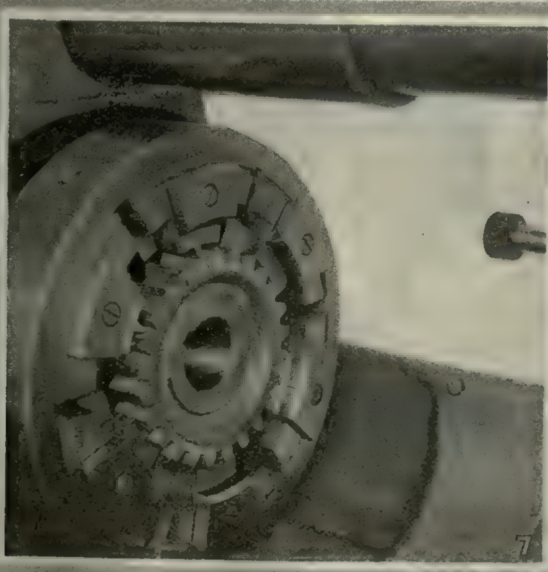


Fig. 6—Bryant chucking grinding machine on Liberty cylinders, 0.035 in. removed. Tolerance 0.0005 in. Roughing 0.030 in., 6 per hour. Finishing 0.005 in., 5 per hour

Fig. 7—Bryant chucking grinding machine. Root control jaws in collet chuck. Hole $1\frac{3}{8}$ x $1\frac{1}{2}$ in., 0.10 in. removed. Tolerance 0.001 in. Production 65 per hour



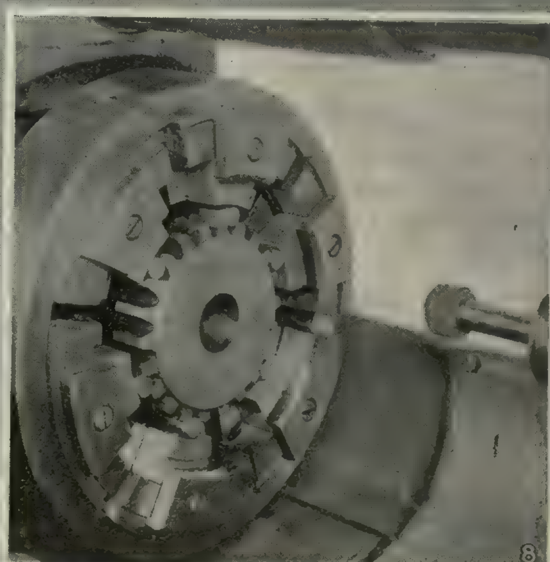
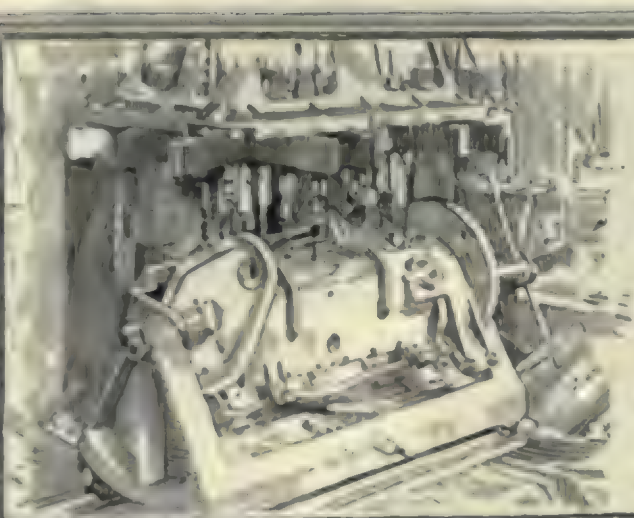


Fig. 8—Bryant chucking grinding machine. Collet chuck with roller for pitch line control. Stock, finish, tolerance and production same as Fig. 7



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Fixtures for Grinding Operations Continued—Methods of Holding for External, Internal, Disk, Surface and Form Grinding—Standard and Special Fixtures and Magnetic Chucks

When work has been previously finished, a collet or fixture of some kind is often found necessary. There are some cases where a chuck can be used such as that shown at *H* in Fig. 411 in the previous article, although for a great deal of work the chuck is not accurate enough to produce first-class results. Fig. 418 shows several methods of holding work which has been previously machined. The example at *A* shows a piece of work *B* held in a collet at *C*. This collet is tapered at *E* so that it fits a corresponding taper in the nosepiece *D*. It is drawn back into position so that it grips the work firmly, by means of a rod which extends back through the spindle as at *F*. In grinding the hole an internal grinding attachment is used, with a wheel as shown at *G*.

For certain kinds of work the method of holding just described will be found satisfactory, although in many cases a collet cannot be considered sufficiently good to produce absolutely accurate work. In the example *H* a piece of thin work *K* is to be ground internally by the wheel *O*. The work locates in a hardened collar *L* which fits it accurately. In order to avoid distortion, the pressure necessary for holding the work is exerted entirely on the end of the piece by means of the clamp *N*, which is bored out to a diameter sufficiently large to allow the grinding wheel spindle to enter. The studs which hold the clamp in place are two in number, and they are inserted in the body of the fixture *M* as shown. For light work the clamp can be set up by means of thumbscrews instead of the nuts. By bringing pressure to bear in this way on the end of the work there is very little danger of distortion, and therefore a piece of work which is thin can be clamped firmly enough to allow the grinding to take place.

In the example shown at *P* the work *Q* is to be ground internally by the wheel *U*. The method of location in this case is by means of the pins *R*, which are set in a hardened ring against which the work is clamped by means of the straps *T*. These straps are operated by thumbscrews as indicated. The fixture *S* is screwed directly to the spindle of the machine. In rare cases this method of holding may be found satisfactory, but it will seldom be so unless great accuracy has been maintained in the previous operations, and unless the locations for these operations have been made from the same holes. There are instances when a piece of work must be ground on the inside after the outside has been finished; and when a subsequent grinding operation for the outside surface is necessary, the hole can be ground first and the work placed on an arbor for the second grinding operation with the assurance that a concentric job will result.

The example at *V* shows a piece of work *W* which has been previously machined on the angular surface *X*, and it is necessary to grind the other side concentric with the angular portion. The work is located on a taper plug at *X* and is clamped by means of the nut and washer at *Y*. The grinding is done by an internal grinding attachment, using the wheel *Z*. This is a very simple fixture and the only points of importance in connection with it are the clearance for the grinding wheel spindle and wheel and the method of clamping. This particular case permits a center clamp,

FIG. 418—METHODS OF HOLDING WORK FOR GRINDING

but other instances may be found where such a means may not be possible, in which case a special method may be found necessary.

In order that a spur gear may run true after it has

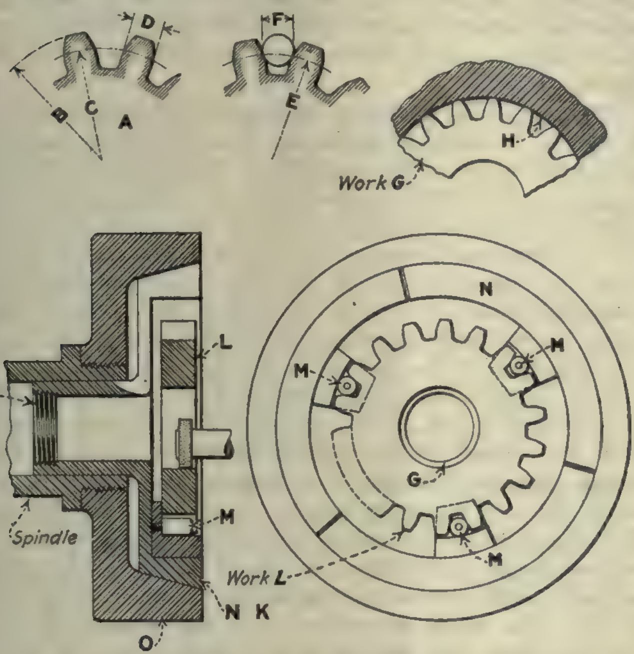


FIG. 419—LOCATING SPUR GEARS FOR GRINDING

been hardened, it is usually considered necessary to grind the center hole. Many times the process of hardening distorts the gear to some extent, so that the teeth do not run perfectly true with the hole. A portion of a spur gear is shown at *A* in Fig. 419. The outside diameter *B*, the pitch diameter *C* and the thickness of the tooth *D* are subject to a certain amount of change during hardening. In order to locate the hole so that it will be central with the pitch line of the gear, pins are placed between the teeth as shown at *F*. The distance *E* from the center of the gear must be determined and maintained with care. The diameter of the pin should be such that the pin will strike the tooth directly on the pitch line, and as this point lies on a

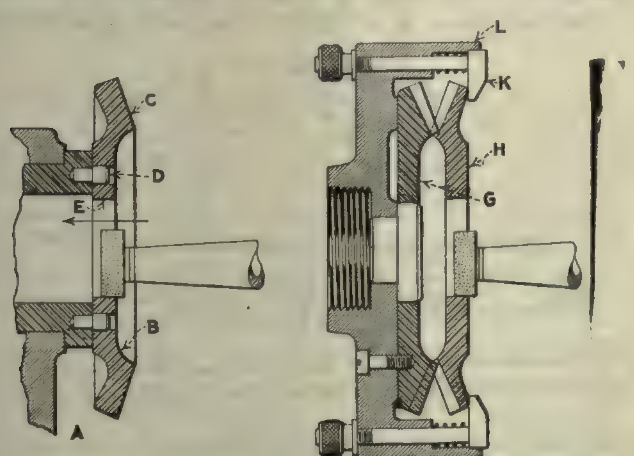


FIG. 420—LOCATING BEVEL RING GEARS

curved surface care must be taken to see that the pin is correctly proportioned.

In the example *G* the method of locating is by means of the outside diameter of the gear in a pocket *H*. This method is not usually considered good, as it may be found that the distortion will not allow the gear to locate properly so that the hole will be central.

The diagram at *K* shows the construction of a collet chuck for holding spur gears. The gear *L* locates on three rollers *M*, which are set in the collet *N* so that they will move inward or outward as the collet is contracted or expanded. The rollers may be three, four, five or six in number, depending on the number of teeth in the gear. They must be so placed that they will come in contact between the teeth and on the pitch line. The collet used is mounted in a nosepiece *O* which screws to the end of the spindle. The operation of the collet is by means of a closer which screws in to the end *P*. Various applications of this principle can be used for any work of a similar kind, and it is only necessary to design the holding device so that the contraction of the collet will cause the rollers to move inward in a truly radial direction.

In Fig. 420 is shown at *A* a bevel ring gear *B* in which the hole *E* must be ground so that the face *C* will run true with the pitch line of the gear. In this case the work is located on three pins *D* and clamped against the hardened ring by means of springs which are applied to the angular face *C*. This method may be considered good, providing the locating surface has been previously ground from the pitch line of the gear, but otherwise there is likely to be trouble due to the warping of the angular surface during hardening.

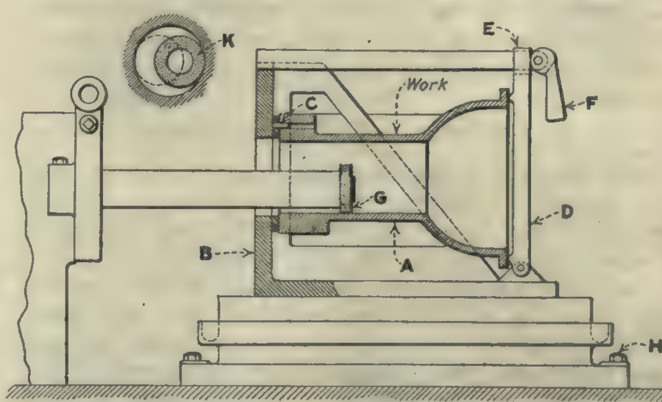


FIG. 421—HORIZONTAL CYLINDER GRINDING

A better way of grinding the hole is shown in the example at *F*. Here a master gear *G* which is accurately made is screwed to the face of the fixture and located centrally. On this master the ring gear *H* is located, being clamped in place by means of the hook bolts at *K*. This gives the pitch-line location, so that when the hole is ground it will be true with the pitch line of the gear. The hook bolts *K* are of light construction and in some cases springs can be used, although the latter must be very stiff unless the gear is of small size. The hook bolts can be operated by thumbnuts at the rear of the fixture *L*.

Cylinders for gas engines are often finished by grinding, and the machine used for the purpose has a spindle arranged horizontally and carried in eccentric sleeves, as shown at *K* in Fig. 421. Provision is made so that the eccentricity of the spindle can be adjusted, to take care of various diameters within the capacity of the machine. The type of fixture required for work of this kind is quite different from any which has been previously shown. Sometimes the work is ground wet and sometimes dry, and provision may be made for the removal of the dust by a vacuum system. Usually the

work A is held on an angle-plate fixture B and clamped against a surface perpendicular to the spindle of the machine. Very often the location is obtained by means of several pins, as shown at C, and the cylinder is clamped by some convenient method.

In the example a latch D is arranged so that it can be thrown down out of the way when not in use, and when in the position E a cam lever F locks it in place and at the same time forces the cylinder against the locating surface. The nature of the clamp used is dependent entirely upon the size and shape of the cylinder casting which is to be ground. In operation the wheel G is mounted on the end of a long spindle, and the table H is fed gradually along while the wheel is in rotation. As the spindle is mounted eccentrically, the path described by the wheel can be controlled so that a specified diameter can be obtained without difficulty.

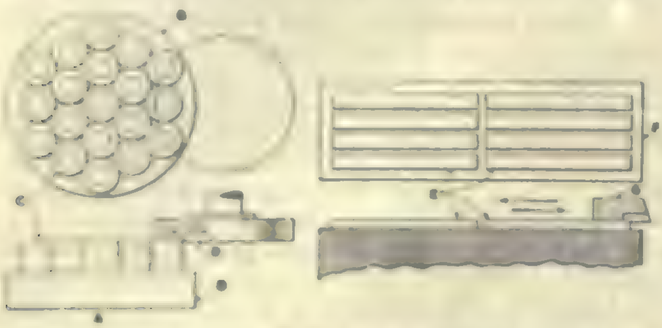


FIG. 422—HOLDING WORK ON MAGNETIC CHUCKS

Holding Work on Magnetic Chucks

The diagram in Fig. 422 illustrates the use of magnetic chucks for holding work when grinding. In the example A the chuck B is arranged so that an electric current can be passed through its coils by closing a switch; and as the current is turned on the magnets are energized, so that they will pull and hold down on the surface any steel or iron parts which are laid upon the chuck. Many applications of magnetic chucks can be made to the process of surface grinding, and in the example indicated a number of bushings C are grouped together on the chuck so that the ends can be ground by means of the cup wheel D. The chuck B revolves and is fed forward under the wheel when in operation.

Another type of magnetic chuck is more in the nature of a table, since it is rectangular in shape as at F. This type is also used for surface grinding, but the table reciprocates in the direction indicated by the arrows, so that the work passes back and forth under the wheel G. In grinding a group of flat bars such as those shown at E, the bars can be laid down on the magnetic table and held there by magnetism.

In extreme cases thrust pins can be suitably placed so that there is no danger of the work shifting while the operation is going on. This is not generally necessary, except in cases where a very small amount of surface of the work is in contact with the table. Magnetic chucks and tables are used extensively in grinding operations, and occasionally a combination of the chucks with some method of locating work can be made. For example, if a location is needed so that work will be ground for only a certain portion of its width or length, suitable stops can be provided.

It is not always possible to hold work by means of a magnetic chuck, and yet a surface grinding operation may be required. A type of fixture used for work of this kind is shown in Fig. 423. The castings A are to be ground on the surfaces B, and they have been previously machined on the surfaces C and in the holes D. The surface C and holes D can therefore be used for location, and a fixture can be designed like that shown at E.

The bed of the fixture is long, and is arranged so that it can be fastened to the table of a horizontal surface grinding machine by means of T-bolts. The work locates on two pins in the holes D and rests on the surface C. It is clamped down by means of straps E at the ends and between the pieces. Fixtures of this kind are very simple in their general construction, although instances are found where the shape of the piece necessitates particular care in the location and clamping.

Care should always be taken to place as many pieces on the table as the diameter of the wheel will cover, and in locating the work the distance between the flanges should be as small as possible, always having in mind the necessity for ease in operating the clamps. It is much better to arrange the work so that the pieces will approach each other, as shown at F, rather than to have them spaced a considerable distance apart, as at G. The wheel H passes over the flanges of the work as the table reciprocates in the direction indicated by the arrows.

Disk Grinding

The fixtures used for disk grinding are generally very simple in their design, as the work which is done is a plain surfacing operation. Fig. 424 shows a piece of work A in contact with a revolving disk B on which there is an abrasive substance. The surface which is to be ground is shown at C. The piece is held in a fixture D, located against pins E and clamped by some convenient method which can be rapidly operated. The table F is arranged so that it can be forced in against the work by means of a lever G, and at the same time it is pivoted on a shaft H so that it can be swung on this shaft as a bearing. A counterweight K balances the entire unit so that it is not topheavy.

The requirements of fixtures for disk grinding on

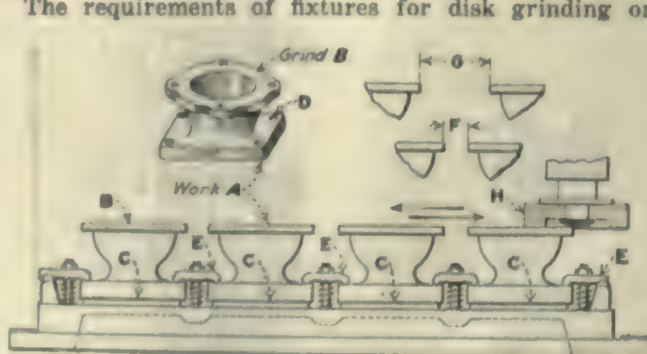


FIG. 423—FIXTURE FOR HORIZONTAL SURFACE GRINDING

machines of this kind are of the simplest. The method of holding must be developed according to the nature of the work, and it is essential to have a quick method of clamping. Aside from this the design of fixtures is along the same lines as those used for milling. The amount of metal removed, however, is comparatively small so that the pressure on the work is not as great as when milling.

The example mentioned is applied to a disk grinding

machine having a single wheel; but it is often desirable to surface two sides of a given piece of work at the same time, and when this is the case the double-disk type of grinding machine is to be preferred. The diagram at *L* illustrates the action of the disks on a piece of work *M* which passes between the two disks *N* and *O*

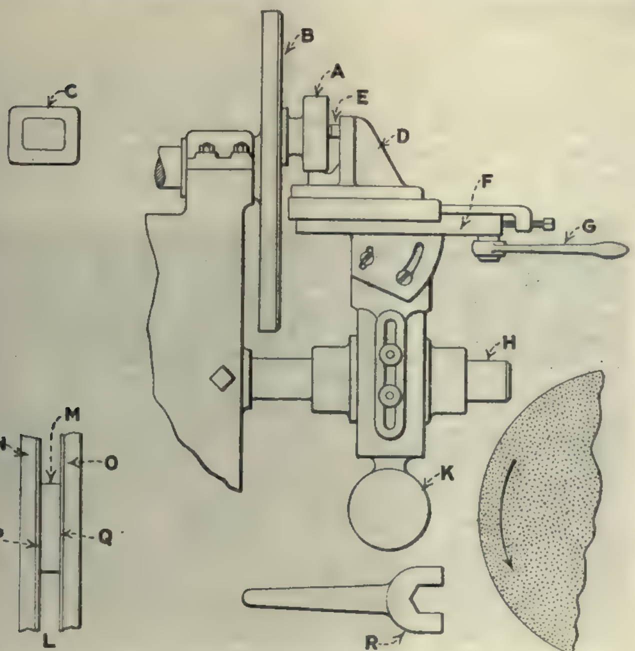


FIG. 424—EXAMPLES OF DISK GRINDING

so that an abrasive action takes place on both sides at *P* and *Q*. The work is usually held on a slide so arranged that it can be passed between the two disks by means of a lever or handwheel.

Any fixtures used for work of this kind must be arranged so that the clamps will not extend beyond the edge of the fixture, as otherwise they would interfere with the action of the disks. For work such as the wrench shown at *R* on which the two sides are to be surfaced, a double-disk grinding machine has many possibilities. There are no other points in connection with the design of fixtures for this kind of work which need comment.

Form Grinding

In the grinding of forms of various kinds two methods are in common use. In one of these the wheel is "dressed" to the shape of the form required, while in the other the wheel is controlled in its movements by means of a form of suitable shape so that the desired contour is generated. Fig. 425 shows an example at *A* in which the work *B* is ground on the diameter *C*, the face *D* and the fillet *E* at the same time by means of a wheel which is shaped to the form shown.

Another example of a piece of work which can be handled by means of a formed wheel is shown at *F*. Here the wheel is formed to the angle *G*, and the portion *H* made straight so that both the angle and cylindrical portion are ground at the same time. In the form shown at *K* the work is of a curved contour, and therefore the wheel must be very carefully formed to the shape shown at *L* in order that the surface may be ground accurately and to the required dimension. These examples all illustrate the field which is covered by the process of grinding with a formed wheel. A cylindrical grinding machine is used for this work.

For the generating of surfaces either internal or external another type of machine is required, but two methods are possible on some of this work. For example, the piece shown at *M* is to be ground on the taper at *N* and in the straight hole *O*. This work can be done by means of an internal grinding machine arranged so that the taper will be generated by the taper slide. After this has been done the slide can be set over to grind the straight portion *O*.

By using a type of machine which has a control or form plate, both surfaces can be ground in the same setting without any change in the position of the wheel or of the slide. Briefly stated, machines of this kind have a spindle which carries a grinding wheel and a follower which controls the position of the spindle. The form plate is made in accordance with the shape which is to be generated, and the follower rides on this plate, thus causing the wheel to produce the shape desired. A plate for the work shown at *M* would have a taper portion to correspond with that at *N* and a straight portion like that at *O*.

Another example, shown at *P*, has a curved portion *Q* running into a straight hole *R*. This work would be done in the same manner as that previously described, and the only difference would be in the shape of the form plate. In the example *S* the work has an internal curved surface running into a straight hole. The form of control plate used for this operation is

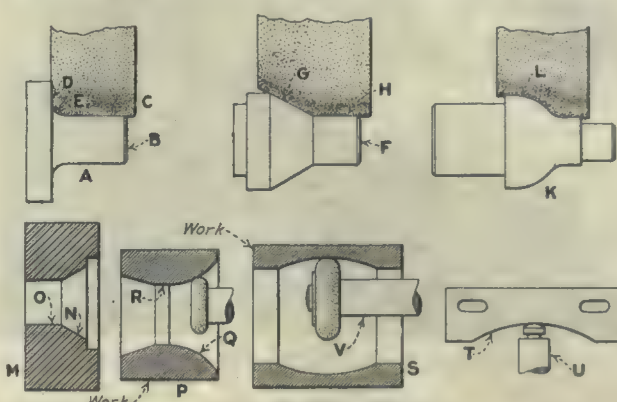


FIG. 425—PRINCIPLES OF FORM GRINDING

indicated at *T*, the follower pin *U* controlling the movement of the spindle *V* to produce the desired contour.

To make sure that the hole is properly shaped, considerable attention must be given to the shape of the follower, in order that the generation may be correct as determined by the movement of the follower pin and the wheel. The proper shape of the grinding wheel periphery must be carefully laid out, and the plate formed in such a way that it will cause the wheel to travel in exactly the direction desired.

The Application of Principles

By Robert Grimshaw

After the principles of management and execution have been laid down distinctly and in considerable detail by "the powers that be," it is the foreman's work to see that they are applied in their entirety wherever he exerts authority and bears responsibility. Naturally, various interpretations of general principles may present themselves to different foremen; but, as a rule, the variations are more in the way in which the principles are applied than interpreted.

Machining the Pierce-Arrow Gear Shifter Fork

Special Fixtures and Milling Cutters—Four Milling Operations Cover Most of the Machining—Casehardening, Annealing and Sand Blasting—Final Operations

SPECIAL CORRESPONDENCE

AFTER rough-grinding and straightening the forgings, the fork is straddle-milled by the pair of cutters shown in Fig. 1. The fork is held in substantial jaws which are almost hidden by the milling cutters themselves. The cutters have forged inserted teeth held in position by suitable clamps and headless screws. The kind of chips removed by the cutters can be seen under the cutter arbor. An allowance of 0.008 in. on each side, is made for further finishing.

The fork is carburized, after which the circle or radius is milled as shown in Fig. 2. The ends of the fork can be seen at *A* and *B*, the fork being held in position by the substantial clamps *C* and *D*. After removing the burrs, the top and bottom, as well as the shoulder of the bolt lug are milled, as shown in Fig. 3, allowing 0.2 to 0.25 in. all around for finishing. The fork is carried in the fixture shown, the sliding jaw *A* forcing it to place against the abutting end of the fixture. The squareness of the fork with the sliding portion, is secured by means of the angle plate *B*.

FIG. 1. STRADDLE-MILLING THE FORK

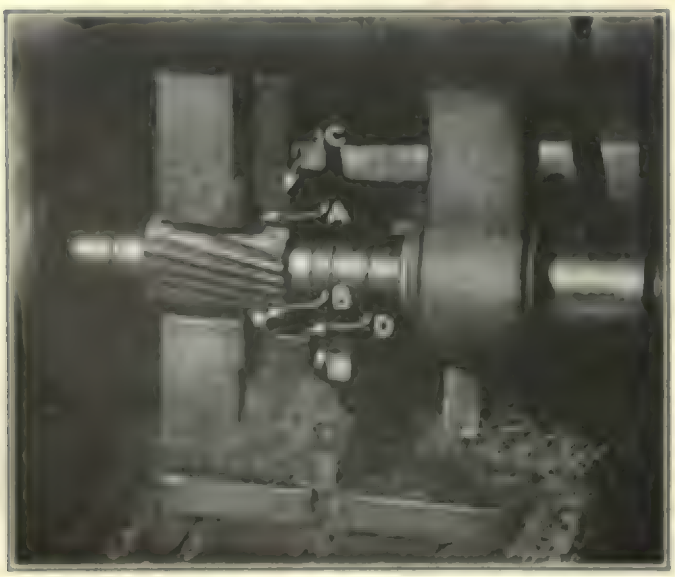


FIG. 2. MILLING INSIDE OF CIRCLE

FIG. 3. MILLING THE BOLT LUG

Next the ends are milled to length, the fork end cut off and after removing any burrs, the fork end is casehardened and the other end annealed. Sand blasting follows these operations, after which a scleroscope test is made on both the hardened and annealed portions of the fork.

The fork is then straightened and opened if necessary, and the large diameter ground. This is followed by another milling operation, as shown in Fig. 4, by which the bottom and shoulder are finish-milled. Drilling, reaming, burring and countersinking the screw holes, together with grinding out the small diameter on the fork end completes the operations as carried out in the Pierce-Arrow plant in Buffalo, N. Y.

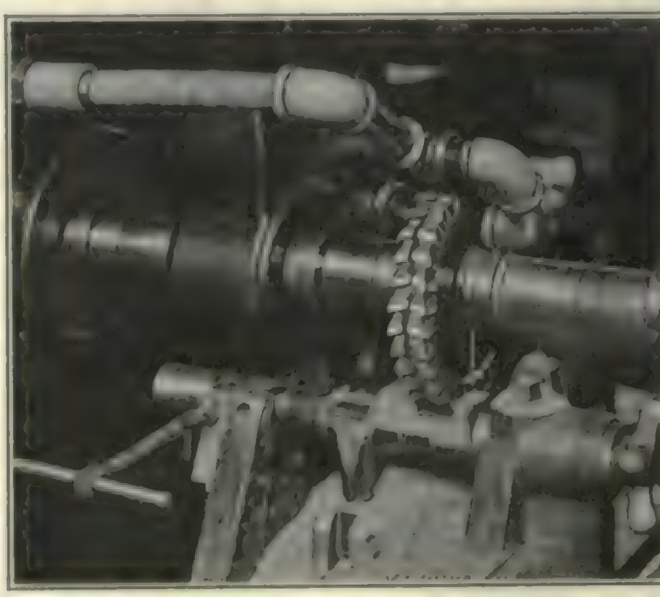


FIG. 4. FINISH-MILLING BOTTOM AND SHOULDER

Methods of Machine Tool Design

Fourth Part of Section on Gear Drives—Good and Bad Points of Cone and Tumbler Device—Requirements for Successful Operation

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

THE oldest, and therefore best-known, so-called quick gear change device is the cone and tumbler. It has the advantage of compactness and simplicity and lends itself to a great many speeds in one shift without additional complications. On the other hand, it requires great care in the design when applied to anything but light loads. Fig. 92 shows it in its simplest form. The gears *A-B-C-D-E-F* are keyed to the driving shaft. Pinion *H* slides on the driving shaft and transmits power to any of the cone gears through idler *G*. Of course this action may be reversed and the cone made the driving member, while the sliding pinion is driven. *G* and *H* are held in the bracket *J* which also slides on the shaft. A handle, attached to *J*, serves to slide *J* along the shaft, and also to swing it so as to bring idler *G* into mesh with one of the cone gears.

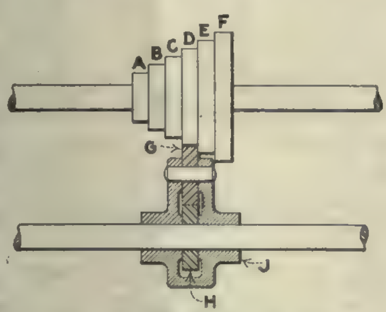


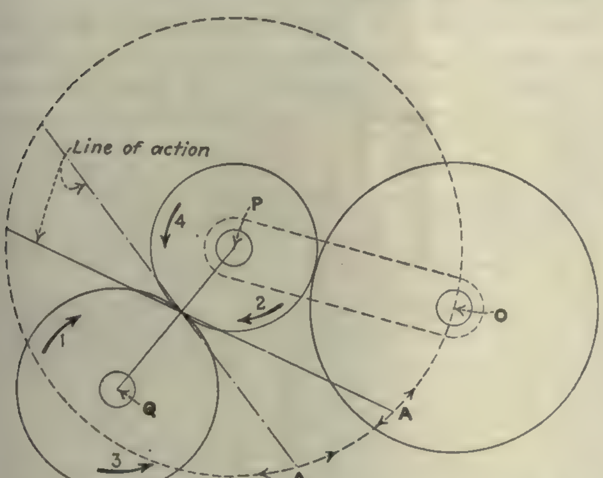
FIG. 92—SKETCH OF CONE AND TUMBLER

Some of the difficulties one meets when applying the cone and tumbler arrangement are very evident even from this crude sketch. The failings of the system were at first not recognized or perhaps overlooked, and the arrangement was applied wherever a quick change device was required. As a result it began to show up its limitations and undesirable qualities and gradually came to be considered by many designers as unfit for anything. It is well to recognize limitations in a device, but this should only serve to limit its application to cases where it properly belongs, and not to condemn and drop it entirely.

In order to make this arrangement a success, it should be so constructed that it can stand the load without danger of breaking or too much deflection and without any features which permit it to vibrate. In addition, it should be possible to operate it with ease. It is, of course, easy to proportion the gears properly for the load, but there are difficulties to face when it comes to the shaft. If, for instance, each of the six gears, *A-B-C-D-E-F*, were of $1\frac{1}{2}$-in. face, their total length on the shaft would be about $9\frac{1}{2}$ in. The length of the pinion shaft between bearings would then be $9\frac{1}{2}$ in. plus the length of bracket *J* on the shaft.

LENGTH OF BRACKET BEARINGS

It is sometimes thought that the shaft finds bearings in bracket *J*, but this is not the case. The shaft does not support the bracket, but is supported *by* it. It might be thought that, this being the case, the bearings in bracket *J* can be made very short, but again this is not the case; for the bracket carries the load of the tooth pressure, so that the pressure between bracket and shaft is equal to this tooth pressure. The length of the bracket on the shaft must therefore be the same as the length of the stationary bearings for this shaft. This causes the length of the shaft between its bearings to be excessive in many cases. In addition to the tooth pressure, the shaft must support the weight of bracket and idler. This condition of having heavy pressure on a shaft of which the bearings are spread far apart makes a very undesirable arrangement and should be avoided when possible.



When Q is driver running in direction 1} With point O to right of A gear P is pulled into mesh
or " P " " " " " 2}- " " O " left " A " P " pushed out of mesh
" Q " " " " " 3} " " O " right " A " P " pulled into mesh
" P " " " " " 4} " " O " left " A " P " pushed out of mesh

FIG.93

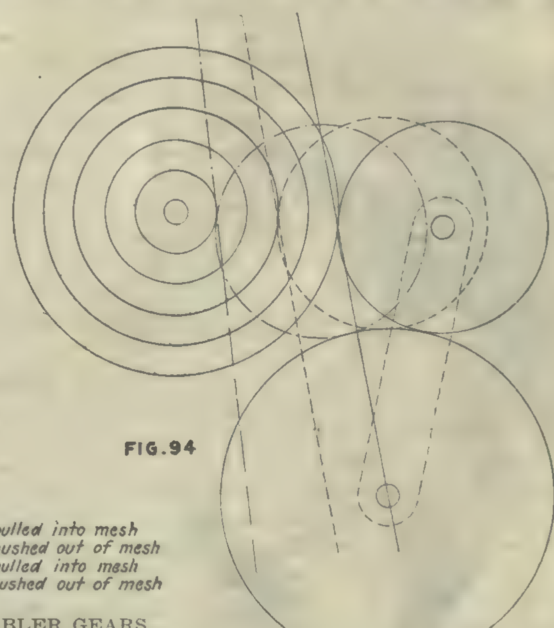


FIG.94

FIGS. 93 AND 94—DIAGRAMS TO SHOW ACTION OF CONE AND TUMBLER GEARS

For the author's forthcoming book.

It is often thought necessary to embody a wide range of speeds in the cone and tumbler arrangement, so that, if we wish to keep the largest of the gears within reasonable limits, we must make the smallest of these gears as small as it is possible to make it, and this means that the driving pinion also should be kept to the smallest possible diameter. Consequently, it is often not possible to give the shaft the desired rigidity by giving it a large diameter. It will therefore be necessary to find a construction to avoid the long unsupported shaft.

The original construction of this device had a single lever by which the bracket was moved endwise as well as swung into mesh. Whether this construction is maintained or whether two separate devices are supplied, one for the sidewise motion and one for the swinging movement, this latter motion presents a problem of its own. Fig. 93 shows a pair of gears in mesh, one of the gears being held on a swinging arm which permits it to be brought into or out of mesh. The line of action between gears P and Q may be either the full line A or the compound line A_1.

Effect of Direction of Rotation

The pressure may be in one direction or in another, depending on which is the driving gear and on the direction of rotation. If Q is the driver and running in the direction of arrow No. 1, gear P will be pulled into mesh so long as O is to the right of A, but will be pushed out of mesh when O is to the left of A.

On the other hand, if P is the driver running in the direction of arrow No. 4, it will be pushed out of mesh with O to the left of A_1, and pulled into mesh with O to the right of A_1.

If Q is the driver, but running in the direction of arrow No. 3, gear P will be pulled into mesh also when O is to the right of A and pushed out of mesh when to the left of A. And finally, when P is the driver, running in the direction of arrow No. 2, it will be pulled into mesh when O is to the right of A, and pushed out of mesh when it is to the left of A.

We see, then, that we must consider the direction of rotation when we devise our controlling mechanism. But there is more than this. The fulcrum of the swinging lever can be so placed in relation to the line of action of the tooth pressure that, whether the stationary gear turns in one direction or another, it will always throw the swinging gear out of mesh. Whether this will happen or not depends on the relative positions of the centers of the two gears, the fulcrum of the lever, and the angle of action.

In Fig. 94 the smallest and the largest of a set of cone gears are shown and it will be seen that an entirely different set of conditions is met according to whether the idler meshes with the small or with the large gear. It may very well be possible that the small gear has a tendency to pull the idler into mesh, whereas the large gear may have the tendency to throw it out. This matter was discussed to bring out the fact that it is necessary to lay out carefully the conditions of centers, and the line of pressure for both the largest and the smallest gear.

As a rule, bracket and lever are so constructed that when the idler is in mesh with one of the cone gears, some part of the bracket or maybe some part of the lever rests against a solid abutment. As the bracket is swung from the outside toward the center of the cone, and as the cone gear has a tendency to pull the idler gear in, a solid stop under the bracket will fill our conditions. It might be asked whether it would be possible to arrange the parts so that the cone of gears has a tendency to throw the idler out of mesh. The answer is, that this is very well possible but that it would be very undesirable.

In the first place, it would be difficult to mesh the gears, especially if we should want to make a shift while the load is on. Even a relatively light load might make the shift impossible. In the second place, even if the shift had been accomplished, there would be a constant tendency to throw the idler out again; and if we should furnish an abutment so as to prevent this throwing out, we would have to place it above the bracket and it would have to be swung out of the way when we desired to make a new shift. In other words, the abutment could not be solid and it would require additional handling.

This fact makes the cone and tumbler arrangement rather unfit where we have a reversal in the direction of movement, and where this reversal mechanism is

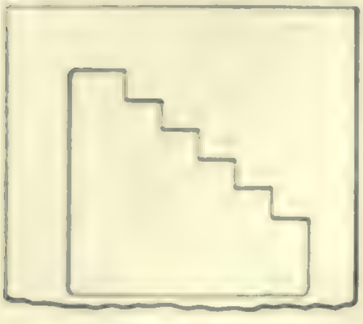


FIG. 95

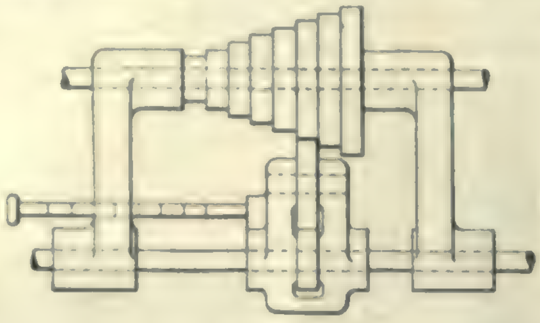


FIG. 96

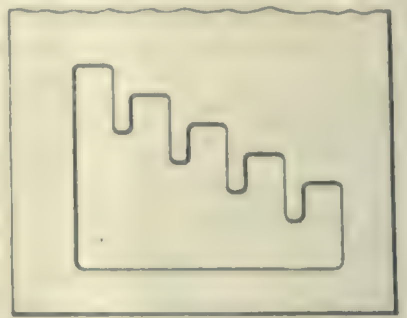


FIG. 97

FIG. 95—LEVER OPENING IN GEAR BOX. FIG. 96—AN ATTEMPT TO SEPARATE SHIFTING AND SWINGING FUNCTIONS. FIG. 97—NOTCHED CASTING FOR LOCATING TUMBLER SHIFTING LEVER

FIG. 98—SHIFTING LEVER WITH LOCATING AND DETENT PINS

located between the source of driving power and the cone and tumbler arrangement. Though we might have made the shift while everything was running in the proper direction, as soon as the reversal had been accomplished the idler would be thrown out of mesh and away from the supporting abutment.

There is another reason why the length of the bracket on the shaft should be considerable, and that is that the shifting lever must be of fair length in order to have enough power to swing the idler into or out of mesh when the gears are under load. This long leverage would cause the bracket to cock on the shaft and prevent the sidewise shifting.

The problem of shifting is a complicated one in practice, though it looks quite simple at a first glance. Fig. 95 represents the opening in the gear box through which the lever projects. The steps shown form the abutments for the lever when the gears are in mesh. In order to change speeds the lever is first brought down as far as the lower edge of the opening permits, after which it is shifted sideways so as to bring the idler opposite the proper gear of the cone. It is quite clear that there is nothing to indicate when this is the case, because the lever is some distance away from its abutment. A mark on the lower edge might indicate the proper position, but this is lost as soon as the lever is swung upward to bring the gears into mesh. There is a chance then that we butt up against the next larger gear. Altogether it requires some skill to accomplish the shift without fumbling.

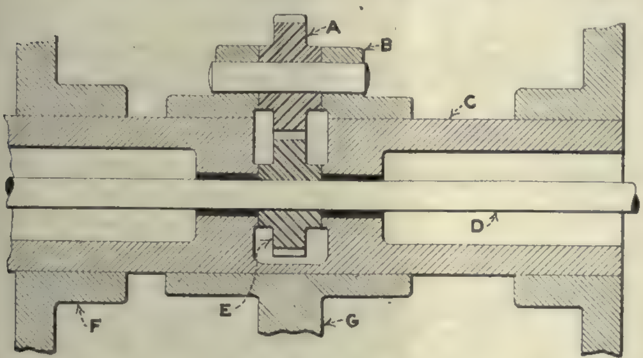


FIG. 99—ARRANGEMENT OF TUMBLER FOR LIGHT MILLING MACHINE

Separating the Functions

For this reason a great many constructions have been developed and patented in which the two functions of sidewise shifting and swinging into mesh have been separated. In one of the earlier attempts a rod was attached to the bracket somewhat as shown in Fig. 96. The rod projects through a slot in the side wall of the feed box; it is provided with a knob for handling and has V-shaped rings turned in, the proper distances apart. The device was crude, but it indicates that the need was felt for a better shifting arrangement.

In other devices a circular rack was turned on the hub of the bracket and a pinion provided for the sidewise shifting, while this entire arrangement was put in a swinging housing of which the trunnion projected through the side wall so that the gear could be swung into mesh by a lever attached to this trunnion. There were, then, two levers, each one provided with a detent pin. The proper number of holes was provided for each pin, so that it was only necessary to make sure that the two pins were located in corresponding holes.

Less complicated arrangements sought to guide a single lever by means of slots in the casting, somewhat like Fig. 97. This scheme works fairly well when the gears are of wide face, but if this is not the case, the projecting narrow strip of the casting becomes too weak and liable to be broken off. In still other arrangements, the lever was provided with a detent pin and another short pin was placed a little distance ahead of the detent, so that it could be located in a slot provided for that purpose before the gears began to mesh (see Fig. 98).

Most of these schemes had some merit, but none overcame the chief objection of the cone and tumbler device, namely that it was supported by a long shaft and that it was merely located and not locked.

Shifter for Light Milling Machines

In Fig. 99 is shown an arrangement patented by the writer and applied by the Cincinnati Milling Machine Co. to the feed box of its lighter millers. It overcomes entirely the first objection, while a solution of the second one was not attempted. In this device *A* is the idler which turns with its shaft in bracket *B*. This bracket is fastened to a finished cylindrical casting, C. This casting is bored out and bushed so as to provide bearings for the driving shaft *D*, and immediately adjoining driving pinion *E*. The cylinder *C* is trunnioned in the frame of the feed box *F*. The shifting lever *G* is bolted to the cylinder. The front wall of the feed box has an opening large enough to allow the shifting lever the necessary play.

It will be seen that the driving shaft is not subject to deflection, due to the tooth pressure, and that the shaft does not have to support the weight of the tumbler. The bearings are close to the driving pinion, as they should be, and furthermore, the cylinder itself closes the feed box completely and makes it dustproof. The great length of the cylinder makes sidewise shift-

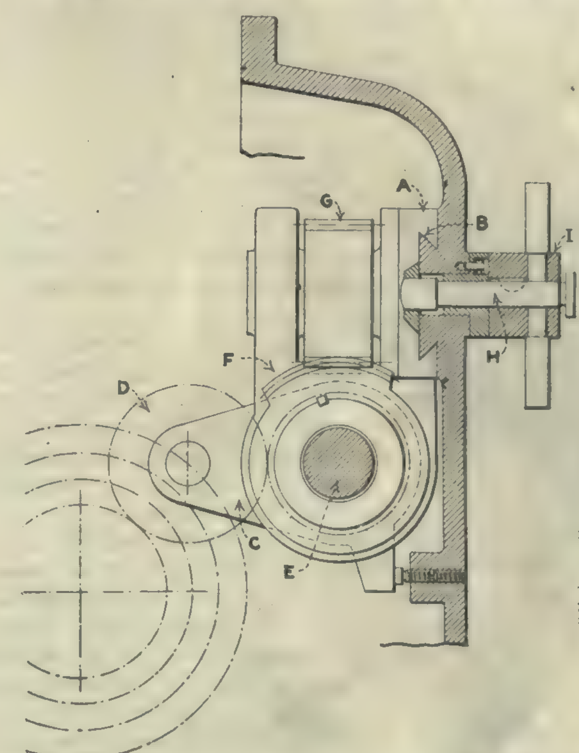


FIG. 100—SUCCESSFUL SHIFTING DEVICE FOR HEAVY-DUTY MILLING MACHINE

ing easy and prevents all possibility of binding. However, the load is still carried by the detent pin and the abutment in the wall of the feed box. Neither is there a proper way of locating the shifting lever before it comes into position.

In Fig. 100 is shown another device patented by the writer and applied by the Cincinnati Milling Machine Co. to the drives and feed boxes of the high power millers. In this device also the shaft is relieved of undue strains, but, besides, the tumbler is powerfully clamped in its proper position, while there are means for positively locating the shifting device before the idler is swung into mesh. In this construction the tumbler bracket A is hung on a tobin bronze plate B along which it can slide. The bracket C which holds the idler D is pivoted in A, so that, when A is moved sidewise, C and D must go with it, while at all times and in any position of A, C is free to swing around its pivot. This pivot is located around the center line of the driving shaft E. The swinging of bracket C is accomplished by two spiral gears, F and G, one of which is located on and keyed to an extension of the trunnion of C, while the other is located on shaft H which finds its bearing in bracket A and projects through a long slot in plate B and in the feed box. A pilot wheel I is keyed to this shaft.

To effect a shift, the pilot wheel is turned to the left which causes the bracket C to swing around the driving shaft, bringing the idler out of mesh with the cone gears. The pilot wheel should be swung as far as it is possible to go. This will bring the idler so far out of mesh that it will not strike any of the cone gears, when the bracket is shifted sidewise.

Though the pilot wheel is keyed to shaft H, it is possible to move it endwise on this shaft. This movement pulls a pin out of a detent hole in the feed box casting. The pin is located in a collar which is prevented from turning by a tongue fitting in the slot of the feed box frame. When the sidewise movement has been completed, the pin snaps in the new detent hole as soon as the pilot wheel has resumed its normal position on the shaft.

Turning the pilot wheel to the right lowers the tumbler bracket and brings the gear into mesh, and a hardened plug in a tail of the bracket against an abutment screw. Continuing the rotation of the pilot wheel brings the tumbler bracket trunnions hard up against their bearings, and the sliding member against its bearing on the plate B. The angle of the spiral gear teeth is less than the friction angle, so that the parts remain locked after the pressure is taken off the pilot wheel. This device meets all requirements of the cone and tumbler arrangement, but is rather expensive and should be used only for important drives which have to stand heavy loads.

Many variations of the cone and tumbler construction have been attempted. Many of them were ill-considered freaks, or arrangements which might be tolerated in crude machinery, but which were not applicable to machine tools. However, some of them had some interesting features which make them worthy of a closer acquaintance.

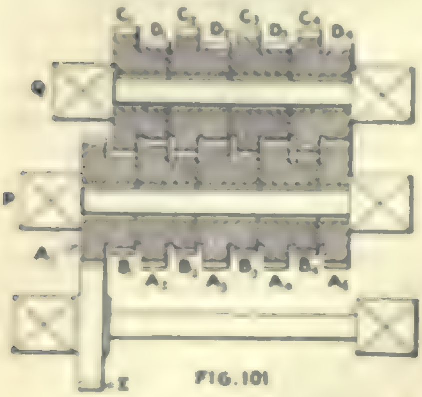


FIG. 101

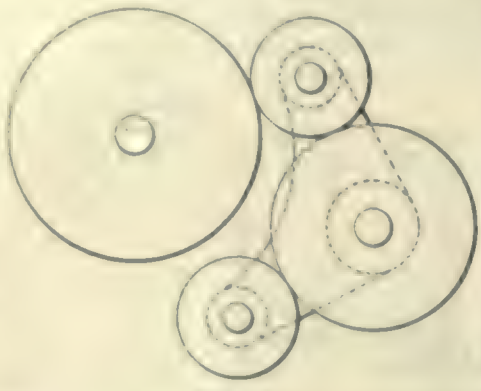


FIG. 102

FIGS. 101 AND 102—VARIATIONS OF THE CONE AND TUMBLER DEVICE

One of these constructions is shown in Fig. 101. There are two shafts, P and Q, on which are mounted a number of sets of gears. Each set consists of two gears of different numbers of teeth. The pairs of gears in shaft P are indicated by the letters A—B and those on shaft Q by C—D. All gears are run loose on the shaft (the shafts themselves do not turn). The gear A_1 is driven in some way not shown in the illustration. Its connecting gear B_1 drives C_1 through D_1 back to A_2. The connecting gear B_2 through C_2—D_2 drives A_3, etc. It will be seen, then, that we have a series of gears, A—A_1—A_2, all running at different speeds, all on the same shaft, and all of the same diameter, so that a sliding pinion E can move from one to the other and thus be made to run at as many different speeds as there are sets of gears in the system. It will further be noticed that the ratio of speeds between two adjoining gears is always the same. This arrangement is very simple in principle and allows for a very simple way of changing speeds by merely sliding the driven gear, but has the disadvantage of requiring a great number of gears, all of which are running all of the time. Besides, a great length on the shaft is required.

FIG. 103—LENGTHENING GEAR TEETH TO FACILITATE MESHING

There were arrangements such as are shown in Fig. 102, in which the driven gear could be connected to the cone by means of two idlers, one above and one below the cone. These idlers might be of different size, so that for each step of the cone there would be two speeds of the driven gear. Or, again, instead of one of the idlers, a pair of compound gears might be used, thus making a greater ratio between the two sets of speeds obtained. Or, instead of a single idler, there

might be two idlers in one branch of the tumbler, so that right- or left-hand rotation would be obtained, according to which side of the tumbler was in action. All these arrangements have the disadvantage that the tumbler is drawn into mesh on one side and pushed out of mesh on the other side by the action of the gears themselves. Such arrangements do not permit of a heavy construction, and can only be used for light loads.

To facilitate the throwing into mesh of the tumbler gear while under load, various means have been employed. The most common way is to provide the tumbler with a long lever so as to give the operator sufficient power to overcome whatever resistance he may meet. Another way is to continue the curve of the teeth of the idler, in other words, to make the idler teeth pointed. The cone gear may also be made pointed. This facilitates the meshing of the gears, but on the other hand weakens them considerably and this method should, therefore, not be employed for heavy loads. (See Fig. 103.)

Summing up the requirements of cone and tumbler arrangements: The length of pinion shaft should be held to a minimum between bearings; the tumbler should not be supported by the shaft, but should have its individual support; for heavy drives the tumbler should be positively locked; some arrangement should be provided to guide the operating lever before the gears are in mesh.

Installing Electric Trucks in an Old Plant

Investigation Necessary to Determine Adaptability—Checking Cost of the Present System —Outfit for Changing Batteries—Ability to Stand General Abuse

BY D. WRIGHT

Manager of Production, Dodge Manufacturing Co., Mishawaka, Ind.

THE plant in which it was decided to use electrical trucks consists of good-sized machine, floor and bench work foundries; machine shop and erection floors for the larger class of work; a large section devoted to wooden articles; a sheet metal shop, sawmill and several departments devoted to the smaller lines of both stock and made-to-order machine work. All of these departments, together with such accessory departments as power, tool, inspection and warehouses, are spread in a more or less regular order over a space of several acres.

The products consist of a very large variety of parts, both metal and wood, ranging in weight from an ounce or so to several tons. A large amount of the output consists of items, whose sales values justify their classification as stock, but there is also a considerable output of those pieces, where infrequent demand or uniqueness of design make it necessary to classify as made-to-order goods.

TABLE I. SUMMARY OF ROUTINE DAILY MOVES

Move	One-man Time, Minutes	Average Daily Trips Single	Average Daily Trips Double	Total Daily Time	Total Daily Cost
Casting stores to department 1..	25	0	10.5	262	1.31
Casting stores to department 2..	35	16.6	5.3	600	3.00
Casting stores to department 3..	45	2.2	9.4	489	2.44
Casting stores to department 4..	30	27	7	616	3.08
Department 1 to warehouse.....	50	0	43	2,150	10.80
Department 2 to warehouse.....	40	0	22	880	4.03
Department 3 to warehouse.....	46	0	6.5	300	1.50
Department 4 to warehouse.....	40	0	11	440	1.83
Total daily cost...............					27.99

The above are merely the common routine jobs, in addition to which there are a large number of regular moves, which are made at longer intervals, together with special jobs of transfer, switching of cars, etc., which are not taken into consideration at this time.

It was this varying nature of output handled, together with the nature of roads to be traveled, that had made it seem uneconomical to consider other than the hand-propelled balanced truck for the moving of material. In fact surveys that had been made by various representatives of electric truck concerns, indicated that it was not feasible to operate either elevating or platform electric trucks over all our runways, and it was this limitation that made it seem inadvisable to consider such an installation.

However, this question was one that persisted in coming up about every so often in spite of its being generally considered as "dead." Anyway, it finally got so persistent that the writer undertook a more complete survey of actual conditions than had yet been attempted, including routes regularly traveled, average trips per day over each of these routes under normal production conditions, average number of men necessary per trip on hand trucks, average time per trip; in fact as detailed a record as possible of all factors entering into our shop transportation system at that time. A summary of the results of these tests appears in Table I.

This investigation proved that there was a large amount of soldiering and unnecesary time lost on each trip over all of the routes, and that, pending the installation of mechanical handling, it was easy to place a time limit on the routes and by means of a rough check on the trips, cut down a lot on actual trucking time.

In the meantime correspondence had been carried on with a number of makers of industrial electric vehicles and a pretty good idea had been obtained as to what the operating cost of various types of electric trucks would be, including depreciation, upkeep, current, operator, interest on investment, etc. The results of this canvass, as summarized in a composite form, are shown in Table II.

TABLE II. COST OF ELECTRIC TRUCK INSTALLATION

(All figures are hypothetical as conditions are changing in market continually and therefore the following can be only illustrative.)

Initial expense:	
Truck..............................	$2,000.00
Skids, trailers, etc..................	200.00
Charging equipment..................	400.00
Total..............................	$2,600.00
Annual expense:	
Depreciation on 5-year basis..............	$520.00
Interest at 7%..........................	182.00
Allowance for upkeep....................	100.00
Total annual charge....................	$802.00
Daily operating expense:	
Daily charge on 300-day basis............	$2.67
Daily cost operator 9 hr. at 50c...........	4.50
Current cost..........................	0.50
Total daily cost.......................	$7.67

The writer had previously used electric trucks of

several makes in other plants, and from his experience with these outfits, had a pretty well-defined preference for one make, of which he had bought seventeen machines in times past. Accordingly it is easy to see that, when inquiries were sent out, there was an obvious advantage in favor of this particular maker. With the stage set in this fashion, it is noteworthy that the selling efforts of the maker of this particular truck developed into a perfunctory series of letters, containing vague and tardy replies to requests for information and a final complete "petering out" of all intercourses.

Contrasted with this was the attention to detail, generous service and pleasing personal intercourse accorded by the salesman of another concern, who although presenting his own products in as attractive a light as possible, took hold of the whole affair in a constructive way and treated it first as an electric truck installation and then as an opportunity for his particular truck to make good.

We had considerable trouble with our charging outfit, owing to the fact that our factory uses direct current of a high voltage, operating only at certain hours during the day, while the charging voltage on batteries is low and should be continuous over a period ordinarily counted as idle shop time. This charging installation was made after investigation and upon recommendation by the truck makers.

After being led to believe that after buying our truck and the beautifully fitted up charging panel, which came along with it, all we'd have to do was to plug in our charging plug at the end of the day and go home, secure in the thought that the little sentinel on the panel board would attend to such minor matters as reducing voltage, cutting off, starting up, etc., it was a poser to come back in the morning and find that instead of being all charged up and in fine shape to run, our battery had lost whatever charge it might have had, and a day of hand trucking confronted us. This was especially true when the generator had been allowed to "die on the line" before the required charge had been put into the battery.

Ultimately a small motor-generator set actuated by standard city current, which is available at all hours, was installed. This equipment handled the charging very nicely, although mechanically it was of poor design. One functional detail that has not been cared for as yet, has to do with the possibility of a momentary stoppage of the current supply and the ability of the charging outfit to bridge this gap and resume operations as current becomes available.

As our product is made up of a big variety of work and there are a lot of things done with our truck, which are not covered in any estimate or figured in on any cost, it was deemed advisable to compile a weekly report, Fig. 1, from a record kept by the truck driver, in which he makes note of all his moves throughout the day.

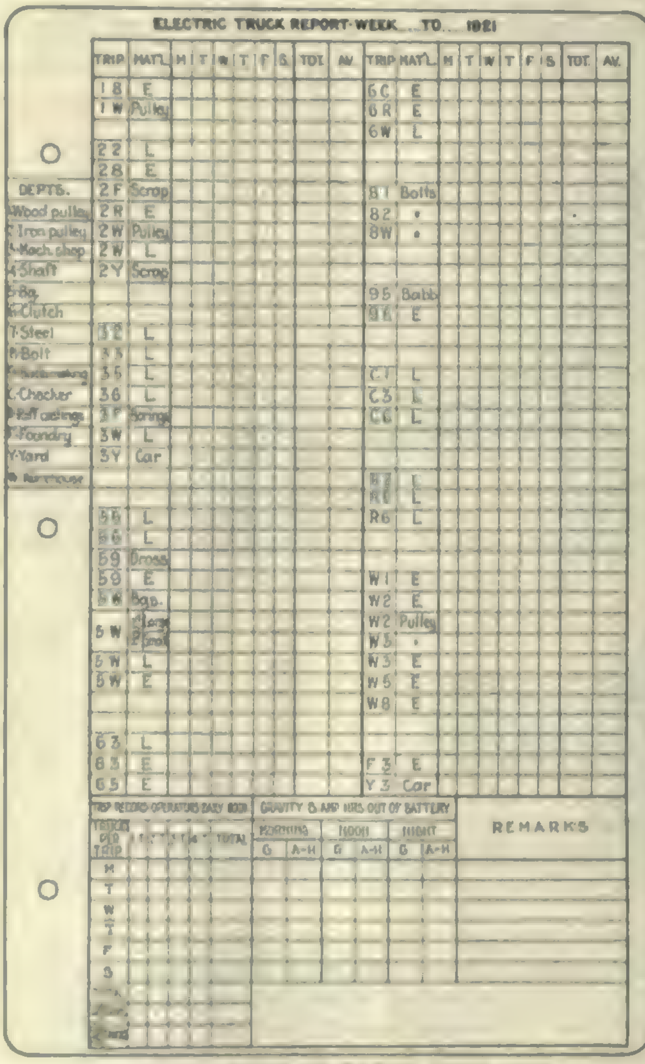
Hydrometer readings are taken morning, noon and night, together with a record of the current consumption for the day up to that hour as shown by the ampere meter mounted on the truck.

This close supervision has had the effect of keeping the equipment in first-class shape and especially as it relates to that mysterious, usually-neglected-because-very-little-understood heart of all electric factory vehicles, the storage battery. Our original estimate figured on replacing our battery at the end of between two and three years, but as matters now seem to be progressing, based upon our daily observations, this limit is going to be materially extended.

While on the subject of storage batteries, there is one point in connection with our particular problem which had a lot to do with the delay in making our installation, owing to the unwillingness of some of the truck makers to guarantee the performance of their product under the condition as it existed in our plant.

Our heaviest routine loads are in the form of finished material moving from the various metal-working departments to our small parts inspection. This department is located on the second floor of our warehouse and shipping building and is reached by a steam-hydraulic elevator from the entrance to the first floor. The first floor is several feet above ground level, with the result that all trucks entering this floor must negotiate a ramp with a grade of about 14 deg. and perhaps 40 ft. long.

This ramp is so located as to be practically impos-



...PORT OF TRUCK OPERATOR

sible of change as to either location or grade and here it was that the greatest discussion arose as to the ability of the various trucks to negotiate the rise.

The writer had always had a preference for a certain type of battery through a belief in its ability to best withstand general abuse in the hands of unskilled operators, but this one troublesome incline finally made it necessary to give ground in favor of a battery of another type which, through its greater ability to meet sudden increases in unloading rates without permanent

injury, was the only one which seemed to meet the requirements. Certain it is that the decision seems to have been borne out by results, as capacity loads have been hauled up this incline for a year or more and the battery is apparently as good as ever.

The following factors seem to be essential to the successful use of power hauling in place of hand trucking in a field of miscellaneous production:

Don't take the salesman's word with regard to the unbeatable possibilities for economy within your plant through the adoption of mechanical haulage. It is not possible for a sales engineer in the course of a brief inspection of your layout to do more than uncover the more or less obvious things. The host of minor details, which have so great a part to play in the why and wherefores of a plant's routine, can only be learned after long and intimate contact.

Don't think that the installation for power hauling is going to eliminate the hand trucker. There will always be certain conditions, where expediency, sudden need or other limiting factors will make it advisable to use hand trucking. On the other hand, it is possible to cut out any men previously maintained for inter-department service alone, and in large departments maintain a man for load shifting within that department. In the case of small shops this may usually be cared for by a general sweeper-trucker-roustabout.

Look beyond the actual trucking and realize that any truck can only give service in proportion to the efficiency and adaptability of its charging outfit. Too little attention has heretofore been given by the truck-maker to ascertaining that the purchaser of his truck had facilities for maintaining it at a point of high efficiency. Some day the truck folks are going to form a combine with the battery and charging equipment people, looking to this co-operative efficiency and then there'll be more trucks sold.

Get your truck maker to tell you frankly what real weaknesses your truck may have. He knows them, and if he's the right sort of chap and realizes that you appreciate that even the best of machines have weaknesses, he should be willing to tell you about them. Then cover yourself against possible tie-ups by laying in a small stock of spare parts to meet anticipated breakdowns.

Recollections of an Old-Time Mechanic

By John J. Grant

The variety of home-made and make-shift equipment that made up Bill Clapp's machine shop in Northhampton (Mass.) was the best I had ever come across in my travels.

We had a suspension drilling machine that was one of the handiest tools I ever saw. Years ago I wrote an article on drilling machines for the *American Machinist* in which I described this drill. A tool of this description would be a valuable tool for shops doing large work at the present day.

We had one planer 24 x 24 in. x 6 ft., made by Gage, Warner & Whitney, Nashua, N. H. The architectural design was rather elaborate, but the machine designer was certainly abroad when the drawings were made (if there ever were any). We had more trouble to the square inch to make that planer behave than any tool I ever saw. The platen was continually running off the gear and tipping endwise to the floor. I finally made a sort of table at the end that prevented this. The elevating screw was in the center of the crossrail and after each raising it was necessary to set it parallel with the platen, with a surface gage. Of course, we changed it as seldom as possible, using long tools for the work.

There was one tool in the shop that stood out from all the others and had nearly all the refinements of tools of its class made today. This was a 42 x 42 in. x 10 ft. planer made by Slate & Brown, Windsor Locks, Conn. It was designed by Dwight Slate, one of the foremost mechanics of his day. I have often talked with him about this tool and it pleased him to have me enumerate its good points. It had the first friction feed box, afterwards applied to Pratt & Whitney planers.

We had a gear-cutting machine bought second-hand from the old Lowell machine shop. It was built on a wooden frame, had an index plate about 30 in. in diameter, and had been used so long that several of the rows of holes looked like grooves. Our gear cutters were all straight face, commencing with about 30 deg. included angle and guessed at for the lesser number of teeth. We filed most of the teeth in the gears to shape, often putting them on studs on a plate and running them together, getting the shape in that way. The only man who knew a thing about gearing was the patternmaker who used to shape the teeth by his eye.

We made gears that certainly ran well even though they were only "notches on the periphery," as Joe Renshaw at the Pratt & Whitney Co. used to call all badly cut gearing.

Our other tools were a bolt cutter, hand lathe and, of course, the usual grindstone under the stairs. At first it was difficult for me to grind a tool on account of the stone running out of true. I simply had to hold the tool solid on the rest and let the high places on the stone hit it when they came around, which by the way is often the case with the abrasive wheels in the shops of today.

After a few months in Old Bill's shop, the Civil War was declared and from that time on for the next three years, we were kept hustling. We did a large amount of work for the Government, such as gunbarrel drilling-machines, barrel-reaming machines, lapping and polishing machines and rolls for forging bayonets. Everything was on the jump and we certainly averaged fourteen hours per day during that time.

We had no addition to our equipment except such small tools as were actually necessary to produce the results called for by government inspectors. Old Bill fought the making of every tool and used to say: "You machinists ought to do anything with all the tools we have in this shop."

Most of the machines we made were well built and I would not be surprised to find many of them still in use at the Armory at Springfield, Mass. That shop did such an endless variety of work that it was no uncommon thing to see in the big lathe, a set of drivers from one of the Hinckley & Drury locomotives used on the Connecticut River R.R., and a man close by repairing a sewing machine. We had no specialists, every man was supposed to know how to handle every machine in the shop. No one man had a machine of his own but took any that was free at the time his job was given to him.

Of course, Old Bill's shop was a jobbing machine shop, and the greater part of it was used for that purpose, although we made standard machines, such as sawmills, waterwheels, and steam engines. It took skill, patience and perseverance to produce good work with such an equipment.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Chart for Calculating Fit Allowances

A. D. SANGER

The tendency in manufacturing today is to work as close to the nominal dimensions for a part or parts as is consistent with the degree of accuracy necessary to the proper functioning of the parts and to the cost of producing. Any further degree of accuracy that is on either side of the standard established, is unnecessary and almost always costly.

From time to time various data have been published regarding this subject and it is not assuming too much to say that nearly every factory has its own individual system for establishing allowances, although several may manufacture the same product. Perhaps the closest attempt toward standardizing allowances for mating parts, has been made by the National Screw Thread Commission. Its investigations and recommendations show conclusively that it is not only possible to arrive at a standard that will be universal in application, but also that this scheme is practicable and desirable from several standpoints.

Years ago the Newall Engineering Co. made an attempt similar to the one conducted by the commission, but confined its endeavors to establishing suitable and practical working allowances for various classes of plain work. Its findings have been published in several handbooks, such as the "American Machinist Handbook," and a number of trade catalogs.

PREVIOUS TABLES WERE FAULTY IN METHODS OF GROUPING

The one objection to the tables for allowances that have been published, is the method adopted in compiling them, a method of grouping too many sizes or too many diameters for one set of allowances. If allowances closer than those tabulated are wanted, they must be estimated or arrived at by solving the formulas given, and these formulas are not always published.

To facilitate this work, the accompanying chart was designed and has been found successful, especially for diameters that are not specified in the tables. Reference to the chart shows that there are three scales, one containing the allowances in decimals of an inch, the second, which is a diagonal scale, giving the diameters of the parts to be made, and the third showing the classes of work.

The class of work scale provides a means for establishing allowances in accordance with the character of the work. This scale eliminates allowances that are too small and confines them to something close to a size that will produce a good working condition for the mating parts. An allowance that would ordinarily be permitted for close tool work or for gages would hardly be practical if applied to the same diameter of a part on an engine or motor. The conditions imposed upon the parts in these cases would, as a rule, be entirely different. Therefore, the allowance made for tool work would be too close for the latter and that which would be acceptable for engine work might prove to be too rough for tool work.

The system is based upon the theory that the hole is of a standard size and any allowance made for the shaft is to be deducted from the nominal diameter of that part. Also, the system recognizes the fact that cutting tools do not always cut to size, especially when new. Therefore, allowance is made for the variation of standard holes above the nominal size, so that when taking the allowance from the chart this value is to be added to the nominal size of the hole. For holes, the allowance is to be applied plus and for shafts, minus. The allowance for the holes is divided into two classes, one of which may be used for the working limits and the other for the inspection limits.

USE OF A STRAIGHTEDGE IN USING THE CHART

A few examples will illustrate the use of the chart. Let the diameter be 1 in. for the hole, in which is to be placed a shaft, the two making what would be termed an "easy" fit. The high and low limits of the shaft diameter are desired. With a straightedge connect Class IV on the class scale with the 1-in. diameter mark on the diagonal scale, allowing the straightedge to project beyond the allowance scale. Where this line intersects the allowance scale, read 0.0025 in. Now, further down on the right-hand scale is another Class IV. Connect this point with the 1-in. diameter mark, and on the left-hand scale, read 0.00125 in. We then have two limits, a high and a low, which means that the diameter may vary from 0.00125 to 0.0025 in. undersize. In actual limit dimensions this means that the shaft size would be specified thus, 0.99875 to 0.9975 in. The tolerance on the shaft will, of course, be the difference between the two limits, or 0.00125 in., and the initial clearance will be 0.00125 inches.

Let us assume another case wherein the shaft is to fit a 2-in. hole and the class of work required is that for fine tool work. Connecting VI with the 2-in. diameter mark the allowance is found to lie between 0.00125 and 0.0015 in. Therefore, we have a choice of either, or something in between, say 0.00135 in. Again connecting the lower VI with the diameter, the allowance is found to be 0.00075 in. Therefore, the shaft may vary from the nominal size, 2 in. by minus 0.00075 in. to minus 0.00135 in. The initial clearance being 0.00075 in. and the tolerance 0.0006 inches.

PROPER ATTENTION TO WORKING LIMITS AN AID TO INSPECTION

Referring to the first example, that of a 1-in. hole, let us assume that it is desired to make an inspection gage for checking the hole; also a gage for the workman is wanted. If the working limits are held closer to the nominal size than the inspection limits we will

be assured that the inspection gage will accept all parts when they have been made to the working gage. Therefore, connecting the I and II marks on the class scale with the 1-in. diameter mark we find the allowance on the left-hand scale to be plus 0.0006 in. and plus 0.0008 in. respectively. If the former allowance is assigned to the working gage and the latter to the inspection gage we are permitted a variation from the standard size sufficient to compensate for the variation in tools and yet we obtain a hole that will not depart too far from the standard size.

The allowance for other sizes and classes of work are found in a similar manner. However, the allowance provided will depend upon the class of work, the character of the tool equipment and the machinery used and the conditions imposed upon the working parts. Therefore, even with the limits provided for by the chart, which are closer than the tabulated values given in tables, good judgment must be exercised by the designer or workman in establishing limits. As a rule, the whims or judgment of the one responsible for establishing tolerances is permitted, which results in a variety of dimensions, increases the chance for errors, and either increases the cost of the manufacture or causes difficulty in the assembling. A little thought concerning the chart will indicate wherein it can be advantageously used on most work in the drafting room.

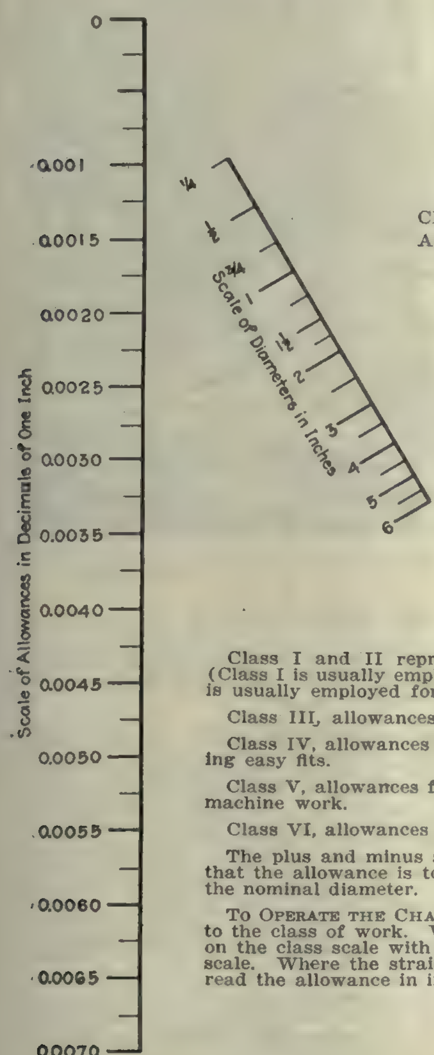


CHART FOR CALCULATING ALLOWANCES FOR VARIOUS CLASSES OF FITS

Class I and II represent allowances for standard holes. (Class I is usually employed for working allowances; Class II is usually employed for inspection allowances.)

Class III, allowances for push fits.

Class IV, allowances for engine fits and other work requiring easy fits.

Class V, allowances for high-speed work and good, average machine work.

Class VI, allowances for fine tool work.

The plus and minus signs after the class numbers indicate that the allowance is to be either added to or deducted from the nominal diameter.

TO OPERATE THE CHART: Determine the fit required relative to the class of work. With a straightedge connect this point on the class scale with the nominal diameter on the diagonal scale. Where the straightedge intersects the allowance scale read the allowance in inches.

What Are the Most Advantageous Angles to Give to Cutting Tools?

BY M. TOLLIVER

For some time past I have been making a study of the most advantageous angles to give to cutting tools, and I know of no better way than to look over articles in *American Machinist* dealing with this subject. I regret to say that I did not find as much as I expected, or maybe I should say that I found a great deal too much. This sounds a little involved but you will see what I mean from the following examples:

In *American Machinist* of Aug. 11, 1921, I find an article by Fred H. Colvin on tools for boring and turning locomotive tires. He illustrates the various tools used in various shops and gives their main elements. Considering that all of these tools are used in the same kind of a job and on the same kind of material one would expect them to be somewhat similar, at least in their essentials. Instead I find differences like this:

Hocking Valley, top rake 8 to 10 deg.

Wabash, top rake 2 deg.

One naturally asks what is the difference between the Hocking Valley and the Wabash that cutting tools should have a difference of 6 to 8 degrees in top rake. After puzzling for a little while on the whys and wherefores of this difference I came to the conclusion that it may possibly be a difference in artistic tastes of the presidents of the railroads, but this nice little theory was knocked in the head when I found in the same tabulation the following:

Grand Trunk, Battle Creek, Mich., top rake 8 deg.

Grand Trunk, Montreal, Canada, top rake, 18 deg.

This shows that it cannot be a matter of personal taste on the part of the presidents but that it may possibly be the result of latitude.

I found so many other differences that I gave it up and I will ask other readers of *American Machinist* to solve the puzzle for me. A tabulation is at the end of this article.

I can see how different shops may have different cutting speeds or feeds. The reason may be that they have different machine tools with more or less power but why there should be a marked difference in the angles of tools is more than I can understand, and I wonder if the people who use the tools understand it themselves. One thing is sure in my mind. All of them

cannot be right and probably one of them is the best or may be the least worst. Possibly some of the gentlemen who decide on the nature of tools to be used for boring tires may be kind enough to enlighten me.

TABLE 1—CONDENSED TIRE BORING TOOL DATA FROM SEVENTEEN RAILROADS

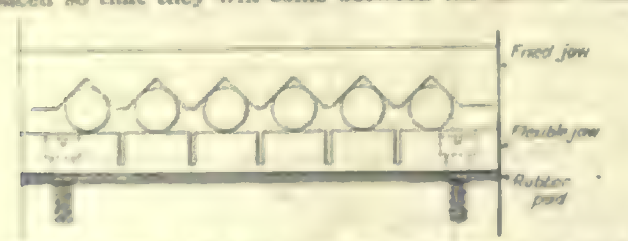
Name of Railroad and Shop	Size of Tool Body, Inches	Top Rake of Tool, Degrees	Clearance at Point, Degrees	Cutting Speed Feet per Min. Roughing	Cutting Speed Feet per Min. Finishing	Feed per Revolution Roughing	Feed per Revolution Finishing
1. Atchison, Topeka & Santa Fe, Topeka, Kans.	See sizes on drawing	12	15	18	18	⅛	⅛
2. Chicago & Alton, Bloomington, Ill.	1¼x1¼	8	6	25	25	⅛	⅛
3. Chicago & Northwestern, Chicago, Ill.	1¼x1¼	12	10	15	15	⅛	⅛
4. Canadian Pacific, Montreal, Can.	1 x1¼	6	6	14	12	⅛	⅛
5. Chicago, Rock Island & Pacific, Silvis, Ill.	1¼x1¼	6	7	16	16	$\frac{1}{16}$	⅛
6. Denver & Rio Grande, Burnham, Colo.	1¼x1¼	8	6	16	20½	$\frac{1}{16}$	$\frac{1}{16}$
7. Grand Trunk, Battle Creek, Mich.	1¼x1¼	8	5	26	26	$\frac{1}{16}$	$\frac{1}{16}$
8. Grand Trunk, Montreal, Can.	1¼x1¼	10	5	23	23	$\frac{1}{16}$	$\frac{1}{16}$
9. Hocking Valley, Columbus, Ohio	1¼x1¼	8–10	7	40	40	[illegible]	[illegible]
10. Lehigh Valley, Bethlehem	1½x2	7	8	12–20	12–20	[illegible]	[illegible]
11. Norfolk & Western, Roanoke, Va.	1x1	4	6	18	18	⅛	⅛
12. New York, New Haven & Hartford, Readville, Mass.	1x2	5	7	55	50	⅛	⅛
13. New York Central, Depew, N. Y.	1¼x1¼	4	4½	24	24	⅛	⅛
14. New York, Ontario & Western, Middletown, N. Y.	1x1	15	6	28	28	$\frac{1}{32}$	$\frac{1}{32}$
15. Pennsylvania, Olean, N. Y.	1¼x1¼	2	7	19½	19½	$\frac{1}{16}$	$\frac{1}{16}$
16. Philadelphia & Reading, Reading, Penn.	1½x3	6	4	30	30	$\frac{1}{16}$	$\frac{1}{16}$
17. Wabash, Decatur, Ill.	1¼x1¼	2	7	30	30	[illegible]	[illegible]

Equalizing Vise Jaws

By S. A. McDonald

Trouble is often experienced in slotting the heads of screws when more than two pieces are being held in a vise at one time, due to slight variations in the diameters of the pieces. To overcome this trouble the vise jaws shown in the illustration were designed.

The fixed jaw is of usual construction. The equalizing jaw is made of tool steel and has a series of slots spaced so that they will come between the screws when



COMPENSATING VISE JAW TO HOLD SEVERAL PIECES

the jaw is in place. This jaw, after being drilled and counterbored for the fillister head holding screws, is hardened and drawn to a spring temper. A piece of ⅛-in. rubber of the same width and length as the jaw is put in between it and the slide.

When the vise is tightened on the screws the rubber is compressed, exerting a pressure on the flexible jaw, bending it to meet variations in the size of the screws.

Erratum

One of our readers has called our attention to an error in the article "Tools for Blanking and Piercing Watch Wheels," on page 114. The dimensions in Fig. 2 should have been given in millimeters instead of inches.

Milling Ports in Valve Bushings

By I. B. Rich

Having a lot of valve bushing ports to mill and no large vertical milling machine to handle them on, the master mechanic of the Readville, Mass. shops of the New York, New Haven & Hartford railroad, rigged up an old vertical drilling machine as shown herewith. It was easier to get the blacksmith to forge up the frame *A* for the head of the milling spindle than to get a pattern made, which accounts for the forged head in-

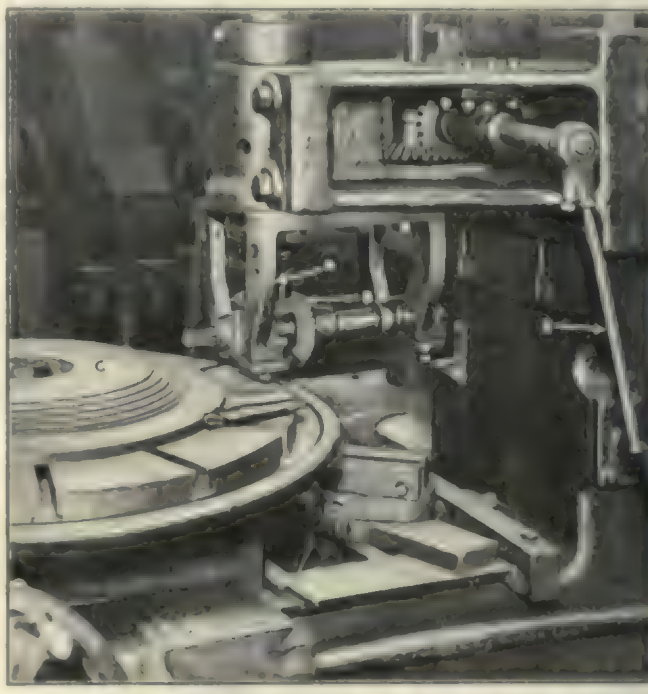


FIG. 1—MILLING PORTS IN VALVE BUSHINGS

stead of a casting. This head carries the spindle which drives the milling cutter, the drill press spindle driving the milling spindle by means of the bevel gears shown at *B*.

The valve bushings are centered on the stepped plate *C*, the steps being turned to fit the different bushings used. The bushings are held in place by a long center bolt. The combination of the rotary feed of the table and the vertical feed of the drilling head gives the desired movements to the milling cutter and the work. The vertical feed is secured by the ratchet handle *D* while the rotary motion is secured by the handwheel *E*, shown in the lower left-hand corner.

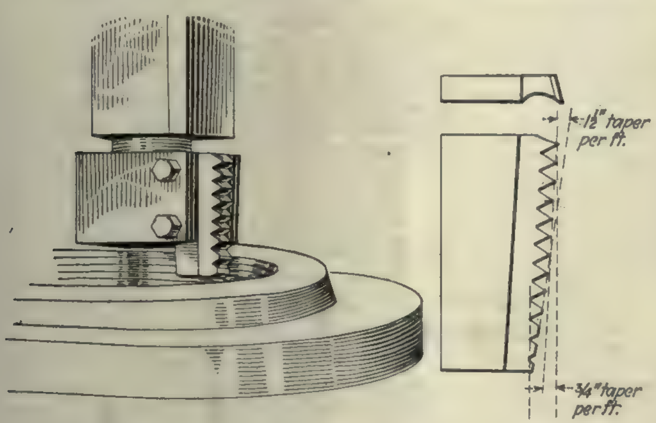
Threading Pipe Flanges in a Boring Mill

By Joe V. Romig

Having a large quantity of cast-iron flanges for pipes to machine, we equipped a boring mill, as shown in the illustration, to do the work. On this machine more than one operation could be carried forward at the same time, thereby gaining considerable time over the lathe with its single point cutting tool.

The flanges were first faced off and properly recessed upon the joint surface, then turned over for boring and threading in the manner described. The mill was provided with a friction feed that could be adjusted to any desired relative advance. A chaser was made and

fitted to a suitable holder as shown, and the feed adjusted as nearly as could be calculated to the required pitch. With the work revolving, the chaser was fed into the hole by power with the tips of the chaser teeth just touching the work, the light line thus made serving to show when the rate of advance was right and enabling the operator to make minor corrections. The chaser would then be withdrawn, the head moved by means of the cross-screw and micrometer dial to



CHASING A THREAD IN A BORING MILL

give the exact depth of cut, and the chaser run through the hole, thus cutting the thread to required depth in one pass. As the cut proceeded the head would be moved slowly toward the center to give the thread the necessary draft.

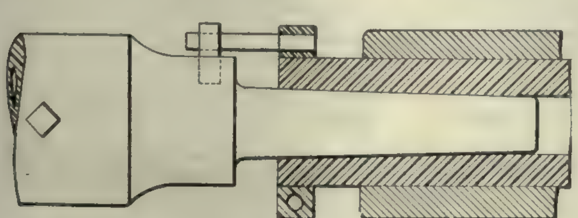
The chaser was made in the shaper by swiveling the vise to correspond with the helix angle and tilting it slightly forward to give the necessary clearance. One of the requisites of a free cutting chaser is the lip, which I have tried to show as clearly as possible in my sketch.

Holding a Drill Chuck on the Tail Spindle of a Lathe

By Charles Kaufmann

To prevent a chuck from wringing loose when it is used in the tail spindle of a lathe, as in drilling, make a clamp ring as shown in the sketch to fit over the tailspindle and provide it with a pin extending horizontally to contact with a pin in the chuck body.

This is simple and easy to make, will not mar the spindle, and will save a great deal of annoyance when



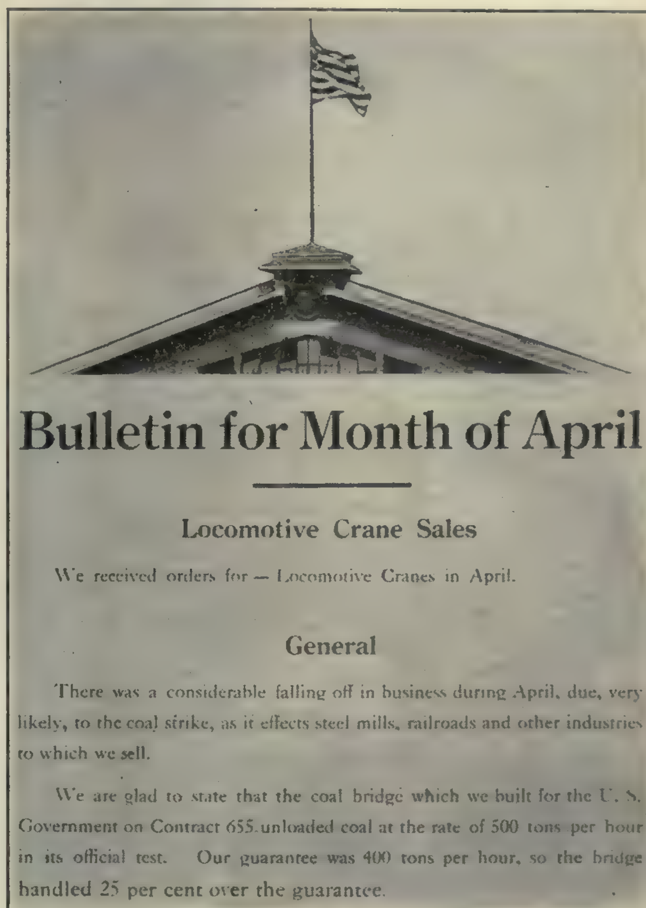
KEEPING A CHUCK FROM WRINGING LOOSE

using a drill chuck in this manner. Do not forget to make the head of the clamping screw in the ring the same size as the toolpost screw, so that you will not have to hunt up a wrench every time it is necessary to adjust it.

Keeping the Shopmen Interested in the Company

By Herbert Crawford

The Brown Hoisting Machinery Co., Cleveland, Ohio, believe that men are more interested in their work and in the company, if they are kept posted as to what they are making and as to how it performs. One method of doing this is shown in the bulletin reproduced herewith. The company also posts blueprints showing the main features of new cranes or hoists with the general dimen-



Bulletin for Month of April

Locomotive Crane Sales

We received orders for — Locomotive Cranes in April.

General

There was a considerable falling off in business during April, due, very likely, to the coal strike, as it effects steel mills, railroads and other industries to which we sell.

We are glad to state that the coal bridge which we built for the U. S. Government on Contract 655 unloaded coal at the rate of 500 tons per hour in its official test. Our guarantee was 400 tons per hour, so the bridge handled 25 per cent over the guarantee.

ONE OF THE SHOP BULLETINS

sions and special features clearly shown. These prints also tell what the machines must do and give other interesting details. Similar methods can be used to advantage in almost any shop.

Two Ways of Making a Core

By M. E. Duggan

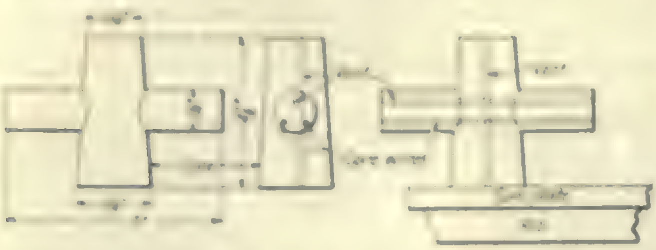
In casting a brass valve body a core, as shown in the accompanying illustration, was used. There were several sizes of this valve, the only difference being in the dimensions, and cores had, of course, to be made for all.

When in doubt as to just how best to make a pattern or corebox I usually consult with the molder or coremaker, or both, and as a rule I accept their "say so" as final. However, there are times when they too make mistakes; some of them costly.

The core here shown should interest patternmakers for the reason that the practice of "drying on end" is the subject of some controversy. I doubt if there are

many patternmakers sufficiently well informed on coremaking practice to give a positive answer to the question "Is this method practicable and economical?"

Brown was the boss coremaker in the foundry where these valves were to be produced in large quantities. In order to produce a perfect core and at the same time speed production, Brown decided that a set of twenty-



CORE FOR BRASS VALVE BODY

four cast-iron core dryers for each size—168 castings in all—were required, and these cost about $95.

Brown quit his job as foreman coremaker and Black took his place. One of the first things that Black did after assuming his new responsibilities was to throw out the 168 dryer castings because, as he said, "the way to dry the cores is on end." Here is how he did it.

A full core was made in an open end box in the usual manner, and straight rods cut full length were inserted in the cross members as shown. The vent rod was passed through both branches of the core after the core rods had been set in place. The corebox was laid flat on the bench and the upper half lifted. The remaining half, with the core in it was then transferred to the drying plate, set on end, and the half box carefully drawn away.

Reference Reading in the Shop School

By Robert H. Barnes
Instructor of Drafting, Rochester Shop School

An outline of the system followed in the Rochester Shop School in regard to the reading by students of references and articles pertaining to their studies as the latter are published in the various trade papers and technical publications, is presented herewith.

The magazines are preserved in binders that allow the addition each week or month of the numbers as they appear. After the advertising pages have been duly read and digested by those interested, they are removed and the editorial section preserved in the binders. A printed plate or form corresponding to the

Note: Make copy of the reference data in note book if your name appears hereon Read matter below Follow instructions as closely as possible, making notes where it seems advisable
Return this copy to desk file

Check Name Reading Assignment; Date: June 6 1922

Reference: American Machinist
Volume: 56 Number: 22
Page 807 to 842 820 Treatment of bearings 823, 824, 833, 836 c.a.g.
Read, and if you consider this construction as something that it is desirable to know Make sketch in notebook and take any notes from reading matter that will aid you to remember same.

Note drawings on pages 807 to 809, 822, 823, 830;

FIG. 2—REFERENCE FORM ON COVERS OF BINDERS

System to be Followed by Boys in Drafting Department
Relative to Time Alloted to Reference Reading

Those whose names appear hereon should make a note of the time they are to use in the pursuance of this assignment, as given on blue print 264, and retain it during the entire term.
Time assignment for reference reading at least one period of 45 min. each week. Time is to be used by those below in completing the assignment.
(Return this copy to desk file)

Check	Name	Department	Term	Weekday	Period
	Craig	Draftsman	5	Tuesday	3
	De Young	Machine	1	Monday every other week	2
	Smith	Machine	1	Tuesday on alternate week	2
	Be kage	Pattern	1	Wednesday " "	2
	Hawker	Machine	1	Thursday " " "	2

FIG. 3—ASSIGNMENT LIST OF STUDENTS

magazine is pasted on the cover of each binder, the one shown in Fig. 1 being for the *American Machinist.*

The forms represented in Figs. 2 and 3 are also pasted on each cover and these are filled out by the instructor, directing the attention of certain students to definite articles in the magazine that it is desired to have them read. Upon reading the specified article a student passes the volume along to him whose name appears next in line, after placing a check mark before his own name to indicate that he has completed the assignment.

Vol. 56 | Number 22 | Date Jun. 6 '22

American Machinist
Magazine

Place on file in Drafting department
of Rochester Shop School

For reading and reference purposes

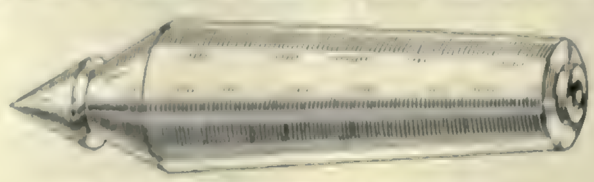
(Keep in file according to volume and number)

FIG. 1—BOOK PLATE USED IN ROCHESTER SHOP SCHOOL (BLUEPRINT 264)

Saving Time in Grinding Centers

By Charles Kaufmann

The centers of the average engine lathe are many times larger than is actually required by most of the jobs that are done upon them. To save time in regrind-



A TIME SAVER FOR THE TOOLROOM

ing hardened centers it will pay to fit each lathe with an extra pair, made as shown in the sketch.

In this way the grinding wheel does not have to cut away a lot of extra metal every time the centers are trued, and the time thus saved will soon pay for the making of this extra equipment.

Editorial

Relative Turnover Rates

ACCORDING to the 1919 Census of Manufacturers, the value added by manufacture to the products of the whole country was slightly less than one and a half times the capital invested. In other words American business as a whole turns its capital approximately one and a half times a year. Further investigations show that the machine-tool industry succeeds in turning its capital only a little more than nine-tenths of one time in a year. Bear in mind that the period under discussion, 1914 to 1919, includes the war years when the industry was making such "fabulous" profits.

It is almost axiomatic that the surest road to commercial success is through small profits and rapid turnover. Apparently the machine-tool builders have endeavored to follow only the first part of the road, the small profit section, without sufficient attention to the second. We say "apparently" because as a matter of fact it is next to impossible, under present conditions, to increase the rate of turnover.

In the long run there seems to be only one way for the machine-tool industry to keep up with the procession. If the rate of turnover in that industry is of necessity less than the rate for other industries, then it is certainly logical to expect a greater return on each turnover provided the whole business is not to be conducted as a philanthropic enterprise.

Encouraging the Manufacturer

WHEN a political campaign impends and the sinews of war are in demand there is much talk of encouraging the manufacturer, protecting him from foreign competition, the good of the community, and so on. Many of the arguments used to support the iniquitous tariff bill now before the Senate are based on such reasoning.

In between times, however, the encouragement sometimes assumes a rather negative character. Take for instance the case of an old New Hampshire machinery concern which was recently visited by state assessors with the result that the valuation of its property was increased ninety per cent. In all probability the assessors were honestly applying the law of the state in making their valuation, but the result of their action is detrimental not only to the state but to the community in which this plant has been an important factor for many years.

The company in question has purchased a factory site in a Middle-Western state near one of the big steel centers, and one that is served by several trunk line railroads. Eventually the old plant will probably be closed, with a loss not only to the state in the matter of taxes but to the community in the elimination of a live industry employing many men, who will be compelled to seek work elsewhere and take their trade from the merchants of the town.

The puzzling part of the situation is that the same legislative encouragers who are so willing to make promises before election are the ones responsible for the kind of taxation law which works so badly for the people they are supposed to represent.

Business and the Artist

THE artist has always been famous for his ignorance or disregard of hard business facts. To him the satisfaction of achievement, of creating some beautiful thing in marble, on canvas or in metal, is sufficient recompense for the hours of hard work put in. The real artist seldom realizes the true value of his work, and puts entirely too low a price upon it. His customers are only too glad to accept his valuation and profit accordingly.

The "practical" man who builds the machinery which makes possible the present scale of living would be the last to consider himself an artist, and yet he answers every item of the description except that sometimes his work is not exactly beautiful according to accepted standards of beauty. One of the best of modern American painters, a man who has given much thought to the psychology of the artist, maintains that the only difference between the painter and the mechanic lies in the medium used by each to express his ideas.

The artistic spirit of the mechanic is typified in the remark made to us by the president of a firm of machine tool builders just after the successful introduction of a new design. He said, "Aside from the commercial value of this tool there is a very real satisfaction in having finally achieved an ideal we have had for years." Judging from the price he put on the tool he is likely to get most of his returns in satisfaction rather than in cash. A trus artist, the mechanic, but not much of a business man.

Unemployment Insurance

IN TWO STATES bills are being advocated to make unemployment insurance compulsory on all manufacturers. Undoubtedly similar laws will be proposed in other state legislatures this autumn.

The subject of unemployment insurance holds out alluring possibilities to the humanitarian, the socialist, the college professor and other well-meaning individuals who are not hampered by the unpleasant functioning of economic laws. In most cases their motives in advocating such legislation are above reproach, but not so their knowledge or acceptance of inescapable economic facts.

To bring the unemployment insurance question squarely before the machinery industry we have two articles in this issue, one on the economic phases of the problem and the other on the private and public efforts to solve it both in this country and in Europe. They merit careful reading as a rigid enforcement of such acts as the Wisconsin Bill of 1921 would do untold harm to the industry.

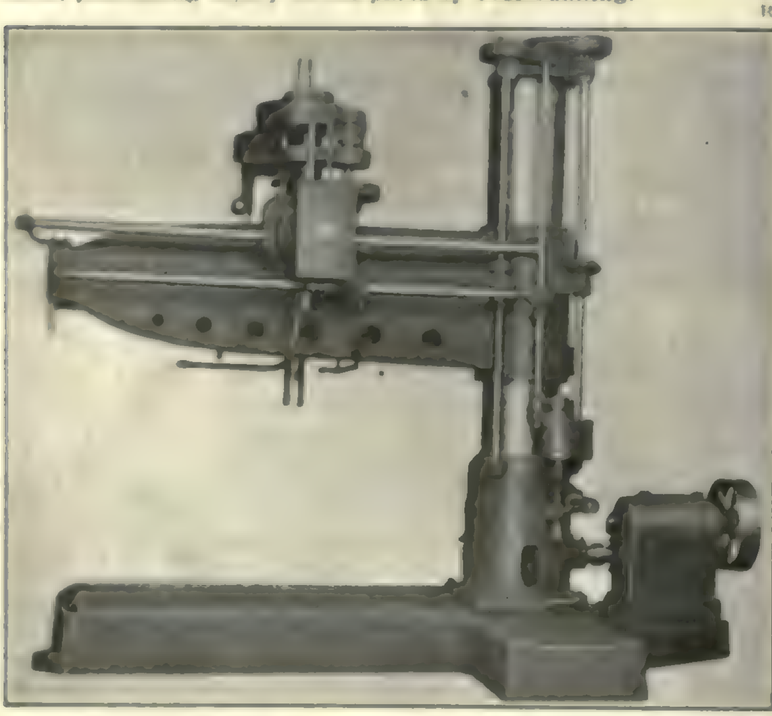
Shop Equipment News

Power Clamping Device for Column of Dreses Radial Drilling Machine

In order to eliminate the necessity for the operator of a large radial drilling machine leaving his place at the head to tighten the column carrying the swinging arm at each shift of the drill, the Dreses Machine Tool Co., Cincinnati, Ohio, has just placed on its machines a device for clamping by power. The clamp is controlled from the head. No air pressure is required for the device, so that it is not necessary to have piping and air hose brought to the machine.

A rear view of a radial drilling machine equipped with the power clamp is shown in the accompanying illustration. The device is driven from the main vertical driving shaft, which extends through the small oval box at the rear of the column. Two friction clutches in the box are incorporated in the drive, so that the screw below the box can be run either right- or left-handed. On this screw there is a nut that operates a forked lever. The hub of this lever is tapped and threaded on the binding screw of the column, so that the column is clamped in position when one of the clutches is engaged.

Engagement of the friction clutches that operate the screw is accomplished by means of a cam on top of the box. This cam is attached to the vertical splined shaft, which is geared to the horizontal splined shaft at the back of the arm. The links and the hand lever attached underneath the head move with it, and can be employed to operate the mechanism and clamp the column. The friction clutches are self-releasing and slip at either end of the movement of the tightening lever, preventing injury to the parts by over-running.



POWER COLUMN CLAMP ON DRESES RADIAL DRILLING MACHINE

Robbins Profiling and Milling Machine

The Robbins Machine Co., 42 Lagrange St., Worcester, Mass., has just placed on the market a vertical-spindle profiling and milling machine, shown in the accompanying illustration, that is somewhat different from the conventional design.

ROBBINS PROFILING AND MILLING MACHINE

The work table has a surface of 16 x 30 in. and the throat depth from the center of the spindle to the face of the column is 14 in., thus accommodating comparatively large work for this type of machine. The table traverse is 12 in. and the cross movement 7 in. The knee may be moved vertically a distance of 6 in. and there is a vertical movement of the spindle of 2¾ in., operated by a rack and pinion.

The crossfeed screw is operated through helical gears from a handwheel that stands in the same plane as the traverse handle, thus making it convenient for the operator to manipulate both movements simultaneously. The end of the cross screw is squared to carry a crank handle in the usual position if desired.

The spindle is 1⅞ in. in diameter and takes a No. 3 Morse taper shank. A through hole provides for the use of a knock-out rod. The spindle runs in three parallel bearings of bronze, each 4 in. long, by which it is held rigidly in alignment. The drive is through gen-

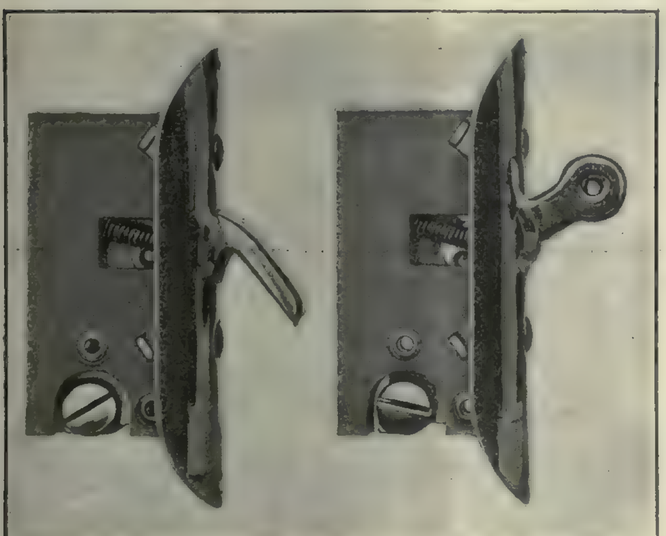
erated bevel gears from a shaft having a four-step cone to provide speed changes.

The normal height of the table from the floor is about 36 in., and the maximum distance from the table to the lower end of the spindle is 9 in. The machine occupies a floor space of 36 x 45 in. and weighs 1,100 pounds.

Cutler-Hammer Tool-Handle Switches

Two types of compact electric switches for use on small tools and appliances have recently been placed on the market by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. The view on the left of the accompanying illustration shows a momentary-contact type of switch for installation in the handle of such tools as portable drills. The switch is usually so placed that when the tool is gripped the forefinger of the operator rests on the trigger, so that the current can be easily turned on. A spring causes the trigger to return to the off position, so that when the grip is released the switch automatically opens the circuit.

The switch shown on the right of the illustration is of different form, and is provided with an operating



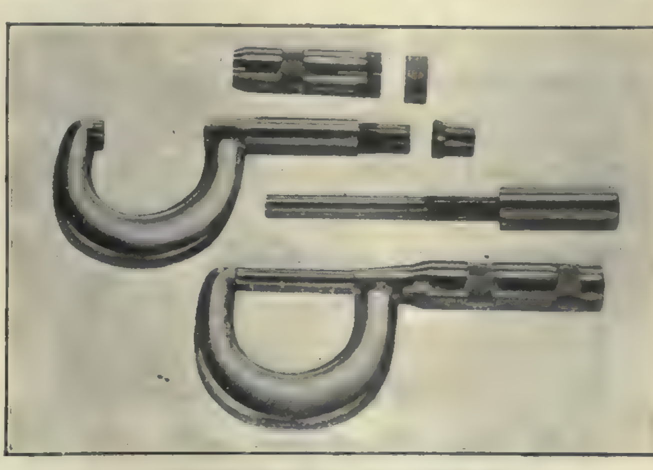
CUTLER-HAMMER TOOL-HANDLE SWITCHES

lever, but no spring to return this lever. The switch is for use in appliances where it is desirable that the switch remain in either the off or the on position until the lever is moved to the other position by the operator. The devices are provided with long phosphor-bronze contacts which engage with a wiping motion.

Jaques Special Micrometer

A micrometer, designated as the "Jaques Special," has just been brought out by the Central Tool Co., Auburn, R. I. It is shown in the accompanying illustrations, the lower view giving the tool assembled and the upper one the component parts. All the parts are shown separately, except that the measuring spindle and its sleeve, which appear as one piece, are two pieces pressed together.

The frame is of oval section and is one piece with the barrel. The outer end of the barrel is split to provide means of compensating for wear of the thread, and the adjustment in diameter is made by the spring nut which may be seen adjacent to the barrel. The thimble is a tight push fit over the sleeve of the meas-



JAQUES SPECIAL MICROMETER

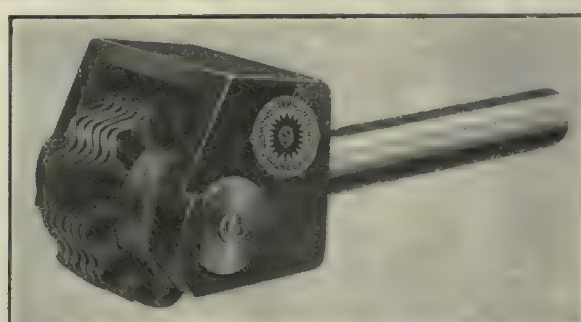
uring spindle and it is also split and provided with a knurled ring nut for clamping it to the sleeve.

The micrometer may be dis-assembled, the adjustments made, and then reassembled in a few seconds with no tools other than the operator's fingers. After the adjustment is completed, the spindle is run into contact with the anvil, and the thimble turned or moved endwise, or both as may be necessary, to bring the zero lines into coincidence. After the outer ring nut has been tightened, the micrometer is ready for use.

Desmond-Stephan Roller Bearing Grinding-Wheel Dresser

The accompanying illustration shows a rotary type of grinding-wheel dresser that has recently been placed on the market by the Desmond-Stephan Manufacturing Co., Urbana, Ohio, in which device the tool-steel disks are carried on roller bearings. The advantage of the construction is the easy running of the disks and the long life of the bearing. It is stated that on a continuous run of 15 hours the bearings showed no wear, and the cutters showed a loss in diameter of $\frac{3}{16}$ inch.

A stud $\frac{3}{4}$ in. in diameter carries a cage holding the rollers of the bearing, which in turn support a bushing



DESMOND-STEPHAN ROLLER-BEARING DRESSER

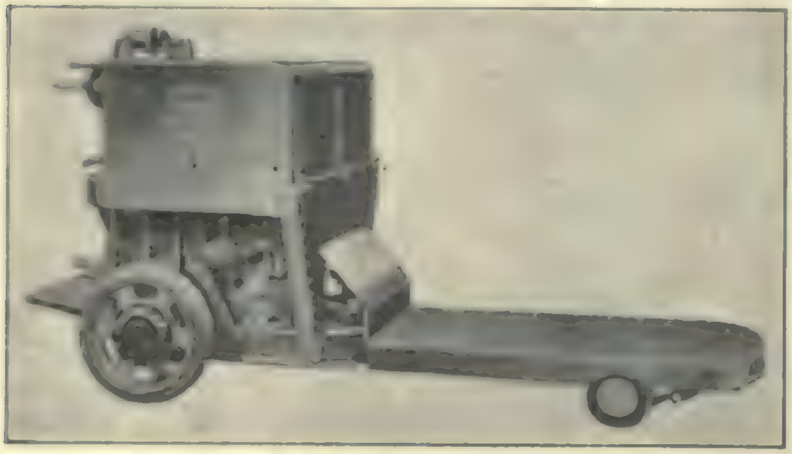
on which the cutters are securely fastened. The construction makes the bearing dust-proof, but provides means of oiling it. The cutters have a corrugated form, are $2\frac{3}{8}$ in. in diameter and may be replaced when worn.

The body of the device is so made that it is applicable to use either in a toolpost or on a magnetic chuck. The shank is employed to hold the dresser in a toolpost; for use on a chuck, the device is turned over from the position shown in the illustration, so that both the top of the body and the end of the shank rests on the chuck table.

Automatic Transportation Co. 3-Ton Lifting-Platform Truck

An electric-driven industrial truck of the lifting-platform type, in which castings have been eliminated throughout the framework, is shown in the accompanying illustration. Structural steel hot-riveted in place is employed to provide a rigid and durable, as well as light, construction for the truck. The truck is a recent product of the Automatic Transportation Co., 2933 Main St., Buffalo, N. Y.

The truck has a lifting capacity of three tons. The battery, the motor, the drive mechanism and the control mechanism are similar to those employed on previous models of this company's trucks. Steel covers enclose the batteries and all of the auxiliary mechanism.



"AUTOMATIC" 3-TON LIFTING-PLATFORM TRUCK

"Everwear" End Test Gage

An end gage for testing micrometers or for use in quantity production of work requiring the accurate gaging of internal diameters, is a recent product of the Central Tool Co., Auburn, R. I. The gage is herewith illustrated with the cap and ball removed from one end to show the construction.

The central part, or stem, is cupped at both ends to receive a $\frac{5}{16}$-in. commercial steel ball, which is retained in place by a sleeve or cup threaded to screw on the stem.

Because of the fact that the actual measuring contacts are provided by round balls, the gage may be adjusted to compensate for wear by merely loosening the sleeves and turning the balls slightly to expose unused portions of their surfaces. After several such adjustments the balls may be discarded and new ones substituted. The name "Everwear" is applied because of the ability to maintain the length of the tool. The gage can be furnished in any desired length above 1 inch.

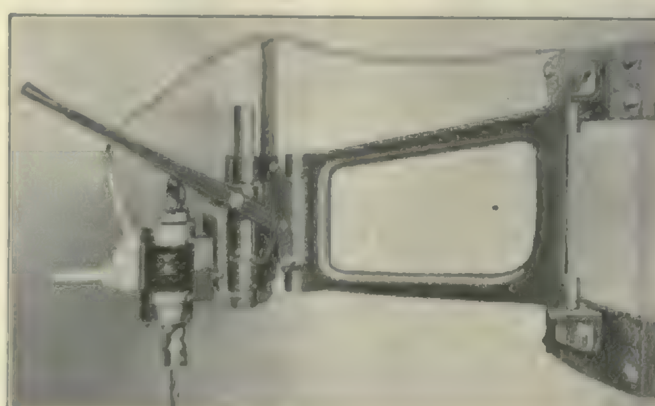
"EVERWEAR" END TEST GAGE

Van Dorn Radial-Arm Electric Drill for Millwrights

In order to provide an electric drill especially adapted to the needs of millwrights and maintenance men, the Van Dorn Electric Tool Co., Cleveland, Ohio, has recently placed on the market the "millwrights' special" radial-arm drilling machine that is shown in the accompanying illustration. The device can be attached to the wall or to a column for performing jobs of a stationary nature where rigidity and greater accuracy are required than can be obtained by holding the drill in the hands.

The power-driven unit of the machine is essentially a portable electric drill of the type formerly made by the concern. The housing is of aluminum; the whole tool is light in weight, and the parts are arranged to permit quick dismounting for greasing and cleaning. The motor is of the universal type, adaptable to both a.c. and d.c. circuits. It is ventilated by means of an aluminum fan on the rotor shaft, which latter is equipped with ball bearings. The drill chuck holds twist drills up to $\frac{3}{8}$ in. in diameter for work in iron and steel, while larger bits can be carried for boring wood.

The arm that carries the drill is light in weight so that it can be easily swung on its pivots or carried to different parts of the shop. Two brackets are bolted to the wall or column to carry the pivots that support the arm. At the outer end of the arm is a second pivoted joint on which the short forearm swings. The outer portion of the forearm is a support and guide for the bracket carrying the drill. The portable drill can be quickly attached to the radial arm by removing one handle from it and bolting it to the adaptor plate. It is stated that less than one minute is required to attach and detach the drill from the arm, thus making the machine available for portable drilling operations.



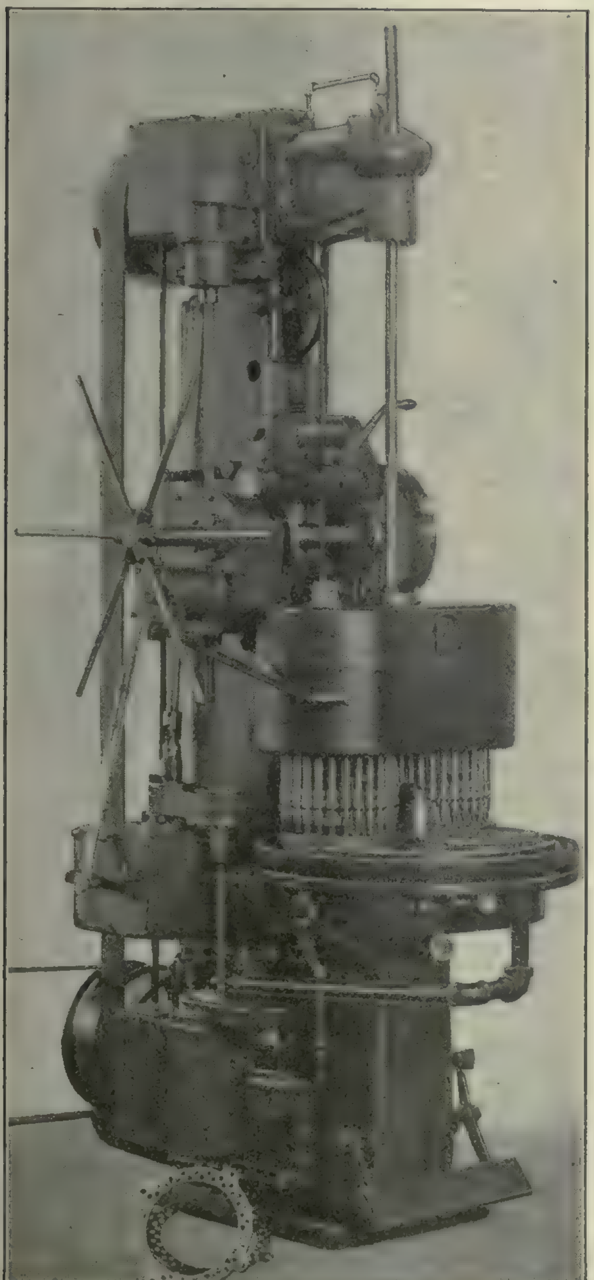
VAN DORN RADIAL-ARM ELECTRIC DRILL

The drill bracket or vertical sliding members can be operated by means of the long hand lever. A tension spring attached to the bottom of the drill bracket counterbalances the weight of the drill. The area of operation for the cutting tool lies within a circle having a radius of 31½ in. from the wall pivots. The auxiliary forearm provides a secondary radius of 10½ in. that permits of varying the distance of the drill from the pivot, and enables locating it over the work.

Fox No. 12 Automatic Countersinking Machine

A single purpose machine designed for such work as countersinking automobile clutch plate holes has just been introduced by the Fox Machine Co., Jackson, Mich. As arranged for countersinking the fifty-two holes in Hudson clutch plates it is a three-station, rotary-table machine with twenty-six spindles in each of two groups mounted in a single head as illustrated.

The speed box on top of the column is similar to the one used on other Fox machines, but the feed box, on the left in the figure, has but one fixed movement



FOX AUTOMATIC COUNTERSINKING MACHINE

instead of the usual changes through sliding gears. The vertical shaft which drives the spindles is driven by a bevel gear from the front of the speed box. The other vertical shaft shown, coming from the feed box, drives the cams through which the spindles get their up-and-down motion of ½ in. A clutch is provided so that the feed can be released or engaged at will.

The shaft with universal joints at both ends transmits power from the feed box to the table indexing mechanism which indexes the table 120 deg. through a modified Geneva motion. The tripping is done by the upward movement of the head.

The countersinks float so that any small irregularity in the spacing of the holes in the work may be taken up. Each spindle has a vertical adjustment graduated to 0.005 in., and a positive lock.

Forced lubrication of the spindle bearings and spindle head gears is provided by a geared pump located in the head. A feature of the design is an arrangement which prevents oil from running down the spindles. The drilling compound is carried in the forward compartment of the lower tank and is forced up through the center of the table to flow out over the entire work surface. The pump is belt driven from the indexing mechanism drive shaft, as is the pump which forces the lubricant to the speed box gears and which is located in the rear compartment of the tank.

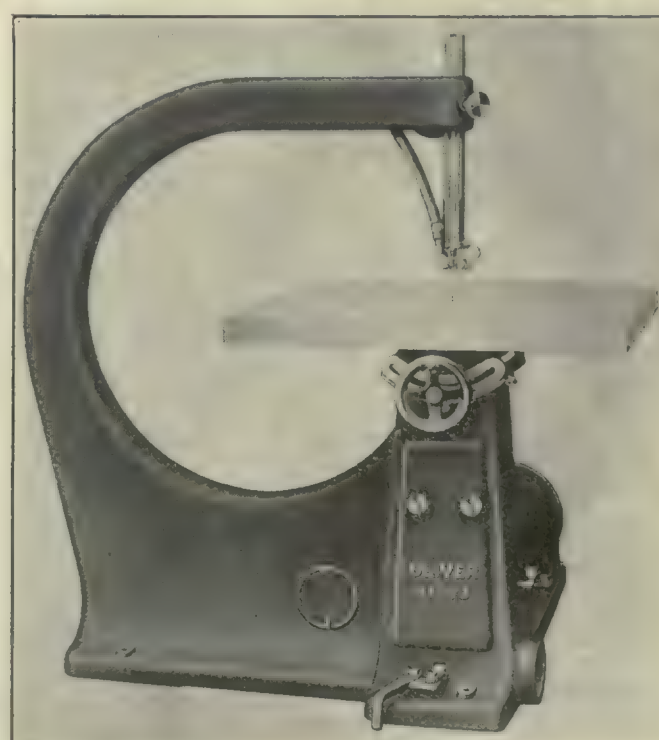
The machine is started up at a rate of ten cycles per minute or a completed plate every six seconds. This arrangement gives the operator plenty of time to change pieces at the loading station and higher production is expected when he becomes more familiar with the machine.

Initial drive is through an automobile type dry disk clutch at the top of the column and controlled by a foot lever at the base of the pedestal. The weight of the machine is 2,450 pounds.

Oliver No. 173 Self-Contained Jig Saw

A self-contained jig saw known as No. 173 has just been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The machine is designed for all kinds of interior and exterior scroll work made of wood or other substances of similar machineability.

As will be seen from the illustration no moving parts



OLIVER SELF-CONTAINED JIG SAW

are exposed except the saw. The fact that the saw is mounted in such a way that it is not under tension is also claimed to add to the safety of the machine. An automatic clamping device below the table operating in conjunction with the sliding block above makes the changing of blades an easy job. The pitman and cross-head are made of aluminum to reduce the weight of reciprocating parts.

The cast-iron table is 39 x 34 in. and may be tilted to an angle of 30 deg. right or left. It is possible to rotate the saw guides 90 deg. in their bearings so that the work may be fed either from the side or the front. The foot control is arranged to be operated from either position.

A slide in the table may be withdrawn by means of a knob on its under side to allow chips and small pieces to drop through the table out of the way. A continuous air blast is directed at the front of the saw to carry away dust.

The speed of the shaft is 1,200 r.p.m. and a flexible coupling is provided to connect it directly with the motor. Belt drive can be provided if desired. The stroke of the saw is 3 in. and saws up to 18 in. long may be used. From the saw to the column there is a clear opening of 36½ in. but longer work can be fed from the side as indicated above. The highest work that can be taken under the guide is 10 inches.

One dozen saws and the necessary wrenches are furnished with the machine.

Bath Inspection Gage and Stand

The inspection gage and stand shown in the illustration has recently been brought out by John Bath & Co., Inc., Worcester, Mass., and is intended for facilitating the calibration of accurate internal diameters in hardened and ground work. The gage is a modification of the Bath internal micrometer that measures internal diameters by means of a combination of a micrometer screw and sliding wedges, which micrometer was described on page 578, Vol. 54, of *American Machinist*.

The under surface of each wedge is inclined at an angle of 15 deg. to the body of the tool, and the wedges are moved longitudinally by the micrometer screw, which is actuated by turning the knurled end of the stem. Because of the amplification of movement obtained through the combination, very fine increments of diameter can easily be discerned. The tool measures readily variations as small as 0.0001 in., each mark on the thimble representing this amount. Measurements involving portions of divisions may be estimated as easily and accurately as upon the corresponding 0.001 in. divisions of the standard micrometer.

A tapered ring of hardened steel at the entering end of the tool enables the inspector to slide the work upon the measuring surface easily while the stand holds the tool firmly. the arrangement leaves the operator's left hand free to handle work, while with the fingers of his right hand he manipulates the knurled measuring screw.

BATH INSPECTION GAGE AND STAND

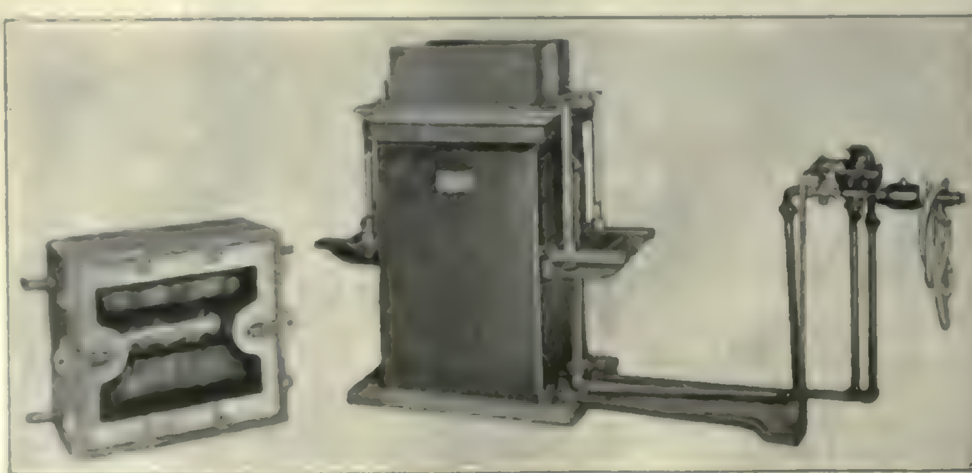
The stand grips the measuring tool by the knurled handle, which has no movement with relation to the body, and the gripping surfaces are faced with soft metal to prevent marring the tool. Measuring tools can be supplied for any diameter above 1 in., and the change from one size to another can be easily made.

Arcade Jolt Stripper Molding Machine

A jolt type of molding machine equipped with a pneumatically operated stripper has recently been added to the line of the Arcade Manufacturing Co., Freeport, Ill. The machine has a 6-in. jolting motion operated by compressed air in the usual manner. The air-operated stripping motion can be furnished with either 8 or 12 in. length of stroke. The machine having the 12-in. stripping motion is placed with half its height below the floor level, but the 8-in. strip machine is placed entirely above the floor.

The accompanying illustration shows a machine having an 8-in. stripping motion. A pattern is mounted on the jolting table, and a flask containing a completed mold is shown on the floor at the left of the illustration. The arrangement of the operating valves can be easily seen.

The stripper frame which carries the vertical pins



ARCADE JOLT STRIPPER MOLDING MACHINE

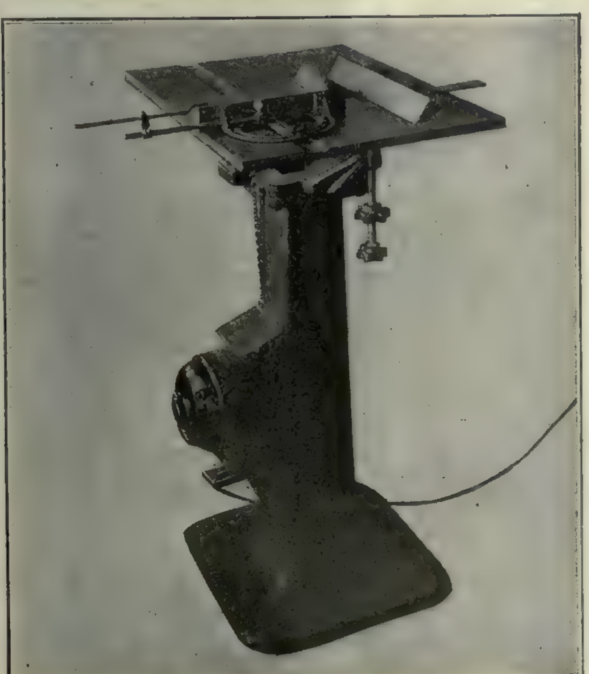
that engage the stripping plate, or that lift the flask when a stripping plate is not used, is mounted on an annular type of piston. This piston fits around the column of the jolt cylinder and inside the large cylinder at the bottom of the machine. Sheet-metal guards cover the pistons and cylinders, so that they are not visible in the illustration. For the 12-in. lift, the annular piston is provided with a bearing 18 in. long on the guiding column. The flask containing the sand can be lifted straight up from the pattern, so that only a very small amount of draft is necessary.

The lifting pins that engage the stripping plate or the flask are adjustable in position, so as to suit work of different sizes. The machine may be made with a hand-operated stripping device for use in connection with small jolt cylinders; also it may be provided with several stripping cylinders for long flasks.

Sisson Portable Saw Bench for Patternmakers

A. C. Sisson, 41 Bayley St., Pawtucket, R. I., has placed on the market a small portable saw bench intended for the use of patternmakers and cabinet makers, and in jobbing machine shops where there is woodworking to be done. The machine is entirely self-contained. The arbor is belt driven from a motor mounted on a bracket at the side of the pedestal, the belt running inside the hollow column. The motor can be attached by a flexible cord to any convenient lamp socket.

The table is 38 in. from the floor, has a working surface of $16\frac{1}{2}$ x $21\frac{1}{2}$ in., and is provided with a rip fence that may be set at any angle for bevel sawing, as well as a cut-off slide that is also adjustable to obtain miters



SISSON PORTABLE SAW BENCH

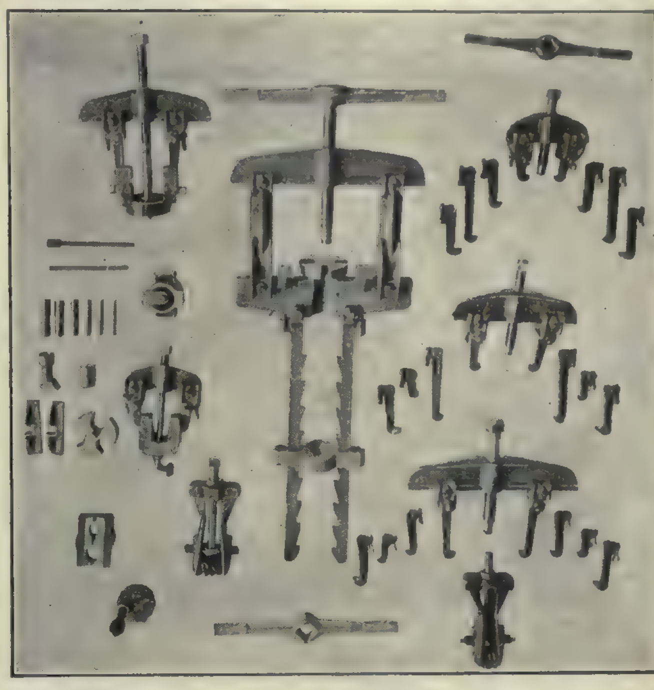
up to 45 deg. An adjustable stop attaches to the cut-off slide for duplicating lengths.

The arbor can carry a 6-in. saw, and it runs at 2,400 r.p.m. The table may be tilted to any angle or swung up out of the way entirely when changing saws. The machine weighs 184 lb. with the motor.

Dover Combination Hand Press and Puller

A combination hand press and puller, designed primarily for use in garages and jobbing shops for the purpose of removing wheels, gears and bushings from their shafts and also for pressing such parts in place, has recently been placed on the market by Geo. W. Dover, Inc., Eddy St. and Thurbers Ave., Providence, R. I.

The base can be attached to the work bench by means of three lagscrews. With the yoke, spreaders and anvil



DOVER COMBINATION PRESS AND PULLER

plate in place, as may be seen in the center of the accompanying illustration, the device becomes an arbor press, for handling round pieces up to 18 in. in diameter.

Three yokes of different lengths are supplied, each having a set of hook arms to adapt the device for pulling off refractory wheels or for extracting bushings. The arms are reversible so that they may be used either side out, and they may be placed any distance apart within the limits of the yoke, to suit the work. Special hook arms are provided for removing gears and bushings from parts for certain makes of automobile that cannot be reached with the regular equipment.

The yokes, arms and other parts that are called upon to withstand stresses are drop forged from 40-point carbon steel, and are capable of sustaining a load of 50,000 lb. per square inch of sectional area. The illustration shows appliances adapted to use with the device.

What Does Complication Mean?

By A. W. Brown

We are told to avoid complication; but if you were to ask me to define this term exactly, I would say very frankly that I could not. One machine is "complicated" because it contains a great number of parts; another, because although it has fewer parts, it has more kinds of parts.

On first thought, I might say that the latter was the more complicated of the two and the next day I might reverse my judgment. Take your choice; but in manufacture avoid unnecessary "complication" of either kind.

News Section

Accountants Will Hold International Conference

The preliminary program of the third international cost conference under the auspices of the National Association of Cost Accountants which is to be held in Atlantic City, September 23, 25, 26, 27 and 28, 1922, has just been issued.

Among the important subjects which are listed for discussion at the various technical sections are "Actual Costs as Compared with Replacement Costs," "Sales and Administration Costs," "Standards as a Means of Reducing Costs," "The Place of Costs in Business Management," "Cost Problems of Specific Industries—Steel and Textile Industries."

It is expected that more than a thousand cost men from United States, England and Canada will be in attendance at this conference. The National Association of Cost Accountants under whose auspices the conference is to be held has become international in its operation through affiliation with cost associations in other countries. More than a thousand business concerns are represented among the three thousand members of the association.

Interchangeable Mileage Bill Passed

The news of the passage of the Interchangeable Mileage bill recently by Congress will be received with no small degree of satisfaction by all persons who travel to any extent whatsoever. The amendment to the Interstate Commerce Act, providing for these books, reads, in part, as follows:

"The Commission is directed to require, after notice and hearing, each carrier by rail, subject to this Act, to issue at such offices as may be prescribed by the commission interchangeable mileage or scrip coupon tickets at just and reasonable rates, good for passenger carriage upon the passenger trains of all carriers by rail subject to this Act. The commission may in its discretion exempt from the provisions of this amendatory Act either in whole or in part any carrier where the particular circumstances shown to the commission shall justify such exemption to be made. Such tickets may be required to be issued in such denominations as the commission may prescribe. Before making any order requiring the issuance of any such tickets the commission shall make and publish such reasonable rules and regulations for their issuance and use as in its judgment the public interest demands; and especially it shall prescribe whether such tickets are transferable or non-transferable, and if the latter, what identification may be required; and especially, also to what baggage privileges the lawful holders of such tickets are entitled."

Now that constitutional authority has been given, it is expected and hoped that immediately following the signing of the bill by President Harding, the Interstate Commerce Commission will act without delay. One of the outstanding features of the new book, when issued, is that the traveler will not be required to carry a number of different books, inasmuch as the one form of book will be universally used and accepted.

Machine Tool Exhibition in New Haven

On September 21 there will be opened in New Haven a machine tool exhibition under the joint auspices of the New Haven branch of the American Society of Mechanical Engineers and the Department of Mechanical Engineering of Yale University.

The Mason Laboratory of the University has been set apart for this purpose and the exhibition, devoted entirely to machine tools, will be held on September 21, 22 and 23.

While the original purpose of the exhibition was to bring before the manufacturers of the State of Connecticut and the engineering students of Yale University the latest developments in machine tool practice, it is also being held this year for the purpose of stimulating industrial activity and hastening a return to prosperous conditions in the machine tool industry.

No charge is being made for space and there will be no admission fee charged for spectators. H. R. Wescott, 207 Orange Street, New Haven, member of the executive committee of the New Haven Branch of the A.S.M.E. is chairman of the exhibition committee and any inquiry for information or space should be addressed to him.

Department of Commerce Opens Atlanta Office

According to B. C. Gelsinger, director of the recently established Atlanta office of the Bureau of Foreign and Domestic Commerce, the only office of the bureau between Washington and New Orleans, the Atlanta district will embrace the five states of Georgia, Florida, Alabama and North and South Carolina. The office, which will be in room 205, Chamber of Commerce Building, Atlanta, will be ready to function on or about August 15.

Of recent years southern manufacturers have developed a large volume of export business with Latin-American countries, and this office is expected to bring about a further increase in this business. At present the principal products of export are machinery, machine tools and machinery supplies, common and face brick, lumber, and iron and steel products and railway equipment, most of the latter items from the Alabama district, and the principal trade is with Cuba, Mexico and Central America.

Philadelphia Industrial Conditions

While there are many general rumors of substantially increasing business the increase in operations and employment in the metal manufacturing industry of Philadelphia during June, though steady, has been but slight, as revealed by the compilation, embracing the reports of 132 metal manufacturing establishments in this vicinity.

According to statistics just compiled by the Metal Manufacturers' Association of that city, 132 shops added 1,313 employees to their payroll during the month of June equivalent to an increase of 3 per cent compared with May. The labor turn-over, while somewhat less than in May, is high, 6,080 hands being put to work to obtain a net increase of 1,313 employees.

The increase in June as compared with May was well divided among all of the varied groups of the industry with the exception of group 1, including shipyards and marine engine plants; group 4, including knitting, weaving, dyeing and drying plants; group 8, including metal stamping works; and group 10, including electrical, surgical and dental specialties and instrument factories.

Average weekly operating hours remained about the same and are slightly more than the average weekly operating hours in July, 1920. No further decreases in wages were made and the average reduction since the depression set in two years ago totals 22.4 per cent which figure is likely to be maintained some little time.

Fewer plants had an increase in weekly man-hours in June than in May and the aggregate increase is very considerably less than it was in the preceding month. This may indicate that the rising tide of business in our lines has temporarily reached its peak and may subside. Similar indications might be drawn from the decreasing demand for labor as revealed by the classified want advertisements in the leading newspapers of this city, which this month have averaged 20 per cent less for male help and 35 per cent less for female help, the male help demand having declined even in the face of large advertisements for labor to take the place of men on strike from the railroad shops.

An examination of starting and prevailing rates for labor in eighty-three metal working establishments now employing 27,059 hands, reveals that there has been only very slight changes in rates since February of this year. The rates for some crafts are slightly higher and for others slightly less. Generally speaking, however, there has been no change of moment and the averages are practically the same as prevailed in February. Unless there is some considerable improvement in business conditions now prevailing it is probable, in our opinion, that the rates now existing will be maintained for quite some time.

Machinery Manufacturer Returns from Trip to Orient

Mr. Henry Harnischfeger, President of the Pawling & Harnischfeger Co. at Milwaukee, Wis., has just returned from a six months' tour around the world, in which he visited Japan, China, the Philippine Islands, India, and several European countries in an investigation of business conditions and possibilities generally, but more particularly in the Far East.

He found those countries suffering from the effects of the world-wide business depression, because of a large surplus stock of materials of all kinds left over from the war days. These, he says, must be used up before new supplies will be needed. Contrary to the general opinion there is a growing market in the Far East for labor-saving machinery of all kinds. This is due to the fact that labor conditions are slowly reaching a point where costs of construction and manufacture are high. Furthermore, in spite of the fact that labor is cheap and so inefficient the labor costs on projects cannot be figured much lower than in this country.

In the steel-making line there is considerable activity as well as in large civil engineering projects, such as power plants, drainage, irrigation and building construction.

The opportunities in Burma for flood control, were especially impressive. They have a problem with the flood disasters on the Irrawaddy River such as we have on our own Mississippi where they are constantly building up embankments to keep the river within its channel. For this reason there is a large market for gasoline-driven excavating equipment. It will be necessary, however, on account of the intense heat, to design gas engines especially to withstand the high heats found in that country. On large railroad projects, particularly, the use of gasoline-driven excavators has been recognized as economical.

In the interior of India there is a large amount of construction work to be done but up to this time it has been particularly hazardous due to the loss of life among workmen, because of wild beasts and reptiles. It is believed that this work can be done very much more safely with the use of machinery.

Of interest to Americans is the attitude of the natives. The Indian people are very well disposed toward American-made goods. They feel that owing to the vastness of their own country and also of ours that we have had problems which are very similar to their own and for this reason they believe that the machinery which Americans designed for the construction of the Erie Canal, Panama Canal, Mississippi flood control and other projects will meet their conditions. This experience which United States manufacturers have had has not been shared by European manufacturers since they have never had to contend with these propositions on such a large scale. There are only two great differences between the conditions in India and United States, first, the different class of labor which they have in India and, secondly, weather and climatic conditions.

Another feature, according to Mr. Harnischfeger, which must be taken into account in the design of equipment for use in these countries is the fact that their bridge capacities and clearances are much less than ours and for this reason, for the present, at least, mobile equipment must be built in such a manner as to permit of its being easily dismantled.

Altogether, Mr. Harnischfeger was much impressed by the possibilities of the Far East and he believes that there is a good market there for labor-saving machinery of all kinds.

Business Is Better in Ohio

By A Field Editor

In spite of coal and railroad strikes, there is a decidedly better tone to business in Ohio and surrounding districts. Not that the strikes have not had their effect, for both trains and interurbans are delayed and it isn't safe to bank on scheduled connections. But there isn't a shop I've visited so far that hasn't greeted me with a happier look than I've seen for the past year. Some haven't really got back into their stride, their organization hasn't been completely rebuilt even with essential men, but they are on the way and business is coming in very satisfactorily.

Direct business is very evident in automobile accessories such as jacks, in household appliances and other lines. This is reflecting itself in the machine tool shops and in the shops building special machinery as well. New products are being developed, such as large milk cans on the vacuum bottle principle, all of which means shearing and punching machines for the sheets, drawing machines for the caps, and welding machines for putting them together.

New types of battery boxes are being molded of non-conducting material to replace the dove tailed wooden box for an outer case. This means large presses for forcing the materials into the molds and again gets back directly or indirectly to the machine tool field.

Then too there is a district movement toward the use of metal, of the duralumin order in airplane construction. One large and well known builder is doing some very interesting work in this line. And even though this may not seem to affect the machine tool business materially at present, it is a step toward it, and one which may eventually amount to quite a volume of business.

Business is decidedly better. Orders are filtering in from unexpected places and the man who still pulls a long face over the outlook should consult a specialist and have his "pessimisticas" removed at once.

New England N. A. S. E. Elects Officers

At the convention of the New England branch of the National Association of Stationary Engineers in Springfield, Mass., July 12 to 15, the city of Hartford was awarded the prize for making the largest gain in membership. Of 38 stationary engineers' organizations in the New England field, 27 are represented in the association. Special emphasis was laid on the progress of the work of the educational committee, by means of examinations, lectures, motion picture films, etc. These officers were elected for the ensuing year: president, James H. Henderson, Lynn; Vice-president, Edwin H. Perry, Worcester; secretary, Freeman L. Tyler, Taunton; treasurer, Walter H. Damon, Springfield.

The New England Association of Commercial Engineers, meeting at the same time, elected Henry H. Lynch, Boston, president; Charles S. Ceilley, New York, vice-president, and Maj. J. W. H. Myrick, Boston, treasurer.

Reports on Three-Shift Day to Be Discussed by Engineers

Findings in a nationwide survey of the three-shift day in American industry will be placed before the Executive Board of the American Engineering Council of the Federated American Engineering Societies, at a meeting of the Board to be held in Boston on September 8 and 9, it was announced following a meeting of the committee on procedure in New York.

Two reports, dealing with exhaustive investigations of the two-shift and the three-shift day problems in numerous industries will be presnted. One, prepared by Horace B. Drury, formerly of the faculty of Ohio State University, will describe the extent of two-shift operations in the continuous industries as well as the procedure followed and the results noted by those companies which have changed from the two-shift day of twelve hours each to the three-shift day of eight hours each.

Among the industries investigated are the metals, glass and cement, lime, brick, and pottery, chemicals, sugar, salt, petroleum, cottonseed and other vegetable oils, paper, flour, rubber, miscellaneous manufactures, and mines, electricity, gas, water, and ice, transportation, communication, care-taking, and personal service.

A second report on an investigation of the *modus operandi* involved in changing the operations of a steel plant from a two-shift to three-shift methods will be made by Bradley Stoughton, former secretary of the American Institute of Mining and Metallurgical Engineers. Both investigations are being directed by the American Engineering Council's Committee on Work Periods in Continuous Operation Industries, of which H. E. Howe of Washington, president of the American Chemical Society, is chairman.

The findings of the committee, which are expected to be a notable contribution to the facts of present day industry, will be presented to the Boston meeting of the engineering board, composed of leading engineers from all parts of the country, for definite action. A preliminary report by Mr. Drury estimates that "very roughly, the number of shift workers in the United States is probably well over 500,000, though likely not as large as 1,000,000." Industries of the South and the Far West are included in the survey as well as the industries of the East and Middle West.

The number of men on twelve-hour shifts in the period preceding the industrial depression was given as "perhaps not far from 300,000, of which about as many were outside the steel industry as within it."

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

SETTLEMENT of the railway strike is deferred pending an adjustment of the seniority question. Without debating the merits of the issue, which are not entirely clear, it may be said that the majority of the public realize that life is but a series of compromises and believe that the railroad executives and the shop men will soon get together.

The coal strike is different. It promises to be a long drawn out fight the cost of which will be largely borne by consumers who will have to pay exorbitant prices for their winter coal. Mr. Hoover is promising that no one will suffer but it does not appear that he or any one else will be able to control prices. Some cynics are meantime asserting that the coal operators are not averse to a continuance of the strike until frost because they will then be able to claim that they had to yield to the men or let the people freeze and so justify the prices to which coal is already mounting in some localities. Much of the profit of this advance, however, is undoubtedly being reaped by speculators.

Facing these possibilities the stock market is a little less confident in tone, though it is still plain that if the strikes were settled the prevailing optimism would speedily express itself in speculative activity and the continued firmness of the railroad stocks reflects the improvement in earnings shown and expected.

The bond market, though less active, is also firm because money is cheap and bankers can get better returns by buying good securities on a 5 per cent basis than they can by buying commercial paper at 4 per cent.

The supply of good commercial paper is, moreover, limited by the indisposition of merchants to increase their stocks of goods while the strikes are unsettled. The weekly statement of the Federal Reserve System shows a reserve ratio of 79.6 per cent as compared with 79.2 a week previous. The gold held has increased by $17,000,000. These figures assure an abundance of bank credit for the balance of the year.

The foreign news is less encouraging. German marks sold in New York at 11⅞ cents a hundred last Wednesday. Their international value is therefore negligible. The decline is attributed to the Balfour note intimating that Great Britain cannot forgive the debts due her by her late companions in arms or her share in the German reparations unless she receives some compensating consideration. In this note the hope of "writing off through one great transaction the whole body of interallied indebtedness" is somewhat despairingly suggested. The suggestion is apparently intended for American ears, but as there seems no likelihood it will be heeded here it remains to be seen what effect it will have upon France with whose premier Poincaire Lloyd George is to confer on August 7th.

If this conference shall not lead the French to make concessions that will justify a loan to Germany continental Europe will find itself in a distressing predicament for an economic debacle that will destroy the productive and purchasing power of the Germans must adversely affect all of their neighbors. The very gravity of the crisis that threatens is my main reason for believing that it will be averted. If it is averted the mark will advance as sensationally as it has declined.

The steel industry is commencing to feel the coal shortage acutely. The demand is good but the mills cannot operate without fuel and the result is more or less paralysis all along the line. One can only hope, but it must be admitted that more or less stagnation and unemployment in the Pittsburgh and Youngstown districts are probable unless coal is soon to be had in increased quantity and at reasonable prices.

Copper is again firmer, but the demand has not yet lifted the price above 14 cents nor is it likely that it will if the steel mills continue idle.

Cotton had a convulsion upon the publication of a Government report which no one understands and but few believe. The advance of nearly two cents a pound proved ephemeral and most of it has been lost. The best trade opinion is that the crop outlook is better but current estimates of the yield are not yet in excess of the expected demand.

But European requirements will be reduced unless the financial collapse of Germany can be averted and it is probable that economic conditions abroad will soon outweigh crop reports as a market influence.

Raw sugar continues to hang around four cents ex duty, with refined selling at the classic price of seven cents or 7 pounds for 50 cents. The statistical strength of sugar is generally recognized and emphasized. It remains to be seen whether it has been discounted. In any event the scarcity predicted cannot be acutely felt for some time yet.

The grain markets are quiet without much change. I had thought that the present price of wheat meant possible loss and distress to the farmers who raised it, but since they do not seem to be complaining I am disposed to think that I was wrong. Perhaps the relatively high prices at which corn and hogs are selling partially offset the low price of wheat. At all events business in the Middle West seems to be good and a fair trade is generally reported.

The dry goods and jobbing trade is still reasonably active though a seasonal August dullness is commencing to be noticeable. Here again it is necessary to take the coal strike into consideration in considering the future. If people have to pay $20 a ton for coal they will buy less clothing.

Wool and woolen goods are somewhat reactionary as a result of sheer weariness over the interminable tariff debate. Most woolen dealers and manufacturers are now praying that Congress will adjourn without passing a tariff bill, but Mr. Lodge has issued a ukase to the contrary and there is not much hope that these prayers will be granted.

In the automobile industry several of the more important producers have reduced prices and there is some talk of a price cutting war which only the fittest will survive. I doubt if this is warranted but the automobile selling season is about over and it is quite natural that the manufacturers should want to clean up the year's output before commencing on their next year's program.

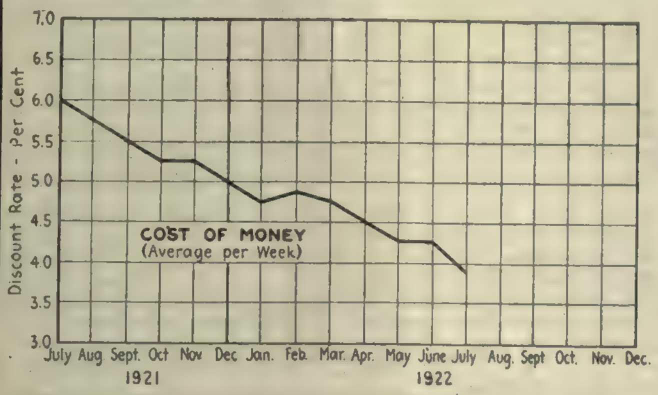
Viewing the outlook broadly and inclusively confidence and optimism appear to be warranted provided the President or some one else can find a way to settle the coal and railway strikes. I am, however, impelled to admit that impatience and irritation over their continuance are now commencing to be noticeable and it is questionable whether the serene and surprising stolidity upon which I have so often commented will persist if the American people have to face a blockade in transportation and a winter in which coal will be scarce and prohibitively high.

That I may get a short holiday and acquaint myself with the feeling of business men throughout the country I shall shortly leave New York for a trip to the Pacific Coast. I go by the Northern route and shall return through Texas and the South. As I travel my impressions will be telegraphed to New York for inclusion in these weekly letters.

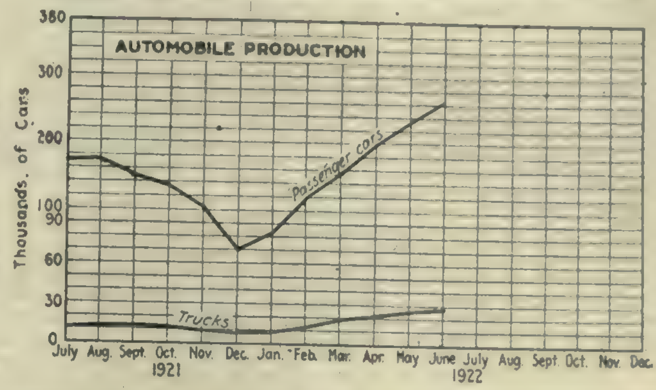
Machinery Companies Consolidate

Officials of the Mackintosh-Hemphill Co., according to information received from Pittsburgh, have confirmed reports that the Pittsburgh Steel Foundries Co. and the A. Garrison Foundry Co., Pittsburgh, and the Woodward Machine Co., Wooster, Ohio, have been merged with the Mackintosh-Hemphill Co. with a capital of $10,000,000. The combination will manufacture rolling mill machinery and will employ 1,500 men. No further plant extension will be made at this time, but the company has purchased forty-five acres in the vicinity of Pittsburgh to provide for future ne

Average weekly rates for 60 and 90 day commercial paper based on New York quotations.



Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce.



RAILROAD earnings for June from reports of 170 roads, recently available, show an aggregate gross revenue of $435,825,442, an increase of 2.4 per cent over the corresponding month a year ago. Net earnings on these same roads totaled $70,601,448 as against $47,979,901, an increase of 47.1 per cent. With these figures as a basis, the June net for all railroads in the United States will probably amount to $76,000,000, approximately 4½ per cent return on the property valuation.

Commercial failures in the United States during July, according to preliminary returns to R. G. Dunn & Co. totaled 1743 with liabilities of $36,900,000. Failures in the month previous totaled 1,740 with indebtedness amounting to $38,200,000. In July of last year there were 1,444 insolvencies.

Contracts awarded for the construction of industrial works in the United States and Canada during the month of July had a total value of $11,616,000 as compared with the high point reached in June, the contract awards in that month totaling $24,560,000. The grand total value of contracts awarded during the month of all classes of construction, including industrial works, reached $119,173,906.

Corporate financing during July continued heavy, although below the exceptionally high mark reached in June. Bonds, notes and stocks issued by railroads, industrial enterprises and public utilities during the month totaled $241,438,380 as compared with June financing totaling $354,355,940. In the corresponding month of last year new financial issues amounted to $128,352,360. Industrials led in July with a total of $117,402,780.

Comparative Prices of Shop Supplies

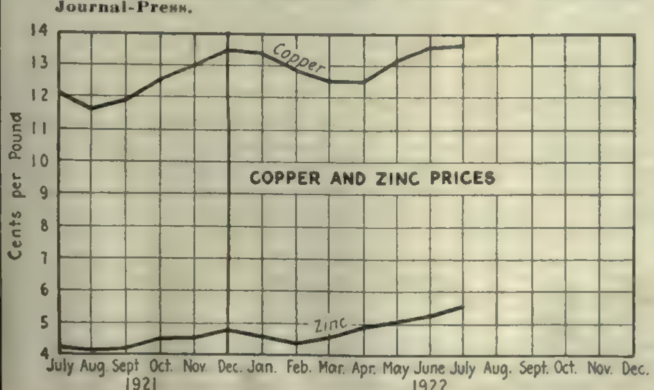
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.026	$0.0252	$0.0278
Cold finished shafting	per lb	0.0335	0.0335	0.0428
Brass rods	per lb	0.165	0.1550	0.159
Solder (½ and ½)	per lb	0.22	0.213	0.18
Cotton waste	per lb	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	....
Lard cutting oil	per gal	0.575	0.575	....
Machine oil	per gal	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

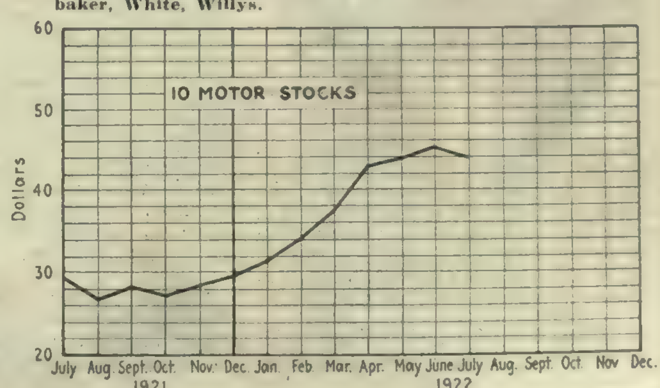
Freight cars loaded with revenue freight on 201 railroads of Class 1, for the week ending July 22, with the exception of coal, reached the highest point in the history of American roads. A total of 861,124 cars were loaded as compared with 860,907 in the week previous, and 788,034 in 1921.

Skilled machine operators are scarce, reports from certain centers indicating that the demand for experienced hands exceeds the supply. Philadelphia is paying from 50 to 85 cents to tool makers; from 40 to 80 cents to bench hands and from 45 to 85 cents to lathe hands. In Detroit, where the demand for good operators is strong, tool makers and lathe operators are being paid from 75 to 80 cents. Chicago is paying from 60 to 70 cents for lathe operators and bench hands and from 80 to 90 cents for skilled tool makers. In the Cleveland and Cincinnati districts the range on tool makers is between 50 and 75 cents; bench hands, between 40 and 60 cents and lathe hands between 40 and 55 cents. Pattern makers in Cleveland are receiving from 65 cents to $1.00. In the New York district 75 cents is the prevailing rate for tool makers with bench and lathe hands receiving from 50 to 60 cents per hour.

Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Mack, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



Business Items

The Associated Engineers, Inc., Milwaukee, Wis., through its vice-president, William E. Skinner, announces the removal of its offices to larger quarters at 373 Broadway, Milwaukee.

The Chapin-Skelton Machine Co., Syracuse, N. Y., recently organized to manufacture the Triplex garment pressing machines, announces the election of the following officers: Orville H. Green, president, and Clifford H. Gearle, secretary. E. I. Chapin, of the Brown-Lipe-Chapin Co., has been appointed factory manager.

The Colorado Fuel and Iron Co., for the second quarter of the current year reports net earnings of $1,012,094 as compared with the first quarter earnings of $596,243. Earnings in the second quarter of 1921 amounted to $[illegible]2,4[illegible].

The Fox Furnace Co., Elyria, Ohio, manufacturers of Sunbeam furnaces, will open a Southeastern office and warehouse in Atlanta in the near future. L. F. McDonald will be district manager and states that a force of salesmen will cover the territory.

The Cushman Chuck Co., chuck manufacturers, Hartford, Conn., has recently established a branch office and distribution store, at 130 High Street, Boston, where it will be better fitted to handle the trade in that section.

The Pennsylvania System, for the month of June, reports a net operating income of $6,637,649, an increase of $1,4[illegible] over the previous month. The net operating income for the first half of this current year, amounting to $44,442,202, represents an increase of $34,7[illegible],204.

The Central Coal and Iron Co., Holt, Ala., it is reported, will resume operations at its furnace at that point early in August, bringing all departments of the company up to full capacity as is now the case at the company's pipe plants at Bessemer and Anniston.

The General Motors Co. for the six months ending June 30, 1922, reports net profits of $30,711,238 and a surplus of $27,403,428, after deducting charges, federal taxes and preferred dividends, which is equivalent to $1.33 per share on the common stock.

The Pugh Bottle Co., Toledo, Ohio, has been incorporated with a capital of $[illegible],000 to manufacture and sell various kinds of bottles. The incorporators are David Pugh, Charles Guernsey, Elmer C. Wicke, Frank R. Smith and Mildred L. Hova, all of Toledo.

The Norwalk Iron Works, Norwalk, Conn., has absorbed the plant, designs, patents and other property of the Automatic Carbonic Machine Co., Peoria, Ill., and plans to remove the plant to Norwalk. The concern manufactures oxygen and hydrogen compressors, etc., and refrigerating machinery.

The New York Central Railroad Co. in its report for June, shows gross and net earnings greater than for any previous month of the current year. The gross amounted to $29,462,408 and the net to $6,008,492 as compared with $27,868,173 and $5,517,555 respectively, in the corresponding month of 1921.

The Wabash Railroad Co. has been granted authority by the Interstate Commerce Commission to issue $4,245,000 worth of equipment trust certificates to be used in paying for $6,305,800 worth of freight cars.

The Missouri, Kansas and Texas Railroad Co., in its report for June, shows an increase in net income of $518,149 over the month previous. This brings the half yearly net up to $5,556,096, or an increase of $2,814,922 over the corresponding period of last year.

The Porcupine Co., Bridgeport, Conn., with a large plant in Fairfield, Conn., manufacturers of boilers, and fabricators of structural steel, has recently filed a certificate with the Secretary of Connecticut, to increase its capital stock from $150,000 to $250,000, the proceeds to be used for expansion of the company's business.

The Baltimore and Ohio Railroad Co. has filed an application with the Interstate Commerce Commission for authority to issue $6,750,000 of certificates in aid of acquisition of freight and passenger equipment, the total cost of which will be $9,069,650.

The Reduction Sales Co., manufacturers of equipment for the oxyacetylene welding and cutting industry, it is reported, will permanently locate a plant in Birmingham, Ala., having obtained a site there for the purpose. The initial investment will be about $250,000.

The New England Brass Mfg. Co., Danbury, Conn., has recently been incorporated under the laws of Connecticut, to operate the brass goods manufacturing business now conducted at the plant on Maple Street, that city, by the firm of the same name. The capital stock is $22,000, and the incorporators are: Frank Peon, Mohammed Inamruddin and M. E. Krebbs, all of Danbury.

The Rome Stove and Range Co., Rome, Ga., has completed its new plant there and started operations. The old plant, known as the Bowie Stove Works, was destroyed by fire several months ago, the company then reorganizing under the present name and rebuilding the plant.

The Bridgeport, Conn., Chamber of Commerce is having preliminary plans drawn up for the erection of an incubator industrial building on Railroad Ave., Bridgeport. The building, as planned, will be five stories high, 60 x 280 feet, of modern mill construction, and will cost $250,000. The idea of the building is to allot space for small industrial enterprises which cannot afford a factory of their own, and in this way help to build up the business of the companies, enabling them at some future time to operate their own building.

The Schroeder Bros. Mfg. Co., Inc., Torrington, Conn., has been incorporated under the laws of Connecticut, to engage in the manufacture of tools, hardware specialties, etc., with a capital stock of $100,000. The incorporators are: Gustave A. Schroeder, Arthur E. R. Schroeder, Ernest E. Schroeder and Hugo C. F. Schroeder, all of Torrington, Conn. The firm will operate a plant on Brook Street, Torrington.

The Virginia Bridge and Iron Co. has obtained a permit in Birmingham, Ala., for the remodeling and enlarging of the plant of the Birmingham Steel Corporation, which is recently acquired.

The Peck, Stow and Wilcox Company, Southington, Conn., manufacturers of mechanics tools and hardware, at its recent annual meeting elected the following officers for the ensuing year: L. E. Fichthorn, president; T. J. Ray, vice-president; George S. Case, secretary; E. N. Walkeley, treasurer.

The Mullins Body Corporation for the first half of 1922 reports gross sales of $1,070,875 and gross profits from sales of $121,038. Net income after expenses and other charges amounted to $35,006. The profit and loss surplus on June 30 before dividends amounted to $1,976,141.

The Minneapolis, St. Paul & Sault Ste. Marie Railway Co. for June reports operating revenues of $4,204,331, an increase of $923,173 and net operating income $844,525, an increase of $1,023,459. For six months ended June 30 operating revenues were $19,254,928, an increase of $12,814 and net operating income $510,322, an increase of $3,396,924.

The C. A. Spotz Co., Inc., Stamford, Conn., has been incorporated under the laws of Connecticut, to make and deal in machinery and mechanical devices, etc. The company has a capital stock of $50,000, and the incorporators are: Chester A. Spotz, Greenwich, Conn.; Carleton Pratt, 50 West 72nd St., New York; Gustavius Pratt, 151 Fifth Ave., New York; Harry M. Rice, 100 Broadway, New York; Gustave Bergmark, Henry G. Bauman, William H. Specht and O. A. Helmer, all of New York City. A meeting will be held shortly and officers will be chosen.

The Fisk Rubber Co. has issued its report for the six months ended June 30, showing a net income of $1,111,191, which, after deduction of allowance of dividends on the first and second preferred stocks, is equal to about 50 cents per share on the common stock of no par value.

The St. Louis Southwestern Railway Co. for the year ended Dec. 31, 1921, reports a net income of $2,493,481, which, after allowing for 5 per cent preferred dividends, is equal to $9.16 per share on $16,356,100 common stock, comparing with a net income of $2,959,836, or $12.01 per share on the common stock in 1920.

The Cherrytree Machine Co., Cherrytree, Pa., according to reports, is moving its machinery and other equipment to Johnstown, Pa., where it will shortly begin the manufacture of mine pumps, hoists and other mining equipment in a new and larger plant. The company, which has been reorganized, will be known as the Brown Mine Equipment Co. and its officers are: H. V. Brown, president; H. J. Meehan, vice-president; and John C. Cosgrove, secretary and treasurer, all of Johnstown.

Personals

A. M. LINDSLEY, formerly connected with the Cincinnati Milling Machine Co., and at the present time chief engineer of the Alvord Reamer and Tool Co., Millersburg, Pa., has been placed in complete charge of the advertising department of that company. He will continue his duties as chief engineer, co-ordinating the work of the two departments.

A. P. ALDRICH, JR., who, with his brother, Robert Aldrich, has for some time operated the Aldrich Machine Works at Greenwood, S. C., specializing in textile machinery work, has accepted a position as specialty engineer with the Saco-Lowell Shops, and has located permanently in Boston. He will have charge of the adoption of ball bearings to the various types of textile machinery manufactured by the Saco-Lowell Shops, a line of work in which Mr. Aldrich is recognized as an expert.

G. A. NORTON, formerly associated with the Utility Trailer Manufacturing Co., has been elected treasurer and engineer of the Hercules Trailer Manufacturing Co., Los Angeles, Cal.

COL. ELMER H. HAVENS, who was president and co-receiver of the old Locomobile Company of Americe, Bridgeport, Conn., has been made vice-president and general manager of the new Locomobile Corp. of America, the new company formed by W. C. Durant, who recently purchased the Locomobile plants in Bridgeport.

J. DUNCAN UPHAM, treasurer of the Sullivan Machinery Co., Claremont, N. H., was elected a director of the Boston and Maine Railroad Co., at the recent annual meeting held in Boston.

CHESTER A. JEWETT, Fletcher Savings and Trust Building, Indianapolis, has been named receiver for the Handi Tool Manufacturing Co., of that city.

WILLIAM D. WOOLSON, treasurer of the Jones & Lamson Machine Co., manufacturers of lathes, etc., Springfield, Vt., was elected a director of the Boston and Maine Railroad, at the meeting held in Boston July 27.

CHARLES H. MASON, formerly associated with the Utility Trailer Manufacturing Co., has been elected president and manager of the Hercules Trailer Manufacturing Co., Los Angeles, Cal.

E. KENT HUBBARD, Middletown, Conn., president of the Manufacturers' Association of Connecticut, is a member of the recently appointed fuel administration commission of Connecticut, made by Governor Everett J. Lake, to have charge of the distribution of coal in the state.

LAWRENCE G. PRITZ, formerly general superintendent of the Canton plant of the Timken Roller Bearing Co. has been named by the Sizer Steel Co., Syracuse and Buffalo, to take charge of production at its plants in those two cities.

R. W. MCLAREN, for the past twenty-five years connected with the Brown & Sharpe Manufacturing Co., has joined the S. W. Card Manufacturing Co., division of the Union Twist Drill Co., Mansfield, Mass., and will act in the capacity of special sales representative.

W. T. JOHNSTON, for the past six years a member of the sales force of the Greenfield Tap & Die Corporation, has joined the S. W. Card Manufacturing Co. division of the Union Twist Drill Co., Mansfield, Mass., to represent that company in Western territory.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An agency is desired by a firm in Italy for the sale of machinery and electrical apparatus. Correspondence, Italian, French, or Spanish. Reference No. 3061.

The purchase of tools and machinery is desired by a mercantile firm in Czechoslovakia. Quotations, c. i. f. German, French, or Holland ports. Reference No. 3054.

A builder and contractor in Northern Chile wishes to purchase machinery for installing a carpenter shop. Quotations, c. i. f. Chilean port. Correspondence, Spanish. Reference No. 3044.

A manufacturer in England desires to purchase automatic, rapid-working stamping machines for stamping medallions and similar articles. Quotations, f.o.b. American port. Payment, cash. Reference No. 2023.

A manufacturing company in South Africa desires to purchase machinery for making red oxide paint, pug mills, mixers, grinders in oil, etc. Catalogues should be forwarded. Reference No. 3047.

A firm of importers in China is desirous of being placed in touch with manufacturers of machinery, electrical apparatus and supplies, mechanical supplies, sundries, etc., who are not already represented in that country. Reference No. 3041.

An agency is desired by a merchant in Italy for the sale of files, locks, wrenches, nails, screws, drills, and tools in general. Quotations, c. i. f. Western Italian ports. Correspondence, Italian or French. Reference No. 3039.

A mercantile firm in Czechoslovakia desires to purchase tools and implements, and also household articles which may be sold by a hardware dealer. Quotations, c. i. f. German, French, or Holland ports. Correspondence, Czech or German. Reference No. 3046.

A mercantile firm in Italy desires to purchase and secure an agency for the sale of metal-working machines, files and twist drills, electric dynamos, machinery belting, tools, and mechanical appliances in general. Quotations, c. i. f. Leghorn or Genoa. Reference No. 3004.

A manufacturer in Mexico desires to purchase a machine for extracting oil from castor beans, of a capacity of 2,540 pounds of beans per day of 10 hours. Quotations, f. o. b. New York. Terms, cash with order. Correspondence, Spanish. Reference No. 3038.

A government official in Palestine desires to purchase a cement gun, and receive technical information, such as catalogues and trade journals, on water supply, hydro-electric power, and kindred public utilities. Quotations, c. i. f. Jaffa. Reference No. 3057.

A mercantile company in the Baltic Provinces desires to purchase and secure an agency for agricultural machines and implements, wood-working machinery, and especially threshing machines, 36 to 48 inch and 22 to 34 inch; steam tractors of 8 horsepower; portable steam engines of 3 to 5 horsepower; emery grindstones for sharpening saws and other instruments; and Diston circular and hand saws; and also kitchen utensils. Quotations, c. i. f. Baltic port. Correspondence, German, Russian, or Lettish. Reference No. 3058.

Trade Catalogs

Motor Starters. The Monitor Controller Co., Baltimore, Md. A special folder on the company's thermaload starter for single and polyphase motors with illustrations showing construction and assembly.

Cork Insulation. The Armstrong Cork and Insulation Co., Pittsburgh, Pa. A folder entitled "A Neglected Source of Economy." This new publication deals with the saving which can be effected in manufacturing plants by the use of refrigerated drinking water systems.

Gears. The Van Dorn & Dutton Co., Cleveland, Ohio. A special publication entitled "Bringing the Van Dorn Plant Home to You." The booklet contains interior views of the Van Dorn plant and is intended to acquaint the user with the company's industrial gear products of various kinds.

Lead Welding. The Bastian-Blessing Co., 125 West Austin Ave., Chicago, Ill. A special folder entitled "Sparks" and known as leaflet No. 2. The leaflet has been prepared to satisfy the demand for information on the subject of lead welding on battery service outfits. Illustrations are shown of two styles of lead welding outfits.

Electric Dynamometers. The Sprague Electric Works, of the General Electric Co., New York City. A special bulletin No. 48718. The bulletin features the Sprague electric dynamometer chassis test system for car manufacturers, service stations and public garages. Numerous illustrations are given showing characteristic installations on test floors of various motor car manufacturers with detailed information as to the operation of the system.

Small Tools. The Alvord Reamer and Tool Co., Millersburg, Pa. A new general catalog, known as catalog No. 6, containing 243 pages. The publication lists the company's complete line of reamers, drills, milling cutters, taps and dies. Special emphasis has been placed upon their high power milling cutters in all styles and types, both of standard and special design. The catalog contains a special section devoted to tables and other useful information conveniently arranged. Besides the general index, it has been arranged with a thumb-index on the edges for ready reference to the various sections of the book.

Elevating trucks, stackers and trailers. The Lewis-Shepard Co., 566 East First Street, Boston, Mass. A general catalog of thirty-two pages conveniently arranged and bound for filing in vertical filing cabinet. The catalog is replete with illustrations showing the various labor-saving specialties made by this company in actual operation in numerous plants. Jacklift elevating trucks, singlelift elevating trucks, wood and metal leg platforms, self-loading barrel and case trucks, the Lewis-Shepard stacker and trailers for electric trucks are all featured in special sections with details given as to their construction and mode of operation. A price list and part list accompanies the catalog, in the arrangement of which considerable care has been taken.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., October 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Machine Tool Builders' Association, annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

The Weekly Price Guide

Rise and Fall of the Market

Advances—Bulk of business in steel shapes, plates and bars quoted at \$1.80@\$1.90 per 100 lb., f.o.b. Pittsburgh. Quotations of \$1.70, however, made for large tonnages on contracts with regular customers. New inquiries for small tonnages quoted as high as \$2 per 100 lb.

Advances in pig iron and mill price of bar iron reflected in higher quotations on machinery castings in Cincinnati; other cities showing upward tendencies. Demand for lead increasing; prices higher in St. Louis. Shortage of zinc; prices up ½c. per lb. in New York warehouses and slightly higher in St. Louis. Copper market firmer. Discounts reduced on heavy leather belting, following advance in hides.

Declines—Tin quoted in New York warehouses at 32¾c. as against 33½c. per lb. Raw linseed oil, 89c. as compared with 91c. per gal. (5 bbl. lots) on keew ago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	\$21.56
Northern Basic	27.27
Southern Ohio No. 2	27.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.66
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.76
Virginia No. 2	30.17
Basic	27.25
Grey Forge	27.25
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	1[illegible]@12	5.0	3@4
New York	[illegible]@10	6.0	4.0
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]	3.78	3.50	3.75
No. 12	2.4[illegible]	3.[illegible]	3.55	3.80
No. 14	2.[illegible]@2.70	3.88	3.60	3.[illegible]
No. 16	2.7[illegible]	3.98	3.70	3.95
Black				
Nos. 17 and 21	3.0[illegible]@3.25	4.15	3.80	4.30
Nos. 22 and 24	3.[illegible]@3.30	4.20	3.85	4.30
Nos. 25 and 26	3.[illegible]@3.35	4.25	3.90	4.35
No. 28	3.1[illegible]@3.40	4.35	4.00	4.45

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	65%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.85
Hoop steel	3.78	3.50	3.48
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	4.80	4.91	5.08
Cold finished shafting or screw	3.50	3.30	3.40
Cold finished flats, squares	4.00	3.80	3.90
Structural shapes (base)	2.83	2.66	2.70
Soft steel bars (base)	2.73	2.56	2.60
Soft steel bar shapes (base)	2.73	2.56	2.60
Soft steel bands (base)	3.38	3.06	3.35
Tank plates (base)	2.83	2.66	2.38
Bar iron (2.25 at mill)	2.70	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{16}$	8.00		12@13
¼	6.50		11@12
$\frac{5}{16}$ to ½	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.75
Lead (up to carlots), St. Louis, 5.45@5.50; New York	6.00
Zinc (up to carlots), St. Louis, 6.30@6.35; New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	19.50	18.75
Brass tubing (100-lb. lots)	21.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.25	17.50	15.75
Brass wire (carlots)	18.25	19.50	.....
Zinc sheets (casks)	8.50	.....	.....
Solder ($\frac{1}{2}$ and $\frac{1}{2}$), (caselots)	23.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.00	36.00
Babbitt metal (commercial)	11.12$\frac{1}{2}$	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J	39.00	.....	..

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	12.00
Copper, heavy, and wire	11.75	11.00	11.25
Copper, light, and bottoms	9.75	9.50	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6.25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.25	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.07$\frac{1}{2}$@\$0.10	\$0.12	\$0.11$\frac{1}{4}$
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13$\frac{1}{2}$x13$\frac{1}{2}$, per lb.	.075	.10	.10
Wiping cloths, 13$\frac{1}{2}$x20$\frac{1}{2}$, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.89	1.17	1.01
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville..per net ton			14.00
Coke, prompt foundry, Connellsville..per net ton			15.00

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	65-10%	60%
1$\frac{1}{8}$ and 1$\frac{1}{4}$x3 in. up to 12 in.	33$\frac{1}{3}$%	60%	60-10%
With cold punched sq. nuts	35%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	....	\$4.00 off
Button head bolts, with hex. nuts	25%	\$3.90 net	.....
Hex. head and hex. nut bolts	30%	....	65-5%
Lag screws, coach screws	50%	....	60-5%
Square and hex. head cap screws	70-10%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60-10-5%	50-5%
Bolt ends, with hot pressed nuts	50%	....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	....	.....
Semi-finished nuts $\frac{5}{8}$ and larger	65%	70-10%	80%
Case-hardened nuts	60%	....	.....
Washers, cast iron, $\frac{1}{2}$ in., per 100 lb. (net)	\$4.50	\$3.50	\$3.50
Washers, cast iron, $\frac{3}{4}$ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	60-5%	65-10%	60-10%
Rivets, tinned	60-5%	65-10%	4$\frac{1}{2}$c. net
Button heads $\frac{3}{4}$-in., $\frac{7}{8}$-in., 1x2 in. to 5 in., per 100 lb (net)	\$4.00	\$3.50	\$3.25
Cone heads, ditto (net)	4.10	3.60	3.35
1$\frac{1}{4}$ to 1$\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
$\frac{5}{8}$ in. diameter *EXTRA*	0.15	....	0.15
$\frac{1}{2}$ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.35 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67$\frac{1}{2}$
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities ($\frac{1}{2}$ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40-5%	40-10-2$\frac{1}{2}$%	50%
Heavy grade	30-5%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$3.85	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3$\frac{1}{2}$ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Cal., Los Angeles—Bittleston Machine Shop, 13[illegible] South Los Angeles St.—tools (used).

Cal., Los Angeles—A. G. Litch, 102 West 38th St., (oil producer)—drill.

Cal., Pasadena—Voss & Jones Co., 38 East Union St.—pipe threading and cutting machines, 1-4 in.

Conn., Bridgeport—The Bassick Co., 38 [illegible] St. (manufacturer of small hardware articles), A. Greenstein, Purch. Agt.—one milling machine, shaper, power press, drill press and lathe.

Conn., Fairfield—G. Gibaleau, 38 Gramercy Ave.—one automatic screw machine for small radio parts.

Conn., Milford—S. Bathgate, 219 East Bway., (machine repairs)—small tools and electric motor ½ hp.

Ga., Rome—Battery Machine Co.—one automatic circular saw gummer, 36 in.

Kan., Wichita—Central Electric Co., North Market Ave., J. Violette, Mgr.—one power lathe and drill press.

Kan., Wichita—J. Drake, c/o McKinney Auto Co., Water and 1st Sts.—drill press and lathe for power equipment.

Kan., Wichita—Kennedy Machine Shop, 1[illegible] East [illegible] St.—cylinder grinder for power equipment.

Kan., Wichita—J. Manlove, Main St., opposite Court House, (garage)—power drill press, lathe, and emery stand.

Kan., Wichita—M. J. S. Radio Co., 128 Loraine Ave., G. Marshall, Purch. Agt.—one power drill press, lathe, belting, shafting, hangers, pulleys and emery stand.

Kan., Wichita—R. W. Reynolds, 215 South Frances St.—power drill press, lathe, emery stand, cylinder grinder, and belting for garage.

Md., D. C., Washington—H. B. Schmidt, P. O. Box [illegible], Penn Ave. Sta.—power lathe and chucking machine.

Mich., Detroit—M. C. Cummings, 250 East Warren Ave.—one band saw and equipment 26 or 30 in.

Mo., Kansas City—M. J. Lawrence, 3250 Michigan Ave.—tinsmith tools, sitting down machine, burring machine, crimper and beader.

Mo., Kansas City—A. B. Scrap Iron & Metal Co., 2036 Central St., manufacturer of iron and pipe—pipe threading machine 1 to 6 in.

Mo., Pleasant Hill—Quick Set Chain Co.—[illegible] machine, power hammer, drill press, emery stand, line shafting, pulleys, hangers, belting, bearings, and 10 hp. motor.

N. Y., Brooklyn—F. J. Gleason, 1552 Bergen St.—eyeletting machine.

N. Y., Buffalo—Allan Mfg. & Welding Co., Inc., 726 Washington St.—one electric floor [illegible] grinder and electric portable grinder.

N. Y., Buffalo—New York Telephone Co., [illegible] Bldg., Church St., C. H. Thomas, Purch. Agt.—equipment for repairing automobiles and [illegible] and two 1,000-gal. gas tanks and pumps for proposed garage on Jefferson and [illegible] Aves.

N. Y., Caywood—J. [illegible]—one automatic vertical type shingle saw.

N. Y., Geneva—W. I. Packard—one or more [illegible] 18 to 20 in. in diameter for use on lathes.

N. Y., New York—Cornell Iron Wks., 601 West 26th St.—twist drill grinder for medium size drills.

O., Canton—National Pressed Gear Co., [illegible] Cleveland Ave., H. Nusbaum, [illegible]—machinery and equipment for proposed [illegible] forged gear plant including equipment for foundry and machine shop.

O., Lima—Lima Locomotive Wks., South Main St.—machinery and equipment for truck house, erecting shop, super-heating plant, store room, paint and truck shops.

O., Toledo—The Toledo Machine and Tool Co., 1726-44 Dorr St.—shears for cutting up scrap rail.

O., Youngstown—Vahey Oil Co., 1028 West Rayen St.—machinery, tools and equipment for garage and service station.

Pa., McKeesport—The Bd. of Educ.—one band saw and electric drill.

Pa., New Galilee—Pittsburgh, Lisbon & Western Ry., N. B. Billingsley, Vice Pres. & Genl. Mgr.—machinery and equipment for locomotive repair and blacksmith shop.

Pa., Oil City—Bd. of Educ.—machine and woodworking shop equipment for high school.

Pa., Phila.—G. W. Blabon Co., 21st and Huntingdon Sts.—additional machinery for the manufacture of oil cloth, also additional equipment for machine shop.

Pa., Phila.—Fox Gun Co., 18th and Windrim St.—boring machines, lathes, planers, etc.

Pa., Pittsburgh—Pittsburgh Rys. Co., Phila. Co. Bldg., 6th Ave.—2 lathes, 2 drill grinders, and 1 bench drill.

Pa., Topton—Topton Fdy. Co., N. Kline, Prop.—machine shop equipment.

Va., Richmond—The City Fire Dept., c/o A. Heckman, Dept. of Public Safety—large lathe.

Va., Richmond—A. J. Lucas, 2112 East Main St., sheet (metal works)—sheet metal machinery (prices).

Va., Richmond—Mann & Mathis, 202 North 5th St., watchmakers—one lathe with motor and one polishing lathe with motor.

Va., Richmond—H. C. Richardson, 1918 East Franklin St.—one drill press, electric drill, and bench tools for auto repair shop.

Va., Richmond—Richmond Typewriter Co., 24 North 7th St.—small lathe.

Va., Richmond—Strickland Machine Shop, 2322 East Main St.—lathe and drill press.

Va., Richmond—Virginia Machine Shop, 2218 East Main St.—planer and milling machine.

Wis., Appleton—G. R. & S. Motor Co., 738 Washington Ave.—machinery for proposed auto repair shop.

Wis., Eagle River—Strong & Manley—machinery for auto repair shop including compressor and gas storage tank.

Wis., Milwaukee—Automotive Service Co., 1008 29th St., A. C. Lauer, Purch. Agt.—battery charging machine and drill press.

Wis., Milwaukee—S. P. Jack, 597 Lincoln Ave.—automobile repair machinery, including drill press and air compressor.

Wis., Racine—Knudsen Sales Co., c/o A. C. Knudsen, 1724 Michigan Blvd.—general line of automobile repair machinery.

Wis., Wausau—Marathon Motor Co., 210 McClellan St.—machinery and equipment for proposed auto repair shop.

Machinery Wanted

Ala., Magazine—Alabama Saw Mills—machinery to replace that which was destroyed by fire.

Cal., Los Angeles—L. R. Cook, 2107 Woolam St.—harness making machinery and loom for weaving.

Cal., Los Angeles—Universal Paper Goods Co., 422 Boyd St., L. E. Bartels, Purch. Agt.—paper making machinery, printing press, belting, paper cutter, pulleys, hangers, and bearings.

Cal., Turlock—Hunt-Jewett-Bonix Co., (California Sweet Potato Corp.)—about \$275,000 worth of machinery for alcohol and vinegar plant on South 1st St.

Fla., Ft. Meade—Ft. Meade Citrus Packing Co., C. H. Walker, Pres.—machinery and equipment for citrus packing plant.

Ill., Chicago—The Clemetsen Co., 2401 West Division St., D. A. Raggio, Purch. Agt.—power printing press for job work (used).

Ill., Chicago—F. Riebel & Co., 6217-21 Wentworth Ave.—machinery for the manufacture of cans, also seaming machine (used).

Kan., Kansas City—Kansas City Second Hand Box Co., 32 Ewing St.—one power planer.

Kan., Wichita—F. E. Church, 206 North Main St., Room 8—job printing press.

Kan., Wichita—Franklin Printers, 324½ East Douglas Ave., E. Operman, Purch. Agt.—job press and Miller feeder, for power equipment.

Kan., Wichita—C. H. Luling, 223 North Market St., (oil producer)—drill rig.

Kan., Wichita—Peerless Steam Laundry, 243 North Market St.—collar laundrying machine (power).

Kan., Wichita—H. C. Pershing & Co., 618 South Water St.—job press with power equipment.

Md., Baltimore—Burnot Fire Proofing Products Co., W. E. Semans, Pres.—equipment and machinery for the manufacture of fireproof roof products, etc.

Mich., Detroit—Detroit Marvel Brass Mfg. Co., 1742 Rivard St.—machine equipment for finishing small brass products.

Minn., Minneapolis—W. Guttman, 558 8th Ave., N.—refrigerating machine for proposed creamery.

Minn., St. Paul—Tilden Produce Co., 65 East 3rd St., W. A. Tilden, Pres.—creamery and refrigerating machinery equipment.

Mo., Joplin—Joplin Fdry. Co., East 7th St., C. Bowers, Purch. Agt.—two chain hoists for 1 and 3 ton.

Mo., Kansas City—C. E. Meyers, 543 Westport Ave., cabinet maker—band saw.

N. J., Camden—C. W. Brennan & Co., 6th and Jefferson Rd., manufacturer of shade cloth, W. H. Jacobs, Purch. Agt.—looms, dryers, impregnators, etc.

N. J., Camden—Honor Knitting Mills, Inc., 216 Federal St., E. F. Price, Purch. Agt.—latch needle machines, full fashion hosiery machines, belting, pulleys, etc.

N. J., Camden—U. S. Wool Combing Co., 9th and State Sts., J. A. Middleton, Purch. Agt.—additional wool cards, combs, and accessories.

N. J., Union Hill (Weehawken P. O.)—A. Van Goethen, 22 Hudson Ave. (engineers)—one Worthington receiver.

N. Y., Buffalo—L. F. Lindall, Atty., Erie County Bank Bldg., (representing Champion Rotary Motors, Inc.)—machinery and equipment for large plant to be established here, for the manufacture of rotary auto engines.

N. Y., Gasport—Gasport Fruit Growers Assn.—machinery and equipment for large fruit packing and storage plant under construction at Orangeport.

N. Y., Jamestown—Jamestown Worsted Mills, 335 Harrison St.—machinery for combing and drawing departments.

N. Y., Mayville—Chautauqua Cabinet Co.—additional machinery for proposed increase in capacity of plant.

N. Y., New York—J. Cassella, 134 West 27th St.—one hand loom (new or used).

N. Y., Niagara Falls—Carborundum Co., Buffalo Ave. and 18th St.—one hydraulic press, pressing space 3 ft. 10 in. x 3 ft. 10 in., pressure 5,000 to 6,000 lbs. (used).

N. Y., Oneonta—Oneonta Battery Co., 24 Broad St.—complete equipment for battery service and repair department.

N. Y., Rochester—Powertown Tire Corp., Ridgeway Ave.—equipment for proposed tire station including vulcanizing equipment.

N. Y., Rochester—E. J. Protopapas, 570 Lyell Ave.—machinery for the manufacture of ice cream.

N. Y., Rochester—Umbsen Mfg. Corp., 155 Sanford St., R. E. Chesher, Secy.—machinery and equipment for the manufacture of patented eye spray, for proposed branch plant at San Francisco, Cal.

N. Y., Saratoga Springs—Bd. of Educ., C. L. Mosher, Secy.—machinery and equipment for woodworking and machine shops in new high school.

N. Y., Solvay—Bd. of Educ.—machinery and equipment for vocational department of new high school.

N. C., Lexington—C. M. Wall & Son—woodworking machinery for box factory and planing mill, including jointers, sanders, tenoners, matches, etc.

O., Ashland—F. E. Myers & Bro.—equipment for (proposed) large foundry addition.

O., Conneaut—J. L. Lovell—portable drilling equipment for either gas or oil well work.

O., Fremont—Hodes-Zinc Co., (manufacturer of automobile equipment and accessories)—machinery and equipment for proposed plant at Erie, Pa.

O., Williamsburg—Williamsburg Furniture Co., J. F. Knight, Purch. Agt.—full line of woodworking machinery to replace that destroyed by fire.

Okla., Oklahoma City—Apco Refining Co., Colcord Bldg.—equipment for proposed refinery, 700 bbls. daily capacity.

Pa., Corry—Kurtz Brass & Wood Bed Co.—machinery for proposed addition to manufacturing plant.

Pa., East Stroudsburg—Weeds Ice Cream Co.—complete machinery and equipment for the manufacture of ice cream, for (proposed) large plant on King St.

Pa., Garland (Warren County)—Grove Mfg. Co., Inc., manufacturer of furniture—additional woodworking machinery for proposed increase in capacity of plant.

Pa., Herrick Center—Bd. of Educ., G. B. Giles, Secy.—mechanical equipment for high and grade school, and vocational shop.

Pa., Phila.—Boger & Crawford, J and Venango Sts., (manufacturer of yarns)—R. C. Boger, Purch. Agt., additional equipment including cards, garnetts, etc., for mills at Lincolnton, N. C.

Pa., Phila.—Breyer-Sharpless, Inc., 8th and Cumberland St.—refrigerating and wrapping machines, also ice breakers, power freezers, steam vats, etc.

Pa., Phila.—Corrugated Container Co., Trenton and Venango Sts.—Colt or Thompson cutter and creaser over 20 x 30 in.

Pa., Phila.—Fay-Keser & Sailer, Inc., Front and Clearfield Sts., manufacturers of hosiery, F. B. Keser, Purch. Agt.—additional knitting machines and looper machines.

Pa., Phila.—Globe Knitting Mills, 2nd St. and Columbia Ave.—additional machinery including full fashion hosiery machine and latch needle machine.

Pa., Phila.—C. Gurevitch, 1214 South 24th St.—one large stationary circular saw with table.

Pa., Phila.—La France Textile Co., 4423 Frankford Ave., manufacturer of tapestries, E. T. Duval, Purch. Agt.—additional Jacquard looms.

Pa., Phila.—Oliver Knitting Mills, 3rd and Huntington Sts.—full fashion hosiery machines, latch needle machines, ribbers and accessories.

Pa., Phila.—Paragon Knitting Mills, 2813 Fletcher St., N. Neuman, Purch. Agt.—additional knitting and sewing machines.

Pa., Phila.—Penna. Music Co., 13th and Appletree Sts. — presses, paper cutter, folders, etc.

Pa., Pottstown — Collegeville Flag & Mfg. Co.—complete machinery and equipment, including stitchery, etc., for proposed plant for the manufacture of flags.

Pa., Scranton—Clark-Snover Tobacco Co., 112 Adams Ave., W. L. Mathews, Pres.—additional machinery and equipment for plant on Dockash St.

Pa., Temple—S. S. Staley—complete equipment for proposed foundry.

Pa., Vandergrift—The Bd. of Educ.—machinery and equipment for vocational department of proposed high school.

Pa., Warren—East Side Bakery, 209 Penna. Ave. E., J. P. Raisor—bakeshop equipment.

Pa., Williamsport—W. R. Hoehn Silk Co., 201 Pine St.—machinery for proposed addition to silk factory.

S. C., Lena—H. L. Lawton—machinery for the manufacture of crates and baskets.

S. C., Norway—S. S. Williams—machinery to equip small canning factory.

Tenn., Erwin—B. S. Abernethy, Lincolnton, N. C., and W. C. Heath, Charlotte, N. C.—machinery for proposed 15,000 spindle textile mill at Erwin, Tenn.

Tex., Beaumont—Boykin Mchy. & Supply Co.—one 48 in. x 48 in. x 12 ft. motor driven planer, also one alligator shear.

Tex., Brady—Mayhew Produce Co.—machinery and equipment for proposed cold storage and refrigerating plant.

Tex., Breckenridge—Dillingham Ice Cream Co.—machinery and equipment for proposed 65 ton ice manufacturing plant.

Tex., Killeem—W. J. Cole, (oil producer)—oil pumps and large oil tanks.

Vt., Barre—Nelson & Berg, (granite products)—machinery and equipment for proposed monumental works on Lincoln and School Sts., Auburn, N. Y.

Va., Dante—Nora Coal Corp., J. W. Gerow, Pres. and Mgr.—complete line of mining machinery.

Va., Norfolk—M. T. Blassingham Lumber Co., Flat Iron Bldg.—woodworking machinery for small planing fill on 25th St.

Va., Richmond—Fleming Aytes, 1006-A Bacon St., manufacturer auto part patent—special machinery.

Va., Richmond—J. Fox & Son, 25th and Franklin Sts., (mill work)—one sash sticker.

Va., Roanoke—Journal Printing & Publishing Co., W. R. Martin, Mgr. and Pres.—machinery and equipment for printing plant, including 7 column press and linotype machine (used).

Va., Tamworth—Moon & Blanton—full line of machinery for a creamery.

W. Va., Charleston—Moore Lumber Co., J. W. Moore, Pres.—one 7 ft. band mill, log locomotive, logs trucks, and 25 lb. relaying rails.

W. Va., Paw Paw—Bd. of Educ., C. R. White, Secy.—equipment for vocational department of new school.

Wis., Fredonia—Gilson Bros.—foundry equipment, including cupola and molding machines.

Wis., La Crosse—Nelson Garment Co., 111 South 2nd St.—stitching and buttonhole machines for proposed factory.

Wis., Madison—The Bd. of Educ., c/o Secretary—machinery and equipment for manual arts and vocational training building.

Wis., Madison—The Way Building Co., 20 North Orchard St.—woodworking machinery for new carpenter shop.

Wis., Marinette—Heath Cedar Co., 1863 Riverside Ave. — belting, shafting and hangers for factory addition.

Wis., Milwaukee—Byrne Bros. Co., 3112 Burleigh St.—air compressor, gasoline storage tank, and pump for proposed garage on Kinnickinnie Ave.

Wis., Milwaukee—Edward Motor Car Co., 2713 Grand Ave.—machinery for repair shop including conveyor, motors, etc.

Wis., Milwaukee—C. Kirchhan, 823 47th St.—foundry moulding machines.

Wis., Milwaukee—J. L. Shonts, 449 21st St., manufacturer of meat products—one No. 52 chopping and stuffing machine, one meat grinding machine (both power driven).

Wis., Milwaukee—J. Zaph, 1341 40th St., (millwork)—one 6 in. sticker.

Wis., Neenah—Jaeger-Dowling Co., 214 South Commercial St.—air compressor, storage tank, pump and machinery for auto repair shop.

Wis., Phillips—Kneeland McClurg Co.—machinery for sawmill including saws, etc.

Wis., Port Washington—Port Washington Beverage Co., c/o J. W. Collins—bottling machinery.

Wis., Rosendale—Central Wisconsin Canning Co.—machinery for proposed canning plant, including conveying machinery.

Wis., Stevens Point—B. V. Martin, 1303 Main St.—one 6 to 8 in. sticker, double drum sander, medium size planer, hollow chisel mortiser, glueing machine and electric motors.

B. C., Kamloops—Northern Construction Co.—prices on new saw mill machinery and equipment for mill on Thompson River.

Ont., Listowel—N. Calder—woodworking equipment for new planing mill including planers, shapers, saws, etc.

Ont., Rhamesville—D. E. Wallace—prices on complete new equipment for sawmills which were recently destroyed by fire. Damage to machinery, $25,000.

Ont., St. Marys—The Hurlbut Shoe Co.—special equipment for shoe factory.

Ont., Stratford—Dufton Woolen Mills Co.—machinery and equipment for woolen mill, partially destroyed by fire.

Metal Working Shops

Cal., Oakland—Chevrolet Motor Co. of California, 69th Ave. and Foothill Blvd., had plans prepared for the construction of an addition, for the manufacture of auto bodies. Estimated cost $150,000. Architect not announced.

Cal., San Francisco—Eames Co., 55 1st St., manufacturer of hand trucks and wheel goods, has awarded the contract for the contruction of a 1 story factory on Howard and 5th Sts.

Ind., Hartford City—Paramount Wheel & Eng. Co. plans to build a 1 story wheel factory. Estimated cost $100,000. Private plans.

Mich., Detroit—A. Kahn, Archt., 1,000 Marquette Bldg., is receiving bids and will open same about Aug. 15, for the construction of a 5 story, 60 x 441 ft. factory (for the manufacture of auto parts) and two connecting bridges to existing building on Campau Ave., for Studebaker Corp., Brush St. and Piquette Ave. Estimated cost $400,000.

N. J., Perth Amboy—The Standard Underground Cable Co., 50 Church St., New York City, has awarded the contract for the construction of a 3 story, 50 x 150 ft. factory, on Washington St., here. Noted June 15.

N. Y., L. I., Morris Park—The Long Island R. R. has awarded the contract for the construction of shop buildings, consisting of a 3 story, 40 x 100 ft. warehouse and a 3 story, 40 x 80 ft. factory, here. L. V. Morris, Ch. Engr.

N. Y., New York—O. K. Building Corp., c/o J. De Hart, Archt. and Engr., 1039 Fox St., is having plans prepared for the construction of a 1 story, 110 x 135 ft. garage on Bryant Ave. and 161st St. Estimated cost $50,000.

N. Y., New York—The Schock Estate has awarded the contract for the construction of an 8 story, 75 x 100 ft. garage and service station at 503 West 56th St.

O., Cleveland—Cleveland Folding Machine Co., 5200 Euclid Ave., has awarded the contract for the construction of a 2 story, 96 x 180 ft. factory, on East 61st St. near Euclid Ave. Estimated cost $75,000. E. H. Jones, Secy.

O., Cleveland—M. Marmorstein, Ulmer Bldg., had plans prepared for the construction of a 1 story, 40 x 94 ft. garage on East 69th St. and Euclid Ave. Estimated cost $40,000. W. S. Ferguson Co., 1900 Euclid Ave., Archts.

O., Cleveland—D. Round & Son, Stop 3, A. B. C., have awarded the contract for the construction of a 2 story, 52 x 275 ft. foundry and shop. Estimated cost $60,000.

O., Youngstown—Vahey Oil Co., 1028 West Rayen St., plans to build a 2 story, 75 x 162 ft. garage and service station on Phelps and Front Sts. Estimated cost $65,000. Architect not announced.

Pa., Ambridge—The Amer. Bridge Co. has awarded the contract for the construction of an addition, including a large crane runway and unloading dock. Estimated cost $15,000.

Pa., Monessen—S. S. Jones, 30 6th St., Belle Vernon, is receiving bids for the construction of a 2 story, 64 x 99 ft. garage on Doner Ave. and 9th St., here. Estimated cost $60,000. Austin Co., Union Arcade, Pittsburgh, Archts. and Engrs.

Pa., Munhall—The Miller Motor Co., 228 West 7th Ave., Homestead, Pa., is receiving bids for the construction of a 2 story, 74 x 108 ft. garage, on 8th Ave., here. Estimated cost $40,000. J. E. Dwyer, 5808 Forbes St., Pittsburgh, Archt.

Pa., Phila.—A. H. Fox Gun Co., 18th and Windrim Sts., has awarded the contract for the construction of a 1 story, 100 x 100 ft. gun factory.

Pa., Phila.—National Biscuit Co., 13th St. and Glenwood Ave., has awarded the contract for the construction of a 1 story 132 x 225 ft. garage.

W. Va., Montgomery—Coal Valley Machine and Electric Mine Car Co. has awarded the contract for the construction of a 1 story, 50 x 100 ft. factory.

W. Va., Wheeling—The National Garage of Wheeling will build a 2 story, 103 x 112 ft. garage on National Pike. Estimated cost $50,000.

Wis., Appleton—G. R. & S. Motor Co., 735 Washington [illegible] and E. A. Wettengel, Archt., [illegible] Ave., are receiving bids for the construction of a 1 story, 32 x 100 ft. garage and repair shop. Estimated cost [illegible]. Noted July 20.

Wis., Eagle River—Strong & Manley had plans prepared for the construction of a 1 story, 120 x 130 ft. garage. Estimated cost $45,000. Private plans.

Wis., Fredonia—[illegible] Bros. plan to build a 1 story, 36 x 120 ft. foundry. Estimated cost [illegible]. Architect not selected.

Wis., La Crosse—McKenzie Mfg. Co., 1646 Liberty St., will build a 2 story, 36 x 140 ft. factory addition for the manufacture of potato sprayers and diggers. Estimated cost [illegible].

Wis., Milwaukee—[illegible] Bros. Co., 3112 [illegible] St., [illegible] bids and opens same about Aug. 14, for the construction of a 1 story, 55 x 150 ft. garage on Kinnickinnic Ave. Estimated cost $40,000. Private plans.

Wis., Milwaukee—Edward Motor Car Co., [illegible] Grand Ave., has awarded the contract for the construction of a 2 story, 105 x 300 ft. garage, on Grand Ave. and 36th St. Estimated cost $100,000.

Wis., Milwaukee—M. Froehlig, 779 6th St., has awarded the contract for the construction of a 1 story, 50 x 125 ft. garage, on Center and 29th Sts. Estimated cost [illegible].

Wis., Milwaukee—Harley-Davidson Motor Co., 3732 Chestnut St., has awarded the contract for the construction of a 1 story, 74 x 125 ft. factory addition. Estimated cost [illegible].

Wis., Neenah—Jaeger-Dowling Co., 214 [illegible] Commercial St., is receiving bids and will open same about Aug. 14, for the construction of a 1 story, 75 x 120 ft. garage on North Commercial Ave. Estimated cost $45,000. Private plans.

Wis., Wausau—Marathon Motor Car Co., 510 McClellan St., has awarded the contract for the construction of a 4 story, 60 x 120 ft. garage addition. Estimated cost [illegible].

General Manufacturing

Fla., Lake Eustis—Lake Eustis Fruit Co. plans to build a 75 x 100 ft. fruit canning factory. Estimated cost including machinery, $19,000. B. Dillard, Mgr. Architect not selected.

Fla., Tampa—Consumers Ice Co., Polk and [illegible] Sts., will receive bids until Oct. 1, for the construction of a 1 story, [illegible] ft. ice plant. Estimated cost including machinery $20,000. C. Perry, Mgr. Architect and Engineer not announced.

Ill., Chicago—Pratt & Lambert, Inc., 320 West [illegible] St., has awarded the contract for the construction of a 2 story, 50 x 150 ft. factory for the manufacture of varnish and paint on [illegible] St. near Princeton Ave. Estimated cost [illegible].

Ind., Hammond—Calumet Baking Co. has awarded the contract for the construction of an addition to its plant. Estimated cost [illegible].

Ind., Indianapolis—The Gem Laundry Co., [illegible] ana Ave., plans to build a 2 story, [illegible] ft. laundry on North Senate Ave. Estimated cost $40,000. W. H. Al[illegible], [illegible] Bldg., Archt.

Ind., Indianapolis—United Brotherhood of Carpenters and Joiners of America plans to build a 2 story print plant on East Michigan Ave. Estimated cost $100,000.

Ky., Summit—Pittsburgh Brick & Tile Co., c/o R. R. Willis, Ashland, plans to build a plant here for the manufacture of [illegible]. Estimated cost $200,000. Private plans.

Me., Sanford—The Sanford Mills has awarded the contract for the construction of a 6 story, 118 x 253 ft. spinning mill and a 4 story 85 x 155 ft. finishing building.

Mass., Fall River—Amer. Thread Co. ([illegible]), has awarded the contract for the construction of a [illegible] story addition to its mill, containing 54,000 sq.ft. of floor space. Estimated cost $125,000

Minn., Duluth—Universal Portland Cement Co., 262 Walvin St., will increase the capacity of plant No. 7. Plans include 200 ft. kiln for burning raw material, dust collecting apparatus and other equipment. Estimated cost $200,000.

Mo., Kansas City—The City will hold an election in November to vote on $150,000 to $150,000 bonds for improving Leeds Farm, including the construction of east wing of building, and an electric plant, installing hospital for drug addicts, refrigerating plants, and laundry for men and womens buildings.

N. J., Camden—C. W. Brennan, 1306 Sansom St., Phila., has awarded the contract for the construction of a 4 story, 40 x 200 ft. factory, for the manufacture of cloth, on 6th and Jefferson Sts., here.

N. Y., Buffalo—Lautz Marble Corp. 861 Main St., has awarded the contract for the construction of a 1 story, 110 x 142 ft. manufacturing and office building.

N. Y., Jamestown—Jamestown Worsted Mills, 335 Harrison St., has awarded the contract for the construction of a 4 story, 70 x 175 ft. addition to its combing and drawing department, and a 122 x 180 ft. dye and filter house, etc. Estimated cost $100,000.

N. Y., Owego—Gotham Shoe Co., plans to build a factory addition on Church St.—Estimated cost $50,000. Architect not announced.

N. C., Winston-Salem—Fogle Furniture Co. is having plans prepared for the construction of a 2 story, 50 x 125 ft. furniture factory. Estimated cost $30,000. F. A. Fogle, Pres. and Mgr.

O., Cleveland—The Ingraham Waste & Supply Co., 1539 Columbus Rd., is receiving bids for the construction of a 1 story, 50 x 125 ft. factory and warehouse at 1450 Hamilton Ave. Estimated cost $50,000. W. E. Monsor, Pres. Poe Eng. Co., Peoples Bank Bldg., Engrs. Noted July 27.

O., Cleveland—The Standard Envelope Co., 1011 Oregon Ave., has awarded the contract for the construction of a 1 story, 155 x 200 ft. factory on East 30th St. and Chester Ave. Estimated cost $100,000, G. H. Altman, Pres. Noted July 13.

O., Columbus—Clark Show Case Co., 31 West Chestnut St., is having plans prepared for the construction of a 4 story, 40 x 120 ft. factory, on Naghten St. Estimated cost $80,000. Private plans.

O., South Akron (Akron P.O.)—Washington Rubber Co. (manufacturer of rubber specialties, plans to rebuild large portion of its factory which was destroyed by fire.—Estimated cost $50,000. Architect not announced.

Pa., Butler—Standard Plate Glass Co., near Lincoln Ave., will build a 1 story, 100 x 250 ft. addition to its glass factory.—Estimated cost $100,000. Private plans.

Pa., Phila.—Penna Music Lithograph Co., 13th and Appletree Sts., has awarded the contract for the construction of a 1 story, 50 x 85 ft. printing plant. Estimated cost $11,000.

Pa., Warren—Crescent Furniture Co. plans to build a 4 story, 50 x 82 ft. addition to its furniture factory also 36 x 50 ft. dry kilns, on South Side. Estimated cost $20,000. Architect not announced.

Pa., Williamsport—W. R. Hoehn Silk Co., 201 Pine St., has awarded the contract for the construction of a 1 story addition to its silk factory.

Pa., Williamsport—Williamsport Building Products Co., c/o E. Dittmar, Archt., 1603 Erie Ave., had plans prepared for the construction of a 1 story, 57 x 160 ft. factory for the manufacture of building products.

S. C., Beaufort—Beaufort Gazette is having plans prepared for the construction of a 1 story, 50 x 100 ft. publishing plant. Estimated cost with machinery $16,000. S. F. Sherman, Mgr.

S. C., Greenville—Norris Bros., Inc., Birnie St., have awarded the contract for the construction of a 2 story, 40 x 128 ft. bobbin factory.

S. C., Greer—Victor-Monaghan Co., Victor Plant, has awarded the contract for the construction of a 2 story addition to its cloth room building.

S. C., Sumter—Sumter Ice & Fuel Co. plans to build a creamery and ice plant. Estimated cost $30,000 to $40,000. E. H. Moses, Mgr. Architect not selected.

Tenn., Erwin—B. S. Abernethy, Lincolnton, N. C., and W. C. Heath, Charlotte, N. C., plan to build a 15,000 spindle textile mill here. Architect not announced.

Tenn., Nashville—Marshall & Bruce Printing Co., 162 4th Ave., N., is having plans prepared for the construction of an office and general printing plant on 9th and Berryhill Sts. — Estimated cost $150,000. Freeland, Roberts & Acker, Independent Life Bldg.,—Engrs., Hart & Nevins, Watkins Bldg., Archts.

Va., Petersburg—G. W. Koiner is at head of a company which plans to build a 5 story, 150 x 200 ft. cold storage plant. Estimated cost $1,000,000. Architect not announced.

Wash., Tacoma—The Carstens Packing Co., Tide Flats, is having plans prepared for the construction of a 4 story, 67 x 72 ft. packing plant addition with 32 x 40 ft. wing. Estimated cost $1,000,000. P. V. Cornils company Archt.

W. Va., Warwood (Wheeling P.O.)—Wheeling Oxygen Co., Wheeling, plans to build an oxygen plant on 16th St., S.S., here. Industrial Eng. Co., Park Bldg., Pittsburgh, Pa., Engrs.

Wis., Appleton.—The Valley Dairy Co.—plans to build a 2 story, 60 x 100 ft. dairy.—Estimated cost $50,000. Architect not selected.

Wis., Green Bay—The Northern Paper Mills Co., Madison and Day Sts., c/o K. McNaughton, Purch. Agt., plans to build a 2 story, 70 x 200 ft. addition to its mill. Estimated cost $100,000. Architect not selected.

Wis., Madison—The Bd. of Educ., c/o Secretary, has awarded the contract for the construction of a 2 story, 60 x 185 ft. manual art and vocational training building. Estimated cost $75,000. Noted July 27.

Wis., Madison.—J. Feldman Paper Box Co., 515 Regent St., is having plans prepared for the construction of a 1 story, 60 x 182 ft. box factory on Charter St. Estimated cost $100,000. J. R. and E. J. Law, Strand Theatre, Archts. Noted Feb. 2.

Wis., Milwaukee—Holeproof Hosiery Co., 404 Fowler St., has awarded the contract for the construction of a 4 story, 64 x 64 ft. textile mill addition on 5th St. Estimated cost $60,000.

Wis., Milwaukee — Standard Victoria Steam Laundry, 69 Ogden Ave., will receive new bids (former bids rejected) for the construction of a 2 story, 40 x 114 ft. laundry. Lesser & Schutte, 82 Wisconsin St., Archts.

Wis., Phillips—Kneeland McClurg Co. has awarded the contract for the construction of a 1 story, 60 x 210 ft. saw mill, to replace one destroyed by fire. Estimated cost $75,000. P. S. McClurg, Pres. Noted July 13.

Wis., Rosendale—Central Wisconsin Canning Co. is having plans prepared for the construction of a 2 story canning plant comprising a main building, warehouse and viner. Estimated cost $100,000. J. R. Hatch, Secy. Private plans.

Wis., Waukesha—Manitowoc Church Furniture Co., 1214 Lincoln Ave., has awarded the contract for the construction of a 1 story, 70 x 90 ft. factory. Estimated cost $50,000.

Mex., Tampico—Pierce Oil Corp. plans to rebuild portion of its refinery which was recently destroyed by fire. Estimated cost $100,000. Engineer not announced.

N. B., St. Johns—Nashwak Paper Mills Ltd. plans to build an addition to its paper plant, to increase its daily capacity from 60 to 80 ton. Estimated cost $500,000. Private plans.

Ont., Aurora—Taylor Rubber Co., 37 Richmond St., E., Toronto, plans to build an auto tire factory on Yonge St. here. Estimated cost $300,000. Architect not selected.

Ont., Fort William—Fort William Paper Mills is having plans prepared for the construction of a paper mill on Mission St. Estimated cost $200,000. Private plans.

Ont., St. Marys—The Hurlbut Shoe Co. has awarded the contract for the construction of a 3 story, 50 x 60 ft. shoe factory at Cadzow Park. Estimated cost $65,000. Noted May 4.

Ont., Stratford—Dufton Woolen Mills Co. plans to rebuild that part of its mills which was destroyed by fire.

Ont., Trenton—The Dominion Combing Mills, Ltd., 709 Continental Life Bldg., Toronto, has awarded the contract for the construction of a 1 and 2 story wool combing and washing plant. Estimated cost $200,000.

Ont., Welland—Maple Leaf Milling Co. plans to rebuild its 5 story flour and grain mill, which was destroyed by fire.

American Machinist

245

Volume 57 NEW YORK, AUGUST 17, 1922 Number 7

Apprenticeship in a Small Shop

Operations Studied—Tendency of the Boys Toward Toolmaking—Their Lack of Practical Imagination—Natural Rate of Progress Cannot Be Accelerated

By A. W. FORBES

APPRENTICESHIP is today rather an indefinite term and when applied to a small shop is scarcely distinguishable from a job. A sharp line is not drawn between the apprentices and the regular employees in a small shop, while systematic instruction is seldom attempted and is not necessary. All the processes are carried on within sight of everyone and the boy may usually secure an opportunity to try any branch of the work, in which he is really interested.

The accompanying illustrations show boys, all under twenty years of age, at their regular work in the Forbes & Myers shop at Worcester, Mass. The large proportion of special machines and tools made in this shop furnishes opportunities always greater than the ability of the boy permits him to grasp, while there are, at the same time, enough parts made by the thousand to give him sufficient examples of production methods.

In Fig. 1 a boy is drilling through a jig. This is the simplest operation in the machine shop, and yet one in which there is more to learn than many machinists imagine. Probably the man who has spent his whole life in studying simple drilling operations would see more possibilities for further study in the subject than either the beginner or the machinist. Yet there has never been a man with a first-class intellect who would give his attention to machine shop practice. As a result, we know less of the fundamental theories of this subject than of the more complex ones such as electricity and heredity. The opportunities for the ordinary boy are greater in this field for he will find less competition with intelligent men.

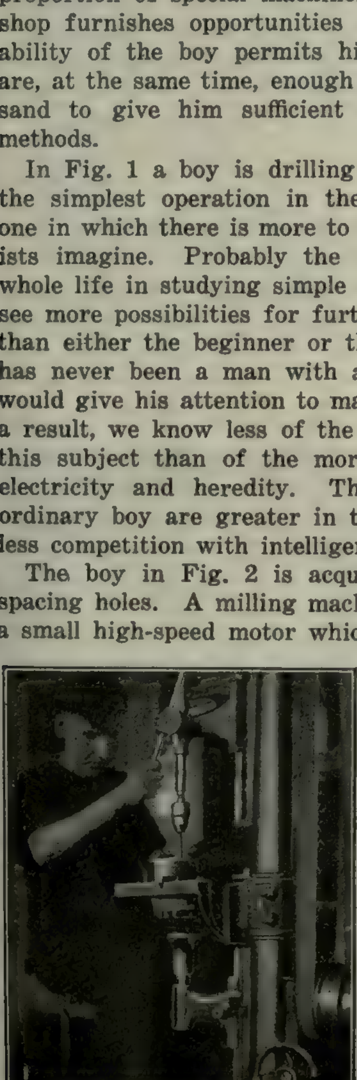
The boy in Fig. 2 is acquiring skill in accurately spacing holes. A milling machine has been fitted with a small high-speed motor which drills through a hardened steel plate into the work. The work is moved by means of the usual milling machine feeds, and the holes are accurately spaced by the graduated dials.

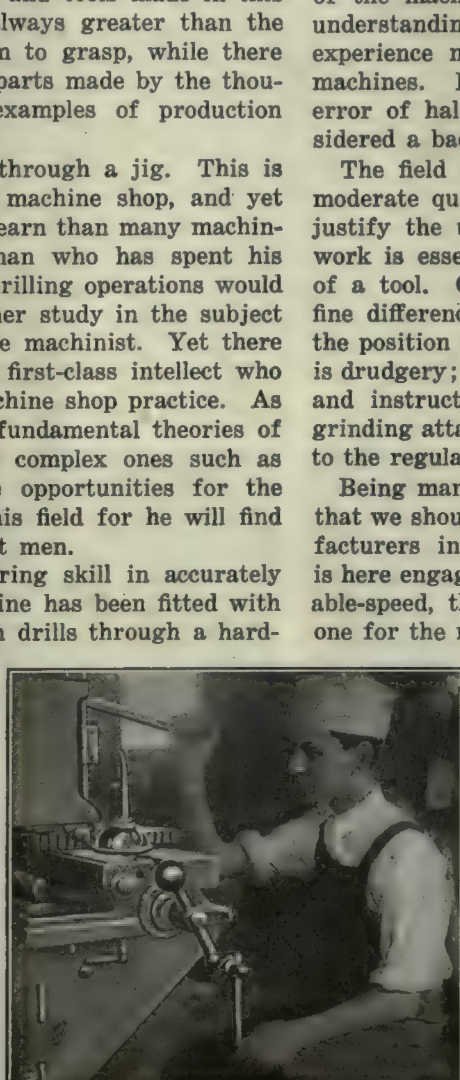
The drilling attachment was made by the boy shown in the illustration, and he is here engaged in making a few changes to secure greater accuracy in drilling. It is possible with such apparatus to drill two intersecting $\frac{1}{16}$-in. holes and have them come out of the back of a $\frac{1}{4}$-in. plate accurate within a thousandth of an inch.

In Fig. 3 a boy is engaged in finishing spindles on a lathe. The lathe is often considered the basic machine of the machine shop. If a boy is given a thorough understanding of the various lathe operations, he will experience no difficulty in handling any of the other machines. In the operation illustrated in Fig. 3 an error of half a thousandth of an inch would be considered a bad mistake.

The field of the turret lathe includes production in moderate quantities, but not in sufficient quantities to justify the use of an automatic machine. Repetition work is essential to the thorough study of the action of a tool. Only in this way is it possible to see the fine differences which are caused by slight changes in the position of the tool. Without study repetition work is drudgery; with study it is one of the most interesting and instructive parts of the training. In Fig. 4 a grinding attachment is used on one operation in addition to the regular turret tools.

Being manufacturers of electric motors, it is natural that we should use them to a greater extent than manufacturers in other lines. The boy shown in Fig. 4 is here engaged in fitting his machine with three adjustable-speed, three-phase motors, one for each feed and one for the main power.





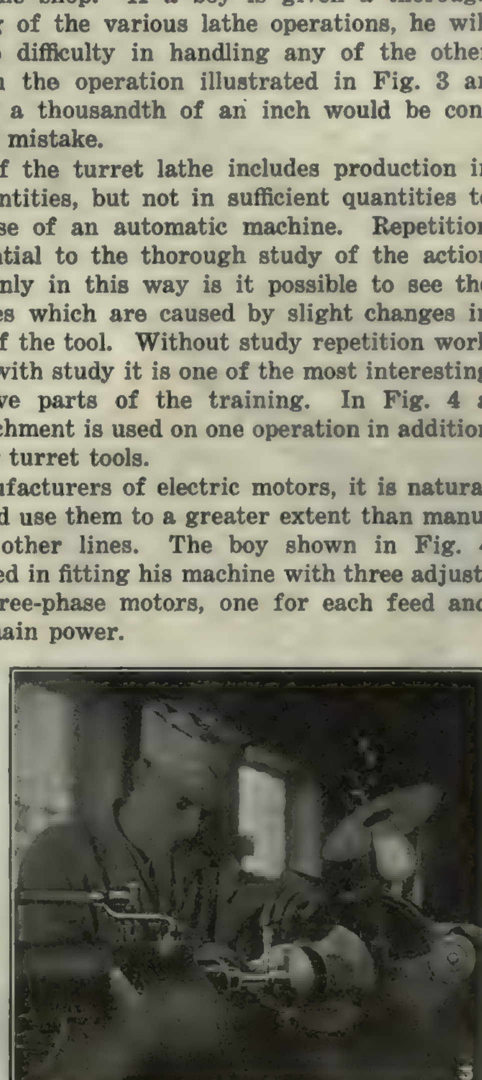


FIG. 1—DRILLING THROUGH A JIG. FIG. 2—ACCURATE SPACING OF HOLES. FIG. 3—FINISHING SPINDLES

FIG. 4—TURRET LATHE OPERATION. FIG. 5—FILING CLEARANCE ON A SPECIAL BROACH

Toolmaking is a highly developed form of machine work, and is a natural line of advance. Practical experience in using tools is an essential preliminary. However, to design and make a set of tools that will work right the first time, a thorough knowledge of the theory of the tool's action is necessary, a knowledge to be secured only through individual initiative and study. Fig. 5 shows a boy filing the clearance on the sides of the cutting teeth of a special broach which has already been machined to shape except for this clearance.

In Fig. 6 a boy is notching armature punchings. Metal stamping is usually done by mature men who have failed to advance to better positions, and in general this is probably the best class of person to do the work. However, as a preliminary to diemaking a certain period of working at the press is quite desirable. The advance from press hand to toolmaker can be readily made in any shop which is not over-systematized. The element of danger is one that has to be considered in using boys on metal stamping, but only a small part of the work is necessarily of much risk. The press is the only type of metal working machine on which we have never had an accident.

In Fig. 7 a boy is doing hand work on a fan die. These tools cut and bend to shape the fan blades used for cooling a small motor. The edges of the die over which the blades are bent, are now being rounded with a file. Metal stampings are one of the most important factors in electrical machinery. Making tools for this work, including the various punching, bending and forming operations is a highly skilled form of toolmaking. A certain amount of training in diemaking is also valuable for the motor designer.

In Fig. 8 are represented some metal stamping tools and the finished product secured with them. Nearly all the work of designing and making these tools was accomplished by a boy who had had twenty months of machine shop experience. Safety is an important fac-

FIG. 6—NOTCHING ARMATURE PUNCHINGS. FIG. 7—HAND WORK ON A FAN DIE

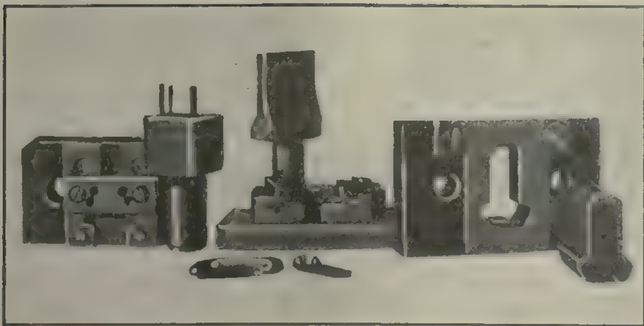


FIG. 8—METAL STAMPING TOOLS AND THE FINISHED PRODUCT

tor in the design of stamping tools. In this case in each operation after the blanking, the pieces are pushed into slots from the front, making it impossible to place the fingers under the punch except by a special effort.

Our work leads naturally in four directions, to the positions of foreman, salesman, motor designer, toolmaker and tool designer. We find that the boys take most naturally to toolmaking, some doing very creditable work after a short period.

In Fig. 9 a boy is building a stator core. For time studies, few jobs offer an opportunity equal to this one. As this is entirely hand work, there is no limit to the speed except in the selection of the proper motions and in the rapidity with which they can be made. Time studies are essential for anyone who wishes to take part in shop management and the best time to learn the principles is while working on a job of this sort. Yet few boys take naturally to time studies, or for that matter to anything connected with management. It is probably best for the average boy to devote his time to the technical side of the work, leaving all questions of management until he is more mature.

Unquestionably the method shown in Fig. 10 is the fastest method of cutting a steel plate into irregular shapes. While it does not leave a finished surface, it has its use, and this use should be thoroughly understood by the designers of machinery.

Manufacturing processes require special machinery. We find it best to build most of this special machinery in our own shop. In Fig. 11 a standard bench press is being fitted with an attachment for rotating the blank while a row of notches is being punched around the outside edge. This press will make twenty-four slots in an armature punching, one at a time, spacing them accurately, in a total time of 9 sec. It is always a question of whether it is better to stamp the slots in this way, or whether it would be better to make a compound die; but, for special motors, the expensive dies are out of the question.

In Fig. 12 a boy is winding an electric motor. The mechanical processes of inserting the wires can be learned in a comparatively short time. The theory of the windings is an entirely different proposition. No boy should take up winding without possessing the interest in electricity and the practical imagination to carry through the study to such positions as electrical designer or research engineer. Very few do so, and I think the reason lies in their lack of imagination. The jump from the actual wires to the current inside and the magnetism outside is too much for the ordinary

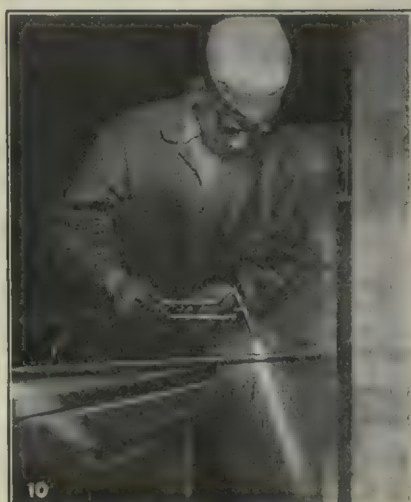
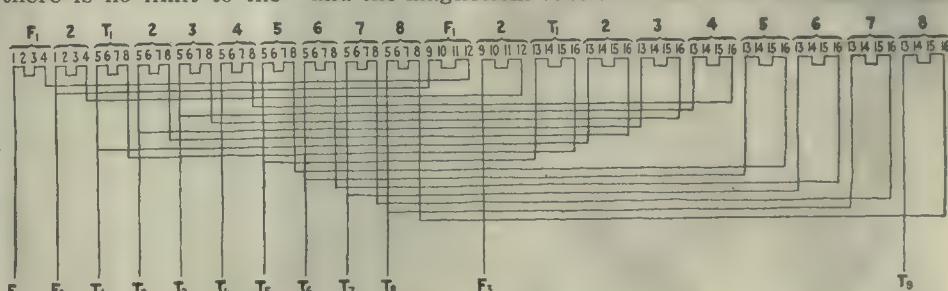


FIG. 9—BUILDING A STATOR CORE. FIG. 10—CUTTING A STEEL PLATE. FIG. 11—ASSEMBLING A NOTCHING PRESS



Field	1	12 tps	# 20
	2	12	24
Trans.	1	2	20
	2	3	20
	3	4	21
	4	11	22
	5	9	23
	6	13	25
	7	18	27
	8	27	28
Arm.		8	19

Estimated Speeds

Size 82

Field Taps	Transformer Taps Prim.	Transformer Taps Sec.	Speeds
1 & 3	1 & 5	1 & 4	9500
1 & 3	1 & 5	1 & 3	7500
1 & 3	1 & 5	1 & 2	5900
1 & 3	1 & 5	0	4700
1 & 3	1 & 6	0	3700
1 & 3	1 & 7	0	2950
1 & 3	1 & 8	0	2350
1 & 3	1 & 9	0	1850
1 & 2	1 & 7	0	1475
1 & 2	1 & 8	0	1175
1 & 2	1 & 9	0	935

FIG. 13—A DIAGRAM OF CONNECTIONS

boy. He succeeds better with toolmaking where he can see more of what is going on.

Connection diagrams may be drawn out carefully by the draftsman, but a simple sketch by the designer serves the purpose equally well. Fig. 13 gives a diagram of a special three-phase adjustable-speed motor being built for the turret lathe shown in Fig. 4. Eighty wires coming from the coils in bundles of eight, can be easily mixed up. When connected by a boy as shown in Fig. 12 they always test out O.K. But some winders make mistakes, and it takes a great deal of imagination to discover which wires were interchanged without disconnecting all and starting again.

The boy in Fig. 14 is attending to some of the firm's correspondence. This is not stenography. The assigned mail is answered, indexed and filed. After the answer has been written it is taken to the proper person for approval and signature.

Saturday afternoons and other times when the shop is open but only part of the equipment in use, the facilities of the shop are available to the boys for making things for their own use. Electric toasters and wireless apparatus are made by the boys in this period.

The majority of the boys in our shop start work when they are fourteen or fifteen years of age. Of our present employees, all started shop work at either of these ages, and 83 per cent came to us before their sixteenth birthday. I think this is the best time to begin work, except for the brightest boys, who might be benefitted by an earlier start. Some boys work the full time from the beginning, that is 40 hours per week, according to the Massachusetts law for boys under sixteen years of age. Others spend part of their time in the shop and part in the city high schools, studying such subjects as mathematics, English, Latin and history. I think that boys who are in the shop should not study vocational subjects in school.

The pay starts at about 20 cents per hour, although it may start at a higher rate in some cases where previous work or study is of such a nature that it is of value to us. This pay is revised once in three months. In determining the rate at these revisions, the amount and quality of the work done during the last three months, as compared with that of an experienced man, are the greatest factors, but not the only ones. It is also necessary to consider the amount of supervision necessary and the regularity of attendance. Boys on short time or irregular schedule cannot expect the same rate per hour as those working full time.

The accompanying illustrations show some of the opportunities for the boys in our shop. The real problem is getting the boys to take advantage of them. I think I can say definitely that every effort to make boys advance along a special line, or to hurry their natural rate of progress has been a failure. It is possible to teach them facts as is done in school, but that is not real progress. We can show them how to do a given job, and they will then do that job better, but this work does not seem to prepare them for the next stage, unless it is consistent with their natural rate of progress. Corrections of mistakes are, of course, necessary, the giving of information when it is desired is often of benefit, and I am inclined to think a certain amount of systematic study is of value, provided it does not encroach on what a boy would naturally learn without it.

We have had some boys who have made considerable progress, such as shown by Figs. 7, 8, 11 and 12, but this progress does not seem to have been caused by any effort on the part of the management toward that result. In one of these cases, I thought the boy would do better in another line and directed his work with this in view, but without results. He made progress only when given opportunities in this one direction, and so naturally he was allowed to specialize in this line of work.

There is one thing that is essential to secure progress, and that is the proper selection of boys. If I am correct in my opinion that each boy has his natural rate of progress that cannot be materially accelerated, but may be retarded if opportunities are lacking, or if his mind is too much occupied with other things, then the principal factor is the selection of boys who have a natural rapid rate of progress in the direction in which the opportunities are offered.


12


14

FIG. 12—WINDING AN ELECTRIC MOTOR. FIG. 14—CORRESPONDENCE

Application of Bedaux Management Methods in the Robbins & Myers Plants

A Single Unit for All Activities — Estimating — Manufacturing — Inspection and Salvage—Knowing Costs at All Times—Reports and Graphs

By L. C. MORROW
Managing Editor, *American Machinist*

SINCE 1918 Bedaux methods of setting work standards and compensating labor have been in operation in the plant of the Robbins & Myers Co., Springfield, Ohio. The results have been so thoroughly satisfactory during both boom and depression that a presentation in detail of the application of the Bedaux methods may now be given to the industrial world.

The Bedaux principle of human power measurement was explained in a previous issue of the *American Machinist* (page 241, Vol. 56). As therein defined it is a principle around which a system has been built whereby there can be expressed in one common unit the work done by every human being, whether laborer or supervisor, in relation to the work that should be done. That unit, called a B, is a fraction of a minute of work, plus a fraction of a minute of rest, always aggregating unity but varying in proportions.

There must, of course, be sixty of these units, or Bs, of productive effort plus rest in one hour and they constitute an hour's normal work, because they include all necessary allowances for rest, recreation, rebuilding, or whatever the renewal of human energy may be called. The system is the property of the Charles E. Bedaux Co., engineers, Cleveland, Ohio.

To show the application of the system, the Robbins & Myers plants have been chosen from some 28 plants, wherein the installation has been successful, because of the diversity of work performed. The products are electric motors, generators, fans, motor generator sets, radio apparatus and electrical parts for automobile starting and ignition systems involving some 200 different operations on 50,000 parts. The productive force of the plants when working at full capacity is 3,000 people. The corresponding clerical force in 200, including the personnel of the standards and planning departments.

The Robbins & Myers organization is not of an unusual type, as may be seen from the chart, Fig. 1. So far as the actual carrying on of the system is concerned, the entire chart may be forgotten, except for the standards and planning departments and those departments that they control. Shop departments now on B work are indicated in the following list: Receiving (partly), material (partly), time keeping (partly, Hollerith punch operator), standards (partly, posting and stenographic), salvage (partly, inspectors), foundry molding, raw material stores, saw and shear, cleaning and chipping, punch press, drill press, lathe, boring mill and heavy machine, screw machine, grinding and shaft turning, J. & L. turret lathe, form making, a.c. armature, d.c. armature winding, armature core building, commutator, polishing and buffing, plating and japaning, medium armature winding, parts stores, polyphase coil winding and inserting, coil winding, small armature winding, small a.c. field inserting, large armature winding, armature assembly, armature finishing, armature inspection, polyphase motor assembly, large d.c. motor assembly, small a.c. motor assembly, motor testing (50 per cent), fan assembly, motor packing, fan testing and fan packing.

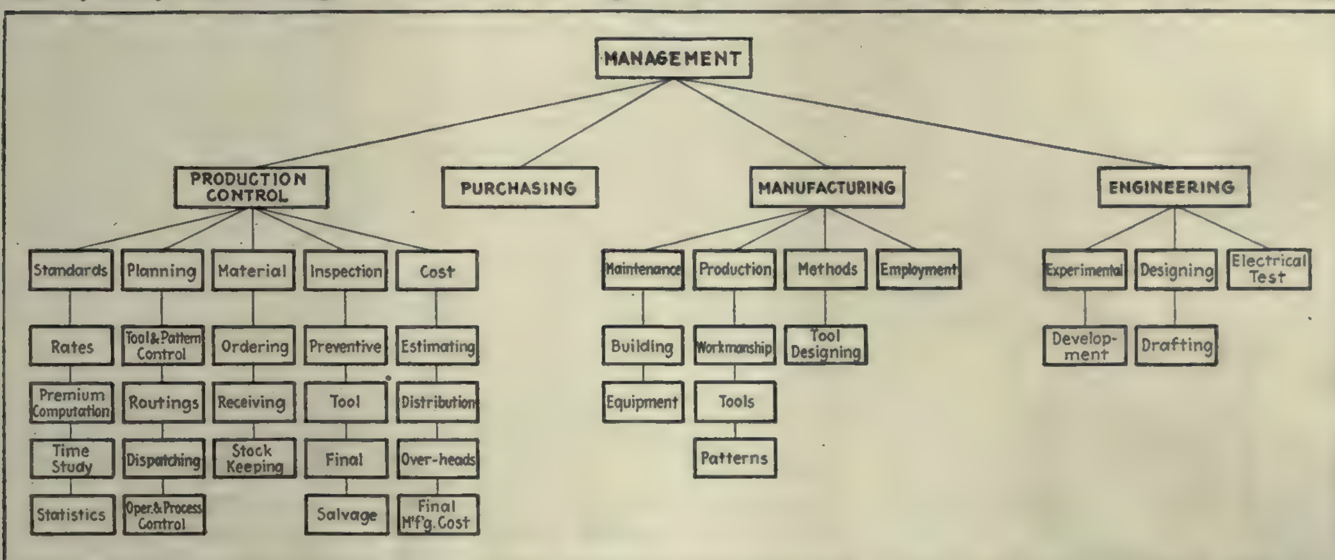


FIG. 1—CHART OF THE MANUFACTURING ORGANIZATION OF THE ROBBINS & MYERS CO.

Of great importance is the standards department. Briefly its duties are to take time studies, set standards, keep records, make adjustments, make analyses.

Time studies are made with the stop watch by men who have been chosen from the shop because they themselves can do the work they are timing, and the best operator in the department is, as a rule, selected as the subject.

Such standards are set that a normal effort will produce sixty Bs of work per hour. Added effort will increase production, and a proportionate reward is given.

PART NUMBER	DESCRIPTION	OPERATION	EQUIPMENT NUMBER	STANDARDS IN Bs			COST PER B		COST			
									SET LABOR		TOTAL	
				TOTAL	SET-UP	MACHINING	LABOR	LABOR & OVERHEAD	SET-UP	MACHINING	LABOR & OVERHEAD SET-UP	LABOR & OVERHEAD MACHINING
1	2	3	4	5	6	7	8	9	10	11	12	13

FIG. 2—ESTIMATING FORM

Reward applies to both productive and non-productive workers.

Only such records as will be of future use are kept. There is a constant clearing of records as information is drawn off for analytical purposes.

Adjustments generally consist of determining whether or not an operator is to be paid for reworked operations. There are certain well defined rules about reworking that are entirely intelligible to the operator, yet are sometimes difficult of application, so that his calling attention to a case is in the nature of asking for information, rather than by way of complaint.

Analyses are made for the use of management. They are few and simple, yet true and complete, as will be shown by the sample forms given later.

Duty of the Planning Department

Expressed as briefly as possible the duty of the planning department is to assign the parts to be manufactured to the departments that will manufacture them. It is an important department because from it emanate all delivery promises. It controls shop orders in every way—routing, follow-up and records.

The preceding paragraphs are intended to give a conception of the system and its operation as a whole. If definitions and principles are kept in mind the details that follow will not be confusing. Bear in mind particularly that all capacities are expressed in Bs. Each operator's capacity is measured in Bs. The capacity of each department is measured in Bs. The capacity of the entire plant is measured in Bs. The requirements of work are expressed in Bs, estimated work as well as work that has been made before. All results are measured and tabulated in Bs. Cost is figured as cost per B. The entire plant is therefore thinking and talking in terms of one and the same unit.

Following Through an Order

For the purpose of this article, we will suppose that the Robbins & Myers Co. is asked to estimate on a motor similar to its standard motors, but enough different that the company does not feel justified in saying, "They are just like our XY motor and we'll make them for Z dollars apiece." The company receives and fills the order and we are privileged to see how the estimate was prepared, the delivery dates determined, the work routed, manufacture carried on and inspection and salvage conducted. We are also permitted to see that the company knew at all times just what were its costs on the job and that there were no continual leaks, permitting profit to escape.

Specifications of the new motor were given to the

standards department for estimating. The first step was to make up an operation list and enter it in Col. 3 on the estimating form shown in Fig. 2. The engineering and planning departments were important factors in making up such a list and in specifying the departments in which the operations would be performed. The standards department then determined the number of Bs required for one operator for each operation and entered it in Col. 5. These standards were determined by making use of the records of accomplishment on previous work. The standards were then split up to show Bs for set-up and for machining and the results entered in Cols. 6 and 7.

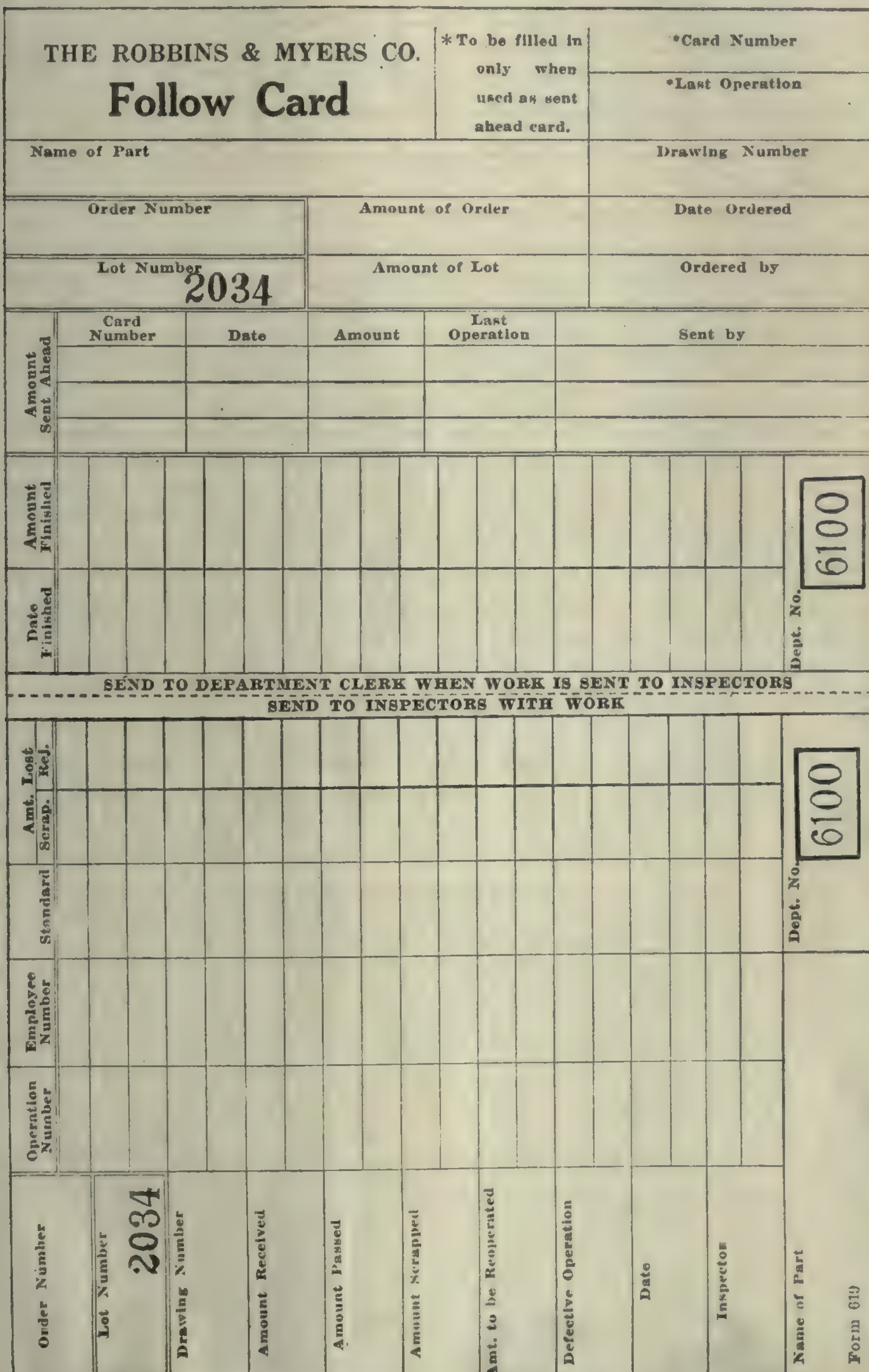

THE ROBBINS & MYERS CO.
Follow Card
*To be filled in only when used as sent ahead card.
*Card Number
*Last Operation
Name of Part
Drawing Number
Order Number
Amount of Order
Date Ordered
Lot Number 2034
Amount of Lot
Ordered by
Amount Sent Ahead
Card Number
Date
Amount
Last Operation
Sent by
Amount Finished
Date Finished
Dept. No. 6100
SEND TO DEPARTMENT CLERK WHEN WORK IS SENT TO INSPECTORS
SEND TO INSPECTORS WITH WORK
Amt. Lost Rej.
Scrap.
Standard
Employee Number
Operation Number
Dept. No. 6100
Order Number
Lot Number 2034
Drawing Number
Amount Received
Amount Passed
Amount Scrapped
Amt. to be Reoperated
Defective Operation
Date
Inspector
Name of Part
Form 619

FIG. 3—FOLLOW CARD

The cost per B for a given operation in a given department, known from definite rates established on each class of work and from records of past performance, was entered in Col. 8. Overhead was added and the result placed in Col. 9. Multiplying Cols. 6 and 8 together gave the cost of labor for set-up, Col. 10. Multiplying Cols. 7 and 8 gave the cost of labor for machining, Col. 11. The costs of labor plus overhead for set-up, Col. 12, and of labor plus overhead for machining, Col. 13, were obtained by multiplying together Cols. 6 and 9 and Cols. 7 and 9 respectively. The resulting costs per operation per piece had to be multiplied by the number of pieces on the order to obtain the total cost of the job. The estimate thus completed was given to the sales department. The entire calculation was of course based on a specified quantity in order to charge correctly for set-up.

With the shop costs made available in that way, the sales department added the cost of general overhead and the amount necessary for profit and submitted the bid to the customer. It was a competitive bid, but we are assured by the Robbins & Myers Co. that in presenting it there was no doubt that if the order should be received and executed, a very satisfactory profit would be obtained. The figures were evidently acceptable to the customer as the order was placed without questioning the price.

Upon receiving the formal order, the sales manager caused the necessary copies to be made, among them one for the planning department and two for the engineering department to be delivered later to the planning department. The copy sent directly to the planning department was an advance notice of the new job. The two copies sent to the engineering department were supplemented in that department by notations and specifications before being sent to the planning department. Upon receipt of those two copies the planning department analyzed the job, giving to the sales department the necessary lot or part delivery promises and attaching to the order riders containing statements of those promises. One copy of the order was then sent to the material department where the material list of the engineering department was assigned on the stock record to determine the amount

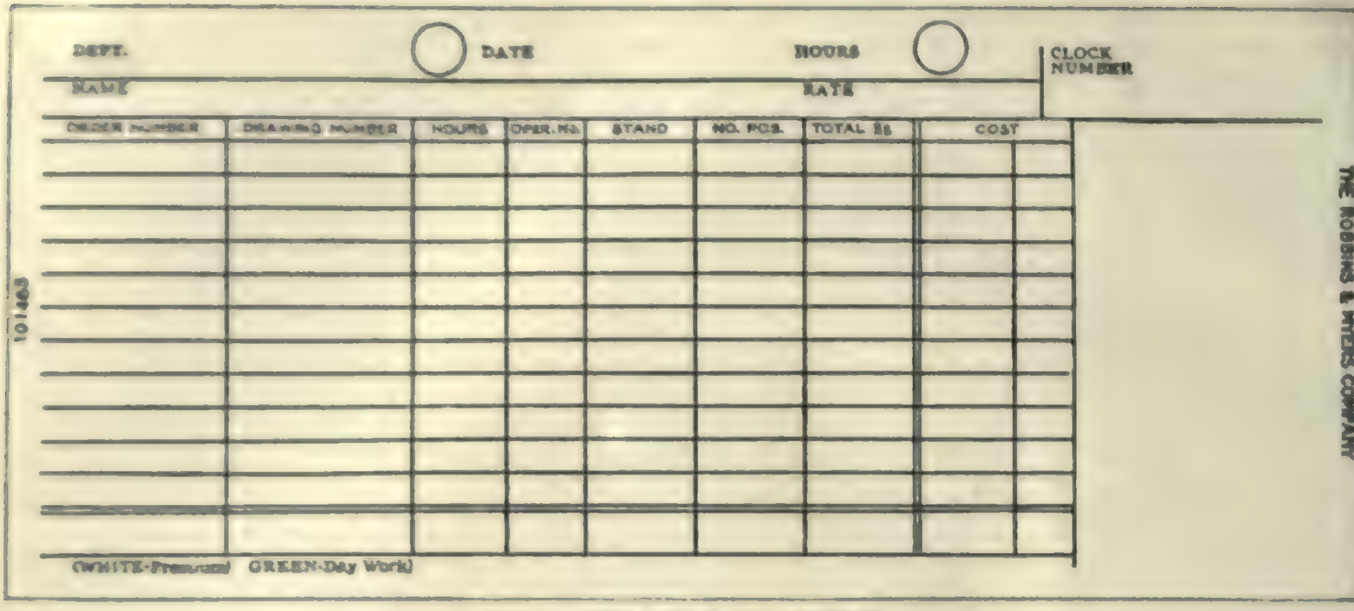

DEPT. DATE HOURS CLOCK NUMBER
NAME RATE
ORDER NUMBER | DRAWING NUMBER | HOURS | OPER. No. | STAND | NO. PCS. | TOTAL Bs | COST
101463
THE ROBBINS & MYERS COMPANY
(WHITE-Premium) GREEN-Day Work)

FIG. 4—OPERATOR'S TIME TICKET

of additional raw material to be purchased and the manufactured parts that were not available in the stockrooms.

Requests for raw material were placed upon the purchasing department, giving the quantity, specification and date needed. The material department also placed requests on the planning department for any manufactured parts needed. Requisitions for raw material and parts on hand were sent to the planning department. Immediately upon receipt of materials that had to be purchased, additional requisitions were made by the material department and delivered to the planning department. No shop tickets were placed by the planning department in the factory until the necessary material had been received and delivered to the stockroom.

Was the planning department able to set delivery dates that it felt capable of living up to, and were those dates met in every particular? The answer to the first part of the question is yes, on the assumption that material could be obtained without delay. The answer to the second part also is yes, except on a few parts where delivery of material was delayed by causes that could not be foreseen. A reasonable factor of safety was used by the sales department in making a delivery promise so that the order was filled well within the dates specified in the contract.

By keeping its records in Bs and because the estimate was made in Bs the planning department knew how much time would be required for each operation in each department. It also knew how much work on other products was ahead of each department and for that matter each machine of each department, when the new order was placed. And the possession of such knowledge did not require an inventory in the shop. It was already on hand because each shop order, in the system followed, shows the amount of work in Bs involved in each operation in each department and the machine the operation is to be performed on. Expressed in another way, the planning department knows at all times how many Bs may be issued against each machine, since it knows that machine's capacity in Bs and the load that it is carrying. Once it has been determined that a certain operation is to be done on a particular machine, everything about that operation may be forgotten so far as capacity to produce is concerned, except the Bs required to produce it and the B capacity of the machine. It is necessary that records be kept of the Bs work assigned to each machine, until completed.

An additional value of such a system for setting capacities against requirements is that the planning department is enabled to advise the material department just when material must be on hand. Likewise it knows that material must not be ordered to the departments before a given time in order to prevent congestion and interference with other work in process.

Details of planning department routine are few, yet they cannot be fully described here. Briefly they include the sending of the shop orders to the shop dispatchers, the checking up of finished orders, and the

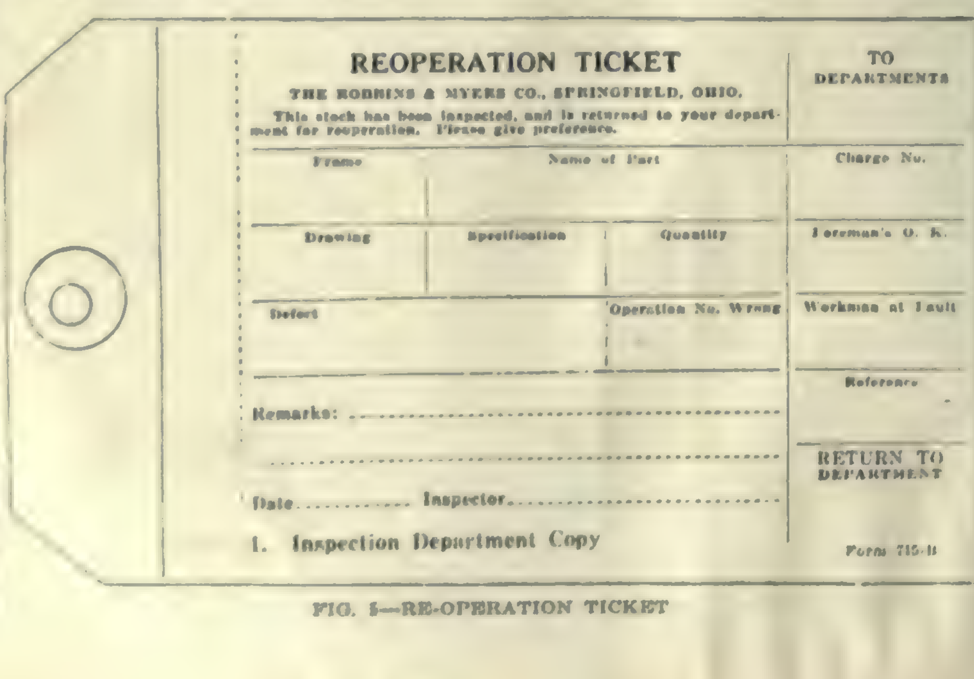

REOPERATION TICKET
THE ROBBINS & MYERS CO., SPRINGFIELD, OHIO.
This stock has been inspected, and is returned to your department for reoperation. Please give preference.
TO DEPARTMENTS
Frame | Name of Part | Charge No.
Drawing | Specification | Quantity | Foreman's O. K.
Defect | Operation No. Wrong | Workman at Fault
Reference
Remarks: ....
....
Date .... Inspector ....
RETURN TO DEPARTMENT
1. Inspection Department Copy
Form 715-B

FIG. 5—RE-OPERATION TICKET

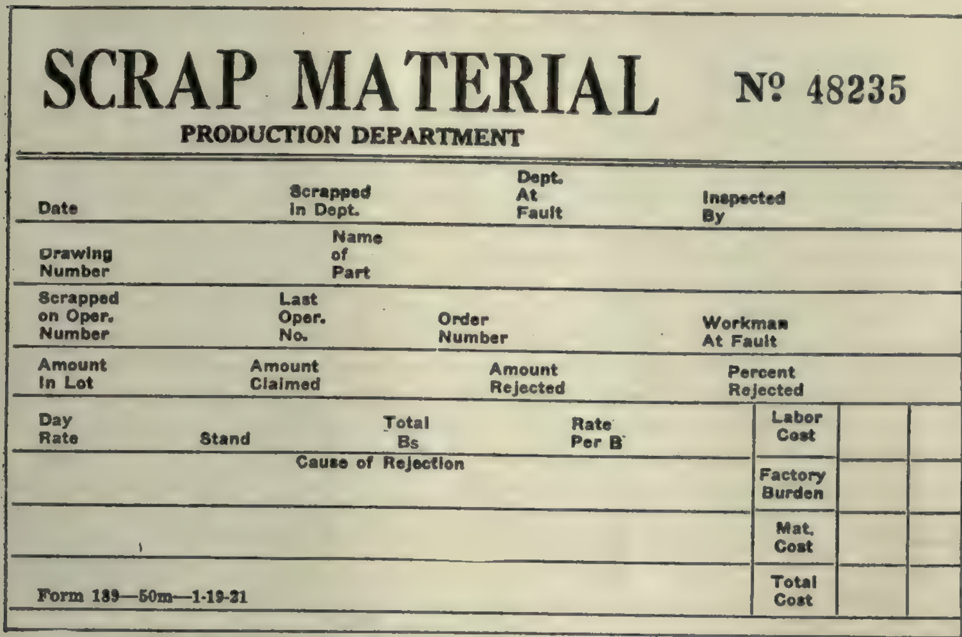

SCRAP MATERIAL Nº 48235
PRODUCTION DEPARTMENT
Date | Scrapped In Dept. | Dept. At Fault | Inspected By
Drawing Number | Name of Part
Scrapped on Oper. Number | Last Oper. No. | Order Number | Workman At Fault
Amount In Lot | Amount Claimed | Amount Rejected | Percent Rejected
Day Rate | Stand | Total Bs | Rate Per B | Labor Cost
Cause of Rejection | Factory Burden
Mat. Cost
Form 189—50m—1-19-21 | Total Cost

FIG. 6—SCRAP MATERIAL TICKET

following-up of delinquent orders, the last named entailing the use of a "delinquent board." The order sent to a dispatcher shows the dates upon which the order should be started and finished. The dispatcher possesses a dispatch board laid out by groups and machines. Pockets on the boards carry load cards giving the capacities of the machines. When the dispatcher puts a job on a machine he notes the load that it is carrying, and is guided thereby. A balance of all load cards is made each day, between work assigned and work finished, so as not to overload. Loads are expressed in Bs.

The dispatcher occupies an important place. He ties up with both planning and standard departments. In addition to handling load cards, he receives the planning department job tickets, and distributes them to the foremen in his department. He requisitions materials, having them delivered either to the machine on which they are to be worked or to other designated positions. (Job tickets are never issued until the material is in stores.) He also returns to the planning department the shop orders as they are completed.

Let us now see how the actual production takes place. It is of course guided by the standards department. Whenever possible on the order we are observing an operation was given a B value, that is, arranged on a premium basis. Many of the operations are nearly identical with operations on the company's standard work, so that it was possible to set B values before the first lot was ordered into the shop. On the other operations, time studies were taken on the first lot and standards set in time for the operators to be paid on a premium basis.

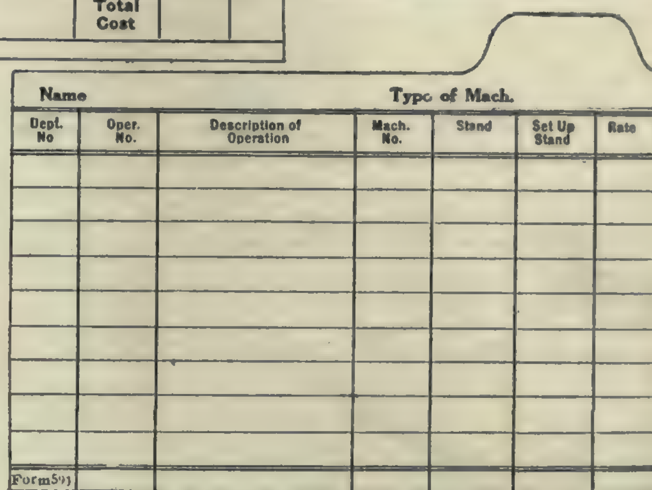

Name | Type of Mach.
Dept. No | Oper. No. | Description of Operation | Mach. No. | Stand | Set Up Stand | Rate
Form 5

FIG. 7—DEPARTMENTAL OPERATION REFERENCE CARD. FRONT AND BACK ARE ALIKE. SIZE 4 x 6 IN.

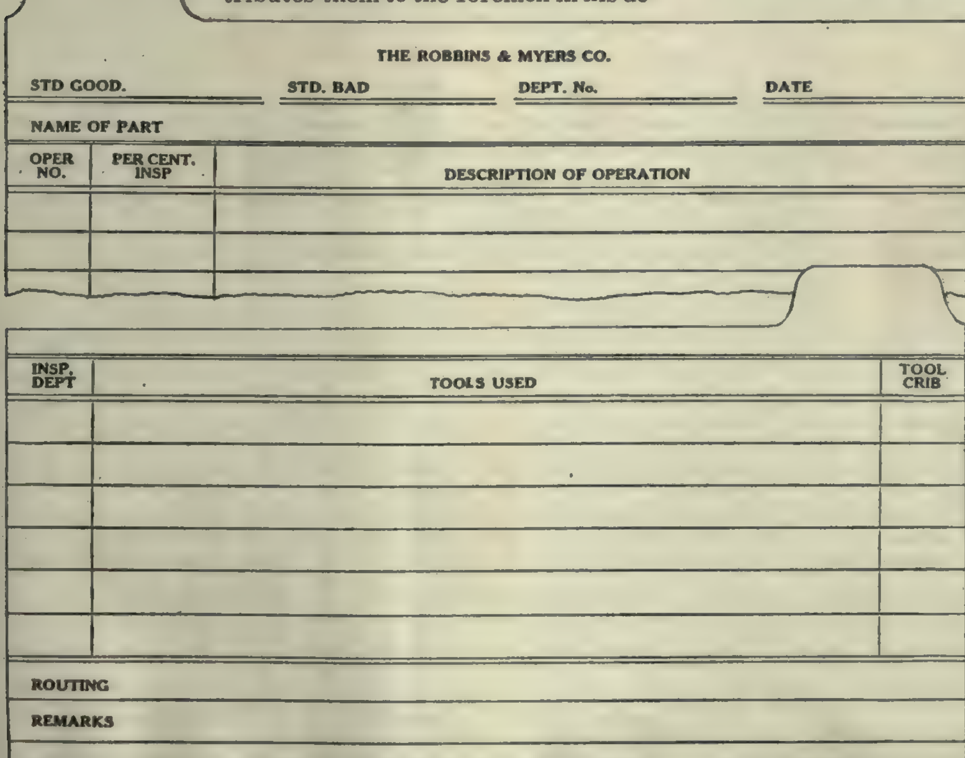

THE ROBBINS & MYERS CO.
STD GOOD. | STD. BAD | DEPT. No. | DATE
NAME OF PART
OPER NO. | PER CENT. INSP | DESCRIPTION OF OPERATION
INSP. DEPT | TOOLS USED | TOOL CRIB
ROUTING
REMARKS

FIG. 8—INSPECTION OPERATION REFERENCE CARD, FRONT AND BACK. SIZE 4 x 6 IN.

Before examining the details of the shop forms and records, it should be fully understood that the Bedaux system does not make use of piece rates. Each employee is hired at an hourly rate, the amount depending upon the rate for labor of the class to which he belongs in the locality in which he works. His job is then given a B value that is guaranteed. His hourly rate is guaranteed temporarily, being subject to change either upward or downward according to general conditions. If it becomes necessary to reduce wages (and that such a neces-

sity at times exists there can be no question) the hourly rate is reduced with no adjustment of B values. Once such a reduction has been determined upon the standards department issues written instructions to foremen, giving the new hourly rates for the various classes of employees. The foremen tell the employees what their new rates are, at the same time explaining why the change has been necessary. There always is a reason because a cut is never made unless necessary. Stated in a broad way, the chief reason is the necessity to meet competition. Just as rates are cut on what might be termed a falling market, so they are increased on a rising market. The method of notification is the same. We have always felt that a cut in piece rates was a sure way to precipitate labor trouble in a shop, so we are impelled to inquire as to how the system of guaranteeing B values and making adjustments in the hourly rates works out. We are assured by no less an authority than the head of the standards department that the amount of trouble caused has been almost negligible. But he tells us also that the secret of having no trouble is confidence of the men in the management, not only in the matter of hourly rates, but in time setting, inspection, premium accounting, adjustments, in a word, all relations. He says that the same is true of all successful systems, but particularly of the Bedaux system on account of its single standard of value.

The base rates, we learn, are set by a committee, composed of (1) the head of the standards department, (2) either the department superintendents or the general superintendent, (3) the head of the production control department and (4) an executive representative. In changing base rates the policy is to change the rates of the entire plant, though that cannot always be done.

In following the work of the standards department it is seen that there are few forms with which the shop comes in contact. The job ticket has been referred to. There are also the follow card, the operator's time ticket,

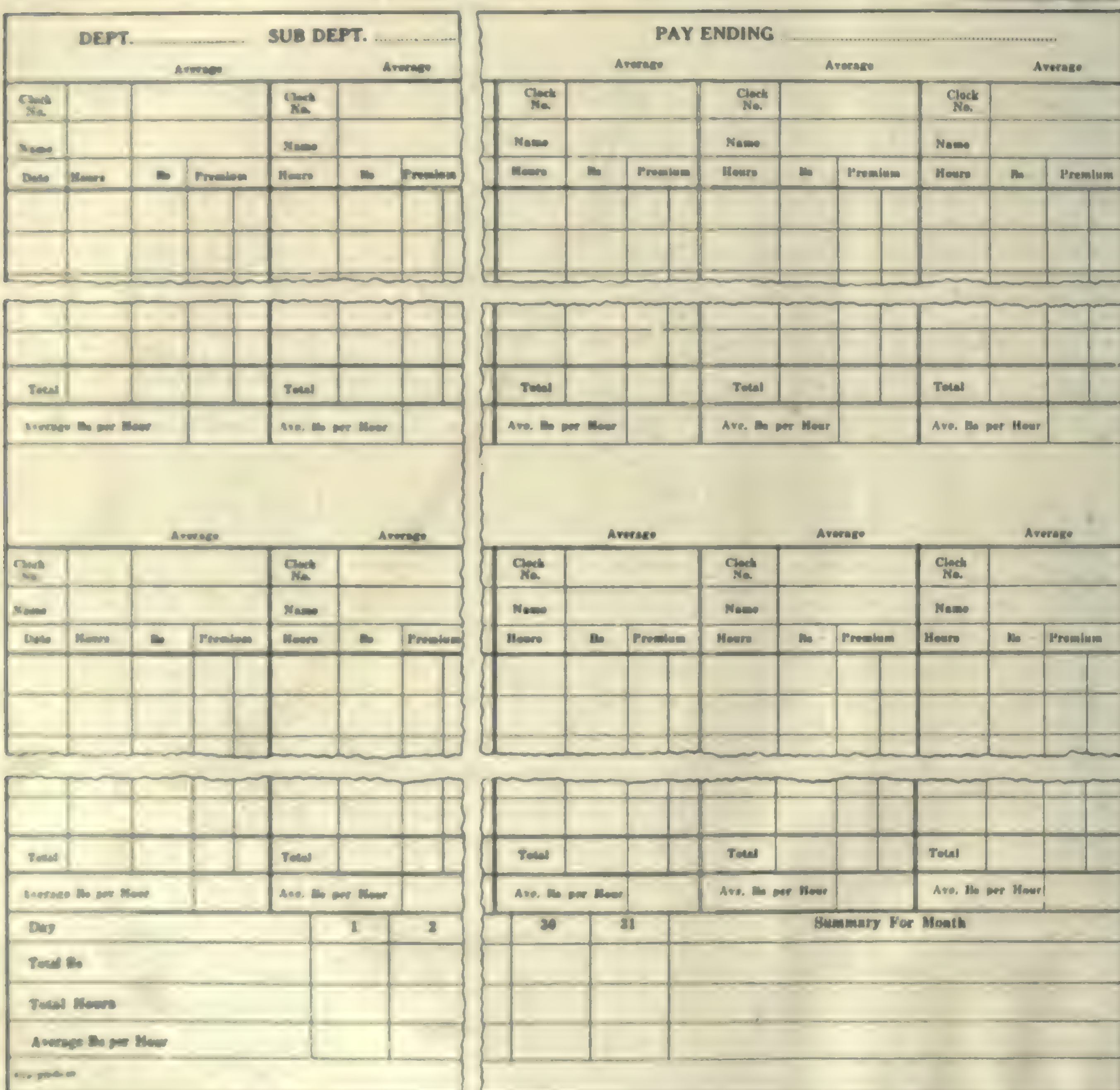


FIG. 2—PLANT POSTING SHEET

the re-operation ticket, the scrap material ticket, the departmental operation reference card, the inspection operation reference card, and the posting sheet.

The follow card, Fig. 3, is made out by a clerk known as the production clerk. Upon completion of the lot the two parts of the card are separated, the lower being sent with the work to the inspection department to be returned with proper entries made after the work has been inspected. The upper part stays with the premium clerk for purposes of record and for comparison with the inspector's part upon its return. It should be noted that the inspector must determine his own count, as the inspector's copy contains no information as to the number of pieces. A blind count is required on all work so that the inspector's count can be verified by the premium checker, as it is found that in a plant where there is a large quantity of small pieces being made daily it is of the utmost importance to know, and have positive check on, the amount of work being completed by operators daily. The inspection department is held responsible for the final count for the reason that all work completed in a given department must be handled by the inspection department before being transferred to the next department or operation.

Each operator is provided daily with a time ticket on which certain entries are made by the premium checker. See Fig. 4. At the close of the day, the ticket is turned in to the standards department, from which it is sent on to the payroll department. The operator is paid at the close of the pay period for the number of hours shown on his time tickets for that period at his base rate, and premium for the Bs produced above his standard requirement. The time ticket serves the additional purpose of furnishing information for the Hollerith cards.

The inspection department has three classifications for inspected work, passed, scrap and re-operation. It fills out the two forms "Re-operation Ticket" and "Scrap Material" shown in Figs. 5 and 6. The re-operation ticket is sent to the premium checker who deducts the B values of the rejected work from the operator's productive Bs. If re-operation is due to no fault of the operator, the operator does not lose. Reworking must be done, of course, and responsibility for the error must be fixed on the proper person or department. Credit is given to the operator for the reworked pieces after they have passed inspection. Four copies of the re-operation ticket are made, one a tag to remain with the work, the three others on three colors of paper for the operating department, the originating department and the inspection department.

Four copies of the scrap material form are made, one for the salvage department, on a card, to be attached to the work, the three others on three colors of paper, for the originating department (it goes to the operator), the standards department and the production department. The B values on scrap tickets are subtracted from the operator's productive Bs. At specified intervals reports are made by the inspection department of the amounts of scrap chargeable against individual operators. They are sent to the department heads.

Two other forms were mentioned, the departmental operation reference card and the inspection operation reference card. They are shown in Figs. 7 and 8. As the names imply, they are production and inspection record cards that are used for reference. For example, each department in the shop holds a set of reference cards that contain the records of its operations. A duplicate set is held by the standards department which also holds a master set showing all operations in all departments. This set is available for cost determination. A master set also is located in the planning department.

Still another form has been referred to, the plant posting sheet. The cut, Fig. 9, shows ten units of the thirty that the sheet contains. By referring to this sheet, which is posted in a conspicuous place, toward the close of the day, the operator may see just what he is accomplishing, and also the other fellow's record. Operators below 60 B (standard) are posted in red.

(To be concluded next week.)

"Scrapping" Employees

By Robert Grimshaw

There are two reasons for "scrapping" equipment, uselessness and unfitness. Just as a machine may be worn out, obsolete, or unfitted for the purposes of the establishment, so the workers may be useless for three reasons. In the first place, they may be no longer physically or mentally capable of doing efficiently the work they had been doing satisfactorily. In the second place, they may constitute elements of discord; or in the third place, they may merely be square pegs in round holes. In any of these cases, scrapping is usually advisable, but never, never on the same basis that applies to equipment. It is necessary to treat the human element from a different viewpoint; it should never be considered as an abstract quantity.

With the second class, which is composed of those who sow discord or discontent among their fellows, or quarrel with the workers and the management, there is usually but one course to pursue; present them, at the psychological moment, with the well-known "key of the street." They would be dear at any price. Of course, if they can be reasoned with and converted from destructive to constructive elements, it is better to retain them. But no amount of threats will abate the evil.

As regards the first and third causes for scrapping, "justice" (that is, to the whole establishment) "must be tempered with mercy" (to the employees). The first step should be to see if the incompetence is not the fault of the management for imperfect instruction and supervision. If so, the fault should be remedied by the one responsible for it. The man should be taught and guided, patiently and competently. When one has a horse that has become balky by bad driving, the animal must not be discarded, but must be cured of his trick by a competent and patient person. Why not apply the same principle to human beings?

The third cause is often due to improper selection and assignment. The remedy is simple and very often highly effective. Shifting should be tried at least once, and sometimes twice, but never three times. The reason for the shift must be clearly shown to be in the worker's own interest. If he cannot be made to see this reason plainly, the one who has tried to explain it to him may be at fault, and someone else may be more logical or more convincing. Sometimes a shopmate who is not personally interested can help out, and at times "friend wife" can be of use.

Manufacturing Calculating Machine Side-Frames

Methods and Tools Used by the Monroe Calculating Machine Company—Locating Points for Various Operations—Gages and How They Are Used

BY FRED H. COLVIN
Editor, American Machinist

THE manufacture of the side frames for the machines made by the Monroe Calculating Machine Co. in its new plant at Orange, N. J., involves a number of interesting features. The frames are made in rights and lefts for the opposite sides of the machine, the left-side frame being shown in Fig. 1 in four different stages. The first operation, after the castings

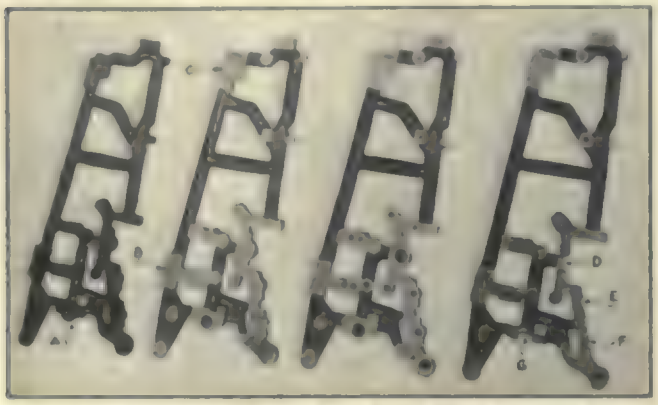


FIG. 1—FOUR STAGES OF THE SIDE FRAME

are snagged and trimmed, is to japan them, which makes them very much better to handle in every way than the plain cast iron. Next comes the rough- and finish-grinding. The first is done on a disk grinding machine, after which they are finish-ground on a Pratt & Whitney vertical spindle machine equipped with a magnetic chuck. This finish grinding secures a uniform thickness and also provides a flat surface on each side, which condition is important in assembling the machine. The tolerance is 0.003 in. The working inspection is with micrometer, but a snap gage is used for final inspection.

FIG. 2—DIAGRAM OF MACHINING OPERATIONS

The drilling operations begin with the large hole at *A*. This is very clearly marked by a conical depression in the casting as can be seen in Fig. 1. Fig. 2 shows the work in outline, the leading operations being indicated by heavy black dots for drilling and by lines for milling. The black triangles show locating points. Figs. 1 and 2 can be studied together to advantage.

Using the hole *A* as the first locating point, the frame is supported on a light milling fixture, and the two pads *B* and *C* milled to form the supports for the frames and the entire machine. Future operations use the pad *C* and the hole *A* as the locating points.

The milling of the feet is with reference to the first hole drilled. The distance from the foot to the hole is tested by the block and plug shown in Fig. 3. A plug in the hole *A* and the block *B* give the correct distance for either setting the milling cutter or testing the frame after milling.

Next comes the drilling of twenty-one holes as shown

FIG. 3—TEST BLOCK FOR MILLING FEET

by both Figs. 1 and 2, the drilling jig being shown in Fig. 4. Here it will be noted the side frames rest on the lower surface of the jig, and a locating pin enters the hole *A*, while the surface *C* (Figs. 1 and 2), rests against a hardened steel block at *B*.

The knurled knob *D*, Fig. 4, controls a cam which holds the frame firmly against *B* during the drilling operation. It will also be noted that the upper plate of the jig which carries the hardened drill bushings is provided with four hardened buttons, *E*, *F*, *G* and *H*, which bear on the ground surface of the side frames. There are also four more hardened buttons in pairs at *I* and *J* which bear on corresponding buttons at *K* and *L*. These buttons aid in holding the drill bushings in the proper plane so as to insure all the holes being drilled square with the frame.

The drill jig cover or bushing plate is locked in position by the turn buttons shown at each end and is also provided with projecting handles so as to be easily raised into the position shown. The jig is used on a six-spindle drilling machine, being moved from spindle to spindle, so that all the various size holes may be drilled at one setting of the frame in the jig.

The location of all the holes is tested after drilling, by a gage made of another frame with pins in each hole. These pins are made with shoulders so as to drive into the frame used as a gage and have the outer ends rounded to aid in entering them into the holes.

The next operation is that of milling for four bearing caps and is a somewhat unusual method in work of this

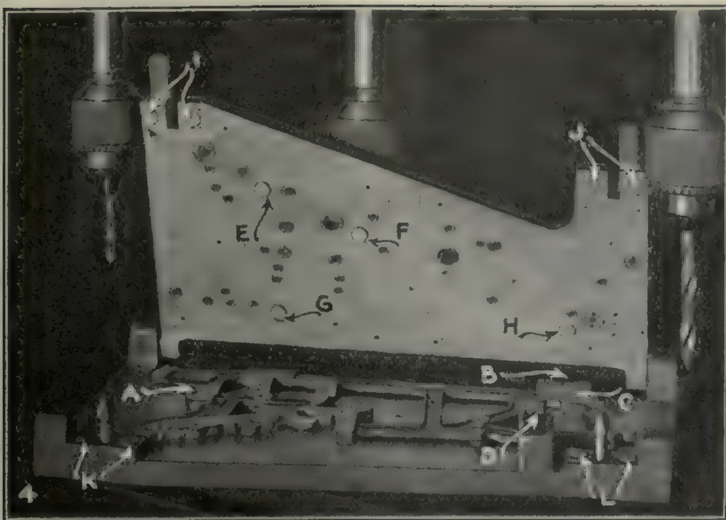


FIG. 4—DRILLING THE SIDE HOLES.

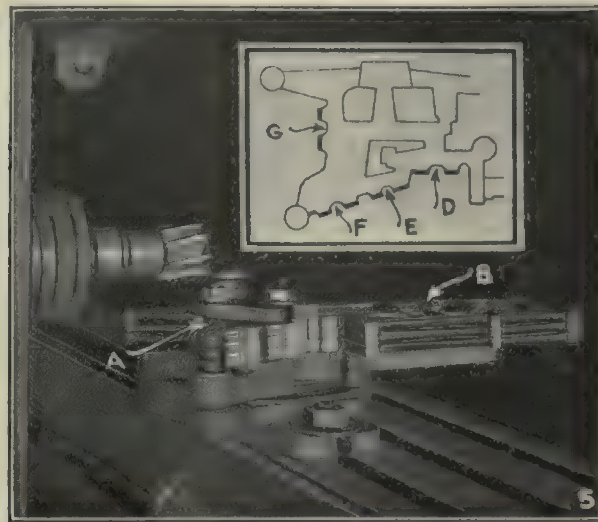


FIG. 5—MILLING FOR BEARING CAPS

kind. The side frames are mounted in groups of three on a knee type milling machine as shown in Fig. 5. The frames are located by pins in reamed holes at *A* and *B*. The milling operation removes the metal surrounding the upper part of the holes for shafts at *D*, *E*, *F* and *G*, shown by the outline above the milling fixture and also in Fig. 2. In Fig. 5 the other surfaces have been milled and the fixture swings around to the second index point for milling the last bearing *G*. The heavy lines show the milled surfaces.

More Drilling and Tapping

In the drilling operations which follow, holes are drilled and tapped for the screws which hold the bearing caps. The caps hold die cast bearings in place, making an unusual construction for machines of this type, but adding materially to their life on account of the cost of replacing bearings. It also aids in assembling the machine.

Some of the drilling and tapping operations which follow are shown in Fig. 6.

This view shows the type of fixture used for most of the holes in the edge of the frame. In the fixture at the left the frame is located in position by the pins *A* and *B*, which insure the holes for the two bearing caps being held level for tapping. The center fixture is used for drilling the bottom feet of the frame. It will be noted that this fixture has feet on three sides, so that it can be used in various positions. Drilling bushings are provided at *C*, *D*, *E* and *F*. It will also be seen that, in order to insure firm and accurate setting in the different positions, hardened steel spots are provided on all the feet.

Another drilling fixture is shown at the right, being for the holes in the angular bearing caps. The frame is located on the upper pin *G* and swung up into contact with the underside of the ledge carrying the hardened steel drill-bushings. The frame is held by the hook bolt *H* operated from the back side of the fixture. This is in contrast to the long strap used in the center

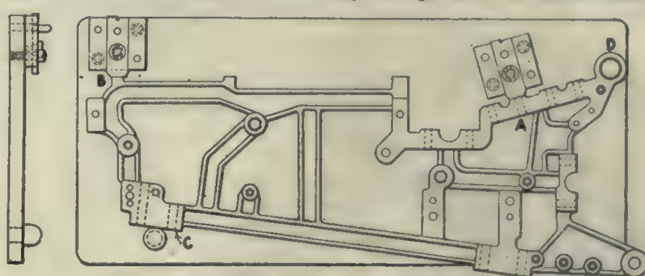


FIG. 7—GAGING THE MILLED SURFACES

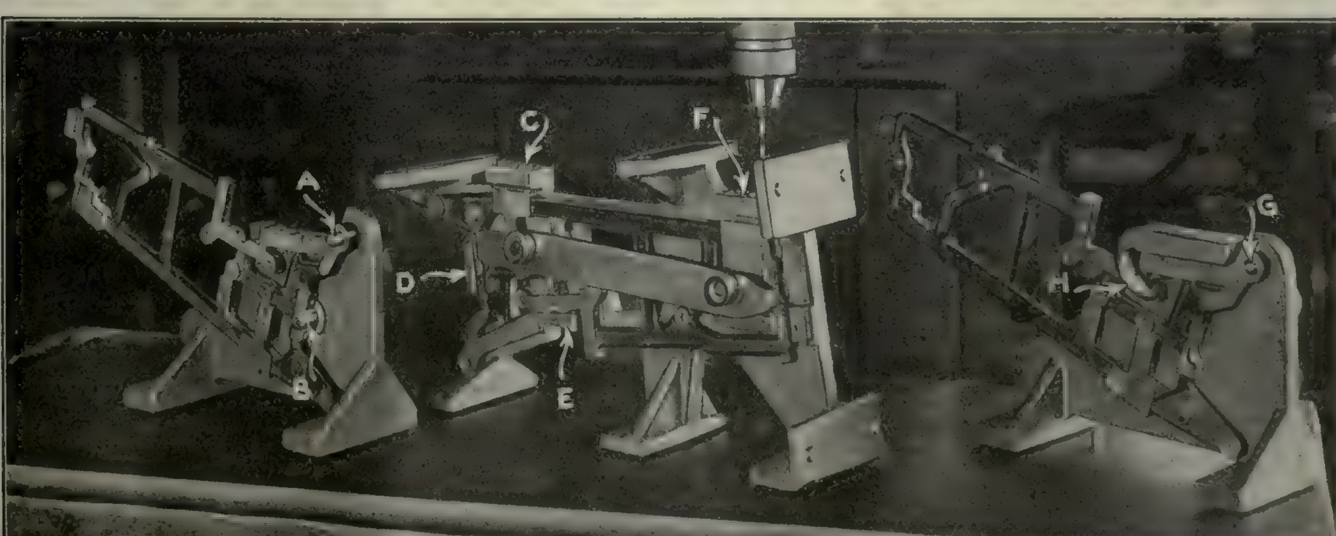


FIG. 6—DRILLING THE EDGE HOLES

fixture for clamping the frame at both ends near the drilling points.

Inspection is a continuous process in the Monroe plant, but this does not mean that it is overdone. The first piece of a new set-up is inspected and passed before proceeding with the job. Floor inspectors are constantly on the lookout for errors to prevent spoilage, which has been reduced to a low point. So far as practicable the fixtures are made to check the preceding operation. But a final checking takes place before going to assembly.

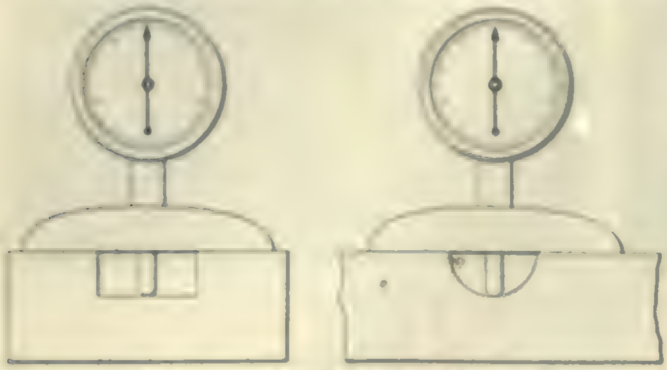


FIG. 8—GAGE FOR BEARING DEPTH

The relations between the angular bearing surface *A*, the upper surface *B* and the foot *C* are tested as in Fig. 7. The foot rests against the pin, while the upper hole fits over the stud *D*. The two flush-pin gages at *A* and *B* test the accuracy of the points mentioned.

The depth of the half-holes for the shafts is also tested in an interesting manner, so as to be sure that the milling is at the proper depth to leave a half circle. An Ames gage with a special foot is used for the testing, as shown in Fig. 8. The test block provides a proper setting for the indicator, so that by simply applying it to the surface of the bearing as shown, the depth is shown on the indicator dial.

The Advantages of Records

By A. W. Brown

Dun & Co. or Bradstreets will tell any one who does not know it, that a large proportion of the business failures, especially of those in manufacturing concerns, is due to the lack of records, or to the reliance on those who do not measure up to the proper standards of what a record should be. Records are more than mere guides. They are insurance. The shop where the foreman carries the piece-work rates in his head is at a disadvantage if he dies or quits—or forgets; or if the workers dispute his statements as to what was agreed upon. Records also enable the after-calculation and the fore-calculation of costs, and make proper tenders for the work. They foil the insurance adjuster's efforts to adjust fire losses downwards, and show the management (and the owners too, if the management is independent of the ownership) whether the business is going up hill or down, at what rate and why. One thing, however, is certain: When records have been made, they should be often consulted.

Anyone who knows horses well can lay down the requisites of the perfect horse, as can also one who judges dogs, or guns, or cloth. There are so many desirable qualities, and so many points to be accorded for the possession of each of these necessary features.

But a very few who use records give themselves the trouble to formulate the essential record characteristics. For that reason, there are fewer really good and profitable records than there should be. A record to be real and stand the test of time and use should be accurate, up to date, comprehensive, unprejudiced, accessible to those entitled to use it, untamperable, legible and comparable with records in similar lines.

These have many advantages in regard to the ease and accuracy of registry and calculation. Unfortunately, owing to the British tendency to do so many things by dozens and their multiples, we are saddled with a 60-min. hour. It is too much to hope for a change to an hour of 100 min. We can, however, divide this unit into ten periods of 6 min. each and we will find this division more convenient and certain than a division of quarters. Just to prove this assertion, suppose we try for one day, dividing our dollar into sixty equal parts, and see how disgusted we get. Yet that is just as rational as using a 60-min. hour.

Every worker who stands around waiting for work, tools, power, instructions or repairs, is a loss to the establishment, and sometimes he is a loser as well. The excuse may be a lack of orders or bad planning; but the main thing is to record all such idle periods and to try to eliminate future occurrences from the same cause. An idle workman is apt to instill idleness in others, but human nature cannot be eliminated.

Some pieces of equipment "made good" from the very date of their installation, while others are a source of trouble and even of loss, either because they are unsuited to the class of work, are too small or too large, or are of a character that demands a different class of operatives from that which is available. Many a printing office is in this predicament because it has too large a press and, in consequence one that is too slow for the average work. This compels the printer to ask an unobtainable price for press work on all jobs that could be done economically and profitably on a smaller machine.

This being so, there should be for each piece of equipment, a card on which are entered all the data that are likely to be useful in determining what classes and sizes of work the equipment is capable of turning out, and what it is not able to do; what parts are constantly giving way or wearing out, and hence need frequent replacement; what class of operatives is the most suitable; the amount of power, gas or water required; and whether or not the piece is likely to be obsolescent or obsolete at an early date.

Sticking to Commercial Sizes

By C. E. Jensen

There are many instances in which a designer has more or less thoroughly handicapped the production department by introducing special dimensions, shapes or materials, that, for all practical purposes, might just as well have been the standards which are found anywhere on the market, or are readily and cheaply manufactured. It may be that a shaft 2⅞ in. in diameter would be exactly strong enough for a given transmission. If this sized shaft, however, would cost more than the usual 2$\frac{15}{16}$-in. shaft, it would be folly to suggest, much less insist upon, the use of the 2⅞ in.-size just because it was technically exact.

Methods of Machine Tool Design

Fifth Part of the Chapter on Gear Drives—Pull-Pin Speed Variators and Their Action—Change Gears—How to Get Odd Ratios

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

PULL-PIN gears are not used to any great extent, but were, at one time, one of the best known means to obtain variable speed. At the present time, a description of a set of pull-pin gears is of not much more than historical value, and will therefore be abbreviated. Fig. 104 shows the standard construction of a set of three pull-pin gears. The gears *A*, *B* and *C* mesh with *D*, *E* and *F* respectively. The latter three gears are keyed to their shaft, whereas the former run loose. For the same reason that it is advisable to have the keyed-on gears of a clutch system as driving member, it is advisable here to drive with gears *D*, *E* and *F*.

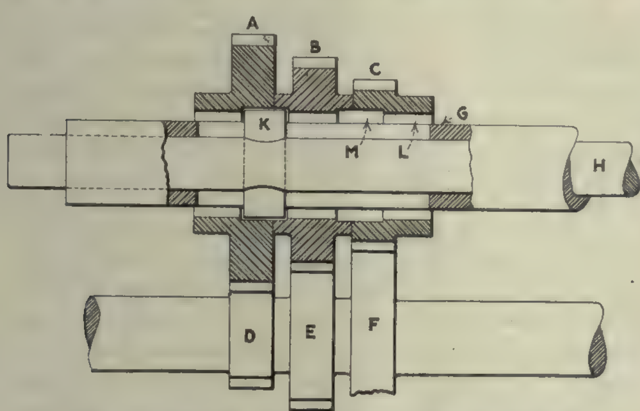


FIG. 104—THREE-SPEED PULL-PIN GEARSHIFT

The gears *A*, *B* and *C* are running loose on a shaft *G*. They are kept from sidewise movement either by collars on that shaft or by adjacent bearings. A hole is bored through the shaft, in which slides rod *H*, which is provided with a cross-key *K*. The gears have keyways *L* and are counterbored at *M* to a size slightly larger than the depth of the keyway and to a combined width slightly more than the width of the key. This counterbore may be all in one gear, or it may be divided between the two adjoining gears. It is merely a place where the key can go without engaging either gear, so that it is possible by the endwise movement of the rod *H* to pull the key out of one gear and have it in a neutral place before it enters another. A slot is made in shaft *G*, in which the key *K* can slide. It will be noticed that the key projects on both sides of the shaft, so that it is double acting.

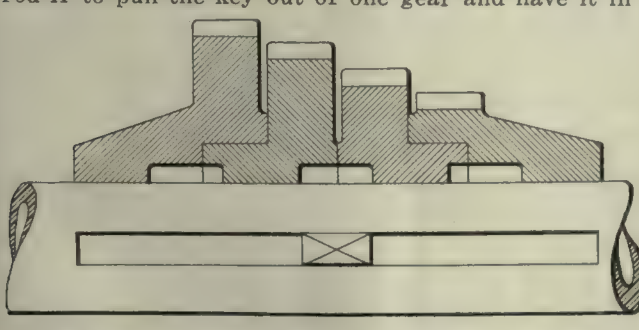


FIG. 105—CONSTRUCTION TO INCREASE LENGTH OF GEAR BEARING

The disadvantages of such a system are evident. There are gears running loose on a shaft, requiring positive means for lubrication, and yet the keyways in the gears and the slots in the shafts make such lubrication almost impossible, so that such gears are confined to light loads and low speeds.

In order to have a sufficient length of engagement between keyway and key the gears must be of considerable length on the shaft. As a matter of fact, the total length of the three gears shown on the shaft must be more than five times the width of key *K*. Even at that, the amount of bearing on the shaft is small.

In order to increase the possible amount of bearing on the shaft without having the gears themselves too far apart, a construction such as shown in Fig. 105 may be made, in which four gears are shown side by side, but of which the hubs are so constructed that a considerable length on the shaft is possible.

In ordinary construction the rod *H* projected through one end of the shaft and was there provided either with a knob to be operated by the fingers of the operator, or else with a special collar which might be operated by a lever. This construction is shown in Fig. 106, in which rod *H*, shaft *G* and spool *C* are shown. The end view shows how such a spool may be operated by a lever.

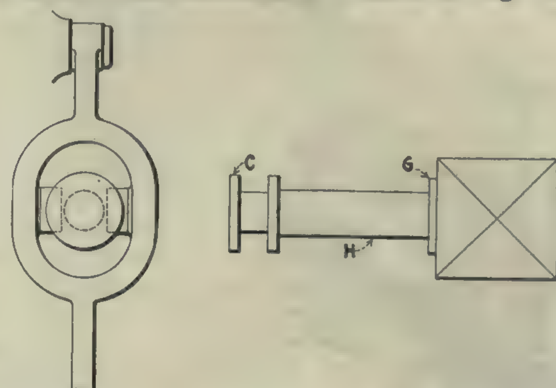


FIG. 106—COLLARS AND YOKE AT END OF PULL-PIN

The projecting part of the pull rod may become excessively long when there are many gears in the system or when they have long hubs. Such a long projecting part of the pull rod is unsightly and is apt to be bent accidentally whether it is operated by hand or by lever. To avoid this, the construction shown takes the form shown in Fig. 107 where another slot in the shaft permits a cross pin to connect the pull rod with the spool before leaving the shaft. Of course, this construction is not always possible. It requires additional available length of shaft. It hardly needs to be pointed out that the shaft is still further weakened by this construction.

The pull-pin arrangement is modified in different ways. In one construction each gear is provided with two hinged keys, opposite each other (just as the construction described in the previous paragraph had two opposite keyways). There is a spring pressing on the back of each key, tending to force it into the groove

or slot of the shaft. The pull rod itself prevents this. This rod is provided with a key completely filling the slot in the shaft except for a few notches or impressions in this key. If one of these notches came opposite the projecting part of one of the keys, that key would drop and cause the shaft to engage the gear. The notches were so placed that only one at a time could correspond to the projection of a key while another would become active as soon as the previous one had passed. In that manner the amount of travel of the rod was limited to a little more than the combined lengths of the projections of the key, regardless of the lengths of the hubs of the gears.

Finally, to show how hard machine tool designers were striving for means to obtain variable speed by

FIG. 107—PULL-PIN ARRANGEMENT TO AVOID BENDING

gearing and how, in their eagerness, they forgot everything except the one object they had in view, a short description will be given here of a variable speed gear device brought out by a reputable machine tool builder some twenty years ago. The device consisted of two cones of gears. One cone was keyed to a shaft, while the other consisted of gears which would revolve on the shaft and which could be coupled to it by a pull-pin device. To avoid the running of idle gears, all loose gears not actively engaged were thrown out of mesh. For this purpose the shaft containing the loose gears was placed below the other, and the gears were bored out to such a size that they would be out of mesh when resting on the shaft. The pull-pin arrangement would first lift a gear into position, and then key it to the shaft. In order that the loose gear should not actually rest on the shaft, supports were provided so that all gears but one were out of mesh and resting on a stationary support while the one gear was in action.

Of the three gear arrangements described so far, the cone and tumbler arrangement possesses one advantage over the other two which may be the deciding feature in the selection of a speed device. Before rapid speed changing devices were employed, simple change gears were used for the purpose. They were used either on fixed or on movable centers. The segment in the feed mechanism of a lathe or the spiral gear driving attachment for the dividing head of a milling machine are instances of the use of change gears with movable centers.

Change gears with fixed centers are found on many special machines or on machines where speeds have to be changed at infrequent intervals only. They are not often found in feed mechanisms. The reason is that many feed mechanisms require a fixed relation to the spindle feed. In the mechanisms mentioned (lathe and dividing head) a certain lead must be produced so that it becomes imperative to select change gears with a given ratio. This is not always possible; in fact it is but seldom possible with fixed centers. If, for instance, there are two change gears meshing with each other, each of 40 teeth, the sum of the numbers of teeth of any two gears placed on these centers must be 80, and if the smaller gear cannot be made with less than 20 teeth, on account of size of shaft or other existing conditions, the following combinations would be possible: 20—60; 21—59; 22—58; 23—57; etc. As will be seen, most of the ratios are odd fractions, fractions which are not likely to occur in our calculations. The ratios which we would be able to obtain and which could be expressed by small numbers are: 20—60 (1 to 3); 24—56 (3 to 7); 25—55 (5 to 11); 30—50 (3 to 5); 32—48 (2 to 3); 35—45 (7 to 9); 40—40 (1 to 1); and the inverted values of these fractions. Such an arrangement would not be satisfactory for screw cutting or any other device which would have to produce a variety of leads.

The arrangement with movable centers, on the other hand, allows of many leads. Fig. 108 shows in diagrammatic form the well-known segment construction. The idler makes it possible to obtain any desired ratio between *A* and *B*.

FLEXIBILITY OF CONE AND TUMBLER

A similar difference exists between the cone and tumbler on the one hand and the construction with sliding gears or pull-pin on the other hand. In these latter constructions, the center distance is fixed so that, generally speaking, a change in the ratio would demand a change in the center distance. With the cone and tumbler there is a possibility of obtaining many ratios without changing anything but some of the gears. For this reason, the cone and tumbler arrangement lends itself particularly well for screw cutting devices.

The segment device of Fig. 108 permits of more changes than the cone and tumbler, because both *A* and *B* can be changed, while in the cone and tumbler device all change gears must be placed on one shaft. Furthermore, so far as the possible gear ratios are concerned, it makes no difference whether we swing the idler around *A* or *B* as center. With the cone and tumbler device, it does make a difference whether the cone shaft is the driven shaft or the driver. If we should want the feed screw of a lathe to make 2, 3 or 4 revolutions for each revolution of the spindle, we would have to put gears of $2n$, $3n$ or $4n$ teeth on the cone shaft and make it the driver. If, on the other hand, we should want the screw to make $\frac{1}{2}$, $\frac{1}{3}$ or $\frac{1}{4}$ revolution per revolution of the spindle, we would again place gears with $2n$, $3n$ or $4n$ teeth on the cone shaft, but make it the driven shaft. In general, a change in the number of teeth of the driving gears affects the numerator of the fraction indicating the relation between screw and spindle; while a change in the number of teeth of the driven gear affects the denominator.

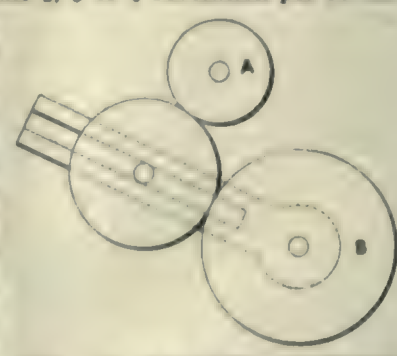


FIG. 108—SEGMENT CONSTRUCTION FOR MOUNTING CHANGE GEARS

When we said that change gears on fixed centers do not permit of a free selection of gear ratios, we took silently for granted that standard spur gears were to be used. However, when we are confronted with the necessity of retaining an existing center distance, we may increase the list of possible combinations very materially by making use of the well-known fact that

involute gears may be placed closer together or further apart than their theoretical center distance without affecting their proper running. Furthermore, it is possible to cut spur gears with involute teeth on the Fellows gear shaper or by similar generating processes which will run properly, though the fixed diameter is not equal to the number of teeth divided by the pitch. The following illustration will show how these peculiarities can be applied in practice:

Center distance.......5 inches
Pitch of gears........8 inches

From this we find that the sum of the number of teeth of the two gears is: $2 \times 5 \times 8 = 80$. In order to find two gears of which the ratio is a to b, we would divide 80 by $(a + b)$, and multiply the quotient by a for gear A, and by b for gear B.

If we take for granted that the ratio of a and b has been reduced to its simplest form, then 80 must be divisible by $(a + b)$ if a set of gears shall be possible with the desired ratio. As 80 can be divided by 2, 4, 5, 8, 10, 20 and 40, any ratio of which the sum of the terms is one of these divisors might be had. However, the smaller of the two gears cannot be made below a certain size, let us say 20 teeth, so that 60 and 20, or 3 to 1, is the largest ratio we can obtain.

Taking the divisor 2, we find that 1 to 1 is possible.
Taking the divisor 4, we find that 1 to 3 is possible.
Taking the divisor 5, we find that 2 to 3 is possible.
Taking the divisor 8, we find that 3 to 5 is possible.
Taking the divisor 10, we find that 3 to 7 is possible.
Taking the divisor 20, we find that 7 to 13, and 9 to 11 are possible. Besides, we can make any ratio of which the sum of the terms is 80, such as 37 and 43, or 23 and 57, etc. If, however, we should meet a ratio of which the sum of the terms is 7 (such as 3 to 4), we would not be able to find two gears of that ratio and of which the sum of the numbers of teeth is 80. We could find gears with a combined number of teeth of 77 or 84. If we take 77 as the sum, the two gears will be 33 and 44. By taking two blanks of the proper diameter for 34 and 46 teeth (note that $34 + 46 = 80$), and cutting them with 33 and 44 teeth, we meet the requirements. If we had selected 84 as the sum, we would have to make the gears with 36 and 48 teeth, cut on blanks of the proper diameter for 34 and 46 teeth. This little artifice can often be profitably applied.

Even if it is not possible to reach a solution in this manner, there is another way of overcoming the difficulty. A helical gear of n teeth, and with a spiral angle α, has the same diameter as a spur gear of n sec. α teeth. If, then, we wish to find two gears with a ratio of 3 to 4, all we have to do is to give them m and n teeth and a spiral angle α so that $n:m::3:4$, and so that

$$(n + m) \text{ sec. } \alpha = 80$$

As sec. α is always more than 1, we must make $n + m < 80$. We could have selected 77 but not 84. We would find sec. $\alpha = 80/77$. We might have selected a smaller number than 77, and we would have found a correspondingly larger value for α. However, it is well to keep the value of α as small as possible; in other words, to keep $n + m$ as near to 80 as possible to avoid the objectionable effects of end thrust due to the spiral angle.

What was said about change gears applies equally well to sliding gears and pull-pin gears. These latter could be arranged as helical gears, but the sliding gears do not lend themselves to this treatment.

Industrial Relations and the Construction Industry

By Ernest T. Trigg

The whole question of "industrial relations," as we have come to call it, is one of the most important and fundamental problems confronting the entire world today. I do believe that there are unmistakable signs indicating a better understanding of the situation and a clearer realization of the responsibilities on both sides than has heretofore existed. Really, the problem is one which I have always preferred to think of in terms of "human relations" rather than "industrial relations," because it is essentially a matter of relationship between man and man—a distinctly human proposition. The great economic loss which we are called upon to stand every year because of disputes between employers and employees, is a bill which the public, as an innocent bystander, has to pay.

It does seem so utterly foolish and unnecessary and could so easily be avoided by proper understanding between the employer and the employee, of the problems, the viewpoints and the necessities of each by the other. The employer is, undoubtedly, the one who should assume the leadership of, and keep the human touch with, his own group of workmen. Unfortunately all employers do not do so and so long as they vacate this position, just so long will there be room for interference in their mutual affairs by third parties who so often are the root of the trouble. Employers are not entirely blameless in the situation. Education of the employers as to their responsibilities and duties is, in my opinion, quite as essential as the education of the employees.

It is the employer's responsibility, for one thing, to see to it that in times of depression, when there are fewer jobs than there are men, the wage of the workingman is not cut down below the living point; on the other hand, the employee should realize that there is a point over which the wage rate cannot successfully go if our industries are to continue to thrive and the wheels in our factories to go round.

From a paper presented at a recent meeting of the National Paint, Oil and Varnish Association, by its president.

Safety Work at the Ford Plant

The Ford Motor Co. recently had an intensive safety week campaign which produced astonishing results. The week's output of 30,972 cars by 46,627 workers was without a single major accident, and minor accidents were reduced one half. Four accidents involved the loss of 1 day each, three of 2 days each, two of 4 days each, one of 5 days, two of 6 days, four of 7 days and one each of 10 and 14 days. This makes a total of eighteen cases and 87 days lost time out of a total of 276,000 days worked.

Every department holds instruction meetings on the hazards of work, shows what has caused and can cause accidents and gives suggestions as to how to avoid injury. These instruction meetings are, in the future, to be held on the first work day of each month. Several departments such as the "drop forge" and "body pressed steel" went through the week without a single lost time accident. The factory paint department, which has a lot of hazardous work such as painting smoke stacks and other scaffold work has a record of forty-six consecutive months without a lost-time accident.

Machining Pierce-Arrow Transmission Cases

BY FRED H. COLVIN
Editor, American Machinist

THE transmission case of the Pierce-Arrow car is of aluminum, as is usual; and in order to positively remove all sand and loose metal the inside of the case is thoroughly scraped and filed before going to the preliminary machining operation, which is milling the face of the joint surface.

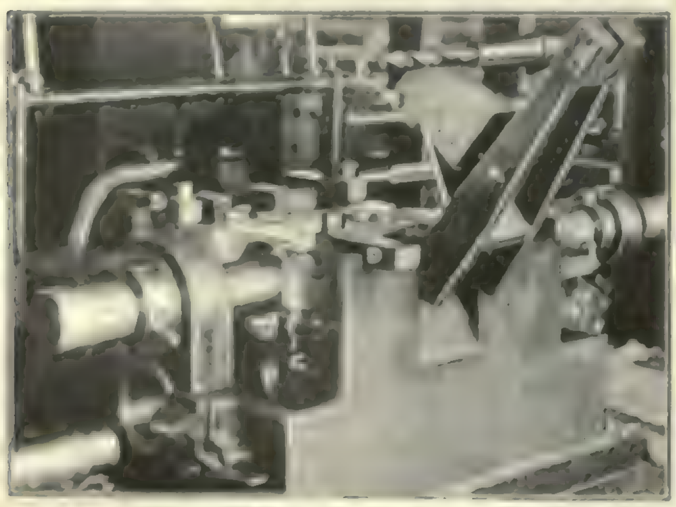
The facing of the lower half of the case is shown in Fig. 1, being done on a Brown & Sharpe vertical milling machine. Provision is made for clamping the case without springing it, the different jaws being so designed as to have a good bearing surface and to avoid distortion. Jaw *A* and its mate on the opposite side are operated by handle *B*. An inspection of 10 per cent of the work follows this operation, after which the other surfaces are milled. Particular attention is paid to keeping everything square and parallel, the tolerance for the latter being 0.005 in.

Then come two profiling operations, after which the surface for the handhole cover is milled as shown in Fig. 2. This view shows how the case is supported by the substantial end lugs at *A* and *B*, the other end being held in a similar manner. This construction makes clamping particularly easy, as the straps *C* and *D* can be handled very quickly and the case lifted either in or out.

Several drilling and tapping operations follow, after which the two halves are mated and numbered and the drain hole laid out in the bottom half. The inspection department watches the numbering very carefully to be sure that no errors creep in at this point. All bolt and dowel holes are then transferred to the bottom half of the case through the top half and the drain hole is drilled, faced and tapped. The parts are then mounted together, the level working-base scraped to a bearing and the holes bored both for the bearings and the shifting rod housing. The hole for the idler gear is next bored and faced, allowing 0.01 in. on the outside face of the boss. A 10 per cent inspection takes place at this point.

The boring of the holes is shown in Fig. 3, which gives a good idea of the construction of the fixture and shows the swinging arm *A*, carrying the guide bushing *B* for the idler-hole boring bar. This view shows how the work is located on the hardened steel buttons, as at *C*, and held in place by the sliding clamps, as at *D*.

The transmission case is then mounted on a mandrel as shown in Fig. 4, both ends are faced and the outside diameter of the large boss extension is turned. This leaves only some counter-boring and the chipping of such clearance for shifting leaves as may be necessary, after which the case is studded and put together ready for inspection before going to assembly. The numbers of any cases scrapped are reported to the inspection room for record.



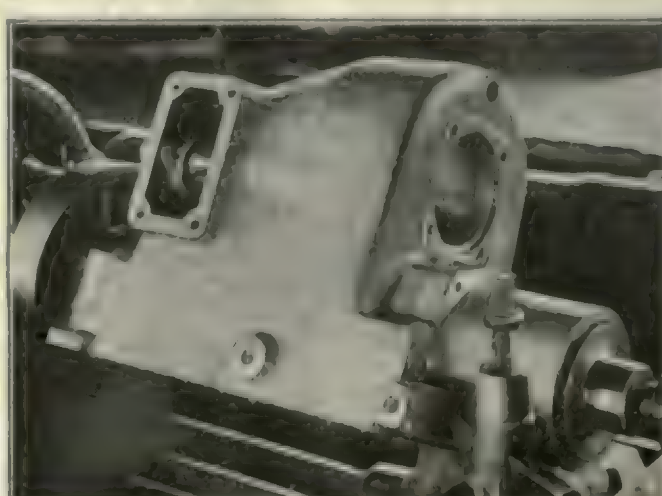
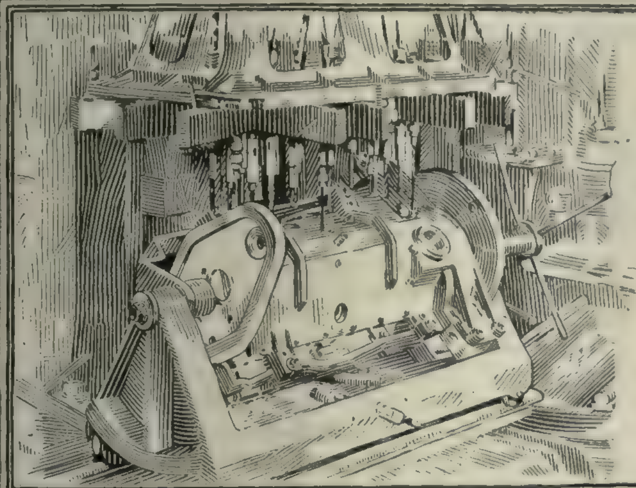


FIG. 1—MILLING THE CASE JOINT. FIG. 2—MILLING FOR HAND HOLE COVER PLATE. FIG. 3—BORING FOR THE SHAFT BEARING. FIG. 4—TURNING THE ENDS AND FACING



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Drop-Forging Dies—General Practice and Important Points—Draft and Machining Allowances—Proportions of Parts of Die-Blocks

HERETOFORE we have discussed fixtures and tools used in the various processes of cutting metals. The tool engineer who is progressive and wishes to become thoroughly familiar with the entire subject, must also understand both principles and details which apply to the bending and shaping of different metals either hot or cold. In discussing matters which pertain to the subject we shall consider first the tools used for forging various shapes.

It is interesting to recall briefly the growth of drop forging and the adoption of forgings in place of castings for many purposes. Some years ago the practice of drop forging was limited to small work of a comparatively simple nature; but during the development stages of the bicycle more elaborate designs were made, although even at this time the parts were of comparatively small size. With the development of the automobile it was found that castings were unsuited to use for many of the parts; hence a distinct advance was recorded in the process of drop forging, which was developed to cover a much wider field and more complicated work. The use of alloy steels of different kinds and special steel for die-blocks has been an additional improvement in the process.

Drop forgings can be produced more cheaply than castings in many cases, and they have replaced the latter for many purposes. Greater difficulty is found in the forging of alloy steels and those containing a high percentage of carbon, and more care must be used when designing dies to avoid sharp points and projections or deep impressions, as it is sometimes difficult to fill the dies when forging alloy steels. It is not our purpose to go into details in regard to the process of drop forging, but a certain amount of information is necessary to enable the tool designer to understand the principles which effect the design of dies.

The simplest form of drop hammer used for forging is the "board-drop" type having a hammer of not more than 2,000 lb. striking weight. For small forgings such as wrenches, turnbuckles, rod-ends and eyebolts, this type of hammer is thoroughly efficient. When heavy forgings are to be handled, however, steam hammers are required. In making a selection of the hammer for use in producing a given drop forging, the size of the work is not always a determining factor, although it has some effect on the selection. It is usually better to select a hammer too large than one which is too small for a certain class of work. The general inclination is toward the use of steam drop hammers, particularly in the automobile industry.

It is customary to work up the forging from short lengths of bar stock rather than to cut the stock into blanks approximating the size of the work to be done. The length which is found to be most convenient for handling ranges from 3 to 5 ft. The bars are first set in the furnace, and after properly heating at one end they are removed to the dies and the forgings produced by the action of the hammer. This procedure continues until the bar is too short to be handled with the tongs. On small forgings it is often possible to produce two parts with one heating of the bar, but on larger work the stock must be heated after each operation.

Accurate forgings can be produced only when proper consideration has been given to the shrinkage of the metal. When work is of such a nature that two heavy ends are connected by a thin strap, the shrinkage is likely to be much greater than when sections of the work are more nearly uniform. A certain amount of variation is to be expected in drop forging practice, but careful design of dies will minimize this and keep it within reasonable limits.

A set of dies used for drop forging consists of two steel blocks, each of which contains an impression of one-half of the forging which is to be produced. One of the dies is attached to the ram of the hammer while the other is mounted and secured on the sow block or anvil cap. Suitable matching surfaces are provided for aligning the upper and lower dies, so that the impressions will join each other properly. Dies are made of cast steel occasionally, but this material is not recommended unless the design of the forging is such that the impressions must be cast in it. There is, of course, a great saving in the course of manufacture when cast steel dies are used, but they are not as serviceable as those cut from the solid metal.

The development of the automatic die-sinking ma-

chine has simplified the manufacture of dies to such an extent that cast steel is not used as much as it was a few years ago, except on very large work. This automatic method of machining dies uses a wood or plaster model as a master. The master is provided with the necessary flash and gutter, and a follower goes over the entire surface while a cutter suitably situated reproduces the form in the die. An immense amount of hand work is saved by the use of machines of this type, so that the cost of die work has been very materially reduced.

The use of cast iron for a light class of forging

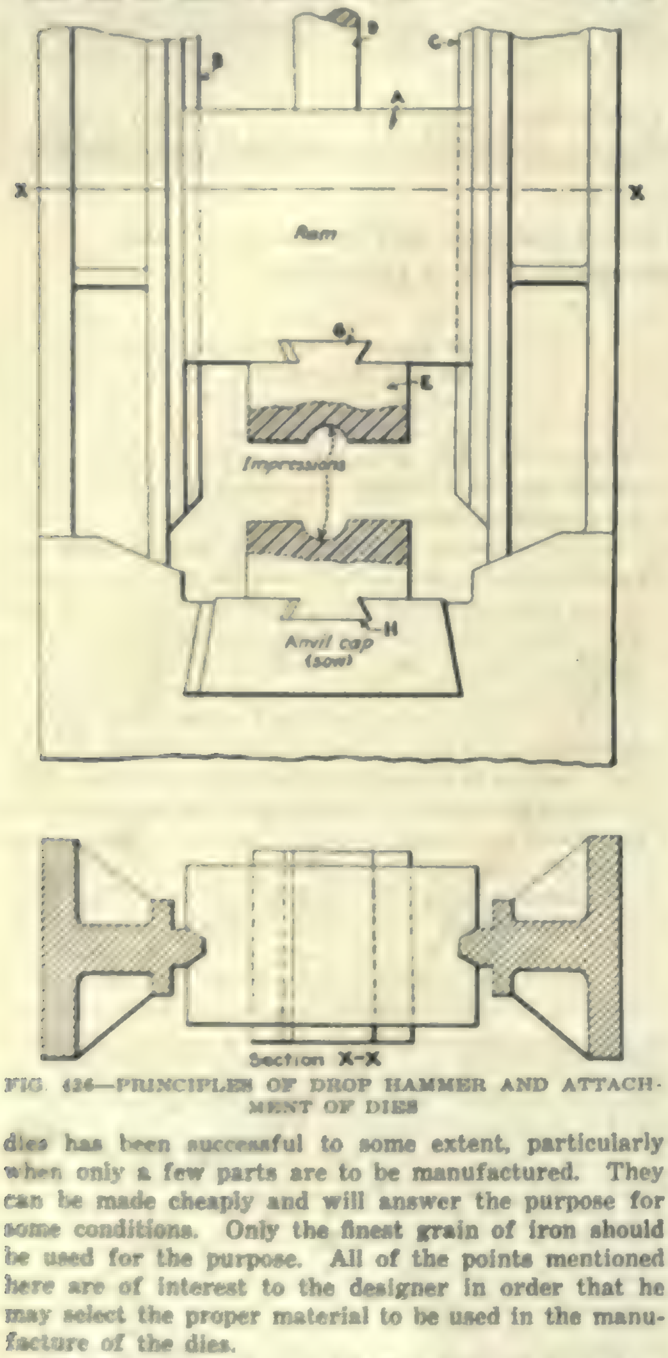


FIG. 426—PRINCIPLES OF DROP HAMMER AND ATTACHMENT OF DIES

dies has been successful to some extent, particularly when only a few parts are to be manufactured. They can be made cheaply and will answer the purpose for some conditions. Only the finest grain of iron should be used for the purpose. All of the points mentioned here are of interest to the designer in order that he may select the proper material to be used in the manufacture of the dies.

After the size and material of a die-block have been determined, the draft allowance, shrinkage and machining allowances must be considered. The ordinary allowance for draft is 7 deg., but in certain cases this is increased to 10 deg. or even to as much as 15 deg. when the depth of the impression is excessive, or if other things in the general design make it necessary. For narrow and deep forgings when the metal must be "shot up" or forced into the upper die, an extra allowance for draft is usually necessary. When there are openings or holes in a forging and when thin sections are being forged, increased draft must be allowed.

When plugs are used for producing holes in matched dies, these plugs are made of such a height that there remains a thin wall in the forging, which web is subsequently punched out. The draft on plugs of this kind is often as great as 15 deg. because, on account of the thin walls, the metal is likely to shrink rapidly during the forging, so that it may contract and "freeze" to the plugs.

Occasionally on small work the draft is as small as 3 deg., and if a shallow impression is required even on large work a small draft allowance like this may be permissible. It is important to provide sufficient draft on all forging work, as otherwise the dies will deteriorate rapidly and break down, so that it will be necessary to recut them. Unless there is sufficient draft, there is a greater likelihood of breakage in forging.

Allowance for Machining

The allowance necessary for machining a given surface must be taken into consideration in the design of the die and sufficient metal left at the points required. The amount of metal allowed for finishing is different in various factories. Many places allow at least $\frac{1}{32}$ in. on small work, while on larger pieces $\frac{1}{16}$ in. is made. On long work which requires accurate machining of length, it may even be necessary to make a finish allowance of $\frac{3}{16}$ to $\frac{1}{4}$ in. Finish allowances should always be made in addition to the allowance for draft.

Some companies have established a method of making forging drawings of full size on each part which is to be manufactured. On this drawing the allowance for draft, machining, etc., is shown, and the outline of the finished part is shown by dotted lines. When forgings are made outside the factory, blueprints of the drawing may be sent to the firm that is to make the forging and any changes which may be found necessary can be suitably marked on the blueprint and returned for approval. This practice is to be commended, yet it is not generally followed, as a considerable knowledge of drop forging is required in order to make the drawings properly. A request may be made of the drop forging company to furnish blueprints or drawings showing the finished allowances, draft, etc., which it proposes to furnish, and any desired changes can be marked on the print at the time of its approval.

There are a number of other points in connection with the design of drop-forging dies and general practice in regard to forging which will be taken up in detail later in this article. The intention has been so far to familiarize the designer somewhat with the general process and give him a few details so that he will obtain a clearer understanding of the general requirements.

Important Points

In considering the matter of dies for a given piece of work, there are a number of points which we will mention in a general way and then take them up in detail later by means of graphic examples. Let us assume that drop-forging dies are to be made for a piece of work; certain information will be found necessary before proceeding with the design.

(1) Number of Parts Required: This affects the dies to a great extent and determines whether they will be of cast iron or steel. A small number of parts might be made in cast-iron dies, while a large number would require the use of steel.

(2) Samples: If a new die is required for an old part there may be a sample available from the old die. This can often be used to obtain an idea of the method previously utilized, providing that the sample is in good condition.

(3) Templets: If there are templets for the dovetail and edges or breaker, or if it is possible to obtain

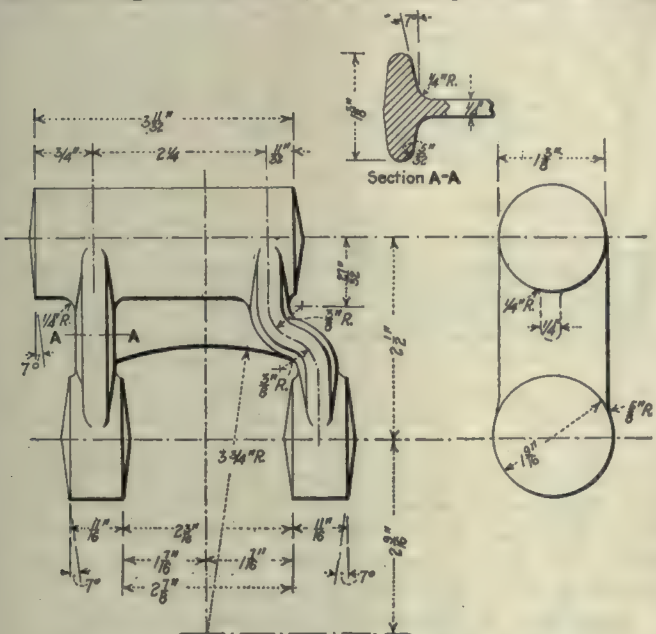


FIG. 427—EXAMPLE OF FORGING DRAWING

those which were originally used for impressions, all of these things will help in the design and manufacture of a new die. Where fullers have been used, a templet may be available for this also. The templet will show the amount of stock which was found sufficient for the needs of the die. If there was a layout of the dies when they were originally made, a reference to this will be a great help; and if accurate drawings can be found, it will obviate the necessity for new ones.

(4) Finished and Forging Drawings: A great deal depends on the nature of the work and whether the part has been previously made or not. In either case, however, a forging drawing is the starting point from which the dies should be developed. It is necessary that a very practical man who understands the process of forging well should be given this work, as otherwise draft allowances and other important matters will not be properly taken care of.

(5) Shanks: The sizes of shanks should be given for the hammer to which the dies are to be fitted. The various dimensions required are: (*a*) width, (*b*) depth, (*c*) angle, (*d*) round corner and (*e*) off set or center.

(6) Type of Lock: A determination should be made as to whether a plain lock will be all that is needed, or whether a counterlock is required. These points will be brought out later in the article.

(7) Draft Angle: The draft angle may be anywhere from 3 to 15 deg., depending on the nature of the work. It is only necessary to make sure that the angle is sufficient so that the work will not stick.

(8) Finish: The allowance for finish is important and should be decided upon and approved before any work has been done on the die.

(9) Other Important Points: Such matters as the match edge, the flash, the gutter, together with its width and depth, and various other points must all be considered in the design.

(10) Tolerance: The amount of tolerance permitted on the forging has a decided effect upon the layout of the work. Certain kinds of steel shrink more than others, and certain forms of forgings require a greater shrinkage allowance than others. These points are determined largely by experience, although it may be generally stated that work having heavy ends and a thin connecting section will require a greater shrinkage allowance than those forgings which are of uniform section. Various other matters connected with die design will be mentioned specifically during the progress of this and the subsequent article.

Attachment of Dies

In Fig. 426 is shown a diagram of a portion of a drop hammer with dies in position in order to illustrate the principles used in forging. A ram *A* slides up and down on the ways *B* and *C*. The shaft *D* is connected with the piston of the hammer when the steam-hammer type is used. For the "board-drop" type a different connection is made, but it is unnecessary to go into detail regarding this matter. The dies are usually spoken of as the upper and lower impressions, as indicated at *E* and *F*. The upper impression fits the dovetail *G* of the ram and moves up and down with it. The lower impression *F* is dovetailed at *H* to fit the anvil cap or sow. The dies are fitted to each member so that they register accurately one with another. The section *X-X* gives an idea of the general appearance of the ram and side columns of the hammer.

We have previously mentioned the importance of having a forging drawing made for each piece which is to be drop forged, and in order to illustrate the manner in which these drawings are made, an example of

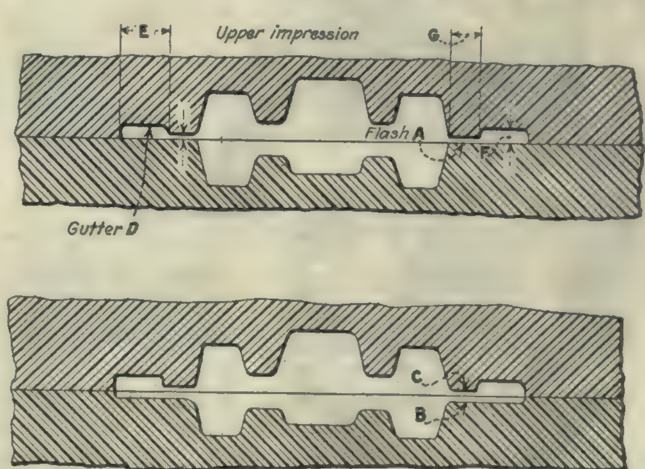


FIG. 428—SECTIONAL VIEW OF UPPER AND LOWER DIES

one is shown in Fig. 427. Attention is called to the care with which all center lines are located so that there is no guess-work about the positions of the various centers used in the construction. A sectional view is given at *A-A* so that the die maker will understand the form at this point. All draft angles are shown, and a suitable allowance has been made for

finishing so that sufficient stock is allowed to permit the work to be machined to the dimensions of the finished drawing. We have considered it unnecessary to show a finished drawing of the part, as we are not concerned with the machining of the work at present.

Important Features of Dies

It is our intention to illustrate the important points in die design by means of graphic examples in order to familiarize the designer with the uses and names of the various parts of a die. Fig. 428 is a sectional view of upper and lower dies, showing the "gutter" and "flash." The purpose of the flash is to allow the metal to flow out slightly beyond the edges of the forging, so that only a thin wall remains which can be trimmed off very easily in a trimming press after the forging has been made. The flash may be entirely in the upper die, as shown at *A*, or it may be half in the upper die and half in the lower, as shown at *B* and *C*. The simplest way of making it is in the upper die entirely, although circumstances alter cases and there may be times when it would be found an advantage to make it in both impressions.

The gutter *D* is an important feature in the design of die, as it is intended to take the overflow from the die in excess of that which lies in the flash. It is necessary always to provide a gutter all around the work, so that there will never be any possibility of the metal being compressed without having an outlet in the event that the stock which is being forged is a little too large. This circumstance would cause a breakage in the hammer or dies or other troubles, unless the gutter was provided. A gutter may be considered in very much the same manner as a safety valve on a boiler, as it relieves excessive pressures in the die. It is important to have a gutter sufficiently large to take care of any extraordinary condition which may develop when forging, so that the width *E* and depth *F* should be great enough to provide for any emergency. Naturally these dimensions are dependent to some extent upon the size of the die and the amount of metal which is being forged.

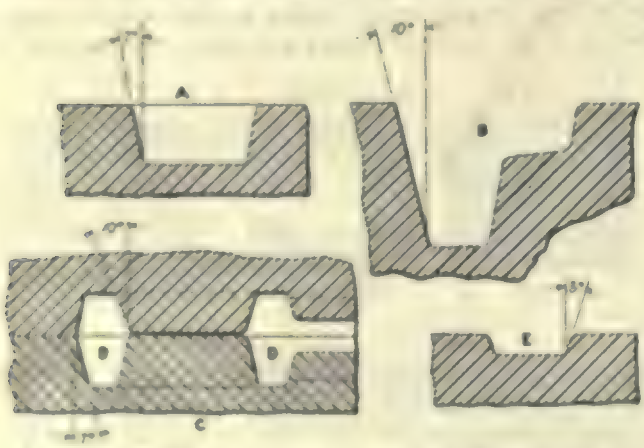


FIG. 429—DRAFT ALLOWANCES FOR FORGINGS

Large dies need more gutter space than small ones, as much more metal is being worked. The flash *A* is generally quite thin, as this makes it easier for the trimming dies. The distance *G* is also dependent upon the size of the die and the work which is being done. Although both the flash and gutter may appear to be rather unimportant points in the design of dies, this is really not the case, for a lack of proper provision for these matters would cause a great deal of trouble. It seems best to call particular attention to them both by means of the diagram shown.

Draft Allowances

The allowance for draft on forgings is dependent almost entirely on the depth of the impression. The purpose of the draft is to prevent the work from sticking in the die after the forging has been made. Another point of importance is the fact that the metal will flow more readily into an angular pocket than it will if the sides are parallel. The variation in draft ranges from 3 to 15 deg., as previously stated, the common draft angle for a large part of forging work being 7 deg., as shown at *A* in Fig. 429. In the case of a deep pocket like that shown at *B*, the angle may be 10 deg., or even as much as 15 deg. in extreme cases.

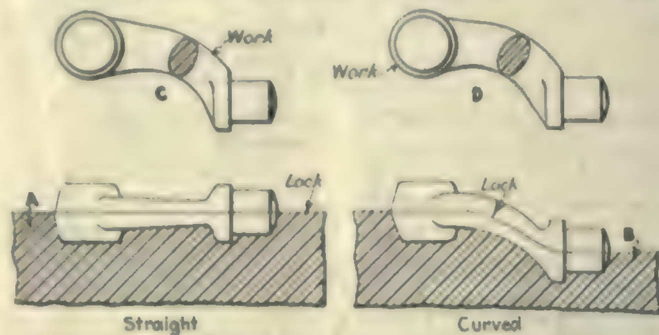


FIG. 430—STRAIGHT AND CURVED LOCKS USED IN FORGING DIES

Sometimes it is necessary to make more than one draft angle on the same piece of work. An example of this is shown at *C*, in which the forging has a circular boss at one end, a section of which is shown at *D*. Here the outside angle of the boss might be made 7 deg., but the upper and lower plugs or inside angle would need to be 10 deg. or more so that they would not tend to stick in the work. For small work and shallow forgings, a 3-deg. angle is sometimes used like that shown at *E*. The fact that the work is shallow makes it possible to use a very acute angle on work of this sort, as there is little danger of sticking and the depth is so small that the metal will flow into the impression readily.

The lock in die work is really the parting line which separates the upper and lower impressions. Locks are made straight or curved, depending on the nature of the work which is to be forged. The method used and the position of the piece which is to be made affect the shape of the lock to a considerable extent. The examples at *C* and *D* in Fig. 430 illustrate two different methods by means of which the same work can be forged. This diagram also shows the difference in the lock which arises from the method of forging.

In the sectional view at *A* the work is forged flat, so that the lock is perfectly straight and both upper and lower halves contain the same amount of metal. In the example *B* the forging is made in another position which necessitates making the lock on a curve. In some cases the shape of the piece may require quite an irregular lock; but, if other things are equal and results can be obtained as well in one way as in another, the straight lock is to be preferred because it is easier to make.

The Art of Milling in 1750

By L. L. Thwing

Some time ago the writer ventured to predict that if the inventor of milling cutters—and milling machines—was ever located, that he would be a watch or clock maker, and probably a French clock maker. Since that time certain information has been secured which seems

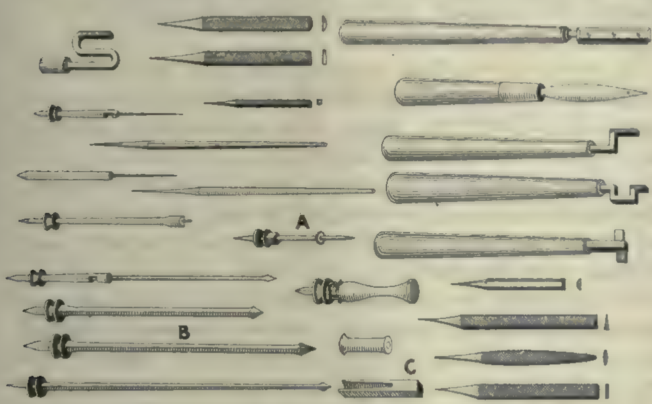


FIG. 1—FRENCH CLOCKMAKER'S TOOLS

to substantiate this prophecy. The French Encyclopedia of 1752 defines the word "Fraise" as a tool or process common to many trades, and continues "it is also a small circular plate of hard tempered steel, cut on the circumference. It is used to cut the teeth in clock gears. Also a sort of 'rochet' mounted on an arbor to make slots for the 'rochets' of the chain."

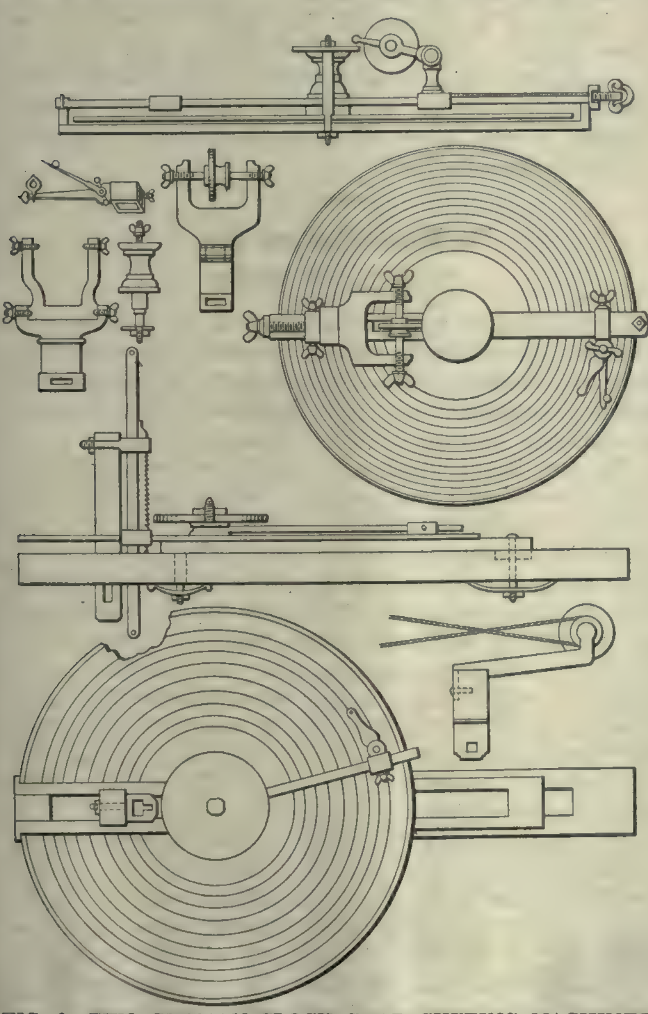
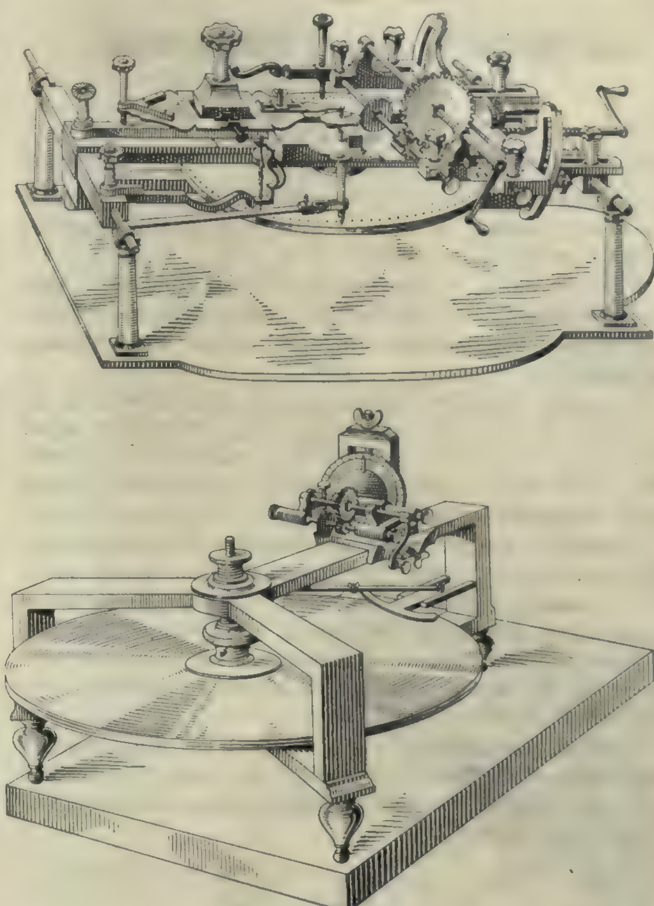


FIG. 2—TWO GERMAN CLOCK GEAR CUTTING MACHINES

This is evidence enough that milling was a known and practiced operation at least as far back as 1750. Fig. 1 is a reproduction of Plate XIV from the French encyclopedia and shows an assortment of clock makers' tools of this period. The tool *A* is the device mentioned in the latter part of the definition, while *B* is the common form of a "fraise," and is what we would call a rose countersink. It will be noted that the end of this looks not unlike a strawberry or "fraise." Attention is also called to *C* which is a hand punch for cutting gear teeth.

Leupold (1724) describes the two gear cutting machines shown in Fig. 2, these being intended for clock gears. The machine in the upper part of the plate shows a cutter with a toothed edge, and in the description the word "schneiden" is used, which certainly does not mean either to grind or to file. The figure in the



FIGS. 3 AND 4—GEAR CUTTING MACHINES OF ABOUT 1745

lower half is intended for heavier gears, and accomplishes this by a reciprocating motion of a toothed cutter. This is more of a broaching or sawing process than a milling process, but the idea of cutting with a formed tooth is close to the basic principle of milling. Figs. 3 and 4 are machines of a later period, but not later than 1745. The milling cutters are plainly shown, and the word "fendre" which means to cut is used in the title.

This evidence would tend to prove the contention of the writer that conditions were most favorable among the clock makers in France for the invention of the milling cutter. On the other hand, an early French writer on the subject of Horlogerie says that all arts and trades flourished and advanced during the reign of Louis XIV except that of clock making, for which

the English seemed to have had an established reputation. He also says that the English were very secretive about their methods so that "the Genevans who wish to learn the watchmakers trade come to France, where they can learn more in one year than in England in ten." This indicates that the process of milling may have been invented in England, possibly earlier than in France. However, all the proof we can have of this at this time would be in the form of an engraving or description. Possibly some of our English readers can supply this. One thing is certain: There is always more knowledge and practical information in men's heads than is to be found on paper, and at a time when it took Besson (1570) about ten years to find a publisher for his book, we may be sure that inventors and discoverers did not rush into print as commonly as they do now.

Are Metal Workers Hidebound?—Discussion

By E. F. DuBrul

General Manager, National Machine Tool Builders' Association

On page 154 of *American Machinist*, the editorial question is asked, "Why is it that so little research work is done on metal cutting?"

Further along in the same editorial you ask, "Are metal workers more indifferent, more stupid, more hidebound than steam engineers, electricians and builders, or what?"

You also ask, "Isn't this subject big enough to be taken up by some big society or a big university, or all universities? Why should the machine-tool trade depend on the Bureau of Standards to find some of the most elementary fundamentals of its business?"

These are all pertinent and important questions for civilized society, simply for the reason that the progress of civilization depends on machinery, and the more we know about producing machinery, the more will society progress. Of course, the cutting of metal is not confined to the metal employed in making machines, but also to all other metal articles.

It is easy enough to think that this is a problem of the machine tool builder alone, but a moment's reflection will show that it is much wider than the machine tool builder's problem.

Responsibility Does Not Rest With Machine Tool Builders Alone

The machine tool builders produce about twenty-five per cent of the total production of industrial machinery, but in addition there are tremendous quantities of electrical machinery, locomotives, railway cars, metal structures, ships, and other products made of metal that far over-shadow the value of the product of the industry that makes the machines that cut the metal. Therefore, the importance of your questions should be realized by the users of the machines, even more so than by the machine tool builders. Conceivably, the machine tool industry might subscribe to a fund sufficiently large to conduct all the research that ought to be conducted for the benefit of all its customers.

So many questions of research have already been raised that it is no exaggeration to say that under proper supervision a productive and valuable research campaign could be conducted, and as much as $200,000 a year could easily and well be spent in that sort of work for a number of years to come.

There is on file in the office of the National Machine Tool Builders' Association a list of questions that deserve attention. It is a long list of about fifty subjects, and anyone of these subjects would require from $5,000 to $10,000 a year for proper research. Unfortunately, the machine tool industry, as such, cannot assume this burden, nor can it ever get enough for its product to do so.

It seems to me that it would be very profitable for all metal working industries to join hands in financing research work of this sort. The fundamental problems are beyond the capacity of any single concern to solve within a reasonable length of time. But if an organized effort were made through the various associations of metal working manufacturers, if a research committee were appointed to supervise the work, and if the funds were forthcoming, all of the questions of your editorial could be answered, and so promptly perhaps as to be surprising in their profit to all. Many years ago I suggested, through a letter to *American Machinist*, the desirability of some sort of a national organization of machinery manufacturers to look after just exactly such movements as these research questions involve, movements that affect all machine builders.

A number of machinery organizations exist. Through a federation they could arrive at solutions of problems that touch all of them, while still retaining their own individualities and organizations that deal with the problems peculiar to each branch. The electrical industry has such a federation; the music industries, the paper industry, the automobile industry, and the lumber industry, all have such federations. The way has been pointed out to the machine industries. It only requires a very slight effort on their part to develop a similar organization.

Do Rush Orders Pay?

By A. L. De Vinne

Do rush orders pay, is a question upon which opinion is generally widely divided. However, the fact that some establishments make a specialty of filling rush orders, would make it appear as though there was considerable to be said on the affirmative side.

We see that a greater proportion of such concerns include merchants and printers rather than manufacturers. Considering the former concerns, we find that their ability usually consists principally in the knowledge of the sources and of the financial strings existing with one or more orders. They can thus lay their hands on job lots or mill runs where ready cash will insure low terms and prompt shipments. Printers take advantage of the fact that, in their line, night work is quite common, and they reduce their overhead percentage by running as nearly 24 hours a day as circumstances will permit. To make a success of this practice, there must be only a few who offer to do such work.

In general, where the larger proportion of the manufacturing costs is in material and overhead, it will readily be seen that rush orders seldom raise the invoice price of the materials, while they do save in storage costs and in interest. The increased labor cost, even where it exists, may be many times overbalanced by the saving in the overhead percentage.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Big Shops versus Little Shops—Discussion

By J. T. Towlson

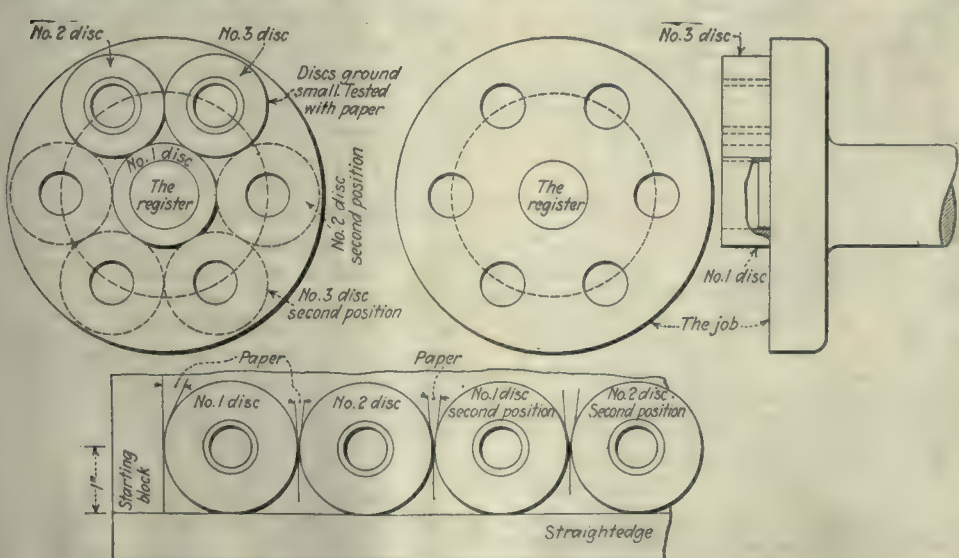
With reference to the interesting contribution of R. F. Moore, on page 368, Vol. 56, of *American Machinist,* I am of the opinion that whether such a job as the drilling of holes so small as $\frac{1}{16}$ in. in diameter in precise location be done in a large shop or a small one, the most dependable method cannot be by way of using a combination center drill, nor yet by actual dependence upon the accuracy of the dividing head. It is quite possible for the head to be all right and yet to have the holes out of position when using such a small drill.

My personal preference would be for the "disk" method, which involves the use of three disks accurately ground to diameter and used as shown in the illustration. With a highly polished work surface and careful workmanship this method is hard to beat.

The first disk is attached at the center of the piece to be drilled while the second is clamped in such position as to touch the central one. This second disk thus becomes a drill bushing, or jig, through which the first hole is drilled and reamed.

The third disk is now clamped to the work in position to touch both the central and second disks, where it becomes the jig for the second hole. The second disk may now be detached and moved ahead of the third one in position to drill the third hole, thus stepping the two disks alternately around the central one until the circle is completed.

In my own practice I prefer to have the disks ground to a slightly less diameter than that necessary to secure the calculated distance between centers of the holes and then use paper of the proper thickness for locating them, as in this way one may be sure that the several locations are right by adjusting the positions of the disks so that the paper will pull from between them.



THE DISK METHOD OF LOCATING HOLES ACCURATELY

[Our contributor's method is an excellent one, but involves the fatal disqualification of requiring about forty dollars' worth of special tools to do a five dollar job.—Editor.]

Buying Machines for Occasional Use

By A. W. Forbes

To a person in my line of work it seems strange that any manager should try to have all the machines in operation at once, a policy that is criticized by John R. Godfrey on page 833, Vol. 56, of *American Machinist.* As the bulk of our machines go to shops where they are not used more than one hour a day, such a course seems to be the only natural one.

When a man buys a micrometer, he never expects to use it for a very large part of the day. When he buys a tool grinder he only has to find a saving of about 2 min. a day to make it a profitable investment. A small engine lathe will require a saving of perhaps 15 min. a day of one man's time, and sometimes 2 min. of work will save 15 min. waiting. Yet it is hard to find the manager who would consider installing a lathe for 2 min. work a day.

On going through a certain shop I saw a drilling machine that looked as though it was idle most of the time. The manager commented that this drill was a very profitable investment. There was one size of hole that a number of men had to drill occasionally, but the nature of the work did not permit its being routed so that the pieces could all be drilled in one lot. There was an average of about six holes a day drilled of this size, requiring a total time of 100 sec. per day, and with the drill in place this was about the total elapsed time. Without this drilling machine the man would have to walk across the room; find out when one of the other machines would be free, and take his work over to it at that time, a loss of perhaps 5 min. on each hole or a total loss of 30 min. a day.

Some managers seem very slow to take advantage of such economies, but looking at my own shop, I find that I am in the same class. I could use another lathe, another drilling machine and possibly some other tools to advantage. I intend to buy them, but *when* is the question.

Gage for Indicating Rake Angles in Hob and Cutter Teeth

By Harry E. Harris

The gage herein described was designed by the writer for his own use; it will indicate the face angle of fluted cutting tools as large as 8 in. in diameter and 10 in. in length. Whether the flutes are straight or helical makes no difference. Its range is from a negative rake of 5 deg. to a positive rake of 30 degrees.

Referring to Figs. 1 to 3, *A* is a knife-edge straightedge sliding in protractor member *B* which has angular adjustment in the base *C*, the latter being graduated in degrees. *D* is a clamping stud for holding the protractor at any angle to which it may be set.

The block *E* slides in the groove *F* in the base *G* and carries the rod *H* on which the protractor is slidable in a direction at a right-angle to the groove *F*. This arrangement maintains the protractor at a right-angle to the axis of the tool to be indicated, in whatever location the protractor may be moved.

The tool to be indicated is supported by the centers *J* which are adjustable axially with the tool.

The center of angular adjustment *M* of the protractor is always in the same horizontal plane as the center line of the centers *J*, and therefore in the axial plane of the tool to be indicated.

By bringing this protractor against the back of the tool to be indicated, and rotating the tool until the extreme cutting edge is coincident with the protractor's center of angular adjustment *M*, the rake angle can be accurately found by means of the straightedge *A* and the graduated sector. The angle thus found is always the rake angle as measured from a radial line at the tooth intersection. As *A* is a knife edge and always makes a line contact with the tooth face, neither angular gashes nor helical flutes affect the accuracy of the angle as read on the sector.

In grinding the tooth faces of fluted tools, abrasive wheels wear so rapidly that the resulting angles do not always agree with the setting of the grinding machine, and as any variation from a predetermined angle on a hob or formed cutter will result in inaccurate work, it is necessary to check the angle of toothface after grinding and before putting the tool to work.

With a little experience in indicating angles of toothface after grinding, and comparing the angles with the setting of the grinding machine, the grinding machine operator will soon be able to set his machine so as to make allowance for any change due to wheel wear.

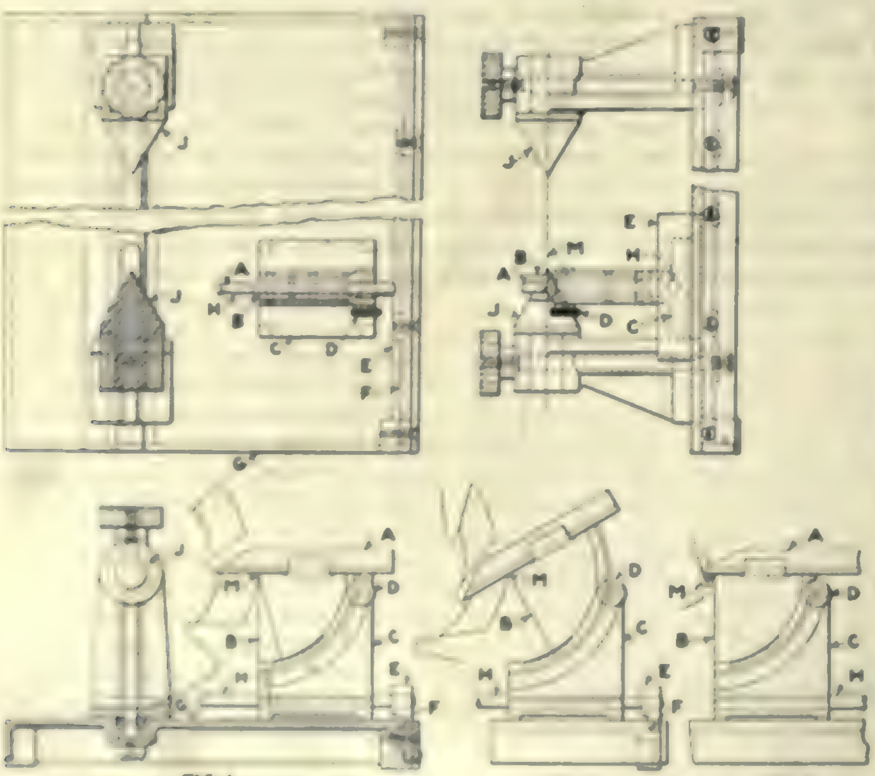


FIG. 1—GAGE WITH PROTRACTOR SET FOR INDICATING A RADIAL TOOTH FACE ON A TOOL 8 IN. IN DIAMETER. FIG. 2—PROTRACTOR SET FOR A HOOKED TOOTH. FIG. 3—PROTRACTOR SET FOR A SMALL TOOL WITH RADIAL TOOTH FACE

Can These Things Be True?

By M. Tolliver

I received the other day a little folder from the A. B. C. Company, which by the way is not the right name. This folder describes the wonderful qualities of a substance the company recommends for heat-treating and hardening of steel. It is a powder; it is poisonous and must be kept dry, like the rest of the United States.

The claims made for this substance are the following: It replaces carbon in burned steel; it makes a tool hard and tough; it eliminates brittleness; it increases tensile strength; it is steel's affinity; and, last but not least, it is the only compound known that will eliminate brittlenesss in stellite.

Forgetting for the present the romantic side of this compound, namely that it is steel's affinity, there is enough left to make a person wonder that the world has gotten along for so many years without this substance. I was particularly interested in the fact that it will eliminate brittleness in stellite. As stellite is not a steel, as, in fact, it has no iron contents at all, and as it is not hardened, I wonder how the powder is used and how it acts.

This little pamphlet is not the only one I have received. Every so often somebody comes out with a powder, or liquid, or crystal which, when applied in a prescribed manner, will convert any wicked steel individual into a paragon of steel virtue. Most, if not all, are failures and I am inclined to think that a good many of them are fakes.

Just the same I know of a good many people who will buy a box (only \$5), or a half-gallon can (only \$7.86), every time a new substance of this kind is advertised. It shows that these people really need something to help them out of their troubles with steel treatment and hardening and I wonder if they do not catch at every little floating straw they see in the hope that they may pull themselves up.

Is there any substance at all which could have such qualities as mentioned here? If so, how does it act on steel and why does it have these results?

Couldn't you give us small fellows some information on this subject or maybe draw out some of the bigger men who have had a chance to do experimenting and really study the matter from top to bottom in plants where facilities were available to investigate the problems more thoroughly than can be done in small shops?

If things like this substance are mere fakes, exposing them would do a great service to a number of people. It is not so much the $5 that is spent, but that every time they try a thing like this, they fool themselves and get just that much further away from real knowledge and the final solution of their problems.

Blueprinting from Typewritten Sheets

BY H. BROOME
Derby, England

Many of your readers may overlook the importance of the kink mentioned by Frank Harazim who, on page 420, Vol. 56, of *American Machinist*, refers to a method of obtaining blueprints direct from typewritten matter, but fails to point out that a special typewriter ribbon has now been placed on the market that gives even better results.

A resumé of the application of the principle may serve to emphasize the point and will undoubtedly be of service to production engineers in search of a simple and direct method of supplying information to the man on the job.

The writer is in charge of the operation section of a large factory organized for repetition work, and a year ago was faced with the problem of instructions for the production of small quantities of components to fine limits without interference with the ordinary shop organization.

Having decided on the typewriter as the quickest method of producing the master list of operations, we stumbled by accident on the method advocated by your correspondent—of securing a clearer blueprint by typing with a reversed carbon sheet at the back of the master list. At the same time we sent out inquiries as to the possibility of obtaining a specially prepared ribbon for the purpose, and ultimately we secured the very efficient "Barco" special blueprint ribbon which gives the required effect and is supplied by the Bar Lock Typewriter Co., Ltd., of London.

It may be of interest to state that by careful experiment we found that, using ordinary detail paper or thin bond paper as used for ordinary typewritten correspondence, we were able to secure a readable blueprints as given below in order of visibility:

1. "Barco" ribbon.
2. Ordinary carbon copy with reversed carbon paper at back.
3. Ordinary purple ribbon with reversed carbon paper at back.
4. Ordinary carbon copy without reversed carbon paper.
5. The ordinary commercial purple typewriter ribbon used alone is practically useless.

It will be obvious that if the paper is unsuitable or an exceptionally good copy is required the special ribbon may be supplemented by the reversed carbon paper, and also that pencil sketches are rendered more effective if a reversed carbon paper is used underneath, which in itself is a useful kink for the man who is making sketches that must show clearly.

A Self-Acting Drift

BY ROBERT BRAINERD

One of the boys in our shop, whose regular job is running a heavy drilling and boring machine, became tired of trying to keep track of his hammer and drift and so invented the tool shown in Fig. 1.

The handle is bored to a sliding fit for the shank

FIG. 1—A SELF-ACTING DRIFT

of the drift, the hole extending down nearly to the heavy part as shown in the sketch, Fig. 2. A slot is milled in the side of the shank and a screw put into the handle with the inner end projecting into the slot so that the drift cannot slip out of the handle. The

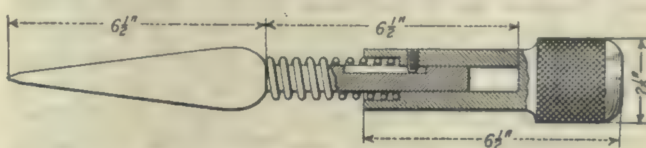


FIG. 2—DETAILS AND DIMENSIONS OF DRIFT

end of the handle is counterbored to receive the spring.

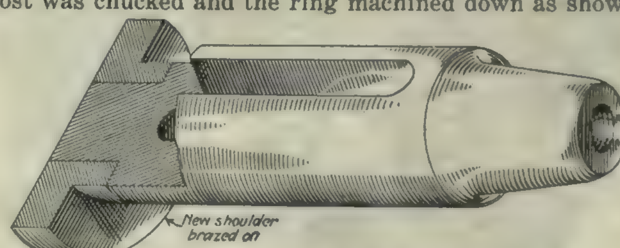
When the operator wishes to remove a drill or other tool from the machine spindle, he inserts the point of the drift into the slot in the spindle and slams the handle against the drift-shank. This can be easily and quickly done with one hand, and works beautifully.

A Toolpost Repair

BY GEORGE WILSON

The toolpost belonged to a new lathe. For some reason the builder had considered that a shoulder ⅛ in. thick was sufficient to sustain the screw pull, and of course it had to pull off just when the machine was most urgently needed.

A quick repair was made by turning down the shoulder end and brazing on a ring. After brazing, the post was chucked and the ring machined down as shown



TOOLPOST REPAIRED BY BRAZING

in the sketch. Cyanide was sprinkled on at the same time the brazing was done, and the piece was casehardened; care being taken to keep the cyanide off the part that had to be machined.

The ring was given a long bearing on the post to increase the area for brazing so the ring would not pull off. The width of shoulder was increased to ¼ inch.

Special Planer for Heavy Work

By Herbert Crawford

The Ajax Manufacturing Co., Cleveland, Ohio, builds forging machinery which runs into large sizes, some of the beds weighing 60 tons and measuring 9 ft. 8 in. in length. The handling of this work in the shop is a difficult proposition and the planing becomes a real problem. To plane these beds in the ordinary manner would require a planer of extraordinary size and power. So the Ajax company has built a special type of planer for machining the beds as shown in Fig. 1. While the moving tool might put this machine in the shaper class, the traveling ram and the crossrail for the toolhead travel, seems to bring it back into line with the planer.

The machine consists of the two rails or ways, *A* and *B*, which carry the traveling ram with its toolhead *C*. The rails are mounted on substantial columns *D* and *E* and tied together by the housing shown at *F*, in both Figs. 1 and 2. Beneath the machine is a massive bedplate provided with T-slots running in both direction as can be seen.

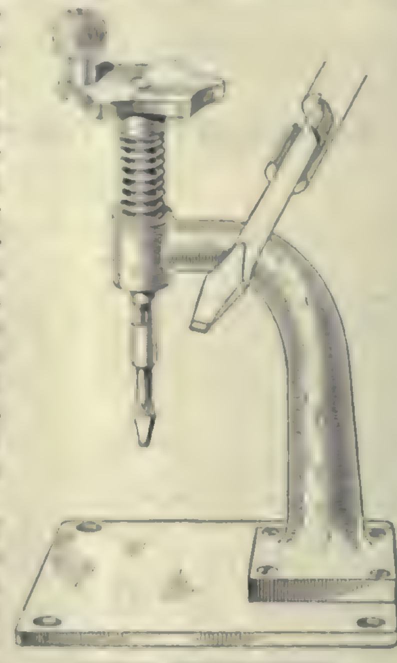
The piece to be planed is located beneath the planer head, blocked up to suit and is then planed in the regular way. The planer head is driven by gearing in much the same way as the table drive in the usual planer. Because of the great weight of the toolhead and the time taken to adjust it through any considerable distance by hand, a separate motor is geared directly to the operating screws. The original drive was from a countershaft located in the gallery as at *G*, Fig. 2, and there were controls on each side as at *H* and *I*, which could be operated from any point along the ways. Since the photographs were taken the drive has been changed. A 35-hp. direct-connected reversing motor is now used and we find the point of reverse more positive and the efficiency increased because of the greater power delivered. It will be noted that the ram travels in V-grooves and also has an upper guide on each side to prevent its lifting off the Vs.

Bench Screwdriver for Rapid Assembling

By T. Covey

The accompanying illustration shows an efficient and cheaply constructed screwdriver to be used in assembling parts that require a large number of small screws.

To a suitable base plate is secured a bracket in the overhanging end of which is a bearing to hold a spindle in a vertical position, and to the lower end of the spindle the screwdriver is attached. At the upper end is keyed a star-shaped knob, or wheel, that enables the operator to secure a firm hand grip when tightening the screws or loosening obstinate ones. A wooden handle, held to one of the projections of the star by a shouldered screw, provides means for rapid and easy rotation of the screwdriver.



BENCH SCREWDRIVER FOR PRODUCTION

The base plate may be secured to the work bench by means of wood screws. A light coil spring below the star balances the weight of the spindle and its attached parts, holding the screwdriver above the work. The strength of this spring should be so calculated that the weight of the operator's hand is sufficient to overcome the tension and bring the blade down to the screw slot.

FIG. 1—SPECIAL HEAVY PLANER WITH TRAVELING TOOLHEAD. FIG. 2—ANOTHER VIEW OF PLANER SHOWING DRIVE ABOVE

Making a Large Gear Wheel Under Difficulties

By K. Saldis

Reading in a recent issue of *American Machinist* of the making of a flywheel under difficulties, I am reminded of a job that once fell to me that taxed my ingenuity to a considerable extent before I could figure out a way to do it.

Quite a while ago we received an order for a job that was about seven sizes too big for our equipment, but, as there were no machines larger than ours within a distance of several hundred miles, it was up to us to get out the work. The order was for a gear wheel, 8 ft. (more or less) in diameter, 6-in. face and 4-in. bore. The wheel that was to be replaced was made of wood and was quite apt to change its size and shape without due notice in accordance with the weather conditions, and had caused such an endless amount of trouble that the owners had decided they must have something that could reasonably be expected to remain true and of one size for quite a while.

Using the Equipment at Hand

Our largest machine for turning was a vertical boring mill of 48-in. swing and therefore all of our work had to be done with improvised tools. Fortunately, the new gear was to have wooden teeth set into pockets or slots in the rim, which was to be about 1 in. thick.

The first thing to do was to make a heavy bushing of steel, which we bored in a lathe to $3\frac{15}{16}$ in. internal diameter, or $\frac{1}{16}$ in. less than the finished bore of the gear. This was used as a hub core, being set in the mold and the iron poured around it. Regular cores for the rim slots were also set in the mold but were not allowed to project clear through the rim section. These cores were set from the inside of the rim so that when the casting was poured the periphery presented a smooth unbroken surface; otherwise we could not have turned it in the way we did.

When the casting was ready to work upon it was leveled up on a floor plate and a yoke built up over the hub with blocks, bolts and straps so that a large pointed setscrew tapped into the horizontal bar that formed the upper member of the yoke would stand parallel to and directly in line with the axis of the casting.

You will remember that the actual hub of the casting was formed by the bushing of steel that had been cast in, so that we now had to remove only the remaining $\frac{1}{32}$ in. of metal all around the bore. A 4-in. reamer was set in place under the setscrew and by means of long wrenches, much muscular exertion and a great many expressive remarks, we were able to turn it through the bore, feeding by means of the setscrew and leaving a smooth true hole that was of the correct diameter and surprisingly near to the center line of the casting.

To turn off the periphery of the wheel we dug a pit out of doors around which we placed a framework of 12x12-in. timbers and to the side members of this framework we bolted improvised wooden bearings. An arbor was driven into the bore of the wheel in which a keyway had been cut by the hammer and chisel process, and the job was jacked up in position while we poured the babbitt. The arbor extended through one bearing far enough to permit a pulley or band wheel, almost as large as the casting, to be keyed on.

The line shaft was extended through the wall and a small pulley placed upon it in alignment with the big one on the arbor. A suitable belt was then placed around the pulleys and we were ready to proceed with the turning.

Holding the Tool

There was considerable discussion at this point as to the best way to hold and manipulate the turning tool. One suggestion was to place a small lathe across the pit facing the wheel and block out the carriage sufficiently to get the tool in the place where it would do some good, but this idea involved so much extra rigging that it was abandoned in favor of turning with a hand tool. This was the way the turning was finally accomplished and was one of the very few occasions in my life when I used a "hook" tool. I do not care to repeat the experience.

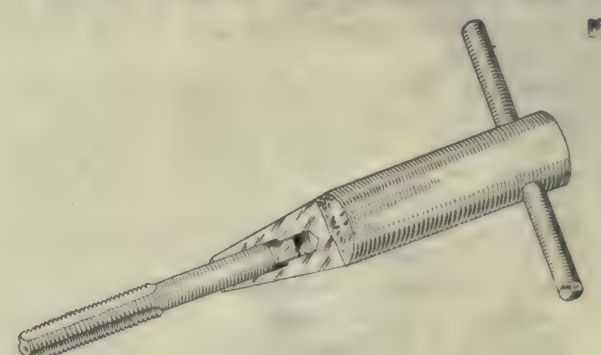
However, we managed to produce a fairly round and true rim. The thin walls left by the cores at the bottom of the tooth pockets were then knocked out by means of hammer and chisel and the slots finished through, ready for the reception of the wooden "cogs."

We secured by this method an iron gear wheel (though with wooden teeth) that ran fairly true, considering the way in which we were obliged to make it, and that was far superior to the all-wood gear that it replaced. I would not, however, advise any readers of *American Machinist* to make gears in this way as a regular practice if modern boring mills or turning lathes of suitable size are available.

A Small Tap Wrench

By Charles Kaufmann

To the toolmaker who has many small holes to be tapped in the course of his day's work, the wrench shown in the sketch will prove a valuable aid. It is made of a piece of brass rod of suitable diameter, tapered toward one end by filing in the speed lathe and drilled with a hole to fit tightly over the shank of the tap. The



WRENCH FOR SMALL TAPS

hole is then drilled further with a drill of a diameter equal to the width across the flats of the squared end of the tap. No broaching is necessary. Hold the tap in the vise and drive the piece of rod over it. The harder metal of which the tap is made will cut its way into the smaller hole and hold the tap against any twisting strain that the tap itself will stand. The wrench is not supposed to be taken off while the tap lasts, but to become a part of and stay with it when it goes in the crib or toolkit.

Editorial

The Brooklyn Bridge

ONE of the four cables of the Brooklyn Bridge slipped lengthwise 1¼ in. That is to say that the total effect of uneven loading over a period of forty years was a shift of 1¼ in. in more than 4,000 ft. To some people this means that the bridge is faulty, unsafe and should be rebuilt. To others it means increased respect and admiration for the men and the profession who can build a structure which, after forty years of continued service and overload is still so fit that an almost negligible shift startles the world out of its dream that anything can be made by human hands which will last forever. Surely if this job did not reach perfection, it came near it.

Standardization for the User of Machine Tools

THERE are two distinct phases to the subject of standardization of machine tools—the advantages to the manufacturer in decreased costs and the advantage to the user in the ability to interchange tools and fixtures from one make of machine to another. The first phase has received considerable attention to the extent of making parts interchangeable on given makes of machines.

There has also been some standardization of machine capacities, notably in milling machines, and planers are also falling in line. But the customer's point of view, the ability to interchange tools and fixtures, has been almost entirely overlooked. It is necessary in many cases to make separate tools and fixtures for each machine, in others the use of adapters of one kind or another is the usual solution. The first means much unnecessary expense, the second is rarely entirely satisfactory, even though it costs less than making new tools and fixtures.

The mention of standardization frequently arouses resentment in the minds of machine builders who seem to imagine that it means the building of all machines to a single pattern. They fear that it will prevent the development of new ideas, that it will not be possible to make their lathe or boring machine different or better than their competitors and some even go to the extreme of deriding all standards.

An answer to this is found in the automotive industry. The S. A. E. has probably adopted more standards, which are in use by its members, than any other organization, yet we know that few of the best known automobiles are alike in details. Using standard bolts and nuts, standard connections for brake rods, standard sizes of wheels and rims, do not make all cars alike. The designer simply picks standard units and works them into his own ideas of a completed motor or chassis.

In order to still further allay the fears of machine builders let it be understood that rational standardization will not affect the dimensions of their bearings, of their feed screws, of their ways or back gears. It only aims to standardize such parts as affect the user of the machine—namely the work-holding and tool-holding portions of the machines.

It is quite possible that the day may come when machine builders will themselves determine the best size bearing for certain duties. They would then select such a size for any new machine as a matter of economy. The present movement however is confined entirely to the user's side of the question, and, so long as a machine does its work and stands up, the user should have no complaint if the bearings do not accord with his previous notions on the subject.

The Need of Data for the Diemaker

THE manufacture of stamped articles has taken enormous proportions. Many shops contain hundreds of power presses and use thousands of dies, many of complicated construction. One would naturally think that an industry of such importance rests on well-known facts and data, and yet the reverse is true.

Almost every time a new piece must be tooled, the diemaker is confronted with a completely new riddle, and his only way of solving the problem is experimentation. A skillful diemaker, a man with much experience, may sometimes get along without much experimenting but he never feels quite sure of the results until the piece is actually produced.

He will start with the finished piece, making one by hand, the best way he can. Working his way back, he develops the various shapes it must pass through and the operations and dies required to bring it from one step to another. Each of these steps is again a subject for experimentation and quite often each one requires a new hand-made model. He may find that the metal will not stand the deformation caused by changing one shape into another and he may have to add operations or, maybe, start all over again. Even when he has solved the problem of how to make the piece, he remains uncertain whether another way would not have been better or simpler. Neither does he know what size press is required for each of the operations. He may know the amount of room but not the amount of pressure needed for forming, drawing or swaging.

He is, in short, absolutely without data. There is no established authority to tell him what to do, and to assure him that he will get the desired results when he does it. Maybe there are data here and there, collected by some progressive concern, but they are private property and will probably be safeguarded as such.

It would seem that a thorough study of this subject would be in order and that colleges, universities and other scientific institutions could make themselves an additional power for good by an investigation of this subject. At the same time, such an investigation by disinterested parties would not relieve the manufacturers of dies and die-produced articles from the responsibility of investing some of their profits in research work. They would get their investment back many times over.

Shop Equipment News

"Elecdrive" Screw and Nut Setting Tools

The electric tools illustrated herewith are the product of the Elecdrive Manufacturing Co., Inc., Syracuse, N. Y., and are for use in driving and setting screws, studs and nuts. Two types of the tools are made, portable and stationary.

The portable tool, Fig. 1, resembles an electric drill in general outline and can be operated from an electric light socket on either direct or alternating current of 110 volts, providing the alternating current has a frequency of not more than 60 cycles.

The stationary tool, Fig. 2, should be operated from a power line, though if the light wiring has a large enough safety factor the tool may be operated from a light socket. The motor of the stationary tool is universal under the same current conditions that govern the motor in the portable tool. The motors in both tools are of the high-speed type and operate the spindles through gearing having a 10 to 1 reduction.

The driving mechanism consists of a multiple-disk clutch, adjustable for any torque within the capacity of the motor, and driving a positive clutch through a splined shaft. The positive clutch automatically "kicks out" when the disk clutch is fully released, at which time the driving spindle is entirely free. This feature permits the removal and replacement of tools while the motor is running at full speed. It is claimed that the slip clutch insures all screws and nuts being driven to the same tension and that it prevents shocks to the motor. The clutch is so constructed that it cannot be overtightened and thus the tool cannot be overloaded.

A special feature is the provision for slow setting up of screws and nuts. During the period the screw or nut is being driven the spindle runs at 1,000 r.p.m., but during the actual setting it is slowed down to about 350 r.p.m. The tools are furnished with recessed and tapered wrenches so that nuts can be picked up while the spindle is running at full speed. Nuts and screws are held in the wrenches with their axes in line with the spindle so that threads can be engaged without danger of crossing.

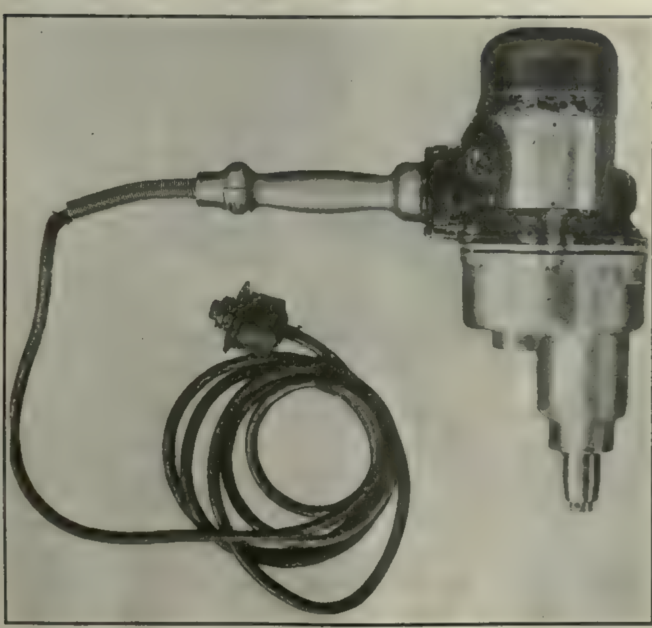


FIG. 1—"ELECDRIVE" PORTABLE SCREW AND NUT SETTING TOOL

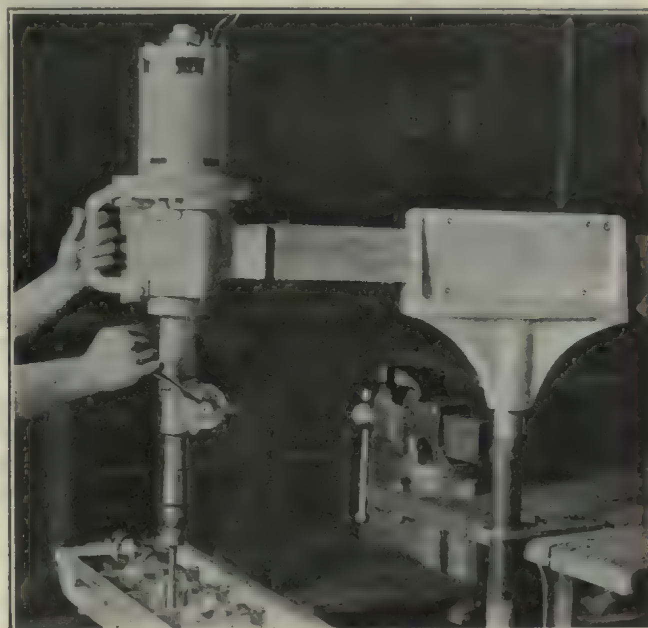


FIG. 2—"ELECDRIVE" STATIONARY SCREW AND NUT SETTING TOOL

The stationary machine can be equipped with a hopper for handling screws and double-chamfered nuts. Both tools will take Jacobs chucks and can be used as electric drills.

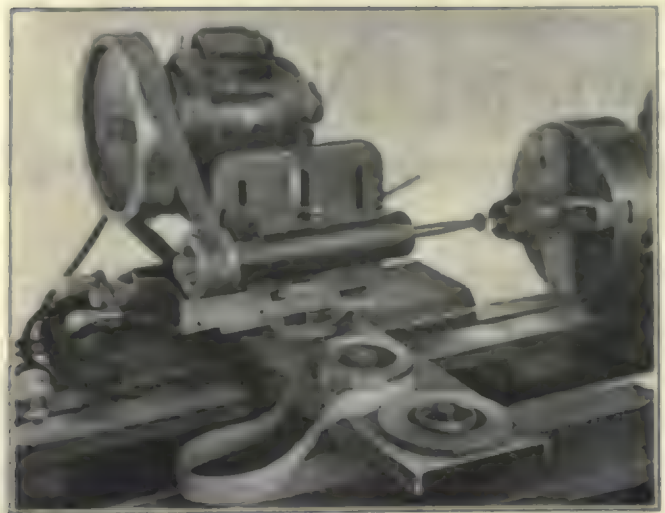
The portable tools are made in two sizes, weighing 11 and 13 lb., and will drive and set nuts from $\frac{1}{8}$ to $\frac{5}{16}$ in. and from $\frac{1}{8}$ to $\frac{1}{2}$ in. respectively. The stationary tool handles nuts from $\frac{1}{2}$ to 1 inch.

U. S. Electrical Tool Co. Combination External and Internal Grinding Attachment

The grinding attachment illustrated herewith has lately been brought out by the United States Electrical Tool Co., Cincinnati, Ohio, and can be used on lathes as small as 10-in. swing.

The angle plate, on which the attachment is mounted, is secured to the toolblock of the lathe, the motor and spindle being on opposite sides of the vertical member.

The motor is of the universal type and can be operated with either direct or alternating current, where the latter has a frequency of 60 cycles or less. The motor is pivoted to the angle plate, permitting movement for tightening the belt. The spindle has a



U. S. ELECTRICAL TOOL CO., GRINDING ATTACHMENT

vertical adjustment of 4 in. and can also be set at an angle. The same spindle is used for both external and internal grinding, the relative speeds being changed by transposing the pulleys. Different lengths of wheel arbors can be inserted in the spindle. Both the motor and spindle are fitted with ball bearings.

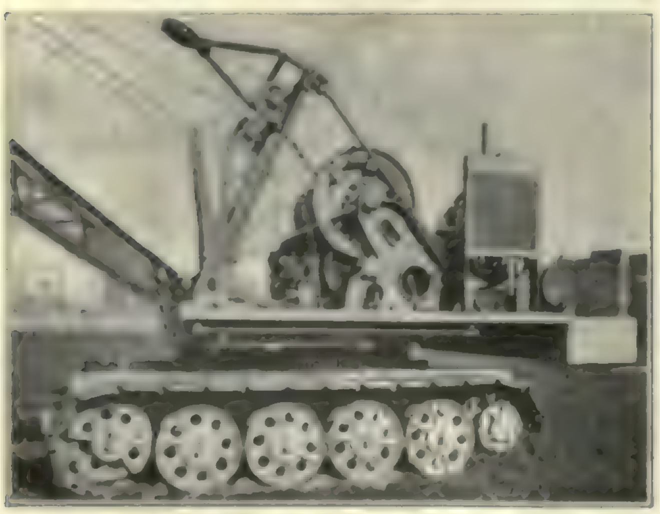
The regular equipment includes: Three pulleys, giving spindle speeds of 30,000, 16,500, 9,500 and 5,500 r.p.m.; two grinding wheels, one 6x¾x½ in. for external work, and one 1x¼x¼ in. for internal work; one wheel arbor 3 in. long, and two woven belts.

Link-Belt Crawler Crane

The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has added to its line the crawler crane illustrated.

The crane is operated by a heavy-duty, 4-cylinder traction engine running at 800 r.p.m. and equipped with an automatic governor, gear-driven fan, centrifugal pump, high tension magneto with impulse starter, and force feed lubrication to all bearings.

The boom is 35 ft. long and is of angle and lattice bar construction. The hoisting cable is ⅝ in. in diameter. The boom-hoisting mechanism is automatically self locking. The rear axle construction is similar to that used in automobile practice, and is equipped with cut bevel gears running in a bath of oil.



LINK-BELT CRAWLER CRANE

There are only sixteen gears in the whole machine and, with the exception of the slow moving rotating gear and pinion, all are cut from solid blanks of steel or bronze.

The clutches for swinging, traveling and hoisting the boom are of the expanding type and require very little effort to operate. The clutches for the hoisting and holding drums are of the same construction and the brake drums are so constructed as to enable the operator to set the brakes either before or while hoisting the load so that the moment the hoist clutch is disengaged, the load will be instantly and automatically held in position.

All bearings are fitted with easily renewable bronze bushings and the principal bearings are all of the same size. All bearings are lubricated with grease under high pressure.

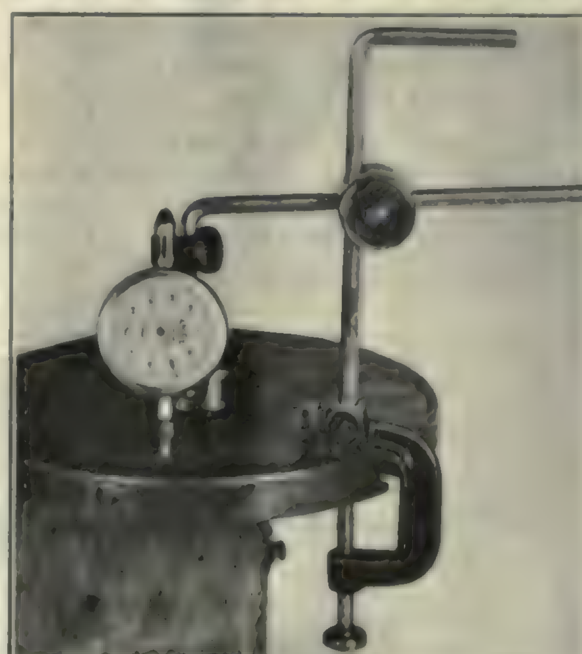
The complete crane is only 11 ft. 8 in. high and can be loaded, completely assembled, on a standard flat car. It can be loaded or unloaded by its own power by providing an incline from the ground to the car.

A 40-hp. electric motor for any standard current can be supplied to operate the crane in place of the gasoline engine, if desired.

Ames "Junior" Universal Attachment

The B. C. Ames Co., Waltham, Mass., has recently brought out the attachment shown in the accompanying illustration for use with its junior dial gage.

The attachment can be applied to any object within the range of the clamp and can be so set at to bring



AMES "JUNIOR" UNIVERSAL ATTACHMENT

the dial gage to almost any position or angle.

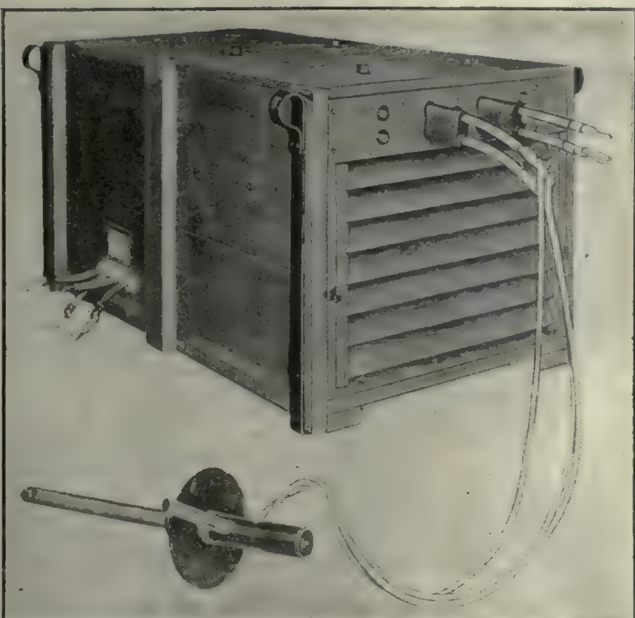
Among the many uses to which the attachment can be put, in conjunction with a dial gage, the maker enumerates the following: Testing straightness of crankshafts, camshafts and valve stems; checking lifts of valves and valve cams; gaging thickness of piston rings, shims, bearing liners, diameters of pistons and indicating the truth of flywheels and shafts.

The attachment can be purchased without the dial gage if desired.

Electric Arc Transformer Rivet Cutter

On page 545, Vol. 49, of *American Machinist* there appeared a description of an arc-welding transformer operated by alternating current. An apparatus of similar type having characteristics that adopt it to cutting, has recently been brought out by the same manufacturer, the Electric Arc Cutting and Welding Co., 152 Jelliff Ave., Newark, N. J. The machine is adapted primarily to rivet cutting, although it can be used also for cutting cast iron, brass or bronze, besides steel.

The machine is made in three sizes. The Type CW, 300-amp. machine is intended for both welding and cutting, the 600-amp. machine for rivet cutting and carbon arc welding, and the 1,000-amp. for cutting alone.



ELECTRIC-ARC RIVET CUTTING TRANSFORMER

The primary magnet wire has micanite between the layers, while double micanite and asbestos spacers are placed between the primary and the secondary winding. There are large air ducts between the iron and the copper and between the layers of the copper. A bucket type of ball bearing blower is arranged to drive air through these spaces continuously whenever power is being used in the transformer.

In order to reduce the power required to magnetize the core, an automatic cut-off arrangement is provided. A magnetically operated switch is provided in the primary, so that the circuit remains open at all times when the electrode is not in contact with the work, or when the arc is not being drawn. A small pilot transformer of 100 watts capacity is employed, making the operation automatic and positive.

The electrical characteristics of the machine are different than for the welding machine in that the voltage across the arc is higher, and the drooping characteristics desirable in arc welding are not so pronounced. In operation, the kva. in the primary can be held constant and the voltage can be kept up to the value desired as the current is increased. The use of the transformer enables working with larger amperages than is possible with direct-current machinery.

Atlas 5-Ton Elevating Platform Truck

The electric elevating platform truck shown in the accompanying illustration has recently been placed on the market by the Atlas Car and Manufacturing Co., Cleveland, Ohio. Its especial use is handling large core racks into and out of core ovens. The truck has a rated capacity of 5 tons, and the platform can be elevated 4 in. in 10 seconds.

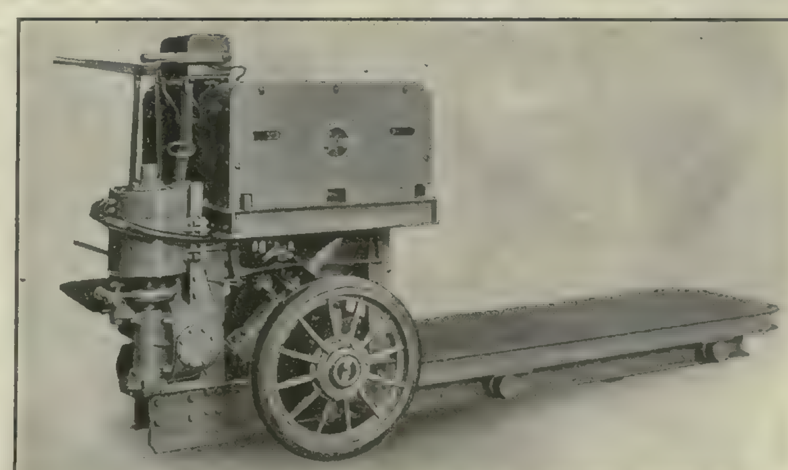
The truck may be operated by either Edison or lead batteries, the latter being standard equipment. The battery compartment is provided with removable end plates and with rails for guiding and holding the storage battery trays.

The elevating mechanism consists chiefly of a motor flexibly coupled to a double worm reduction. Four crankshafts placed crosswise of the truck, two at each end, are connected by means of bevel gears to the worms. Hardened steel rollers on the crankpins bear against hardened steel wearing plates on the under side of the platform. The crankshafts are caused to revolve simultaneously one-half revolution when it is desired to raise the platform. A limit switch is operated automatically at each end of the travel of the platform, so that the motor is stopped and the platform is held in position.

Reduction in the driving mechanism is obtained by means of an inclosed worm and wheel, the motor being flexibly coupled to the worm. A contracting-type shoe brake is interlocked with the pedal and controller safety switch, so that the brake is applied whenever pressure is completely relieved from the pedal. Three speeds are provided in each direction. A signal horn is operated by a push button on the controller handle.

The steel driving wheels are provided with rubber tires 27¾ in. in diameter and 4½ in. wide. Their maximum speed of rotation gives the truck a speed of 700 ft. per minute, or 8 miles per hour when unloaded. The trailing or load-carrying wheels are of steel 10¾ in. in diameter and 4¾ in. face, the tread being 11½ in. They are mounted on double-row ball bearings, and a ball thrust bearing is provided to give ease of steering. Steering is applied to all four wheels.

The load platform is 7 ft. 2½ in. long and 30 in. wide, and 11½ in. from the floor in the lowest position. The machine has an overall length of 11 ft. 8 in. and a width of 4 ft. The inside turning radius is 5 ft. 9 in. and the outside 12 ft. The machine can be operated through intersecting aisles 8 ft. wide, while carrying a core rack 5 ft. 1 in. wide and 7 ft. long.



ATLAS 5-TON ELEVATING PLATFORM TRUCK

News Section

Industrial Engineers Annual Convention

Representatives from progressive manufacturing companies in all sections of the country will meet at the Hotel McAlpin, New York, October 18-20, to attend the three-day National Convention of the Society of Industrial Engineers, it is announced by the American Engineering Council. Prof. Joseph W. Roe, president of the society, and head of the department of industrial engineering at New York University, will preside.

"Economics of Industry" will be the theme discussed by speakers of national reputation. Sectional meetings for Managing Executives, Production Managers, Sales Managers, Industrial Relations Directors, Accountants, and Educators are included in the program.

The international committee for the Elimination of Unnecessary Fatigue will hold an open meeting.

A special feature will be an exhibition of factory and office equipment and appliances designed to save labor and reduce fatigue. The exhibition will be held in the commodious Winter Garden adjoining the ball room in which the principal meetings will be held.

All the meetings will be open to the public. On the evening before the convention, there will be a joint meeting of this society with the Taylor Society and the American Society of Mechanical Engineers.

The official program will be ready for distribution early in September. Copies may be obtained from the S. I. E. offices, 327 S. La Salle St., Chicago.

National Fire Prevention Exposition

Manufacturers of fire-resistive materials and of fire-fighting and retarding apparatus, for the first time, will have the opportunity of taking part in a Fire Prevention Exposition to be held October 2 to 7, 1922, at the twenty-second regiment armory, New York City, where will be shown, by exhibit and demonstration, what a vital part in the fight against the great annual fire loss is played by fire-safe materials and apparatus.

The exposition originated with the fire prevention committee of the National Association of Insurance Agents as part of its program of fire prevention activities. It has been endorsed by the National Fire Protection Association, the National Association of Credit Men, by Frank G. Reynolds, president, of the International Association of Fire Engineers, the National Board of Fire Underwriters and other associations.

A lecture hall is in the armory building and it is planned to make each day of the exposition a special day, with lectures and motion pictures in the lecture hall. One day will probably be devoted to municipal authorities and fire department officials, with addresses on municipal fire prevention and protection.

Already requests for space are reaching the exposition committee and it is expected that every foot of available space will be taken within a few weeks. A. E. MacKinnon, 405 Lexington Ave., New York City, is chairman of the exposition committee.

Machinery Exports Show Big Increase

Exports of metal-working machinery took a decided upturn in June. The total value of these exports was $1,446,866, or over a half million dollars greater than those of May, the total exports for that month amounting to $892,078. The total almost equalled that of the exports in June, 1921, in which month machinery to the total value of $1,488,213 was shipped abroad. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, follow:

EXPORTS METAL-WORKING MACHINERY

	May 1922	June 1922
Lathes	$66,604	$84,198
Boring and drilling machines	69,424	68,580
Planers, shapers and slotters	17,590	52,280
Bending and power presses	15,806	31,531
Gear cutters	6,174	15,937
Milling machines	25,255	51,622
Sawing machines	2,930	6,678
Thread cutting and screw machines	17,668	17,290
Punching and shearing machines	12,610	20,685
Power hammers	13,188	3,162
Rolling machines	16,270	585
Wire-drawing machines	2,248	3,152
Polishing and burnishing machines	83	894
Sharpening and grinding machines	83,304	69,297
Chucks, centering, lathe, drill and other	26,028	13,605
Reamers, cutters, drills and other parts for machine tools	113,696	110,007
Pneumatic portable tools	18,930	30,687
Foundry and molding machinery	75,887	53,447
Other metal-working machinery and parts of	308,383	813,229
Total metal-working machinery	$892,078	$1,446,866
IMPORTS		
Machine tools	$29,977	$26,599

Record Auto Output for July Indicated

Shipping reports to the National Automobile Chamber of Commerce, 90 per cent complete, indicate that July shipments from all factories will reach a total of 28,412 carloads, 28,022 driveaways and 6,855 boats.

On this basis it is estimated that 246,600 passenger cars and trucks were produced by all makers in July, exceeding July, 1921, by 39 per cent and the best previous July (in 1920) by 20 per cent; the decrease under June, of 14 per cent, is seasonal and expected. This is a record for production in July and is the third largest single month's production in the history of the industry, being exceeded only by the two preceding months.

Legion of Honor for Dr. Kennelly

For distinguished services as exchange professor in engineering to the French Republic, the Cross of the Legion of Honor has been awarded to Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology.

Dr. Kennelly was the first exchange professor sent to France from America under the scheme of regular annual exchange of professors in engineering and applied science, inaugurated last fall between the French University Administration and seven American institutions.

The French representative in America, Professor J. Cavalier, director of the University of Toulouse, and an authority on metallurgical chemistry, has recently returned to France after a year spent at the seven co-operating institutions, Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, Pennsylvania and Yale.

Professor Kennelly is the third American engineer thus to be honored recently, the others being Colonel Arthur S. Dwight, president of the American Institute of Mining and Metallurgical Engineers, and Charles F. Rand, chairman of the Engineering Foundation. He will be succeeded this year as American exchange professor by Dean John Frazer of the University of Pennsylvania, now in France. Professor Cavalier's post in the seven American universities will be filled by Dr. M. E. deMargerie, director of the Geological Service of France.

Employment Service for Engineers

An employment service for engineers of every variety of training and experience is conducted by the four national engineering societies of the United States. This service brings in touch with the various business men the services of 50,000 trained technical men who are members of these societies and one of the objects of it is to show to the various commercial houses the aid which engineers are rendering to others in the same lines and to help these firms and corporations secure similar assistance.

Men of engineering training are prominent in all branches of commercial endeavor and their creative ability is recognized as being of great help in the building up of the nation's wealth.

This service is in a position to supply chemical engineers, civil engineers, mechanical engineers, electrical engineers, sales engineers, production managers, superintendents and other trained executives, and is under the direction of W. V. Brown. The office is located in the United Engineering Building, 29 West 39th St., New York City, and is free to employer and employee.

Business Conditions in Germany

By OUR BERLIN CORRESPONDENT

AFTER the negative result of the Genoa conference and the bankers conference, the critical conditions visible for some considerable time, are perceptibly becoming more and more accentuated. In the public's opinion the country's business has entered into an era of crisis, opposing interests working to gain control. The fear of the impending impact is casting a gloomy spell over the country. For the last seven or eight months the population had been hoping for financial improvement, and the business world has shaped its course accordingly. Especially with regard to the bankers' conference, a favorable outcome resulting in a large loan was commonly expected, even to the extent of full conviction in quarters where carefully formed opinions and even scepticism prevails as a rule. Such general expectations, which, if realized would have marked results upon every phase of business life, could not fail to hold in suspense numerous arrangements of even the most pressing nature. When they ultimately broke down, a state of affairs ensued resembling the bursting of a dam, the combined effect of the long restrained business actions gravitating towards an outlet and, indeed, lending to the situation all the signs of a severe crisis.

Stringency of Capital Acute

The most threatening conditions by which industry is now faced are the stringency of capital, the shortage of material, and the growing unrest among the laboring class.

The stringency of capital, the causes of which have already been explained in these columns has, during the last two months, taken alarming dimensions. Banks were compelled to reduce their rate of credit on securities and these have declined steadily in value. The same can be said of all other forms of collateral. Credits are, indeed, strained to the utmost. Under such conditions, it is not surprising that numerous manufacturers have delayed covering themselves with raw material, especially the imported kinds, hoping that a large loan to the country would relieve the financial strain. Upon the sudden realization of the vainness of such hopes, a general rush took place, and this is largely responsible for the recent financial landslide. Storm and stress having created a disposition in the population, including the leading business men, to go from one extreme to the other, it is believed that experiment to support the mark has broken down, and that there is nothing more to prevent its complete collapse.

The immediate effect upon industry of this state of affairs is that large quantities of raw material needed for orders in hand and partly paid for have to be bought now at prices entirely out of keeping with original estimates. Even if the money for these purchases can be found in all cases, which is extremely doubtful, great difficulty will be encountered later on in the matter of prices. It is true that most domestic orders and part of the orders for export are placed upon a sliding scale, but the agreed-upon stipulations of the scale do not take care of such contingencies as the neglect of the manufacturer to provide himself with the raw material needed at the time of receiving the order. If the latter does not succeed in unloading the increase of price upon the purchaser, he will be faced either with the loss of money or of orders. The latter could, no doubt, be sustained more easily, and the tendency is to retreat in this direction.

It is commonly estimated in business circles that the stringency of capital will last until the vast sums now being tied up in enormous quantities of goods in the course of manufacture have reached the consumers, provided that the latter are not then inclined to place further orders of equal size. Hardly any fear is felt on the latter account, and for this reason a release of tied-up capital is generally expected next fall. As an alternative is hoped that foreign capital will flow into the country in the shape of investments in industry, attracted by the extremely low quotations on all industrial stocks. Industry urgently needs fresh capital to an extent which, in the light of statistics, appears to be no less than 20 to 50 billion marks. In the first five months of this year the joint stock companies, which represent nearly 80 per cent of industry as a whole, only received 15 billion marks, compared with nearly 9 billion marks for the same period of last year. In the capital demands of industry, the machine building industry occupies, by far, the front rank. It has required 2½ billion marks of fresh capital during the first three months of the year. When taking into account that the purchasing power of money since last year has decreased from 25 to 30 per cent, and that, on the other hand, the industrial activity has nearly doubled, the cramped condition of industry can be realized. Under present conditions there appears to be no way out of the difficulty. Even the usually strong support lent to manufacturers by the banks has weakened considerably.

Shortage of Raw Materials

Almost in the same proportion as the stringency of capital, the shortage of raw material has increased along the entire list, starting with fuel. The shortage of coal which, in public discussions of the situation forms the chief topic, is said to be caused by the drop in the production of Ruhr coal and by the division of Upper Silesia. The dimensions which the imports of foreign coal have taken lately, running up quickly in the case of British coal to the pre-war average, have further accentuated the growing difficulty. Nevertheless, the shortage of coal is somewhat exaggerated in connection with the new adjustment of the coal tribute now under consideration.

More pronounced is the shortage of iron, steel and other metals. It is being stated that numerous machine tool building works, crowded with orders, have had to reduce working time on this account. The shortage of iron and steel is attributed to the mills being handicapped for lack of fuel, but this can only apply to the present hand-to-mouth conditions, and could have been obviated by better foresight on the part of the producers. Lack of raw material is, in the first instance, caused by the enormous industrial activity which has not been foreseen and taken care of in proper time. In fact, the present time can be taken as a test of the capacity of German industry. It can be clearly seen that the utmost limit of this capacity has been reached or even passed. The rate of production is estimated at only 60 per cent of pre-war production, and this can be taken as the present standard of capacity. This standard coincides with the efficiency of the workman. According to a statement made recently at the annual meeting of the German machine tool building works, this efficiency last year was 60 per cent, and has even dropped during the second part of the year. As further accentuating the strained situation of the industry there has been added lately a shortage of labor. Complaints on this score are coming chiefly from the mining districts and also from the metal trades.

Labor Situation Threatening

The strong revival in the building industry, drawing workmen to it by high wages, is the chief cause. It appears, indeed, that if all lines of work are to be kept going at the present rate of production, the amount of labor available in the country will be insufficient. The relief coming from the emigration of workmen of German nationality from the Polish part of Upper Silesia which has taken place lately is too slight to cause a marked difference. The chief difficulty of the labor supply is the housing problem.

The third, but by no means the least important of the threatening conditions prevailing, is the labor situation. The latter is chiefly ruled by the control which, so far, has been exercised upon living cost. Recent developments have shown that the theory held out some time ago that this control has broken down is not far from the truth. At no time since the armistice has the upward movement of prices been anywhere as rapid as during late months.

According to the index of living costs, the latter increased 20 per cent in April as compared with March, and 9 per cent in May over April. From May to June a further large increase has taken place. The living costs for May were 35 times higher than the pre-war level, and the cost of food is 47 times higher. The increase in wages of machinists during the same period can be seen from the following figures, giving the wages per week:

	July, 1914	May, 1922
Trained Machinists		
Bachelors	42.44-M	825-M
Married men	(Not Given)	1,011-M
Half Trained Workmen		
Bachelors	39.96-M	791-M
Married men	(Not Given)	977-M
Untrained Workmen		
Bachelors	30.62-M	772-M
Married men	(Not Given)	958-M

These figures apply to conditions in Berlin. In a few other towns they are higher, but in the majority of lo-

(*Continued on page 280b*)

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, Commerce and Finance, New York

MINNEAPOLIS, MINN.

REALIZING that business prosperity or depression is largely a matter of popular sentiment or feeling I am on my way across the Continent with the purpose of ascertaining, if I can, how the people of this country feel in regard to the future. Thus far I have visited Chicago, St. Paul and Minneapolis. In each of these cities I have had opportunity to talk with many prominent men, including not a few highly placed railroad officers. They are all optimistic. The merchants say that most of the crops are good, that they have been economically produced, that they are bringing fair prices and that the farmers are and will continue to be liberal buyers. An active trade, at least until well into the autumn, is therefore generally expected.

Confidence does not seem to be perceptibly disturbed by the certainty that there will be a coal famine unless the coal strike is soon settled. The present and prospective scarcity of coal is indicated by the receipts from April 1 to July 31 at Duluth and Superior, from which ports most of the fuel supply of the extreme Northwest is distributed. The figures compare with previous years as follows:

	Tons		Tons
1922	397,210	1921	6,233,000
1920	2,345,000	1919	5,240,000
1918	3,669,000	1917	3,430,000

This showing is ominous, but the feeling of the community is expressed by one man who said that he had heard coal famines talked of all his life but that he had never seen one and did not expect to. The conference at Cleveland, even though only 20 per cent of the operators in the central field are represented, holds out hope for an earlier settlement of the strike than seemed possible a week ago, and once even part of the operators agree on terms the settlement is likely to spread.

As to the railroad strike the executives seem to regard the fight as won. They say that the men will tacitly waive the seniority question, pending decision by the Labor Board in accordance with the President's proposal, that the strikers will have learned that in future strikes they cannot keep their cake and eat it too, and that the result will be immunity from labor troubles for some time to come.

There has been surprisingly little delay in moving either freight or passengers in this region and as there is every prospect that the autumn traffic will be enormous the officials are all cheerful and the outlook for the transportation industry is better than it has been for a long time.

The banks report that there is an abundance of money, that old accounts are being rapidly collected, that the frozen credits are being thawed out and that financial conditions generally are easier than they have been since 1920 and sounder than then because there is not yet any over speculation.

In the West as in the East high rents, high taxes and the probability of high priced coal are bitterly complained of but in so far as the Northwest is concerned it seems unlikely that for the present or the immediate future anything short of a cataclysm can seriously disturb the confidence that is so pervasive and one is impelled to conclude that in so far as both mental and material conditions are concerned the indications are in the main highly reassuring.

The bumper crops forecast by the August report will add at present prices well over a billion dollars to the farmers' purchasing power as compared with 1921, and if there is, as many expect, an advance in the prices of wheat and rye this figure will be increased materially. The gain in what the farmers will receive amounts to about 20 per cent, which is considerably more than the average increase in the things they have to buy.

If there is no setback in the condition of the crops, therefore, business in the farming states is likely to be even better than most merchants expect. The most authoritative reports obtainable indicate that retailers' stocks are small, and as these facts become generally appreciated the conservative hand to mouth buying which is now the rule is likely to give way some time during the fall to a spurt which will advance prices sharply. In any event buyers are likely soon to begin placing their orders for two to three months' supply of goods instead of filling only their immediate needs.

The First National Merchandise Fair, which is the first trial in this country of an ancient marketing method still widely used in Europe, has been opened, apparently with great success. It has brought an unprecedented number of buyers into New York, and they seem confident that business will be good during the fall. The lessons of the past eighteen months, however, have taught them super-conservatism, and many are disposed to limit their buying, I think, too closely, forgetting the scramble which will follow if all discover that they are understocked at the same time.

Candidates who advocate the soldiers' bonus are making poor showings in the primaries, and perhaps this demonstration that support of the largesse is not a sure step to political preferment may turn Senatorial sentiment away from it. Like the ship subsidy, however, the issue is still to be fought out. Meanwhile it is worth noting that the states have by no means completed their contemplated financing to pay bonuses to their own soldiers, and in so far as this is a factor contributing to "secondary inflation" its effects have not worn off.

Colonel Ayres, of the Cleveland Trust Co., has made an interesting study of previous depressions which shows a remarkable similarity in the course of bond prices during recovery. Taking the lowest point of pig iron production as the bottom of depression he has discovered that bond prices uniformly reached their peak about fourteen months later. Should this be true of the present recovery the peak would be reached in September. Colonel Ayres of course knows that the precedents of the past do not always govern the present and future, and he is too sagacious to predict that the interval will be the same in this instance, but as a "take it or leave it" statement his conclusion is particularly interesting because there are other factors which seem to support it, particularly the trend of the money market.

Analysis of the loans and investments of the member banks of the Federal Reserve System shows that in the past fifteen months there has been a decrease of about $1,250,000,000 in the total of commercial loans, and an increase of about $1,150,000,000 in the total of their security holdings or loans based on securities. This has been accompanied by a steady advance in bond prices and a decline in money rates, and it is reasonable to suppose that when commercial loans start increasing again the trend will to some extent be reversed.

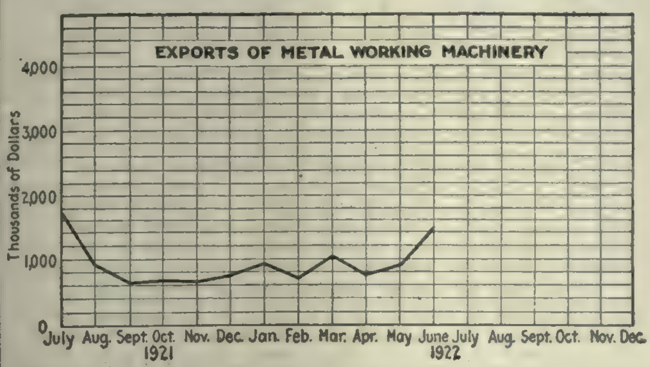
If, as everyone expects, this increase in commercial loans first becomes marked in the autumn the rise in bonds is likely to be stopped concurrently. Nevertheless they need not be expected to decline greatly. Colonel Ayres' study shows that in the past they generally entered a period of comparative stability. The peak of stock prices was not reached until some time afterward.

I am informed that a number of large investors, including banks, intend to handle their bond holdings in accordance with this theory, and if there should be enough profit taking it would produce exactly that halt in prices which Colonel Ayres' conclusion indicates.

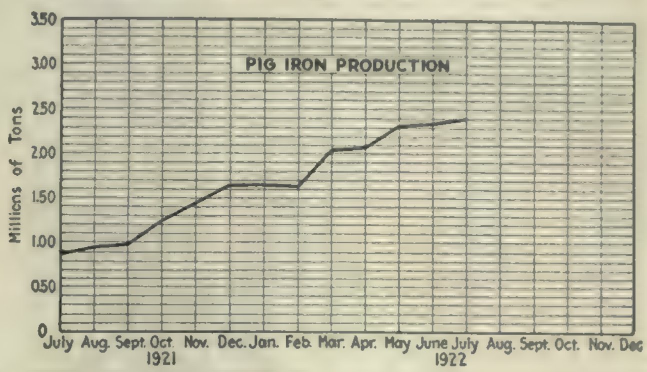
The Federal Reserve statement for the week re-emphasizes the certainty of ample funds to sustain commercial expansion. Due to a decline in rediscounts the reserve ratio is up to 80.4 per cent, the highest since the spring of 1917, though gold holdings are virtually unchanged.

American confidence seems impervious both to the strikes and to anything which happens as far away as Germany. And in nearly all respects, save the outlook abroad, this faith and confidence, which are just as important ingredients of prosperity as actual conditions, seem to be warranted.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Monthly pig-iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Association.



AMERICAN FOREIGN TRADE figures for June from the Department of Commerce show total imports to the value of $260,390,000 and total exports valued at $327,198,000. In both, there is an increase over May. Chiefly is the increase in imports made up of raw materials or partly finished goods. In manufactured goods ready for consumption there is only a slight increase. On the other hand our foreign sales of manufactured goods show an increase of over nine millions.

British foreign trade figures for June show two facts of interest. Her imports of raw materials, valued at £69 millions is not merely equal to, but is slightly above the 1913 average. Her exports of manufactured goods, on the other hand are but slightly more than half of her pre-war volume.

Railroad earnings for June, according to the final report of railway operations shows 199 roads out of 200 in Class 1, having a net operating income of $76,470,500, equivalent to a return of 4.78 per cent on their tentative valuation. In the same period of last year, the net income of these same roads totaled $50,984,000 or an annual return of 3.18 per cent. For the first six months of 1922 the net operating income of the carriers totaled $348,387,400 as compared with $145,639,800 during the same period of last year, or a return of 4.43 per cent per annum as against 1.85 per cent in the first half of 1921.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

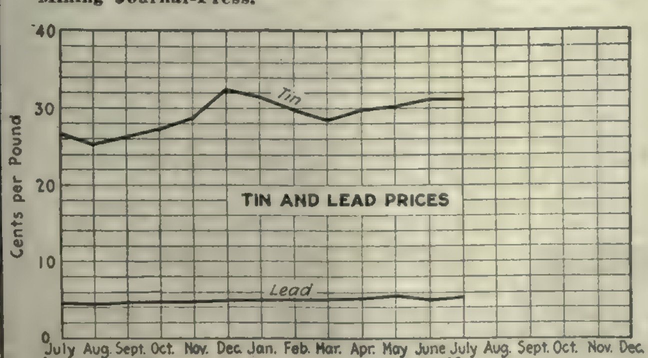
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0263	$0.0252	$0.0278
Cold finished shafting	per lb.	0.0340	0.0335	0.0428
Brass rods	per lb.	0.165	0.1550	0.159
Solder (½ and ½)	per lb.	0.22	0.213	0.18
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.00	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

Unfilled tonnage on the books of the U. S. Steel Corporation on July 31, increased 140,630 tons over June. The forward orders totaled 5,766,161 as against 5,635,531 tons on June 30. The increase however, is only about one-third of that recorded in June over the month of May. With the exception of February which showed a decrease of 100,000 tons, every month of the current year shows an increase, although a decrease because of the strike situation, is expected during August.

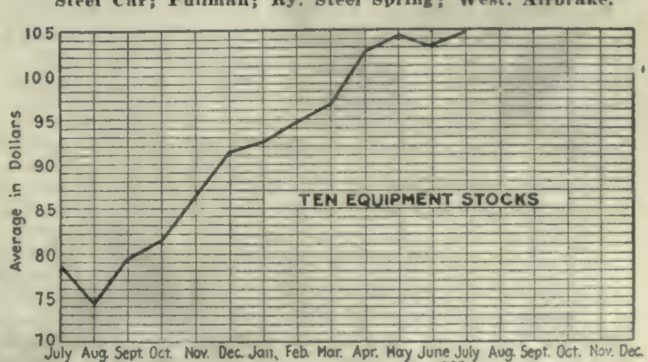
Loadings of revenue freight on American railroads for the week ending July 29 totaled 859,733 cars as compared with 861,123 in the week previous. Compared with the corresponding week of last year there is an increase shown of 64,301 cars, but the figure shows a decrease of 76,633 as against the same period of 1920. Coal loadings increased 314 cars over last week but decreased 73,065 cars as compared with the 1921.

Freight cars idle on American roads on July 23 because of business conditions, totaled 382,322 as compared with 417,029 in the week previous. Of the total 198,322 were cars in good repair in excess of the current requirements. The remainder, 184,000, were bad order cars in excess of the normal unfit for service. Contrary to the general impression, the number of locomotives in bad order is not excessive. On July 15 there were 15,764 in need of repairs as compared with 15,437 on July 1, 1921.

Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West. Airbrake.



Business Conditions in Germany

(Continued from page 279)

cations they are lower. In the case of trained workmen the increase, since pre-war times, is 24 times greater and in the case of untrained workmen it is 31 times greater. With the exception of a few vocations the foremost of which are the mines and the building trades, the wages have not kept pace with the increase in living costs. Great efforts are being made to preserve the proper ratio between the two but in view of the growing discontent prevailing among the labor classes, the success is doubtful. The time does not seem to be far off when the labor situation will have to be grappled with seriously. The employers are trying to solve the problem by increasing the working time, while the workmen, on the other hand, are centering their efforts more and more upon sliding scales of wages. The gulf separating these two objectives is so wide that it is difficult to see how it can be bridged. The employers in their opposition to sliding scales of wages are able to point to the bad experience in Austria, where such scales led to a state of affairs in which neither side has profited and industry is losing ground steadily. The strike fever is growing perceptibly, and the impending labor conflict is becoming more and more pronounced.

Machinery Industry Stagnant

Viewed from the outside, no material change of the state of business could be seen until a few weeks ago. In addition to the numerous orders held in abeyance pending the outcome of the various conferences, business has increased from April to May. The same applies to the rate of employment according to the official returns given by the Labor Ministry. As far as machine building is concerned, it was stated that in May 77 per cent of all works were employed to fullest capacity and 23 per cent were only a little below full production. This is exceptional, and reflects a state of affairs not experienced since the war. That such appearances are deceptive has lately been stated by the leading men in industrial affairs.

At many meetings of industrial associations gloomy views of the future prevailed. In the meeting of the National Association of the German Industry, the president of the association, Dr. Karl Sorge, managing director of one of Germany's largest machine building works, prophesied a stagnation close at hand on account of the decreased purchasing power of the domestic market. The keynote of his speech was that once German industry has to reckon with world market prices and compete with them, it will begin to realize the height to which costs of production have risen. The change in conditions already mentioned as having taken place recently, has not yet taken effect sufficiently to enable one to judge its tendency and dimensions. It has, however, made its force felt already on several important lines in the machine building industry, the foremost of which is the machine tool building.

According to information received from numerous works, the drop in business in the latter is marked and universal. It extends over all lines of machine tools equally. It is, at the present time, difficult to say whether this change is a reaction of a transitory character or the first stage in the prophesied slump. Manufacturers are hoping that the recent decline of the mark will again call buying into activity, but if what has been stated repeatedly from authoritative quarters is true, that the purchasing power of the domestic market is for the time being impaired by the stringency of money, such a hope could only be realized by a revival of export activity. Judging from the experience gained during the last twelve months, which shows that the demand from abroad hardly follows the rise and fall of exchange, such a hope seems rather idle. According to the reports of the machine building associations, amongst them the Society of German Machine Tool Builders, exports amount to hardly more than from 20 per cent to 30 per cent of the total production. From January to April the total machinery exports have increased from 33,000 tons to 39,000 tons, but judging from preliminary reports of the May and June business, a drop has taken place during this period.

This decrease is already visible in the case of machine tools which, as a rule, are leaders in the business fluctuations in the machinery market. From 7,336 tons in February, machine tool exports have dropped in March to 6,800 and in April to 5,800 tons. The total of machine tool exports during the first four months of the year was 27,000 tons compared with 23,700 tons in the same period in 1913. From the latest reports of export business it appears, however, that the official returns on machine tool exports have included wood working machinery. Deducting the latter from the total of machine tools, it appears that the April exports were only 4,300 tons compared with 5,900 tons in April, 1913. Deducting wood working tools which, probably, during the first four months of the year were 5,000 tons, the total volume of exports was somewhat lower than in pre-war times.

With regard to export prices of machinery, the statistics show that some progress has been made in raising them with the depreciation of the exchange, but not in the same proportion. The total of machinery exports during January-April, 1922, were valued at 5 billion paper marks, which is 34,400 paper marks per ton, compared with a pre-war average of 1,200 gold marks. The average depreciation of currency during the same period was 1 to 60. In the case of machine tools, the average during the first four months of the year was 25,000 marks, and in April 40,000 marks. The prewar average, at the rate of exchange prevailing during April would equal nearly 80,000 marks per ton, or almost double the actual price received.

Machine Tool Export Prices

From statistics it is apparent that the directions given by the Association of German Machine Tool Builders for quoting export prices are not properly observed. According to these directions the average price per ton in April should have been 54,000 marks per ton. By way of explanation, manufacturers as well as dealers state that they find it more and more impossible to enforce these directions to the full extent. Speaking of these directions, the rate of increase over November prices has, from May to June, been raised by from 120 to 145 per cent.

The death of Dr. Rathenau has been a severe blow, not only to Germany as a whole but particularly to German industry. In fact it is in the latter field that his chief excellence lay, as even his many enemies admit. The development of the Allgemeine Elektricitäts Gesellschaft (General Electric Company), whose president he was, is a monument to his foresight as an industrial leader.

The organization of the A.E.G. is, doubtless, one of the best in Germany. One of the chief features is the independence of the various departments of each other, giving managers a free hand to procure from outside sources articles manufactured by the company itself if its own product cannot compete in the way of prices. The stimulus thus imparted to the various departments of the company has never failed to work. In spite of such qualities, Dr. Rathenau had many enemies, not only in political circles but also in industrial affairs. His late policy was to bring about an improvement of the mark and its stabiliztaion, even in the face of the severe crisis threatened thereby to industry, recognized, doubtless, by him as well as by others. The opposition encountered from his brethren was chiefly centered on the contention that the time for going through such a crisis had not yet come, and that temporizing was the thing most needed.

Reparations and Russia

In view of the stagnation in export business, some attention is now again being devoted to the reparations question. No progress has been made in this respect in spite of various agreements concluded. The latter have not been ratified, and must, for the present, be considered shelved. Of actual supplies made for the reparations' account, the chief place is occupied by coal, coal by-products and chemical products. Machinery so far has been entirely neglected. Although France and Belgium are among the chief foreign buyers of German machinery, these products have been supplied only in the course of regular export business.

No material progress is being made in the furtherance of the Russian business, although preparations are being conducted with great vigor. The experience gained from trading with the export department of the Soviet Republic is most disappointing. In many cases it has turned out that the goods to be supplied by Russia in exchange for German goods are not available for shipment, being tied up by some community or co-operative society. It has been found necessary to deal with the latter separately and this, in many cases, has resulted in better and quicker business. For this reason the actual official returns from Russian export business to Germany in no way reflect the total volume of business transacted. The official transactions in the second half of 1921 comprised goods to the value of only 200 million paper marks, and in the first quarter of the current year 105 million paper marks. Flax and wood were the chief imports. A complete re-organization of Russian foreign trade is said to be in the course of development, consisting, in most cases, of companies in which the Russian State as well as foreign capitalists are shareholders.

Washington Notes

By Paul Wooton

To keep alive in such times as these the requisite knowledge of, and skill in, the mechanical arts peculiar to ordnance manufacture is a very serious problem, General C. C. Williams, the Chief of Ordnance of the Army, points out. With the principal nations well stocked with ordnance material, private manufacturers of these articles are without orders and their shops are closed down, says General Williams. There are no prospects that they will receive any orders for many years to come and as a result the whole burden of keeping alive the very exacting art of ordnance manufacture in this country has fallen upon the Government.

During the current fiscal year the Ordnance Department's appropriations have been cut $3,000,000 lower than the average appropriations during ten pre-war years, that is from 1904 to 1914 inclusive. Despite this handicap every effort is being made to apportion just as much of the money as is possible to work at the arsenals. Arrangements have been made whereby all of the manufacturing arsenals will be kept in operation during the next year. While the force at these ordnance manufacturing plants is simply a skeletonized organization, it will make possible the preservation of a certain amount of skill which must be kept alive, General Williams says. In addition it allows a certain amount of development work to go forward.

Just at this time the Ordnance Department is giving particular attention to the development of an automatic loading shoulder rifle. The advantages that come through no interference with aim such as is caused when a bolt must be operated to reload are so great that General Williams regards it as certain that this will be the next step forward in shoulder rifle development. He reports that highly satisfactory progress is being made in the development of aircraft bombs.

A patent infringement suit involving the unitary oscillating magneto ignition equipment employed upon practically all stationary and portable gasoline engines is before the Supreme Court for decision. The case was brought on appeal by the Webster Electric Co., against the Splitdorf Electrical Co., from the Circuit Court of Appeals for the 7th Circuit. The lower court declared the patent in question was void, while the Webster Co. contends that if this ruling is sustained it will act to invalidate half of the U. S. patents in existence. The Webster case is based on an alleged infringement by the Splitdorf Co., of the Kant patent granted September 24, 1918. The district court found the patent valid and infringed but it was reversed by the circuit court. The circuit court gave two opinions in the first of which it declared the patent void for want of novelty. On rehearing the court admitted error in the first opinion but held that while the patent is a novel and meritorious invention, it was invalid because it was not formulated and presented in the patent application until shortly before its allowance.

In a House speech discounting alleged disadvantages under which American ships operate as compared to foreign ships, Representative Hardy of Texas, in opposing the ship subsidy bill, stated that much of the cost of ships comes from complicated and expensive machinery but that our manufacturers of machinery have shown "that in almost every line they can hold their own in the markets of the world." He stated that the oil burner and the Diesel engine are effecting as great a revolution in shipping as the displacement of wooden ships by iron ships did in the fifties of the last century. The economies affected by this new fuel and machinery, in operation and cargo space and greater speed and quicker turn around are marvelous, said Mr. Hardy, and it will take a long time for the other nations to junk their existing coal burning fleets, while the United States can fairly start with the new era. As to the high labor cost of operation of ships, Mr. Hardy said the labor cost is not more than 8 to 12 per cent of the total cost of operating an American coal burning ship. That percentage will be lessened, he says by the use of oil burners and the Diesel engine and when this class of ships comes in competition with coal burners, which constitute the bulk of foreign shipping, the percentage of labor cost to the whole cost of operation will be less on American ships than on foreign.

Unreasonable rates on machinery from various points to Omaha are alleged in a complaint to the Interstate Commerce Commission by the Metropolitan Utilities district of that city.

Senator Harrison, of Mississippi, has introduced by request of Senator King, who is in Utah, a resolution calling for a report by the Interstate Commerce Commission as to whether the acts of Congress requiring railroads to equip their locomotives with safe and suitable boilers and calling for regular inspection of boilers, is being violated. The resolution was referred to the Senate Committee on Interstate Commerce for consideration as to the feasibility of calling on the commission for a report.

Germany Again Buying Our Copper

A sign of good omen in the copper situation is found in a recent announcement that the Copper Export Association has just drawn for redemption $3,000,000 of their 8 per cent gold notes of series "B," and $6,000,000 of their 8 per cent gold notes of series "C" to be paid on August 15, 1922.

For the fiscal year ending June 30 the figures, it is reported, will show approximately $90,000,000 have been realized in the sale of copper to foreign consumers, the greater portion of which has been handled through the association.

Of interest, chiefly, as bearing out past history, has been the exports of the red metal to Germany. As in the pre-war days, she has been the mainstay of the foreign demand, taking and paying for more than $30,000,000 worth of copper in cash. In the past two years she has taken more than $50,000,000 worth of the metal.

Export shipments for the month of May were 58,085,033 pounds as against 62,196,956 pounds in April. The total exports for the entire year of 1921 amounted to but 32,259,011 pounds.

Southern Industrial Conditions

The Southern Metal Trades Association from the Atlanta headquarters announces that the railroad strike has not as yet slowed up industrial operations in the Alabama district to any material extent, and that most of the manufacturers believe a settlement will be reached before the situation becomes serious. The plants are continuing unabated production the only difficulty being in getting products to market.

The end of July found 23 furnaces operating in Alabama, the largest number that have been active at any time in that district since the period of depression began almost two years ago. Several furnaces started up in July.

The base price for No. 2 foundry iron is $19 to $20 with most makers asking the $20 price. Encouragement is found in the recent action of the Louisville and Nashville Railway and the Southern Railway. These two roads have formally announced that the new and lower rates on Birmingham pig iron to Cincinnati and St. Louis will go into effect Sept. 1. The present rates are $4.05 and $5.17, while the new rates will be $3.53 and $4.22, respectively.

All industrial operations over the southeast continued upward during July but the pinch of the strike is now beginning to assume more serious proportions in the district, causing a material shortage of cars.

China Also Having Its Labor Troubles

According to reports from the Far East, the lowly Chinese wage-earner, perhaps the most abject of all the world's toilers, is just learning of the power he is able to wield through the medium of organization, and like a great flood the movement to form various trade guilds is sweeping the country.

It was hardly more than a year ago that China witnessed its first important strike. Since then the larger cities have experienced walkouts in almost all classes of work, with the result that business is demoralized, transportation is so uncertain that merchants refuse to ship, and in many cities the public health is menaced through strikes of street and water-works employees.

At the present time in Canton the carpenters, painters, school teachers, butchers, street sweepers and city employees are on strike, while the seamen and launchmen, who but recently returned to work, are on the verge of another walkout. The City of Macao is in the thick of a general strike which is almost a state of siege. The casualties to date have been forty killed and nearly 200 injured.

The seamen's strike here has had a tremendous effect all over the Far East, as it has given the laborers confidence in their new guilds and stimulated their desire for better living conditions. The seamen have been so successful in forcing their demands that they now talk of going into the shipping business for themselves. The men are being asked to subscribe $5 each, and judging from the eagerness with which they are responding the backers of the project expect soon to have a steamer running between here and Canton.

Business Items

The Bay State Tap and Die Co. has taken over the plant of the Blancke Twist Drill Co., Taunton, Mass., which went through bankruptcy about a year ago, and will, it is reported, start operations about September 1.

The C. C. Carter Machinery Co., dealers in machine tools and supplies, has moved from 36 Garnet Street to its new quarters at 150 Chestnut Street, Providence, R. I.

The Bull Dog Lock Washer Co., Baltimore, Md., has arranged to increase its capital to $[illegible], the funds to be issued for proposed expansion.

The Metallic Press Cloth Co., Augusta, Ga., which recently established a plant in that city, is now manufacturing a metallic press cloth recently invented by William A. Lee, of Augusta, which cotton oil mill superintendents have approved as an invention of decided importance to this industry.

The Semet-Solvay Co., Ensley, Ala., has fired up sixty additional coke ovens which, with 240 ovens already in operation, brings production up to a full 100 per cent.

The Georgia State Legislature has before it at the present time a bill, which has been favorably reported in the current session, designating Savannah, Ga., as the official state port, and authorizing the investment of $15,000,000 for the establishment there of state-owned and operated port terminals, warehouses, etc.

The Chicago Flexible Shaft Co. announces that the address of its New York office for Stewart Industrial Furnaces, which has been located at 350 Broadway since it was established early in 1920, has been changed to 16 Reade Street. The office, as before, is in charge of J. W. Lazear.

The Ricker Machinery Co., Seattle, Wash., has been incorporated with a capital of $25,000 by James W. McBurney, Hoge building; E. M. Ricker, H. J. Armstrong and Jas. W. McBurney, all of that city.

The Jones Machine and Tool Co., Philadelphia, has purchased ground at Primos, Pa., and begun work on a building. Employment will be given to 150 men. The pattern and designing shop, under construction, will be followed by other shops.

The Lockport Foundries Corporation, Lockport, N. Y., has announced that it has acquired control of the Jefferson Union Co., Lexington, Mass., manufacturers of pipe fittings, and that plans are under way for the erection of additional buildings.

The Hartford Tap and Guage Co., Hartford, Conn., has recently filed a certificate with the Secretary of the State of Connecticut to change the name of the company to the Hanson Tap and Guage Co. The directors and officers of the company remain the same, and there will be no other change at this time.

Van Vleet, Inc., Hedden Place and North 15th St., Newark, N. J., has been organized with an authorized capital of $125,000 for the purpose of conducting auction sales of machinery, industrial and manufacturing plants and work of appraisal. The officers of the company are B. Dorf, president; S. H. Berger, vice-president and Herbert Segal, treasurer.

The Mount Vernon Machine and Motor Co., Mount Vernon, Ill., has filed notice of change in name to the Davis-Settlemire Co.

The Hubbard Oven and Manufacturing Co., an Illinois corporation, has filed notice of organization to operate in New York with a capital of $200,000. C. S. Sharp, 260 West Broadway, represents the company.

The Board of Commerce, Bay City, Mich., is negotiating with the Michigan Central Railroad Co., Detroit, regarding the erection of its proposed new main car shops on local property. A site has been selected and inducements have been offered to have the plant established here.

The McKinley Hardware Co., Rock Island, Ill., has arranged for an increase in capital from $10,000 to $50,000.

The American Cylinder Grinding Co., Newark, N. J., has filed notice of organization to operate a works at 682 South Eleventh Street. A general machine shop will be conducted.

The Dasco Spring Cover Co., Allston, Mass., will commence the operation of a new works on the second floor of the Wilcox Building, Athol Highlands, Athol, Mass., recently acquired for this purpose. The company will manufacture spring covers for automobile service.

The Ajax Bolt and Screw Co., 1571 Wellington Street, Detroit, Mich., has arranged for an increase in capital from $25,000 to $200,000.

The Hercules Trailer Manufacturing Co., Los Angeles, Cal., incorporated in April of this year with a capital of $50,000, and now producing Hercules trailers in its new plant at 1327-33 Santa Fe Ave., has elected the following officers and directors: Charles H. Mason, president and manager; A. C. Pferdner, secretary; G. A. Morton, treasurer and engineer; C. A. Herberts and Major Whittingham, directors.

The Malco Products Corporation, 220 West South Temple St., Salt Lake City, Utah, is equipping a modern plant to manufacture automobile accessories as well as to do experimental and contract work requiring stamping, blanking, shaping and spinning. It desires to receive advertising literature and catalogs from tool and machine builders.

The Wisconsin Electric Co., manufacturer of Dunmore electric tools, Racine, Wis., has established offices for the New Pork and Northern New Jersey districts at 27 Warren St., New York City with E. S. McGonegal in charge as sales representative.

The Sullivan Machinery Co., Chicago, Ill., has recently purchased 125 acres of ground at Michigan City, Ind., where it is planning to erect buildings and shops for a new and greatly enlarged plant. Upon completion of the proposed construction, the buildings comprising the Chicago plant of the company will be sold after the equipment has been moved to Michigan City. The company plans, however, to retain its present office headquarters in Chicago, Illinois.

The North & Judd Manufacturing Co., New Britain, Conn., one of the largest manufacturers of hardware tools, etc., in the east, held its annual stockholders' meeting during the past week and elected the following officers for the ensuing year: H. C. Noble, president; E. M. Wightman, vice-president and secretary; F. M. Holmes, vice-president and treasurer; Samuel MacCutcheon, assistant secretary; and Frederick J. Ward, assistant treasurer. The directors chosen were: F. S. Chamberlain; George C. Clark, Charles Glover, F. M. Holmes, G. M. Landers, H. C. Noble, A. J. Sloper, and E. M. Wightman.

Personals

W. F. TRENARY, of Atlanta, Ga., inventor of the pump bearing his name, has been granted a patent for certain improvements on the Trenary centrifugal pump, which prevents leakage, retains the priming and protects the impeller from undue abrasions. The modification consists of a water-sealed stuffing box and an adjustable journal box, which do away with loss of priming and enable the journal to be adapted to the wear of the impeller.

R. G. PLUMB, sales manager of the New York office of the Eagle Lock Co., manufacturer of hardware, locks, etc., Terryville, Conn., has been chosen a director of the company at its recent annual meeting. Mr. Plumb succeeds the late Rollin J. Plumb, who was also president of the concern.

CHARLES GLOVER, of the Skinner Chuck Co., manufacturer of chucks, etc., New Britain, Conn., was re-elected a director of the North & Judd Manufacturing Co., New Britain, at the latter company's recent annual meeting.

JAMES F. PULLAN has entered the employ of the Lincoln Machine Co., Pawtucket, R. I., in the capacity of general superintendent.

E. S. MCGONEGAL has been appointed resident sales representative of the Wisconsin Electric Co., manufacturer of Dumore electric tools, Racine, Wis., for the New York and northern New Jersey districts and will make his headquarters at 27 Warren Street, New York City.

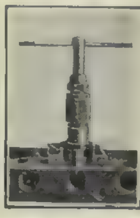
Obituary

Frank Toomey, Sr., founder and for many years president of Frank Toomey, Inc., Philadelphia, Pa., died on Wednesday morning, Aug. 2, at the home of his daughter, in Scranton, Pa., after an illness of approximately three weeks. He was born in Liverpool, England, 72 years ago, of Irish-English parentage, and came to this country when quite a young man. He became connected with the Baxter Engine Co., Hartford, Conn., and had charge of their exhibit at the centennial exposition at Philadelphia in 1876, subsequently starting, the same year, the

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Valve Reseating Tool, Boring, "Davis"
Hinckley Machine Works, Hinckley, Ill.
"American Machinist," May 11, 1922

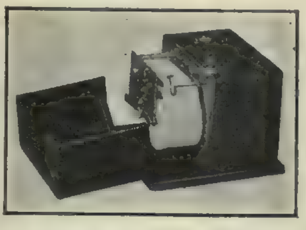



The tool is used on cylinder blocks of automotive engines, as shown at the right. A large bearing above the valve seat holds the cutter bar in place, and is located in a plate or holder clamped to the work. The bar is inserted in the top of the holder and the cutter put in place at the bottom of it. The cutter bar is turned by handle, and feed is provided by a screw. The set includes three boring bars, with $\frac{5}{16}$, $\frac{3}{8}$ and $\frac{7}{16}$-in. pilots, two valve seating cutters, one knurled turning handle, two boring cutters, hexagon setscrew wrench, and an attachment for handling Buick valve cages. Weight, 18 lb. Boxed for export, 25 pounds.

Grinding Machine, Internal, Vertical, "Bright"
Garvin Machine Co., New York, N. Y.
"American Machinist," May 18, 1922

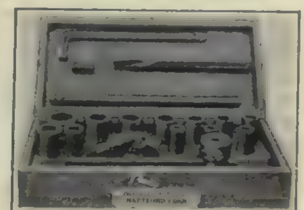
The machine grinds cylindrical holes only. The chief feature is the revolving and reciprocating of the work spindle in one bearing. The wheel spindle is directly driven by a $1\frac{1}{2}$-hp. induction motor at the top at speeds of from 7,500 to 12,000 r.p.m., while the work and feed mechanism are driven by a motor at the rear. A feed screw with a large graduated wheel is carried on the column at the right of the wheel spindle, and feeds the grinding wheel a distance of 0.0001 in. per graduation. The feed is automatically operated. The work-spindle speed of rotation is 100 to 385 r.p.m. in five steps, and the ten reciprocating speeds give from 4 to 48 strokes per minute. Capacity, 4 x 4. Swing, 11 in. Floor space, 20 x 45 in. Height, 63 in. Weight, 1,250 pounds.

Time-Study Machine
H. H. Williams, 1613 Chestnut St., Philadelphia, Pa.
"American Machinist," May 18, 1922



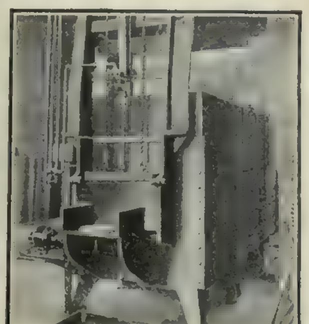
The machine is used in timing machine operations, and makes a permanent record. A strip of paper is moved at a uniform rate of speed by a positive drive regulated to suit conditions. A pen, moved back and forth by two finger keys, traces a line on the moving strip of paper. The graph or record obtained gives all the data for filling in a time-study observation sheet. The length of time between each step can be read on the strip by means of a decimally divided scale. The motor, of spring-driven clock work, is independent of any outside power. Observations of 0.001 min. can be recorded and twenty-four steps or elements are obtainable. The machine is 8 x 8 in. square and $6\frac{1}{2}$ in. high. Weight, $9\frac{1}{2}$ pounds.

Wrench Set, Square and Hexagon, "Bay State"
Allen Manufacturing Co., Hartford, Conn.
"American Machinist," May 18, 1922



The set is expressly for automobile and garage work and comprises a reversible ratchet wrench, universal joint, extension bar, screwdriver and twelve sockets ranging in size from $\frac{7}{16}$ to $\frac{13}{16}$ in. hexagon, and including $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$ in. square sockets. The set is put up in a hardwood case, and is designated as the No. 19 box set.

Furnace, Hardening, Automatic, Electric, Gleason
American Industrial Furnace Corp., 10 Post Office Square, Boston, Mass.
"American Machinist," May 18, 1922

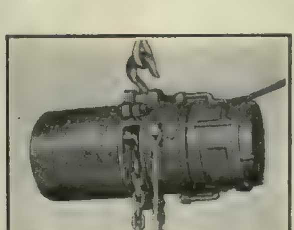


The furnace is used for hardening automobile transmission gears, and is adapted to hardening small and medium-sized parts. The hearth is made up of a series of "thermalloy" rolls geared together and driven by a variable-speed motor. It is designed to operate at temperatures from 1,000 to 1,800 deg. F. There are fourteen changes of speed to the rolls. Hearth: Width, 17 in.; length, 132 in. Electrical capacity, 65 kilowatts. Work capacity, 450 to 700 lb. per hour.

Comparator for Gaging Gears, Hartness
Jones & Lamson Machine Co., Springfield, Vt.
"American Machinist," May 25, 1922

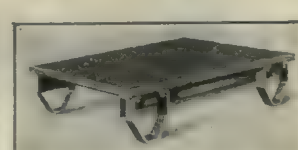
A mirror throws the image on the back of a ground-glass screen. Since the chamfered ends of gear teeth do not focus clearly when projected, the instrument is focused at some point along the face of the tooth, while the gear is slightly tilted for the light rays to strike the side of the tooth. Needles, placed in the plane to be explored, give a very sharp projected point and show the outline of the tooth. This outline lies in the image on the screen between the point of the needle itself and the reflection of it in the face of the tooth.

Hoist, Electric, McCollum
Joslyn Manufacturing and Supply Co., 3700 South Morgan St., Chicago, Ill.
"American Machinist," May 25, 1922



The speed-reducing gearing consists of three internal ring gears, three planetary pinions, and a high-speed pinion mounted on the motor shaft. A reduction of speed of from 100: 1 to 350: 1 is obtainable between the driving pinion and the sheave. The action is not reversible, so that the speed-reducing gearing can be operated from the motor end only. Either a.c. or d.c. motors using from 110 to 440 volts can be employed. The hoist is supplied with either rope or chain lift. With the chain lift, a hook can be used on either end. The hoist requires only a small amount of head room.

Skid, Lift-Truck, Steel-Frame
Cowan Truck Co., 7 Water St., Holyoke, Mass.
"American Machinist," May 25, 1922



The platform or skid is used with hand-operated lift trucks. The frame of the skid consists of two $2\frac{1}{2}$ x 2 x $\frac{3}{16}$-in. angle irons. Pine planking is secured to the angles by four counter-sunk bolts. The feet of the skid are $1\frac{1}{2}$ in. wide and $\frac{1}{4}$ in. thick and are secured to both the top and the sides of the angle-iron frames. The skids are made in eight lengths from 24 to 80 in., and in nine widths from 24 to 48 in. All sizes can be furnished in heights of $6\frac{1}{2}$, $7\frac{1}{2}$ and $9\frac{1}{2}$ in., and the larger sizes of $11\frac{1}{2}$ in. also. Special sizes and forms of skids can be furnished to suit special requirements.

Clip, paste on 3 x 5-in. cards and file as desired

business which now bears his name. He was instrumental in disposing of several thousand of the Baxter boilers and engines in the eastern part of the United States, and was one of the first to rebuild and guarantee the equipment which he sold. He incorporated the business of Frank Toomey, Inc., in 1909 and retired from the presidency in 1916, being succeeded by his son, Frank Toomey, Jr. Mr. Toomey was a man of remarkable vision and was well and favorably known throughout the United States and Canada for his honorable and square dealings. He had a wonderful memory and could readily recall various types of equipment that were long obsolete, describing same in detail. He was particularly noted for his kindliness and cheerful disposition, and was held in great esteem by his employees and all who came in contact with him during his long and successful business career.

VALENTINE B. CHAMBERLAIN, JR., New Britain, Conn., mill superintendent of the Stanley Works, died suddenly at Oak Bluffs, Mass., August 5, at the age of 36 years.

LAWRENCE A. DANTON, vice-president of the Litchfield Manufacturing Co., Waterloo, Iowa, died at his home in that city, July 31. Mr. Danton was widely known throughout the central western states through his work as general sales manager for the company. He entered the employment of the concern in 1895 and in 1907 moved to Waterloo to become general sales manager. In 1912 he was elected secretary and in 1920, vice-president.

Book Reviews

Metal Cutting Tools. By A. L. De Leeuw. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, and 6 and 8 Bouverie St., E. C. 4, London, England. 328, 6 x 9-in. pages, 306 illustrations. Price $3.

The author in an extended experience as engineer in large manufacturing establishments has had abundant opportunities to study the action of cutting tools under varying conditions.

He has used his opportunities both wisely and well, and now gives to the public the results of his observations and experiences through this book, which like many other good books, had its inception in a series of articles written for *American Machinist*.

Perhaps there is nothing in mechanics so little understood as the real action of metal cutting tools or why some are successful while others fail. Mr. De Leeuw plainly states in his preface that the purpose of the book is to bring before the reader the principles that must be applied in the selection, maintenance and use of metal cutting tools rather than to acquaint him with the multitude of existing tools. That he has more than fulfilled his purpose will be evident to anyone who reads the book.

Beginning with a chapter on the formation of chips, the author leads logically and progressively up to tools of all conceivable types and varieties and thoroughly explains their principles and analyzes their action. Perhaps one of the most valuable features of the book, especially to young engineers, is that in presenting many and varied types of tools, the author thoroughly explains why some are good and some are bad.

Practice based on a study of this book by tool designers and executives in charge of production would undoubtedly show results in increased efficiency. No one in any way responsible for the efficiency of metal cutting tools, either in their design or operation, can afford not to make use of the lessons taught in this book.

The author is to be congratulated on having set before the engineering public, the principles governing the design and efficiency of metal cutting tools in such a clear manner as will enable designers to avoid many pitfalls.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A merchant in Canada wishes to purchase vinegar pumps. Quotations, f. o. b. port of shipment. Cash to be paid. Reference No. 3088.

A commission merchant in Spain desires to purchase and secure an agency for typewriters, modern office equipment, scales, and machinery in general. Quotations, c.i.f. Gijon or Santander. Correspondence, Spanish. Reference No. 3085.

A merchant in France desires to secure an agency for the sale of weighing machines which will automatically indicate the price of any weight of goods when the price of a unit of the goods is known. Quotations, c.i.f. Dunkirk. Reference No. 3074.

The purchase is desired by a merchant in South Africa of machinery for crushing and refining orthoclase feldspar, which has a potash content of over 10 per cent. Capacity of machinery to be 500 tons monthly. Quotations, f. o. b. New York. Payment, letter of credit in United States. Reference No. 3082.

An engineering firm in Italy desires to secure an agency and purchase electrical machinery (motors, transformers), conductors, compressors, transmission materials, metallic wire lamps at half watt, and electrical appliances in general. Quotations, c. i. f. Leghorn or Genoa. Correspondence, Italian or French. Reference No. 3070.

Pamphlets Received

Power Losses in Automobile Tires. Bureau of Standards publication No. 213, by W. L. Holt, associate mechanical engineer, and P. L. Wormley, physicist of the Bureau. For sale by the Superintendent of Documents, Washington, D. C., price 5 cents.

Testing Materials. American Society of Testing Materials, Philadelphia, Pa. A summary of the proceedings of the twenty-fifth annual meeting of the Society held in Atlantic City, June 27-30, 1922, C. L. Warwick, secretary, 1315 Spruce Street, Philadelphia, Pa.

Crankshafts and Bearings. A treatise on the subject of Crankshafts and Bearings by K. R. Peters. The purpose of the treatise is not to introduce a new process, but to show the most efficient and up-to-date methods of perfect fitting and alignment of bearings and crankshafts. Published by the Peters Engineering Co., 3271 Woodland Ave., Philadelphia, Pa.

Industrial Relations. Proceedings of the Industrial Relations Conference held Oct. 24-27, 1921, at Harrisburg, Pa. The publication contains the complete records of the meetings held during the four days' session, viz., Oct. 24, Boiler Progress and Boiler Uniformity; Oct. 25, Industrial Cooperation, Women and Children in Industry, Stabilizing Industry; Oct. 26, Industrial Education; Oct. 27, Industrial Publicity, Medical Supervision in Industry and Workmen's Compensation. Published by the Commonwealth of Pennsylvania, Department of Labor and Industry, Clifford B. Connelley, Commissioner of Labor.

Trade Catalogs

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. A special illustrated booklet containing a story of temperature control in a large industrial plant with a description of the method used to obtain it.

Hand Vise Lathe. The Campbell Manufacturing Co., Worcester, Mass. A bulletin describing the Ramsdell hand vise lathe, a complete set of tools in a case, consisting of a double-sided combined tool and die holder, feeding device, double end balanced box tool holder, two cutting knives and a set of bushings to take stock from ⅛ in. to ⅝ in. as well as the corresponding S. A. E. dies. The set is especially suited to the needs of the machine owner, garage man or farmer to enable either to make emergency repairs.

Motor Starters. The Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. A new booklet, Folder 4,500, illustrating and describing the company's line of full-safety motor starters, designed to afford complete protection to the operator and the motor. Four types of starters are featured having capacities ranging from the smallest motor up to 15 hp., 550 volts.

Electric Motors. The Ohio Electric and Controller Co., 5900 Maurice Ave., Cleveland, Ohio. An eight-page bulletin, known as bulletin No. 203, containing detailed descriptions with numerous illustrations, of the company's fractional horse-power alternating and direct current motors, the former product in 110 to 440 volts, 25 to 60 cycles, and the latter, in 32 to 250 volt sizes. The last page of the bulletin contains a complete price list and specifications governing both types manufactured by the company in the various sizes of horsepower.

Steel Windows. The David Lupton's Sons Co., Philadelphia, Pa. A new publication of seventy-two pages, known as catalog No. 110. This new catalog, featuring the steel windows manufactured by the company, shows the excellent skill and arrangement which has marked the other publications of the company. It contains a great variety of illustrations showing not only the construction details of the company's steel window products, but numerous cuts of complete installations. There are also contained many line cuts and considerable data of value to architects and engineers.

Electric Tools. The Black & Decker Manufacturing Co., Baltimore, Md. A new forty-page catalog entitled "P.M.P." the initials signifying products, markets, policies. The catalog is unque in arrangement in that it is a complete merchandising program covering the company's comprehensive line of electric tools published under one cover. The first part of the catalog contains detailed descriptions of each of the many styles of tools with their special features emphasized. A market analysis follows, pointing out the various fields in which the tools are applicable. The publication concludes with an outline of the company's manufacturing and sales policy which is of especial interest to jobbers and dealers, containing as it does, numerous sales and advertising aids. The catalog shows skill in the selection of the many illustrations and in the general preparations of the material and data contained therein.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Buck Falls, Pa., (Delaware Water Gap).

National Machine Tool Builders' Association, annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Milling Machine, Vertical, High-Speed, No. 2
Becker Milling Machine Co., Worcester, Mass.
"American Machinist," May 25, 1922

The No. 2 vertical milling and routing machine has been changed to fit it for high-speed work. It is equipped with an auxiliary ball bearing to take the belt pull, so that the machine can be run 50 per cent faster than the standard machine. Two sizes of interchangeable pulleys are provided for the spindle. Another improvement in the machine is the use of a full box-form knee. A steel chip guard is provided in the knee in front of the carriage, to protect the crossfeed screw.

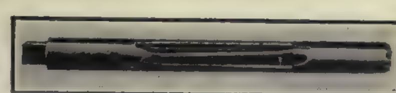
Hoist, Wheel, Tire Press, Hand
Reliance Trailer and Truck Co., 1642 Howard St., San Francisco, Cal.
"American Machinist," May 25, 1922

The hoist is used on presses to lift automobile truck wheels into place when changing tires. Two clamps, secured to the upright frame of the press, carry adjustable brackets in which the trunnions of the swinging arm are fastened. Hoisting is accomplished by hand, through a gear reduction connected to the crank at the pivoted end of the device. The wheels are secured by means of cones placed in the hubs. Besides being used on a tire press, the hoist is adaptable to general work around the shop. Different brackets can be furnished for securing it. Capacity, 1,200 pounds.

Grinder, Electric, Portable, Model 35
Forbes & Myers, 172 Union St., Worcester, Mass.
"American Machinist," May 25, 1922

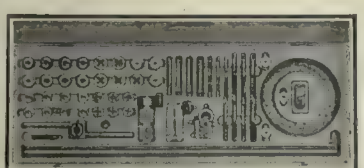
The motor of the device is of the squirrel-cage induction type and has fireproof windings. The insulation is asbestos specially treated to bind the fibers into a mass capable of withstanding a red heat indefinitely. The motor has $\frac{3}{4}$ hp. and a normal speed of 3,600 r.p.m. The wheel ordinarily carried is 6 x 1 in. in size. In order to prevent the operator from receiving an electric shock from the tool, a grounded wire is employed. The wheel is equipped with a guard and convenient grips are provided for the operator. The switch is within easy reach in the handle.

Reamer, Expansion, "Parob"
Gammons-Holman Co., Manchester, Conn.
"American Machinist," May 25, 1922



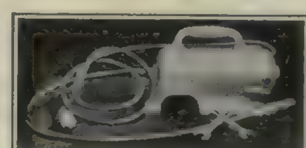
The cutting edges of the reamer are alternately parallel and oblique to the axis of the tool. The reamer is expanded from the center by means of a tapered plug, adjusted by a screw in the end. The end of the pilot is recessed to a considerable depth to protect the screw head, and to act as a center for regrinding. Cutting edges on the extreme end of the pilot portion remove the burrs and permit the reamer to enter the hole easily. The reamers are made in one piece, with blades cut from the solid. They are made in standard sizes from $\frac{1}{2}$ to $1\frac{1}{2}$ inches.

Vise-Lathe Set, Hand, Ramsdell
Campbell Manufacturing Co., Slater Bldg., Worcester, Mass.
"American Machinist," May 25, 1922



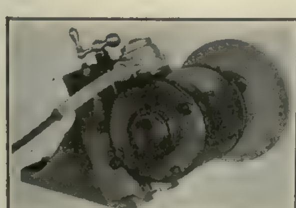
The tool is intended for accurately cutting screws, studs and pins from bar stock without the use of a lathe or screw machine, the work being held in a vise. Wire springs can be wound to any desired pitch. Any combination of bushings, dies and taps in U. S. S. or S. A. E. standard sizes can be furnished. For turning, a different set-up is employed. Bar stock up to and including 1 in. in diameter can be handled. Each set is furnished with a knurling attachment and with centering bushings from $\frac{1}{4}$ to 1 in. in diameter, by $\frac{1}{16}$-in. steps.

Flexible-Shaft Outfit, Motor-Driven, Portable, H-250
Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn.
"American Machinist," May 25, 1922



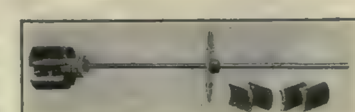
A high-speed motor of $\frac{1}{8}$ hp. for operation on 110-volt a.c. or d.c. is inclosed in an aluminum casing having a base and handle. A ventilating fan keeps a current of air passing between the field and the armature windings and cools both front and end cap bearings. The flexible shaft is $\frac{1}{4}$ in. in diameter, 3 ft. long and wound with wire. A ball-bearing handpiece with a $\frac{3}{16}$-in. chuck is provided. The No. 4 or 5 shaft, sheath and handpiece are interchangeable on the motor unit. Six feet of drop cord with an attachment plug are provided with each motor.

Grinding Attachment, Angle-Plate, Motor-Driven, 12-In.
Van Dorn Electric Tool Co., Cleveland, Ohio
"American Machinist," May 25, 1922



The principal feature of the attachment is an inclined slide by which both feed and spindle height adjustment can be obtained by movement in one plane, giving the effect of both horizontal and vertical slides. The rigidity of the machine is greater than that of the vertical slide type. The shaft is $1\frac{7}{16}$ in. in diameter through the motor and 1 in. through the wheel. Motors for a.c. or d.c. are interchangeable, and have a normal continuous capacity of $1\frac{1}{3}$ hp., with a peak capacity of $2\frac{1}{4}$ hp. and a speed of 1,800 r.p.m. Weight, 175 pounds.

Lapping Tool, Internal
Stimson Engineering Co., 598 Sixty-Eighth Ave., Milwaukee, Wis.
"American Machinist," May 25, 1922



The device is used for lapping the bores of automotive cylinders. The shoes which make the contact with the cylinder bore are held by flexible connections at one end of the shaft, and can be easily removed. Two sets are provided to fit bores $2\frac{3}{4}$ to $3\frac{1}{2}$ in. in diameter, and $3\frac{1}{2}$ to $4\frac{1}{4}$ in., respectively. A nut operating the taper adjustment serves to fit the shoes to the cylinder. The disk mounted on the shaft is adjustable in position, acting as a stop and preventing the tool from feeding too deeply into the cylinder. The tool can be operated by an electric or air-driven portable drill or by a drilling machine, or it can be attached to a lathe tailstock. The tool requires no lining up with the cylinder.

The Weekly Price Guide

Rise and Fall of the Market

Advances—Price of steel shapes, plates and bars, f.o.b. Pittsburgh, nearing minimum of $1.80 per 100 lb. Quotation of $1.70 fast disappearing, except on orders for shipment during last quarter. Sustained demand, however, giving rise to quotations of $2 per 100 lb. on plates in small tonnages, for early shipment. Recent rise in mill price of bolts, nuts and rivets, reflected in reduction of about five points in warehouse discounts in Cleveland and New York.

Lead quoted at 6½c. as against 6c. per lb. in New York warehouses. Copper sales heavier than year ago; prices firm. Linseed oil up 2c. per gal. (5 bbl. lots) in New York.

Declines—Tin quoted at 32½c. as compared with 32¾c. per lb. last week, in New York warehouses. Zinc market easier; lower prices in St. Louis.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.56
Northern Basic	27.27
Southern Ohio No. 2	27.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.66
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.76
Virginia No. 2	30.17
Basic	27.25
Grey Forge	27.25
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	8.75	6.5	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]@2.60	3.78	3.50	3.75
No. 12	2.45@2.65	3.83	3.55	3.80
No. 14	2.50@2.70	3.88	3.60	3.85
No. 16	2.70@2.90	3.98	3.70	3.95
Black				
Nos. 17 and 21.	3.00@3.25	4.15	3.80	4.30
Nos. 22 and 24.	3.05@3.30	4.20	3.85	4.30
Nos. 25 and 26.	3.10@3.35	4.25	3.90	4.35
No. 28	3.15@3.40	4.35	4.00	4.45
Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14.	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21.	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24.	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	[illegible]
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	3.78	3.50	3.48
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	4.80	4.91	5.08
Cold finished shafting or screw	3.50	3.30	3.40
Cold finished flats, squares	4.00	3.80	3.90
Structural shapes (base)	2.83	2.66	2.70
Soft steel bars (base)	2.73	2.56	2.60
Soft steel bar shapes (base)	2.73	2.56	2.60
Soft steel bands (base)	3.38	3.06	3.35
Tank plates (base)	2.83	2.66	2.38
Bar iron (2.25 at mill)	2.70	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{16}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.50
Lead (up to carlots), St. Louis ..... 5.52½; New York	6.10
Zinc (up to carlots), St. Louis ..... 6.30 ; New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	19.50	18.75
Brass tubing (100-lb. lots)	21.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.25	17.50	15.75
Brass wire (carlots)	18.25	19.50	.....
Zinc sheets (casks)	8.50	9.00	.....
Solder (½ and ½), (caselots)	23.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.00	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	12.00
Copper, heavy, and wire	11.75	11.00	11.25
Copper, light, and bottoms	9.75	9.50	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6 25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.25	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	5.60	7.25
IC,	14x20		7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.17	1.01
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville..per net ton		13.50@14.00	
Coke, prompt foundry, Connellsville..per net ton		15.00@15.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	60%
1⅛ and 1¼x3 in. up to 12 in.	25%	65%	60-10%
With cold punched sq. nuts	30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	....	$4.00 off
Button head bolts, with hex. nuts	20%	$3.90 net	.....
Hex. head and hex. nut bolts	25%	....	65-5%
Lag screws, coach screws	45%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	....	55%
Tap bolts, hex. head, list plus	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70-10%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.00	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	55%	65%	60-10%
Rivets, tinned	55%	65%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$4.50	$3.50	$3.25
Cone heads, ditto (net)	4.60	3.60	3.35
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.35 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	30-5%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Norwalk—Commerce Street Garage, Commerce St., A. Erickson, Purch. Agt.—one lathe and tool grinder for automobile repair work.

Conn., South Norwalk—Schaub & Byrne, 16 Washington St.—one lathe for garage work (used).

Ill., Chicago—J. L. Mott Iron Wks., 1010 North Clark St., A. D. Erickson, Purch. Agt.—lathe, drill press, belting, shafting, hangers, bearings, tab hammer, pulleys, and cutting off power machine.

Ill., Chicago—B. J. Stephens, 20 North Clinton St.—power punch press.

Kan., Sedgwick—The Sedgwick Alfalfa Mills, J. S. Congdon, Purch. Agt.—power lathe.

Kan., Wichita—Bunker Auto Co., South Topeka Ave.—electric portable steel drill.

Kan., Wichita—Philadelphia Battery Co., (Electrical Dept.) 1st and Topeka Sts., A. Center, Purch. Agt.—power lathe.

Kan., Wichita — White Truck Co., 217 West Lewis St., J. F. Kremel, Purch. Agt.—power drill press, lathe, emery wheel and stand, shafting, belting, hangers, bearings and pulleys.

Md., Frederick—G. W. Sheeley Co.—small punching machine to stamp light road punch work.

Mich., Grand Rapids—Wolverine Metal Specialties Co.—machine shop equipment.

Minn., Minneapolis — Minneapolis Metal Products Co., 10th Ave. S. E. and 8th St.—machine tools for sheet metal work, including shears, punches, and one electric spot welder.

N. Y., Buffalo—Allen Mfg. & Welding Corp., 726 Washington St.—electric floor base grinder, also electric portable grinder.

N. Y., Buffalo—D. Liberty, 167 Bway.—machinery, tools and equipment for proposed [illegible] garage.

N. Y., Long Island City—Wappler Electric Co., 162 Harris Ave., A. Verhoef, Purch. Agt.—one No. 2 surface grinder (Brown and Sharpe).

N. Y., New York City—H. Medalie, 460 East 164th St.—equipment for machine shop.

S. D., Minot—B. Johnson—heavy machine shop equipment.

Pa., Forest—Bd. of Educ.—variety saw, [illegible] bench tools, and woodworking machinery.

Pa., Pittsburgh—The Blaw-Knox Co., [illegible]—sheet metal squaring shears.

Pa., Rochester — M. R. Regan — pipe [illegible] equipment.

Pa., Scranton—C. W. [illegible], 1208-1212 [illegible] Ave.—complete mechanical equipment and tools for large gas and service station, now under construction.

Pa., Scranton—[illegible] Coal Co., 108 [illegible]—equipment for proposed 1 story machine shop near Wilkes-Barre.

Pa., Sharpsville—[illegible], 12th [illegible]—equipment and machinery for proposed machine shop.

Pa., Wilkensburg (Pittsburgh P. O.)—[illegible] Machine & Mfg. Co., [illegible] Ave., [illegible], Pres.—drill press, forge, and welding outfit.

Pa., Williamsport—Imperial Band Instrument Mfg. Co., c/o [illegible] Miss, Archt.—machinery for the manufacture of band instruments.

Va., Richmond—Acme Auto Service Co., 207 Hull St.—drill press.

Va., Richmond—W. T. Gray Co., 511 West Clay St.—lathe and drill for automobile repair shop.

Va., Richmond—Hearn Motor Co., 1101 Hull St.—drill, lathe, and burning in machine.

W. Va., Clarksburg—Pittsburgh & West Virginia Gas Co.—machinery for machine shop, garage and repair shop.

Wis., Madison—Madison Garage & Machine Co., 18-24 North Charter St., C. L. Lodine, Mgr.—machinery and equipment for auto repair and machine shop.

Wis., Madison—A. Maisano, 821 Regent St.—machinery for proposed auto repair shop, including a 1-ton press.

Wis., Milwaukee—Diamond Motor Service, c/o L. F. Miller, 714 Holton St.—auto repair machinery including drill press, air tank and pump.

Wis., Milwaukee—P. Portman, 3212 Burleigh St. (auto repair shop)—grinder, lathe, drill press, air tank and pump.

Wis., Waukesha—P. Wolf, 220 Main St., (auto repair station)—drill press and small tools.

India, Bombay—Valabhdas Runchordas & Co., 70 Appollo St.—lathes, milling machines, shapers, drills, tools for small shop work, machinery for the manufacture of tin gramophone horns, tin toys, gramophone records, gramophone and sewing needles and needle boxes; machinery for cutting mica from 1 to 3 in. in diameter; woodworking machinery for the manufacture of gramophone-cabinets; spraying machinery for painting gramophone horns and toys; printing machinery. Catalogue with full particulars and lowest export prices, also samples of gramophone needles, springs and cabinet fittings of all kinds, required in the manufacture of cabinets.

Machinery Wanted

Conn., Bridgeport—McCathron Boiler Wks. Co., 72 Knowlton St.—air compressor, capacity 80 cu.ft. per minute.

Ga., Atlanta—W. H. Bradley, 219 Grant Bldg.—one 20-ton narrow gauge saddle tank locomotive.

Ill., Altona—The Record—one 25 in. power paper cutter.

Ill., Charleston—The News—one 30 point headletter mold, 13 ems.

Ill., Chicago—Chicago Book Bindery, 500 South State St.—one 14 x 22 printing press for power equipment.

Ill., Chicago—Wanner Mchy. Co., 716 South Dearborn St.—power folding machine, large and small power paper cutter, also power stitcher.

Ind., Fort Wayne—Fort Wayne Oil & Supply Co., 225-229 East Columbia St.—one 6 to 12 in. motor driven pipe machine.

Ind., Goshen—News Printing Co.—linotype machine, model No. 5.

Kan., Wichita—M. R. Amerman, (general contractor) 248 North Market St.—paving mixer.

Kan., Wichita—The Fibre Mfg. Corp., Room 612, New Orpheum Bldg., C. T. Banon, Pres.—wood and fibre working machinery, shafting, hangers, bearings, pulleys, belting, sawing, cutting off.

Kan., Wichita—J. K. Gano, 252 South Chautauqua Ave.—power printing press.

Kan., Wichita—Lumber & Supply Co., Murdock Bldg., A. Glikinson, Purch. Agt.—power planer.

Kan., Wichita—J. A. McMaster, 1352 South Water St.—job printing press for power equipment.

Kan., Wichita—G. Miller, 742 Hendricks St.—large job printing press and power, lathe.

La., Baton Rouge—Bd. of Educ., R. C. Gordon, Pres.—woodworking and ironworking machinery and equipment for new school.

Mass., Palmer—The Journal—one 16 x 21 in. press for power equipment.

Mich., Williamston—C. King—one 4 page, 7 column news and job presses, and folder for power equipment.

Minn., Minneapolis — Washington-Crosby Co., (flour manufacturers)—mechanical equipment for proposed 4 story warehouse at Blackwell Canal, Buffalo, N. Y.

Mo., Kansas City—Bd. of Educ.—equipment for boys manual training shop, also floor scarifier.

Mo., Kansas City—Davis Truck Co.—one truck, 3 to 5 ton.

N. Y., Amsterdam — Fitzgerald Bros., manufacturers of hosiery—thread cutter (floating type), also style 60 U. D. Merrow sewing machine.

N. Y., Auburn—Auburn Converting Co., Inc., 185 Clar St., S. Tabor, Dir.—machinery and equipment for the manufacture of twine and twine products.

N. Y., Auburn—W. J. Henry—complete machinery and equipment for proposed \$100,000 tool plant on York St.

N. Y., Brooklyn—Clifton Knitting Mills, 134 Stanhope St.—16 in. Brinton circular machines.

N. Y., Geneva—Supply Sales Corp., F. Dwyer, Pres.—machinery for the manufacture of cloth and wood specialties.

N. Y., Lockport—Lockport Fdry. Corp., R. E. Bryant, Treas.—foundry and machine shop equipment for proposed extension to plant, also iron working machinery.

N. Y., Odessa—H. Couch—equipment for development of salt deposits, here.

N. Y., Rochester—C. C. Hall, Inc., 347 Blossom Rd., (packers of fruit and apples)—packing machinery, also equipment for large forge plant.

N. Y., Rochester—Rochester Telephone Corp., 59 Stone St.—equipment for proposed building on St. Paul St., to include service and repair departments, garage, stockrooms and cabinet shop.

N. Y., Rochester—Sill Stove Wks., Inc., Oak St.—machinery and equipment for proposed foundry cleaning plant at 524 Oak St.

O., Delaware—Climax Rubber Co., T. Waddell, Purch. Agt.—2 vulcanizers, and other tube making machinery.

O., Mansfield—Pederson Machine Co.—machinery for the manufacture of umbrellas.

O., Newton Falls—Newton Falls Herald, A. Todd, Jr., Purch. Agt.—linotype and stereotyping outfit.

O., Portsmouth — Portsmouth Stove & Range Co., Gallia and Campbell Sts.—machinery and equipment for proposed addition to factory.

O., Toledo—The Milburn Wagon Co.—one 5 ft. steel power brake, to handle up to 16 in. gage metal.

Okla., Bartlesville—Phillips Petroleum Co.—machinery and equipment for proposed gasoline absorption plant.

Okla., May—The May Bugle, A. Latta, Purch. Agt.—newspaper power and job press.

Okla., Orlando—E. Davis—leather working and polishing machinery, shafting, hangers, bearings, and pulleys.

Pa., Carrick (Pittsburgh P. O.)—Bd. of Educ., G. L. Suttler, 2417 Brownsville Rd., Pres.—equipment for vocational department of proposed new school.

Pa., Easton—Uhl's Brewing Co., G. F. Coffin, Solicitor—machinery for manufacturing bottling and preparing beverages.

Pa., Freedom—Freedom Oil Works—machinery and equipment for proposed 2 story addition to garage and repair shop.

Pa., Glen Olden—A. K. Sonnekalb (machine shop and trunk factory)—3 riveting machines for power equipment.

Pa., Grove City—McKay Carriage Wks., Erie St.—equipment for addition to shop, will manufacture automobile bodies.

Pa., Patton—Bd. of Educ., F. L. Brown, Secy.—equipment for manual training department of new high school.

Pa., Pittsburgh—Pittsbugh Railways Co., 6th Ave.—one locomotive crane.

Pa., Pittsburgh—United Engineering & Fdry. Co., Farmers Bank Bldg.—one 40 ton and two 10 ton mill type cranes for National Enameling & Stamping Co., St. Louis, Mo.

Pa., Pittsburgh—U. S. Drug & Chemical Co.—equipment for proposed drug and chemical plant.

Pa., Sharon—Bd. of Educ., W. Whitehead, Secy.—equipment for manual training department of proposed high school.

Pa., Sharon—Ebblie & Hunter, 64 Vine St.—one machine paper baler.

Pa., Sharon—Z. N. Mason, 691 South Irvine St.—U. S. Hoffman pressing machine; medium size electric finisher; machinery and equipment for electric shoe repair.

Pa., Warren—P. V. Edgett, 49 Clark St.—one mortising machine. (new or used).

Pa., Waynesboro—The Frick Co., (manufacturer of refrigerating plants and ice machines)—two 5-ton, one 10-ton, and six 25-ton cranes.

Pa., Wrightsville—H. K. Smith—machinery and equipment for the manufacture of thermometers and like instruments.

Tenn., Memphis—Memphis Sash & Door Co., 673 South Dudley St.—complete equipment and machinery for proposed sash and door factory, including jointers, planers, jigs, etc., on R.R. St. and Roland Ave.

Tex., Beaumont—Stedman Fruit Co.—refrigeration machinery and equipment for $180,000 refrigerator plant.

Tex., Cleburne—Home Steam Laundry, 416 East Wardville St.—boiler feed pump.

Tex., Dallas—Brown Garage—4612 Main St.—band saw for power equipment.

Tex., Sherman—Hunter Printing Co.—one 7 column quarto folder, and set of 8 point mats.

Va., Richmond—S. W. Hatton, 905 Hull St. (batteries)—rectifier.

Wash., Brewster—D. L. Gillespie, Proprietor of Brewster Herald—presses and linotype machine.

W. Va., Clarksburg—Clarksburg Ice & Storage Co.—machinery and equipment for proposed ice storage plant, capacity 4,500 ton.

W. Va., Clarksburg—Hornor Bros.—equipment and machinery for proposed $30,000 ice cream plant at Shinnston, W. Va.

W. Va., Weirton—Weirton Steel Co.—one ladle crane.

Wis., Cudahy—J. Bersic, Layton Ave. and Kingan St.—machinery for sheet metal working.

Wis., Green Bay—The Bd. of Educ., I. H. McIntyre, City Hall, Supt.—equipment and machinery for proposed manual training building.

Wis., Milwaukee—Ever-Glow Light Co., 776 Tentonia Ave., J. Geissman, Purch. Agt.—special machinery for the manufacture of metal lighting fixtures, belting, and shafting.

Wis., Milwaukee—H. E. Krueger, 1040 Holton St.—equipment for mechanical bake shop, and electric motors.

Wis., Milwaukee—Midwest Die Casting Co., c/o E. A. Rathgen, 1211½ National Ave. (rear)—die casting machinery.

Wis., Milwaukee—Milwaukee Steam Appliance Co., c/o L. E. Ficheurx, 120 Wisconsin St.—special machinery for the manufacture of oil pumps, gauges, etc., also shafting and belting.

Wis., Milwaukee—Western Newspaper Union, 286 Milwaukee St.—auto press.

Wis., Platteville—E. H. Johnson—woodworking machinery for proposed toy factory.

Wis., Racine—Horlick Malted Milk Co., Horlicksville—special machinery for proposed manufacturing plant.

Wis., Wausau—Tractor & Truck Improvement Co., c/o D. Healy, 506½ 3rd St.—machinery for the manufacture of tractor drives and transmissions.

Wyo., Casper—Lukis Candy Co., C. C. Lukis, Pres.—machinery and equipment for large candy manufacturing plant.

Ont., Ganonoque—Ontario Steel Products Co., Ltd.—$60,000 worth of machinery for steel plant.

Ont., Niagara Falls—Dominion Insulator Co.—machinery and equipment for proposed insulator factory.

Ont., St. Thomas — St. Thomas Metal Signs, Ltd.—Hoe front delivery, stop cylinder printing press No. 9½, to take sheet metal 36 x 60 in.

Ont., Sarnia—Brutons Pure Food Bakery—complete modern machinery and equipment for 2 story, 65 x 150 ft. bakery and confectionery building.

Ont., Thamesville—B. E. Wallace—prices on saw mill equipment and machinery to replace that destroyed by fire.

Ont., Toronto—Toronto Transportation Comn., Yonge and Front Sts.—equipment for proposed car barns and repair shops.

Ont., Wallaceburg—Dominion Glass Co., Ldt.,—cable conveyors for handling 33 x 10 in. pallets from machine to drying racks.

Ont., Wallaceburg—Sydenham Brick & Tile Co., E. Morse, Genl. Mgr.—equipment for addition to brick and tile plant.

Que., Acton Vale Town—J. S. St. Pierre, Secy.-Treas.—supply of mechanical gravity filters and equipment for pumping station.

Que., Montreal—Talpis & Kert, (metal merchants) 125 Nazareth St.—complete laboratory equipment to replace that which was destroyed by fire. (between $2,000 and $3,000).

Metal Working Shops

Ariz., Superior—Magma Copper Co. plans to build a large smelting plant here. Estimated cost $500,000. Architect not announced.

Cal., Los Angeles—Union Pacific Ry., 610 South Main St., plans to build shops and classifications yards and make other improvements on a 516 acre site adjoining southern boundary of city. Estimated cost $29,000,000. Work will be supervised from local offices. Private plans.

Cal., San Francisco—H. Baumann, Archt., 251 Kearny St., is receiving bids for the construction of a 1 story garage and battery service station on 4th Ave. and Geary St., for J. Weissbein, c/o architect. Estimated cost $12,000.

Ill., Chicago—S. Malty, c/o Dubin & Eisenberg, Archts., 19 West Washington St., has awarded the contract for the construction of a 1 story, 125 x 200 ft. garage on Taylor St. and Independence Blvd. Estimated cost $60,000.

Mich., Battle Creek—Rich Steel Products Co., Springfield Pl., plans to build a 3 or 4 story factory. Estimated cost $500,000. Will not mature before 1923. Architect not selected.

Minn., Duluth—M. O. Anderson, 1930 East 4th St., will build a 1 story, 100 x 140 ft. garage on Superior St. and 14th Ave. E. Estimated cost $75,000.

Minn., Minneapolis—The City, c/o W. R. Young, registrar, Water Dept., City Hall, plans to build a 2 story warehouse, shops, garage and offices, on 5th St. and East Hennepin Ave. Estimated cost $60,000. Architect not selected.

Minn., Minneapolis—The Dayton Co., 7th St. and Nicollet Ave., has awarded the contract for the construction of a 2 story, 100 x 143 ft. garage on 11th St. and 1st Ave., N. Estimated cost $61,000.

Minn., Minneapolis—Payne Motor Co., 1301 Hennepin Ave., has awarded the contract for the construction of a 3 story, 100 x 150 ft. garage and sales building on 14th St. and Harmon Pl. Estimated cost $117,098.

N. H., Manchester — F. P. Carpenter, Mechanic St., had plans prepared for the construction of a 1 story garage, service station and repair shop. Estimated cost $50,000. W. H. Rhodes, 574 Congress St., Portland, Me., Archt.

N. Y., Auburn—W. J. Henry and others, 128 South St., plan to build a large tool factory on York St. Estimated cost $100,000. Engineer not announced.

N. Y., Rochester—Gallagher Motor Co., Inc., has awarded the contract for the construction of a 72 x 159 ft garage and service station, 32 ft. high, on Monroe Ave. Estimated cost $50,000. Noted July 20.

N. Y., Rochester—Rochester Telephone Corp., 59 Stone St., is having plans prepared for the construction of a 2 story, 145 x 200 ft. building on St. Paul St., to include service and repair departments, garage, stockrooms and cabinet shop. Estimated cost $130,000. J. F. Warner, c/o owner, Archt.

O., Cleveland—A. W. Henn and J. L. Free, 1004 Prospect Ave., have awarded the contract for the construction of a 1 story, 100 x 200 ft. commercial building and garage at 3746 Prospect Ave. Estimated cost $75,000. Private plans.

O., Columbus—Lawwell-Leish Co., 97 North 4th St., is having plans prepared for the construction of a 2 story, 32 x 187 ft. garage and service station. Estimated cost $40,000. Private plans.

O., Lima—Lima Locomotive Wks., South Main St., has awarded the contract for the construction of additions to its plant, including 5 buildings. Estimated cost $1,500,000.

O., Portsmouth—Portsmouth Stove & Range Co., Gallia and Campbell Sts., has awarded the contract for the construction of a 5 story addition to its stove factory. Estimated cost $75,000. Architect not announced.

O., Portsmouth — Universal Motor Co., 9th and Chillicothe St., has awarded the contract for the construction of a 2 story, 130 x 296 ft. garage. Estimated cost $80,000.

Pa., Carbondale—S. D. Chandler, 82 Main St., plans to build a 3 story garage and salesroom, on South Main St. Estimated cost $40,000. Architect not announced.

Pa., New Castle—American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, plans to build a tin mill unit at its Shenango Wks., here. Estimated cost $5,000. Architect not announced.

Pa., Oil City—National Transit Pump and Machine Co. plans to build a 1 story, 80 x 200 ft. foundry. Private plans.

Pa., Osgood (Greenville P. O.)—De Roth Steel Truck & Car Wheel Co., 611 Keystone Bldg., Pittsburgh, has awarded the contract for the construction of a 1 story, 100 x 200 ft. manufacturing plant here. Noted Aug. 3.

Pa., Pittsburgh—J. P. Koehler & Co., 3718 Liberty Ave., has awarded the contract for the construction of a 1 story metal factory. Estimated cost $15,000.

Pa., Pittsburgh—Standard Underground Cable Co., 16th and Pike Sts., has awarded the contract for altering its manufacturing plant. Estimated cost $20,000.

Pa., Starbrick (Warren P. O.)—Warren Steel Car Co., plans to build a 1 story, 90 x 200 ft. factory. Estimated cost $15,000. Private plans.

W. Va., Clarksburg—Pittsburgh & West Virginia Gas Co., plans to remodel present buildings and build a small addition, to include complete machine shop, garage and repair shop. Estimated cost $5,000. Architect not announced.

Wis., Chippewa Falls—F. A. Bigler, 14 East Central St., is having plans prepared for the construction of a 2 story, 124 x 130 ft. garage on Grand Ave. Estimated cost $[illegible]. E. J. Hancock, Laycock Bldg., Eau Claire, Archt.

Wis., Madison—A. Maisano 521 Regent St., has awarded the contract for the construction of a 2 story, 50 x 90 ft. garage and repair shop. Estimated cost $40,000.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St., has awarded the contract for the construction of a 1 and 2 story, 60 x 160 ft. factory and office building. Estimated cost $65,000.

Ont., Leaside—Durant Motor Co. of Canada, Royal Bank Bldg., Toronto, has awarded the contract for the construction of a 1 story, 40 x 100 ft., 2 story, 80 x 401 ft., a 2 story 100 x 401 ft., a 1 story, 20 x 200 ft. and a 1 story 130 x 500 ft. auto factory, here. Estimated cost $750,000. Private plans.

Ont., Sault Ste. Marie—Algoma Steel Corp., 503 Queen St. E., plans to build a 1 story heat treatment plant. Estimated cost $50,000. Private plans.

Ont., Toronto—James, Proctor & Redfern, Engrs., 36 Toronto St., are receiving bids for the construction of a 2 story garage, show room and auto parking station, for the Court St. Auto Parking Service Co., Ltd., 14 Court St. Estimated cost $100,000.

General Manufacturing

Ala., Magazine—Alabama Saw Mills plans to rebuild portion of plant destroyed by fire. Estimated cost $50,000. Architect not announced.

Cal., Burlingame—Dairy Delivery Co., 2550 19th St., San Francisco, is having plans prepared for the construction of a 1 story dairy on San Matteo and Howard Aves., here. Estimated cost $20,000. W. H. Toepke, 942 Market St., San Francisco, Archt.

Cal., Santa Clara—Wolfe & Higgins, Archts., Ameriais Bldg., San Jose, are receiving bids for the construction of a 1 story newspaper plant here for the Santa Clara News.

Cal., Turlock—Hunt-Jewett-Bentz Co., (California Sweet Potato Corp.) has awarded the contract for the construction of a 1 story [illegible] and vinegar plant on North 1st St. Estimated cost $100,000.

Conn., Danbury—The Mallory Hat Co. has awarded the contract for the construction of a 6 story, 40 x 60 ft., and a 2 story, 60 x 160 ft. manufacturing building. Estimated cost $100,000.

Conn., Manchester—The Orford Soap Co., Hilliard St., has awarded the contract for the construction of a large addition to its plant. Noted July 6.

Conn., New London—New England Carpet & Lining Co., Water and John Sts., has awarded the contract for the construction of a 1 story, 40 x 100 ft. factory addition. Estimated cost $20,000.

Fla., Tampa—The White Star Laundry, Inc., [illegible] Cass St., has awarded the contract for the construction of a 2 story, 105 x 172 ft. steam laundry. Estimated cost $200,000. H. T. Richards, Pres.-Mgr.

Ill., Chicago—Chicago Butchers Calf Skin Assn., Inc., 705 Milwaukee Ave., had plans prepared for the construction of a 3 story, 24 x 140 ft. fertilizer plant at 3208 South Robey St. Estimated cost $50,000. H. C. Christensen, 7258 Union Ave., Archt.

Ill., Chicago—McAdam Mfg. Co. has awarded the contract for the construction of a 2 story factory, for the manufacture of paints, on 27th and Troy Sts. Estimated cost $100,000.

Ind., Frankfort—R. W. Voorhees plans to build a 1 story, 44 x 140 ft. lumber plant and mill. Estimated cost $30,000. Architect not selected.

La., Price (Isabel P. O.)—The Foster Canning Co., Biloxi, Miss., plans to build a canning plant, for shrimp and oysters, here. Estimated cost $30,000.

Mass., Palmers—M. J. Whittall and associates, Brussels St., Worcester, will build a 2 story, 70 x 210 ft. addition to carpet mill, also a 1 story storage building, at plant here. Estimated cost $80,000. Private plans.

Mich., Kalamazoo—City election in September to vote on $2,000,000 bond issue, for a gas plant consisting of 6 buildings. Preliminary survey is being made by Burns & McDonnell, engrs., 400 Interstate Bldg., Kansas City, Mo.

N. J., Trenton—The Panelyte Board Co., 119 North Montgomery St., plans to build a factory on Whiteheads Rd., for the manufacture of cardboard products. Estimated cost $150,000.

N. Y., Jamestown—Ideal-Peerless Laundry Co., 26 Forest Ave., has awarded the contract for the construction of a laundry addition. Estimated cost $15,000. Noted July 13.

N. Y., Niagara Falls—Kimberly-Clark Co., Inc., Packard Rd., plans to build a paper plant and store house addition. Estimated cost $14,000. Private plans.

N. Y., Rochester—Powertown Tire Corp., Ridgeway Ave., plans to build a 40 x 125 ft. tire service station and salesroom on East Ave. Estimated cost $40,000.

N. Y., Rochester—Rochester Composite Brick Co., East Ave., plans to rebuild portion of plant destroyed by fire. Estimated cost $80,000.

O., Cleveland—L. Bondy Harness Co., c/o C. Bondy, 730 Bway., plans to build a 2 story, 46 x 110 ft. commercial building and factory at 3323 Superior Ave. Estimated cost $40,000. H. Nare, c/o owner, Archt.

O., Cleveland—Wolf Envelope Co., 1749 East 22nd St., is having plans prepared for the construction of a 1 story, 84 x 130 ft. factory addition. Estimated cost $50,000. N. G. Dryfoos, Pres.

O., Warren—General Fire Extinguisher Co., had plans prepared for the construction of a 4 story, 80 x 200 ft. factory. Estimated cost $200,000. W. A. Neracher, Vice. Pres. G. S. Rider & Co., Century Bldg., Cleveland, Archts.

O., Williamsburg—Williamsburg Furniture Co., is having plans prepared for the construction of a 2 story furniture factory. Estimated cost $40,000. J. F. Knight, Pres.

Okla., Bartlesville—Phillips Petroleum Co. plans to build a 4 unit gasoline absorption plant, daily capacity 10,000,000 ft. Estimated cost $400,000. Architect not announced.

Okla., Oklahoma City—Apco Refining Co., Colcord Bldg., plans to build a refinery, capacity 700 bbls. per day. Estimated cost $50,000. Architect not announced.

Pa., Bridgeport—J. Lees & Sons, have awarded the contract for the construction of a 5 story, 103 x 132 ft. factory for the manufacture of textiles.

Pa., Columbia—Peerless Folding Box & Crate Co., c/o F. S. Shuman, Swank Annex, Johnstown, plans to build a 1 story, 50 x 200 ft. factory, for the manufacture of boxes and crates, here. Architect not selected.

Pa., Lancaster—E. A. Wilson, Archt., 1208 Chestnut St., Phila., is receiving bids for the construction of a 3 story, 80 x 176 ft. cigar factory, here, for Bayuk Bros., 3rd and Spruce Sts., Phila. Estimated cost $70,000. Noted June 29.

Pa., Phila.—Bayuk Bros., 3rd and Spruce Sts., have awarded the contract for the construction of a 4 story, 84 x 109 ft. cigar factory on 10th and Bainbridge Sts. Estimated cost $90,000. Noted June 22.

Pa., Phila.—Congress Cigar Co., 3rd and Spruce Sts., has awarded the contract for the construction of an 8 story, 70 x 140 ft. cigar factory at 300-4 South 3rd St. Estimated cost $150,000.

Pa., Phila.—The Phila. Partition and Building Block Co., c/o W. Chapman, Medical Arts Bldg., has awarded the contract for the construction of a 2 story, 100 x 200 ft. factory. Estimated cost $25,000.

Pa., Phila.—E. A. Wightman, Archt., Heed Bldg. is receiving bids for altering and building a 3 story factory addition for the manufacture of abdominal trusses, for Hastings & McIntosh, 912 Walnut St. Estimated cost $20,000.

Pa., Pittsburgh—Air Reduction Co., 342 Madison Ave., New York City, has purchased a site on Neville Island, here, and plans to build a plant for the manufacture of acetylene. Estimated cost $100,000. Private plans.

Pa., Pittsburgh—U. S. Drug & Chemical Co. has had plans prepared for the construction of a 3 story, 100 x 140 ft. factory, for the manufacture of drugs. Estimated cost $200,000. P. R. Possello, 406 Congress Bldg., Detroit, Archt.

Tenn., Memphis—Memphis Sash & Door Co., 673 South Dudley St., has purchased a site on R.R. St. and Roland Ave., and plans to build a 2 story, 200 x 300 ft. factory for the manufacture of sash and doors. Architect not announced.

Tenn., Nashville—M. McKissack, Archt., 231½ Cedar St., will soon receive bids for the construction of a 4 story publishing plant and office building on 4th and Cedar Sts., for the National Baptist Sunday School Bd. (negro). Estimated cost $250,000.

Wis., La Crosse—Nelson Garment Co., 111 South 2nd St., is receiving bids for the construction of a 1 story, 94 x 160 ft. factory on 3rd and Cameron Sts. Estimated cost $50,000. O. J. Sorenson, 216 Main St., Archt.

Wis., Marinette—Heath Cedar Co., 1803 Riverside Ave., will build a 1 story, 50 x 100 ft. factory addition on Sherman and State Sts. Private plans.

Wis., Platteville—E. H. Johnson plans to build a 1 and 2 story, 60 x 150 ft. toy factory. Estimated cost $60,000. Architect not selected.

Wis., Racine—Horlick Malted Milk Co., Horlicksville, had plans prepared for the construction of a 5 story, 123 x 123 ft. manufacturing plant. Estimated cost $200,000. L. Lehle, 3810 Bway, Chicago, Archt.

Wis., Racine—Wisconsin Gas & Electric Co., 305 6th St., is receiving bids for the construction of a 1 story, 50 x 95 ft. addition to its gas plant. Estimated cost $40,000. S. B. Sherman, Supt. Private plans.

Wyo., Casper—The Fargo Oil Co., Poison Spider Oil Field (near Casper), will build a gasoline compression plant, daily capacity 10,000,000 cu.ft. Estimated cost $100,000.

B. C., New Westminster—New Westminster Paper Mills, Ltd., has awarded the contract for the construction of a paper mill on the North Arm of the Frazer River, on the Indian Reserve. Estimated cost $100,000. Private plans.

Ont., Collingwood—J. H. Yates plans to build a tannery. Estimated cost $100,000. Private plans.

Ont., Toronto—Kingston Road Lumber Co., Ltd., 828 Kingston Rd., has purchased a site and plans to build a planing mill next year. Will require all kinds of woodworking machinery.

Ont., Wallaceburg—Sydenham Brick & Tile Co., plans to build an addition to its brick and tile plant. Estimated cost $30,000. E. Morse, Genl. Mgr. Architect not announced.

American Machinist

Volume 57 NEW YORK, AUGUST 24, 1922 Number 8

Some Unique Operations in the Manufacture of Gunsights

Delicate Parts Involve Special Machines and Methods—Fixtures and Tools Developed for the Work—Automatic "Digging" Machine Rivals Milling Cutter

SPECIAL CORRESPONDENCE

AS EVERY mechanic who has ever "toted" a rifle or shotgun is aware, the little device known in gun parlance as the "sight" is a very important adjunct to a gun, for without it the user of the gun would be unable to hit the object at which he aimed. These gunsights are made in many forms, adapted to all kinds of guns, and many of them are provided with very accurate means of adjustment for elevation and windage, comparing very favorably with some of our split-thousandth measuring instruments.

The manufacturers of gunsights are few in number, as the field is somewhat narrow. Their shops, however, contain many ingenious and effective machines and devices designed to perform operations that are perhaps without counterpart in other lines of industry. One such shop, from which a few examples will be cited, is that of the Lyman Gunsight Corporation, located in the little Connecticut village of Middlefield.

The founder of this business, William Lyman, was himself an expert marksman with a world-wide reputation for accurate target shooting, and the business grew out of his early efforts to perfect sights for his own guns. He started nearly fifty years ago in a little wooden building that now appears in Fig. 1 as a very insignificant part of the modern factory.

His first product was practically all hand made, for at that time there was little machinery available for performing the many special operations required by the nature of the work. As the business grew, the necessity for production machinery to replace the slow and tedious hand operations became apparent, and with true Yankee ingenuity he set about designing, and in most part constructing, many of the machines and tools that are here illustrated.

A few of the completed sights may be seen in Fig. 2, which will serve to give the reader an idea of the number and special nature of the parts required. To describe all the fixtures used and operations performed in their making would fill a volume and, therefore, only a few of the more interesting will be attempted.

The part shown in Fig. 3, and in successive operations in Fig. 4, goes upon the outer end of a gun barrel. Though others of similar appearances are adjustable, this one is not and it is made in one piece. It is of importance that the small bead be located exactly in the center of the ring.

The stock from which it is made is received at the factory in bars drawn to the exact section, shown at *a* Fig. 4, and the piece therefore requires no machining or other operations except polishing upon its outer contour. The first step is to cut off the pieces to length in an automatic screw machine, which at the same time produces the counterbore to be seen at *b* in the same figure.

The problem of continuing this counterbored recess to make a through hole, round and true, without disturbing the metal at the center that is later to form the little bead and its slender support is one that requires considerable study. Drilling, punching, broaching, milling and shaving are some of the operations that contribute to its making.

Most of the special tools are shown in Fig. 5, where, beginning at the left of the picture, is the jig by means of which the piece is drilled as shown at *c*, Fig. 4, preparatory to punching out the remainder of the stock. In Fig. 5 the jig is shown inverted and open ready for loading. The work is placed over the central plug of hardened steel in which are the guide holes for the drill,

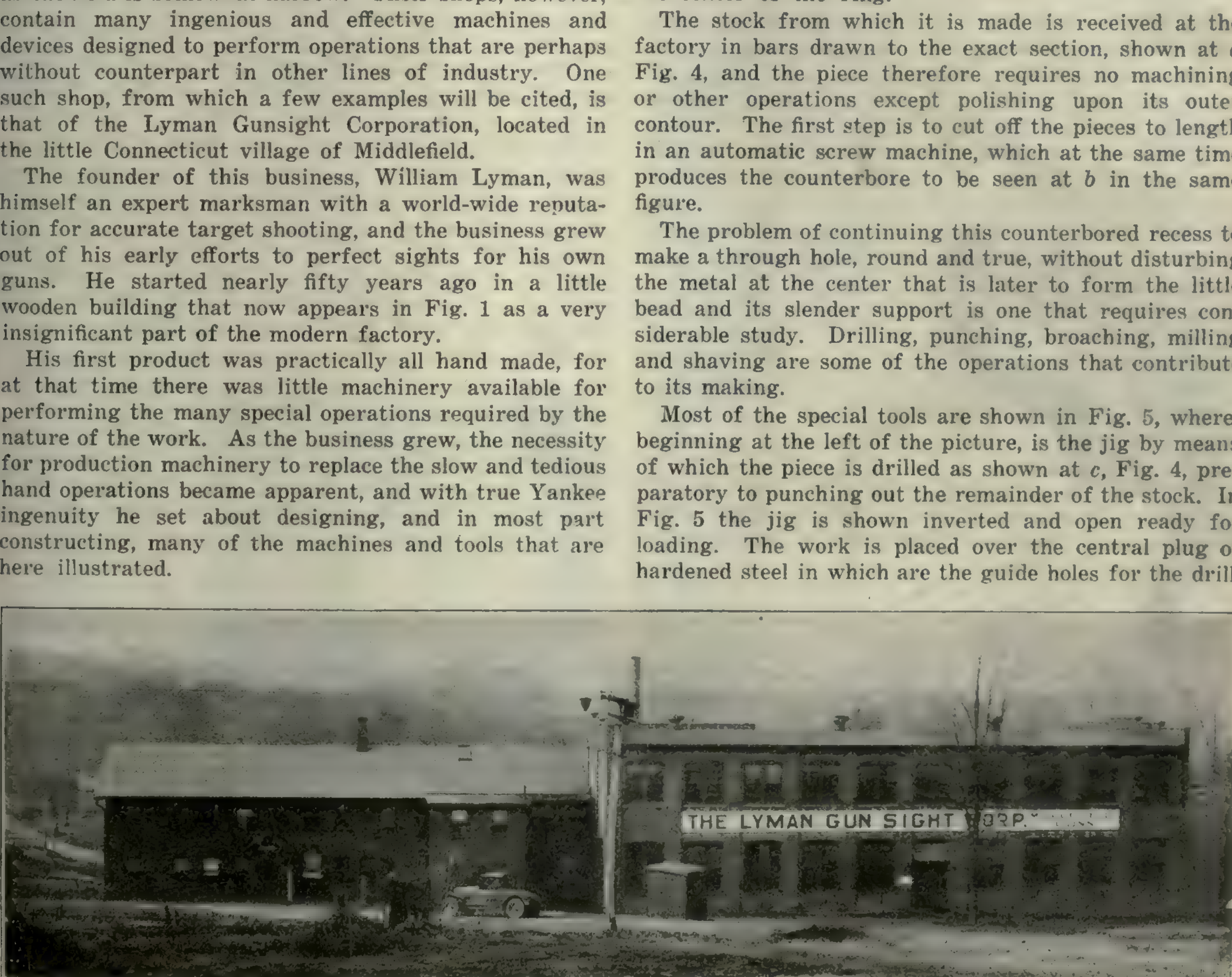


FIG. 1—FACTORY OF THE LYMAN GUNSIGHT CORPORATION AT MIDDLEFIELD, CONN.

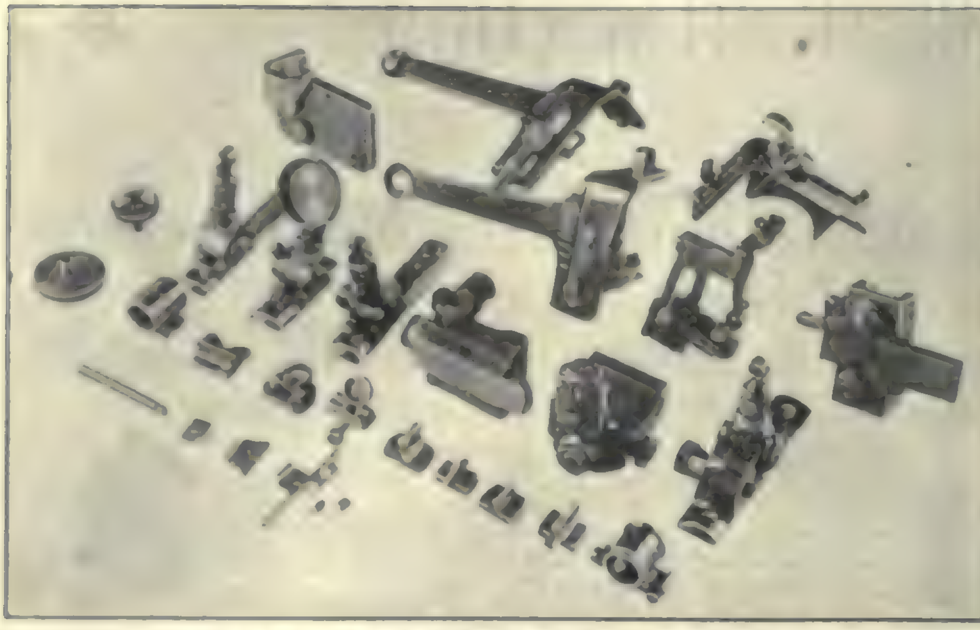


FIG. 2—SOME OF THE MANY FORMS OF GUNSIGHTS

round hole has been broached to size. The broaching tools are shown at D and E in Fig. 5. The work is placed in the holder D and the loose broach is pushed through by a plain piece of round stock held in the punch holder of the press. The broach passes clear through the work and is caught by the operator as it falls away from the under side of the bolster after passing through the holder.

The tool shown at F is the shaving die which reduces the bead to its finished form as shown at g in Fig. 4. The work is placed over the projecting stud (in this case a die) and is pushed into it by the round punch G. The operation is somewhat unique in that no formed punch is used.

and it is clamped by turning over the latch handle A, in the outer end of which is a small cam lever to apply the clamping pressure. The operator now turns over the jig so that it rests upon the ends of the four posts, and drills the five holes shown at c in Fig. 4.

The drilled piece next goes to a punch press where the tools shown at B and C in Fig. 5 punch out the stock at the bottom of the recess without disturbing the metal at the center, leaving the piece as at d in Fig. 4. The usual position of the die and punch is reversed in this operation, the punch B being attached to the bolster plate and the die C held in the press gate. The scrap passes up through a curved hole in the stem of the die and falls out at the back of the gate.

FIG. 3—A SPECIFIC FORM OF GUNSIGHT

On the punch B will be noticed two small pins projecting from the shoulder, parallel to the punch. These are ejectors for the purpose of lifting the work off the punch; and, together with a third ejector lying within the slot in the punch, are operated by means of the handle in front of the tool.

This punching operation may be termed "roughing out," for the resulting hole is not to size nor is the bead finished. As will be noticed in parts d, e and f in Fig. 4, there is still considerable metal to be removed from the bead before it reaches its final shape. Because of its slender nature, it would not be practicable to finish it until all the other machining operations were completed. It is shown in the finished stage at g in this picture.

Between stages d and e there are several milling operations which will be described later. The transformations are slight and difficult to show by means of a photograph. The difference between e and f is that the

At this stage the rough bead is still flush on one side with the surrounding ring of metal. As the work lies upon the die a small punching of soft iron, shown at h in Fig. 4, is laid upon it. As the press gate comes down the work is pushed into the shaving die, while the small amount of scrap removed is swaged into the soft punching as the latter is squeezed between the punch and die. A punching is needed, of course, for every piece shaved, and these punchings are produced at small cost upon an automatic press.

The reason for doing the shaving in this peculiar manner instead of with a formed punch is that in no other way that has been tried is there assurance that the fragile bead will not be distorted or twisted out of its proper relation to the surrounding ring. If such twisting occurs it would be a difficult matter indeed to correct it. The first action of the punch is to force the soft punching partly into the hole, the harder metal of which the work is made forming a partial impression of the bead in the soft iron of the punching, which thus supports the bead on all sides as it passes into the die.

This method could hardly be depended upon to produce clean, sharp edges, but they are not necessary. The following operation, shown in Fig. 6, mills away a part of the bead, leaving it about $\frac{1}{64}$ in. below the surface of the ring and bringing the corners up sharp.

The machine for milling is a special one made somewhat like a bench drill press, but holding a very small end mill. The manner of holding the work by the bead

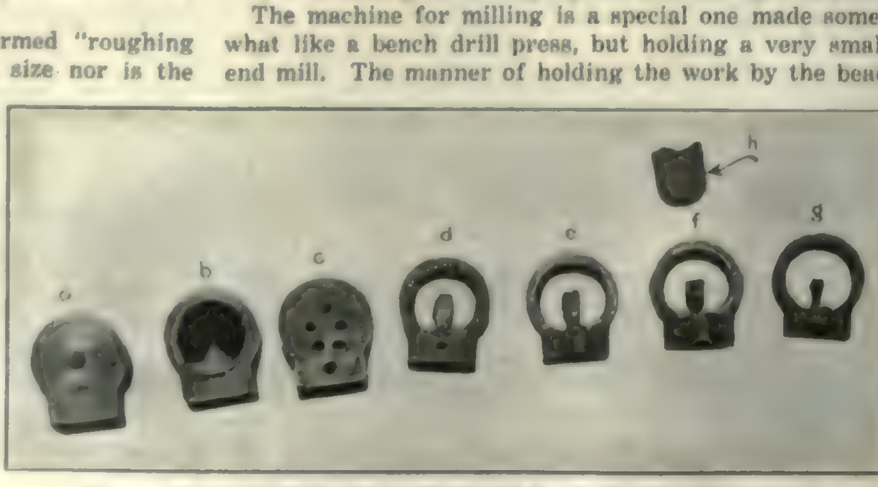


FIG. 4—PROGRESSIVE OPERATIONS ON PART SHOWN IN FIG. 3

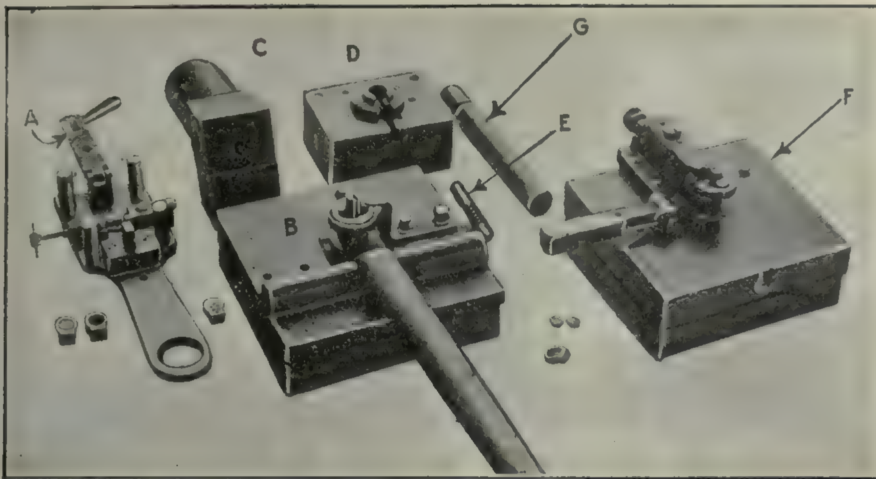


FIG. 5—TOOLS USED IN PRODUCTION OF SIGHT

is clearly shown in the illustration. The jaws of the holding device are in the form of a split stud, the periphery of which fits the round hole, and the two parts of this stud are pinched together upon the bead by means of a cam operated by the small lever. The spindle of the machine is then lowered to a stop and the work fed forward to the cutter by the lower handle.

The milling of the rounded tang to be seen on the last three pieces to the right in Fig. 4 might be thought to be a job for a straddle mill, but it is not so made. The work is done in a device, much used in this shop, called a "flop-over" fixture. Such a fixture is used on many other small parts that must be parallel or definitely tapered. One of the fixtures is shown in Fig. 7 set up for milling a dovetail.

The vise in which the work is held may be considered a two-jawed chuck, as both jaws are moved in unison to and from the center of rotation by means of a right-and-left-hand screw. False jaws are fitted to adapt the device to various shapes of work. The vise, or chuck, in mounted on the end of a spindle that may be rotated 180 deg. and held in either position by means of the toggles, one of which may be seen in action in the picture. There is a similar toggle on the other side of the fixture for holding the spindle in the opposite position, and also an index pin for holding the spindle at the 90-deg. angle if desired. This pin may be seen in Fig. 8, which is the rear view of the same fixture.

The lever *A* Fig. 7, rests in either extreme position upon an adjustable anvil so that though the normal range of movement is 180 deg., this may be varied slightly and by definite amounts by turning an adjusting screw when it is desired to produce slight tapers, as in the case of dovetails that are to be driven to place. The fixture is here shown mounted upon a hand milling machine. It is a very versatile device, however, and is used in this factory in many other places where a reliable three-position indexing fixture is needed. It has proved its worth by continuous service.

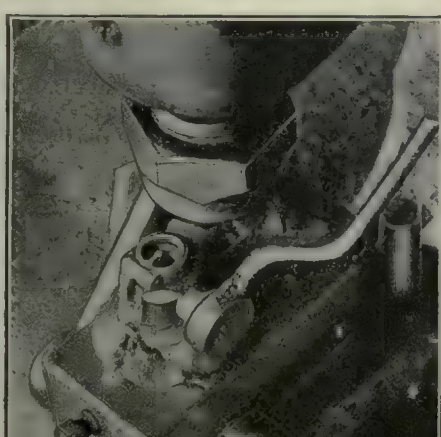


FIG. 6—A DELICATE MILLING OPERATION

Continuous milling fixtures and devices have in recent years become quite common. That the principle is not a new one is indicated by the fact that it is applied in the machine shown in Fig. 9, which has been in service for many years milling parts of gunsights. One of the pieces may be seen at *A* in this figure. A portion of the contour at each end of the piece has been rounded to conform to the curvature of the gunstock of which it is to become a part. In this machine a slowly revolving central spindle carries a mandrel to which the parts to be milled are successively attached by means of countersunk-head screws.

Two cutter spindles carry gangs of formed cutters that may be arranged to suit the size and shape of the work in hand. The center distances of the cutter spindles are adjustable with relation to each other and to the work spindle. The milling is continuous, as many pieces as the mandrel will hold being completed at each revolution of the latter. As each piece reaches the top position it is taken off and another one substituted.

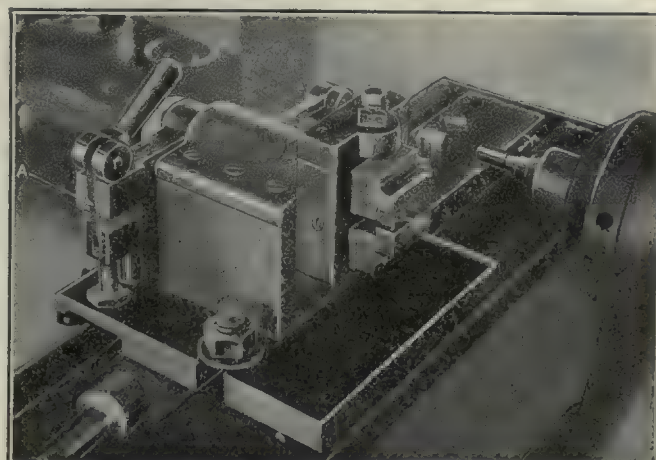


FIG. 7—A "FLOP-OVER" FIXTURE

In Fig. 10 is a drawing of an elevating screw used in many of the sights, and upon which some of the operations are performed in an unusual way. For instance, the part that looks like a small rack is in reality a portion of a square thread. If this thread were continuous any toolmaker would at once suggest that it be cut with a die upon a screw machine; but because of its lack of continuity, this method would seem to be out of the question. That it may be so cut, despite its peculiarities, the little machine shown in Fig. 11 amply demonstrates.

In the chuck of this machine is mounted an ordinary single-piece die of square shape and proper thread characteristics, while held stationary within the spindle, just back of the die, is a bushing fitted to the stem of the

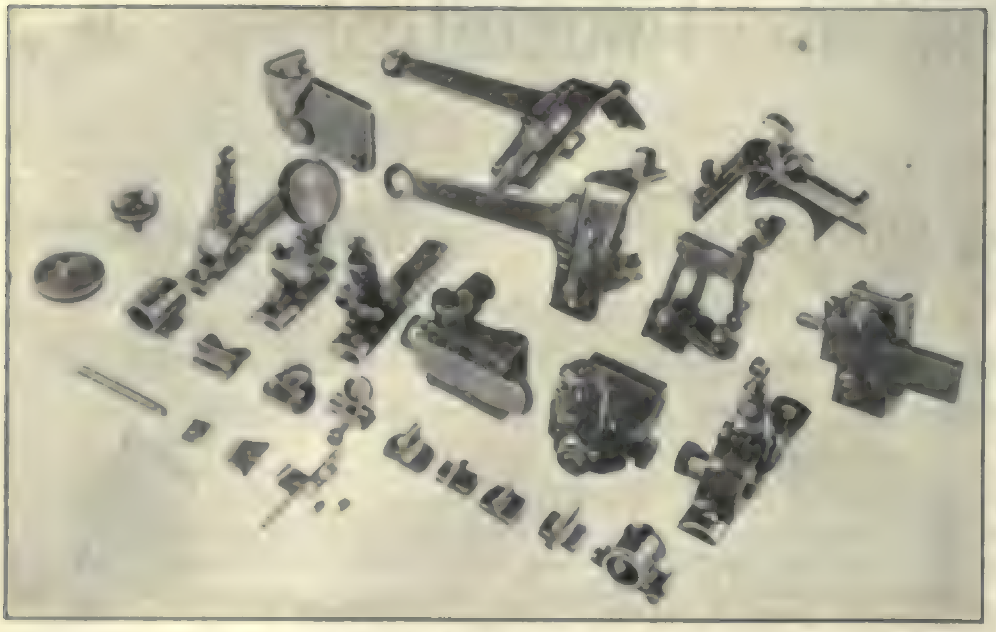


FIG. 2—SOME OF THE MANY FORMS OF GUNSIGHTS

and it is clamped by turning over the latch handle *A*, in the outer end of which is a small cam lever to apply the clamping pressure. The operator now turns over the jig so that it rests upon the ends of the four posts, and drills the five holes shown at *c* in Fig. 4.

The drilled piece next goes to a punch press where the tools shown at *B* and *C* in Fig. 5 punch out the stock at the bottom of the recess without disturbing the metal at the center, leaving the piece as at *d* in Fig. 4. The usual position of the die and punch is reversed in this operation, the punch *B* being attached to the bolster plate and the die *C* held in the press gate. The scrap passes up through a curved hole in the stem of the die and falls out at the back of the gate.

FIG. 3—A SPECIFIC FORM OF GUNSIGHT

On the punch *B* will be noticed two small pins projecting from the shoulder, parallel to the punch. These are ejectors for the purpose of lifting the work off the punch; and, together with a third ejector lying within the slot in the punch, are operated by means of the handle in front of the tool.

This punching operation may be termed "roughing out," for the resulting hole is not to size nor is the bead finished. As will be noticed in parts *d*, *e* and *f* in Fig. 4, there is still considerable metal to be removed from the bead before it reaches its final shape. Because of its slender nature, it would not be practicable to finish it until all the other machining operations were completed. It is shown in the finished stage at *g* in this picture.

Between stages *d* and *e* there are several milling operations which will be described later. The transformations are slight and difficult to show by means of a photograph. The difference between *e* and *f* is that the round hole has been broached to size. The broaching tools are shown at *D* and *E* in Fig. 5. The work is placed in the holder *D* and the loose broach is pushed through by a plain piece of round stock held in the punch holder of the press. The broach passes clear through the work and is caught by the operator as it falls away from the under side of the bolster after passing through the holder.

The tool shown at *F* is the shaving die which reduces the bead to its finished form as shown at *g* in Fig. 4. The work is placed over the projecting stud (in this case a die) and is pushed into it by the round punch *G*. The operation is somewhat unique in that no formed punch is used.

At this stage the rough bead is still flush on one side with the surrounding ring of metal. As the work lies upon the die a small punching of soft iron, shown at *h* in Fig. 4, is laid upon it. As the press gate comes down the work is pushed into the shaving die, while the small amount of scrap removed is swaged into the soft punching as the latter is squeezed between the punch and die. A punching is needed, of course, for every piece shaved, and these punchings are produced at small cost upon an automatic press.

The reason for doing the shaving in this peculiar manner instead of with a formed punch is that in no other way that has been tried is there assurance that the fragile bead will not be distorted or twisted out of its proper relation to the surrounding ring. If such twisting occurs it would be a difficult matter indeed to correct it. The first action of the punch is to force the soft punching partly into the hole, the harder metal of which the work is made forming a partial impression of the bead in the soft iron of the punching, which thus supports the bead on all sides as it passes into the die.

This method could hardly be depended upon to produce clean, sharp edges, but they are not necessary. The following operation, shown in Fig. 6, mills away a part of the bead, leaving it about $\frac{1}{64}$ in. below the surface of the ring and bringing the corners up sharp.

The machine for milling is a special one made somewhat like a bench drill press, but holding a very small end mill. The manner of holding the work by the bead

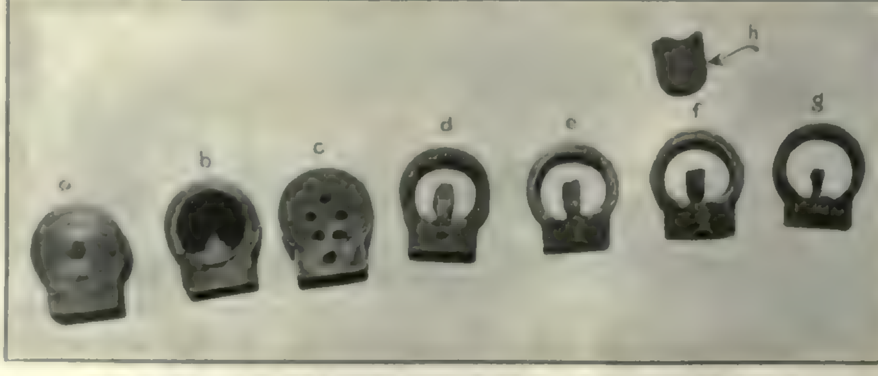


FIG. 4—PROGRESSIVE OPERATIONS ON PART SHOWN IN FIG. 3

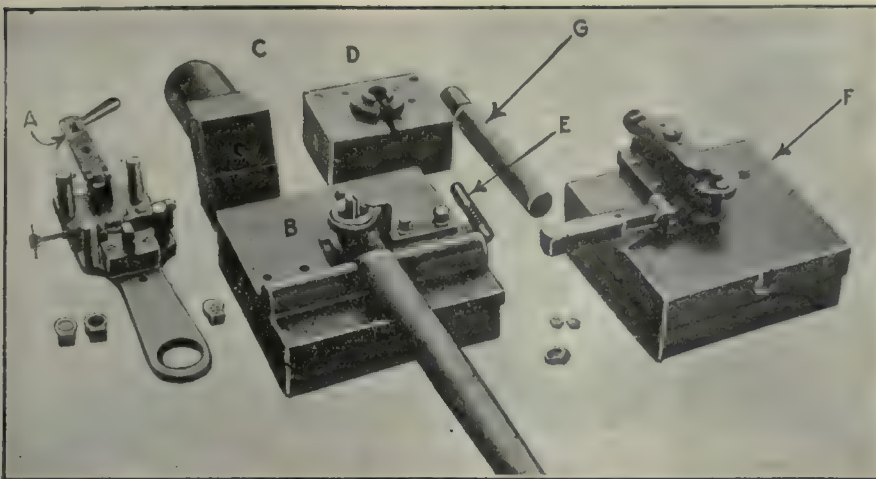


FIG. 5—TOOLS USED IN PRODUCTION OF SIGHT

is clearly shown in the illustration. The jaws of the holding device are in the form of a split stud, the periphery of which fits the round hole, and the two parts of this stud are pinched together upon the bead by means of a cam operated by the small lever. The spindle of the machine is then lowered to a stop and the work fed forward to the cutter by the lower handle.

The milling of the rounded tang to be seen on the last three pieces to the right in Fig. 4 might be thought to be a job for a straddle mill, but it is not so made. The work is done in a device, much used in this shop, called a "flop-over" fixture. Such a fixture is used on many other small parts that must be parallel or definitely tapered. One of the fixtures is shown in Fig. 7 set up for milling a dovetail.

The vise in which the work is held may be considered a two-jawed chuck, as both jaws are moved in unison to and from the center of rotation by means of a right-and-left-hand screw. False jaws are fitted to adapt the device to various shapes of work. The vise, or chuck, in mounted on the end of a spindle that may be rotated 180 deg. and held in either position by means of the toggles, one of which may be seen in action in the picture. There is a similar toggle on the other side of the fixture for holding the spindle in the opposite position, and also an index pin for holding the spindle at the 90-deg. angle if desired. This pin may be seen in Fig. 8, which is the rear view of the same fixture.

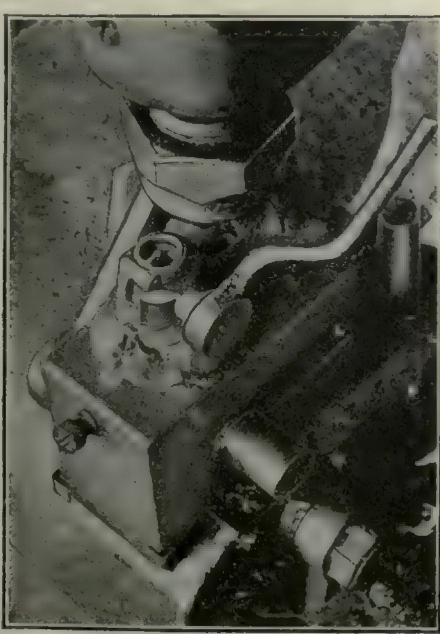


FIG. 6—A DELICATE MILLING OPERATION

The lever *A* Fig. 7, rests in either extreme position upon an adjustable anvil so that though the normal range of movement is 180 deg., this may be varied slightly and by definite amounts by turning an adjusting screw when it is desired to produce slight tapers, as in the case of dovetails that are to be driven to place. The fixture is here shown mounted upon a hand milling machine. It is a very versatile device, however, and is used in this factory in many other places where a reliable three-position indexing fixture is needed. It has proved its worth by continuous service.

Continuous milling fixtures and devices have in recent years become quite common. That the principle is not a new one is indicated by the fact that it is applied in the machine shown in Fig. 9, which has been in service for many years milling parts of gunsights. One of the pieces may be seen at *A* in this figure. A portion of the contour at each end of the piece has been rounded to conform to the curvature of the gunstock of which it is to become a part. In this machine a slowly revolving central spindle carries a mandrel to which the parts to be milled are successively attached by means of countersunk-head screws.

Two cutter spindles carry gangs of formed cutters that may be arranged to suit the size and shape of the

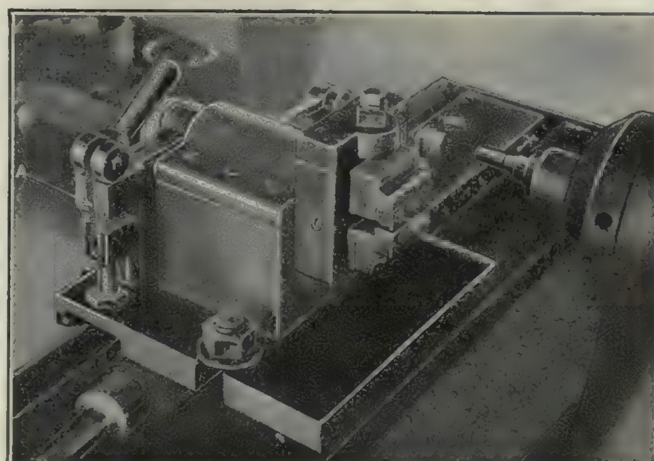


FIG. 7—A "FLOP-OVER" FIXTURE

work in hand. The center distances of the cutter spindles are adjustable with relation to each other and to the work spindle. The milling is continuous, as many pieces as the mandrel will hold being completed at each revolution of the latter. As each piece reaches the top position it is taken off and another one substituted.

In Fig. 10 is a drawing of an elevating screw used in many of the sights, and upon which some of the operations are performed in an unusual way. For instance, the part that looks like a small rack is in reality a portion of a square thread. If this thread were continuous any toolmaker would at once suggest that it be cut with a die upon a screw machine; but because of its lack of continuity, this method would seem to be out of the question. That it may be so cut, despite its peculiarities, the little machine shown in Fig. 11 amply demonstrates.

In the chuck of this machine is mounted an ordinary single-piece die of square shape and proper thread characteristics, while held stationary within the spindle, just back of the die, is a bushing fitted to the stem of the

FIG. 8—REAR VIEW OF SAME FIXTURE

screw and having a slot or keyway to allow the threaded part to pass. Geared to the spindle and extending under the slide in which the work is held is a left-hand lead screw of the same lead as the die. A split nut, operated by the thumb-nut *A*, may be closed upon the lead screw at the will of the operator.

With one of the parts gripped in the holding clamp the operator moves the slide forward until the round stem of the screw has entered the bushing, then closes the split nut upon the lead screw. The slide is thus

FIG. 9—A CONTINUOUS MILLING MACHINE

carried forward at the same rate of advance as if the die were cutting, until the spline to be threaded has passed clear through the die, the thread being cut thereon in its passage. The machine is now stopped, the spindle turned by hand to bring one of the clearance spaces of the die opposite the threaded spline, the split

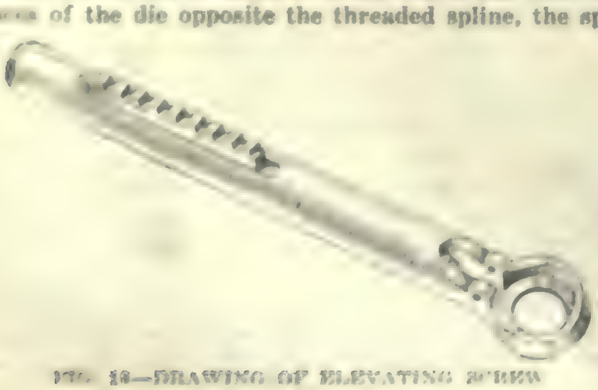


FIG. 10—DRAWING OF ELEVATING SCREW

nut released, and the work withdrawn. The whole operation takes no more time than would be required to thread a complete screw by running the die on and off.

In the drawing Fig. 10 it will be noticed that the cross-hole passing through the round head of the screw is recessed from both sides. This would seem to be a job for an ordinary counterbore or a hollow mill, but these tools have been tried and discarded in favor of the little machine shown in Fig. 12, in which the work is done by a single-point tool.

The piece to be counterbored is slipped over a short stud arbor in the spindle of the machine and is backed up by a cup center in the tail spindle, which is brought to bear upon the work by means of the cam lever *A*. The driving is done by the pin which extends from the face of the driver parallel with the arbor, and against which the work is shown resting.

Another pin extending radially from the periphery

FIG. 11—THREADING THE SCREW

of the driver engages the short studs in the face of the small wheel *B*, which thus becomes a sort of crown gear driven by a one-tooth pinion. This wheel is mounted by means of a spring-adjusted friction upon a short shaft that is geared to what may be termed the lead screw of the tool slide *C*

When the machine spindle is revolved the wheel *B* revolves, though intermittently, and through the friction device turns the screw forward to feed the formed

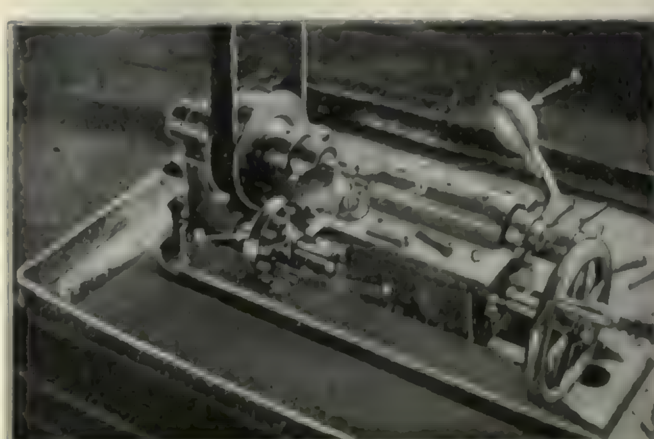


FIG. 12—A SPECIAL COUNTERBORING MACHINE

cutting tool *D* into the work. The forward movement of the tool slide is limited by a stop which regulates the depth of the cut and makes all parts alike as regards depth of the recess. When the limit is reached the wheel *B* continues to turn as long as the machine is

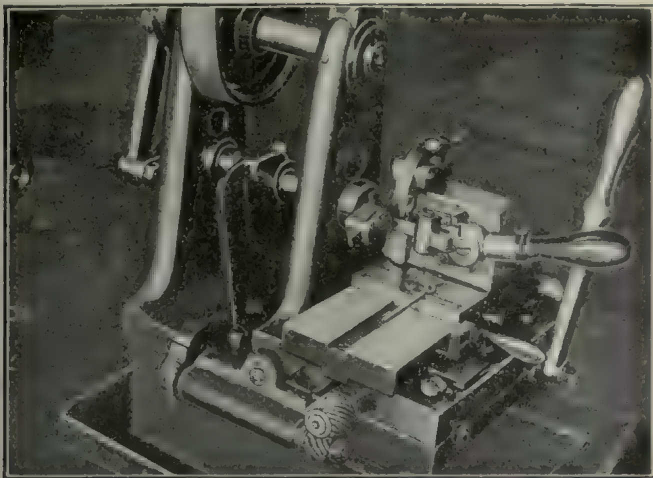


FIG. 13—"DIGGING OUT." A METHOD THAT COMPETES WITH MILLING

running, but because of the slippage of the friction no turning movement is imparted to the screw.

Should the tool become dull and refuse to cut as fast as it ought, the friction slips and adjusts the feeding pressure to accommodate the reduced efficiency of the tool. The feeding will continue, however, until the established depth of recess has been reached and the

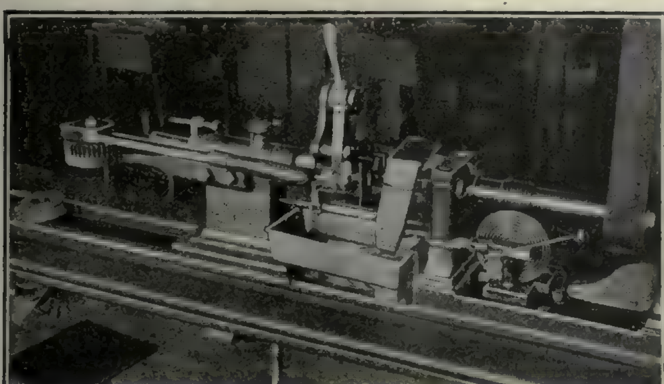


FIG. 14—OLD MACHINE FOR KNURLING

stop engages, which point is indicated by the stoppage of the handwheel at the right which is keyed to the screw. The tool may be withdrawn from the cut at any time by turning back the handwheel, slight effort being required to overcome the resistance of the friction drive.

If Whitney cutters could have been purchased fifty

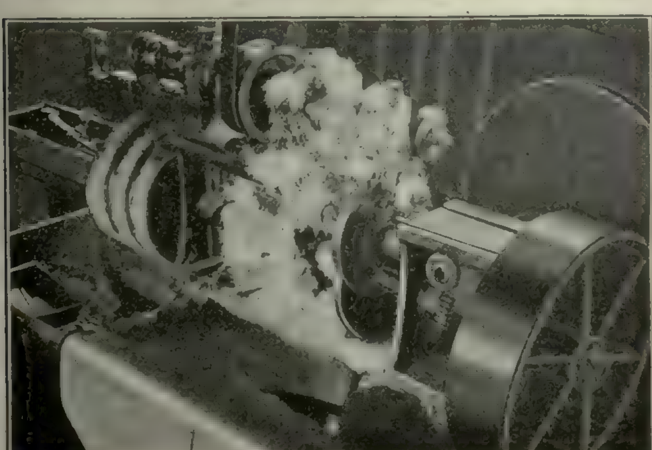


FIG. 15—HARTFORD AUTOMATIC PRODUCING IVORY BEADS

years ago at present-day prices, the machine shown in Fig. 13 probably never would have been built. As they could not, and as the small groove that cuts radially into the deeper recess in Fig. 10 had to be made, this machine was designed to do the work.

Except for unloading and reloading, the machine is automatic in its movements. The work (the piece, Fig. 10) is clamped upright in the vise with the deeper recess facing the tool held in the cutter head *A*. This cutter is ground as an ordinary parting tool, and the head gives it a peculiar rocking motion actuated by two pitmans, one of which may be seen at the left and the other between the housings, both being driven from the horizontal shaft above. The forward movement of the tool is analogous to the action of a fly cutter, or single-toothed milling cutter. Reaching the end of its stroke

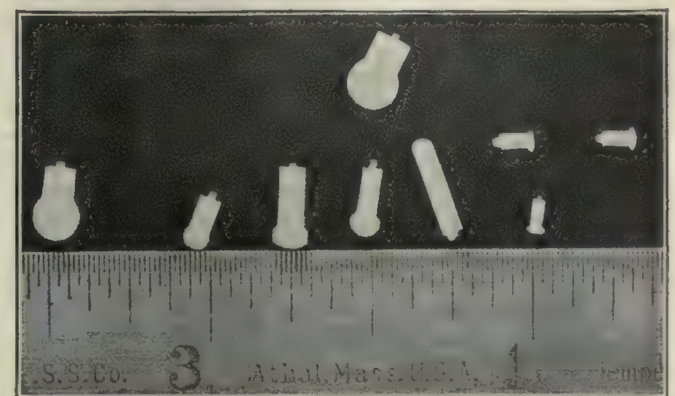


FIG. 16—SOME OF THE BEADS PRODUCED

it is withdrawn slightly, rotated backward, and again advanced to the cut. The cross-slide and work is in the meantime moving slowly and continuously forward toward the tool until the pre-determined depth of cut is reached, when it unlocks and recedes.

The machine is very rapid in its action; so rapid in fact that the eye cannot follow it. If the job were up today for consideration, a special milling machine using

FIG. 17—A VETERAN EMPLOYEE

Whitney cutters would doubtless be selected; but to make the change now would involve the design and construction of an entirely new machine which, when completed, would neither increase production nor produce better work. It is on that account, therefore, that this ingenious device remains on the job.

One part of certain gunsights requires a small care-

fully knurled handle and, contrary to usual practice, four knurls are used to produce it. These knurls are mounted upon the compound lever compensating device shown in Fig. 14 on the tail spindle of the machine. With the work held in the chuck the knurls are brought forward by means of the lever-operated rack and pinion, the compensating levers are brought together by the small handle at the top, while at the same time the "nut" on the slide *A* is pressed into engagement with the constantly turning scroll.

The slide is, of course, attached to the tail spindle and draws the knurls forward over the work until the length desired has been knurled, when the knurlholder is automatically released and the nut thrown out of the scroll. This machine is also a rapid producer and, despite its age, it would be difficult to design a machine to beat it.

Making Ivory Beads On a Screw Machine

In Fig. 15 is shown a machine that appears to be operating under a snow drift. This machine has no special claim to distinction as it is one of the early Hartford automatics and has many counterparts still at work throughout the country. It is doubtful, however, if any of the others are handling the same kind of material, for the product is some one of the many small beads shown in Fig. 16, and the material is ivory.

The ivory comes to the machine in the form of short round rods, some of which may be seen in the little pan on the base of the machine. These rods are fed through the hollow spindle, one pushing another, by means of the usual form of wire feed. When a short end is reached it is either thrown out of the collet or is knocked out by the cutter, the result being only that the machine makes one idle cycle. Some of the tools used are the same as would be employed upon similar parts of steel, but all the forming is done by revolving cutters.

The machine is entirely automatic in its action and its attendant has many other duties to perform while "keeping his eye on it." One of the things that he does *not* do, however, is to clean off the chips. Ivory readily absorbs, and is discolored by, oil. The chips are therefore allowed to collect and thus act as a protection to the product by catching up any stray drops of oil that may be thrown off by the revolving parts of the machine.

Besides veteran tools, the company has some veteran employees. Though the founder of the business has long since passed away, several of his early associates are still on the job. One of them may be seen in Fig. 17 at the work in which he has been engaged for nearly half a century. He is "going to die right on this stool; but not for a long time yet;" as he himself says.

Testing Gears by Micrometer Measurement —Discussion

By Fred Ross Eberhardt
Gear Department Manager, Newark Gear Cutting Machine Co.

In an article under the above heading on page 195 of *American Machinist*, S. O. Gordon gives some interesting formulas for use in making micrometer measurements of gears over plugs. We wish to compliment Mr. Gordon on his mathematics, although we question the value of gear measurements made in this manner. Some of the worst running gears that the writer has seen have passed a careful inspection of this kind.

An involute gear, as such, has only two unchangeable characteristics; namely, the number of teeth, and the diameter of the involute base circle. The pitch diameter depends entirely upon the mating gear and the center distance. This fact being the case, it is clearly impossible to measure the pitch diameter of any one gear by itself. Suppose a certain pitch diameter is assumed arbitrarily. If the teeth should be cut 0.001 or 0.002 in. too thin they would still be within the limits required for most work, but a measurement over plugs would seem to indicate that the pitch diameter was undersize. Of course, this would be erroneous.

The only gear test of value is some sort of a running test, which may be supplemented by a micrometer measurement of each tooth if desired. The gears should be mounted on true running spindles set at the same center distance at which the gears will actually operate and should be run at a fairly high speed under load. A good testing speed is approximately 1,000 ft. per min. pitch line velocity. This velocity may be roughly calculated as being equal to ¼ r.p.m. × pitch diameter (in inches). A load may be applied by means of a brake, a stick of wood or a piece of belting.

The gears should be run in both directions. Any inaccuracy in tooth spacing, as well as an eccentricity, thick teeth, or gear running out, will be shown up at once by the noisy operation. An incorrect tooth form will also be apparent, from the noisy operation and from an examination of the bearing area on each tooth. When the gears are on the centers, tests for backlash may be made by shaking one gear while the mating gear is firmly held.

If it is not convenient to make a power test as outlined, the gears may be mounted on spindles set at the correct center distance and revolved by hand. This test should be accomplished by turning one gear very slowly, and resisting the movement with the other gear. If no delicate rumbling or bumping is felt as the teeth are engaged and disengaged, and if a satisfactory bearing is shown, it is likely that the gears will not operate noisily because of any inaccuracy in the teeth.

It is very difficult, if not impossible, to test any one gear by itself, and to be certain that the gear will run satisfactorily. Every gear is one of a pair or a train, and has no properties of its own, so that one would hardly know what to measure on a single gear. The correct way should be to make up a mate, and test the pair. If this could not be done, perhaps the best alternative would be to make a clay mold, using the gear as a core, and to cast a lead form. Testing the gear in every different position of the lead form shows up any inaccuracy in spacing as well as the variation in tooth form and tooth thickness. Any of these errors would prevent the gear from fitting the lead form except in certain positions and yet in spite of these errors the gear might operate perfectly.

Where there are many gears to be tested, a testing machine may be used, with a hardened and ground master gear. Variations in the center distance, as well as backlash and thick and thin teeth will be noted at once without a running test. If quietness is desired, a running test, or at least a hand test of feeling for any rumble, is necessary.

Methods of Machine Tool Design

Sixth Installment of Chapter V Discusses Back Gears—Arrangements for Light and Heavy Drives—Double Back Gears—Objections to Back Gears

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

PERHAPS no speed variator is so well known as the back gear, especially when it is used in combination with the cone pulley. There is a quite general belief that back gears are so called because they are generally located at the back of the lathe headstock. However, the location has no more to do with their name than with their action. They are called back gears because their action brings the drive *back* to the shaft from which it was taken. The term "back gears" simply means "return gears."

In their best known form, they are arranged as shown in Fig. 109. *A* is the shaft (generally a spindle) upon which the cone *B* runs. Keyed to this cone is pinion *C* which drives gear *D*. The gear *D* is connected to pinion F through sleeve *E*. Finally *F* drives the face gear *H*,

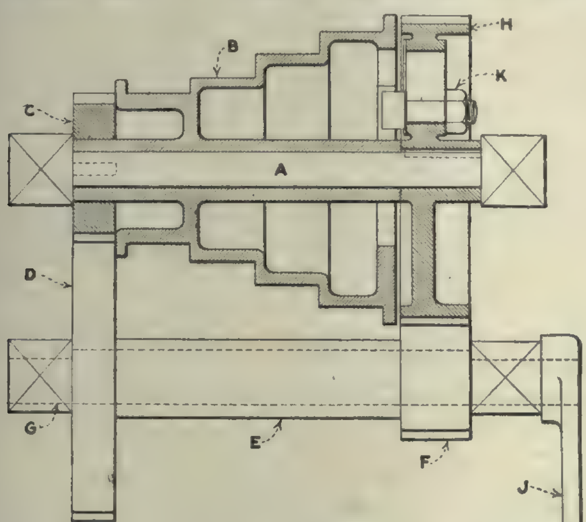


FIG. 109—USUAL ARRANGEMENT OF BACK GEARS

which is keyed to the spindle. Under these conditions the spindle speed equals cone speed $\times \frac{C}{D} \times \frac{F}{H}$

However, it is possible to disengage *F* from *H*, and *D* from *C* simultaneously. For this purpose sleeve *E* is made to run on an eccentric shaft *G* which can be turned by handle *J*. When this is done cone *B* is free to turn on the spindle, without affecting face gear *H*. This gear has a slot in which a block can slide in a radial direction. The block can be clamped in position by nut *K*. The cone is provided with an inner rim, into which one or more notches have been cut. By pushing the block into one of these notches and locking it, cone and face gear are connected and run together.

For light machinery a somewhat simpler lock is used which can be operated without a wrench. It consists of a pin which is pushed into one of a number of holes in the face of the cone. The entering edge is beveled. The other end is provided with a knob. The pin and the spring which assist in pushing it into the hole are contained in a bushing which is driven or screwed into the face gear. When the pin is withdrawn from the cone it is prevented from jumping back by a cross pin which rests in a shallow groove in the top of the bushing. When the pin is in action this cross pin rests in a deeper slot, as shown in Fig. 110.

CONSTRUCTION OF ECCENTRIC SHAFT

As a rule the eccentric shaft *G*, Fig. 109, is made in one piece which may cause it to be quite large, thus compelling the use of a rather large pinion *F*. The small part of the eccentric shaft should be kept large enough to permit of a substantial handle being attached to it. If the face gear is of 3-P, then the throw of the eccentric would have to be more than ⅔ in., let us say ¾ in. Fig. 111 shows how this eccentricity affects the dimensions of the shaft. For the turning (or grinding) of this shaft, two centers are required O_1 and O_2. These centers are ¾ in. apart. In order to have sufficient supporting metal around O_1, the distance O_1A should not be less than ¼ in., so that O_2A is not less than 1 in. This makes O_2B also 1 in. O_1B is therefore 1¾ in. and consequently the diameter of the large shaft cannot be less than 3½ in. In general, if the eccentricity is E and the amount of metal around the center is t ($O_1A = t$), then

$$d = 2(E + t)$$
$$D = 2(2E + t)$$

It may be necessary to keep the large diameter of the eccentric shaft down to a convenient size. This can be done by having O_1 fall outside of the eccentric. (See Fig. 112). This arrangement has the disadvantage that it becomes very difficult to turn or grind the main part of the shaft. To avoid this difficulty and for other reasons, of which more later, the shaft is made straight and eccentric bushings are pinned on, as shown in Fig. 113. This makes it possible to make the shaft of any convenient diameter. Under the conditions as shown in Fig. 113,

$$D = 2R = 2\ (E + \tfrac{1}{2}\ d + t_1) = 2E + d + 2t_1$$

It is of course necessary to pin the bushings to the

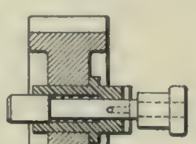


FIG.110

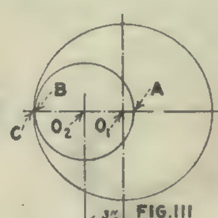


FIG.111

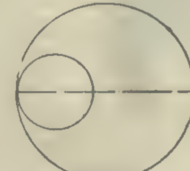


FIG.112

FIG. 110—PUSH PIN LOCK FOR A LIGHT MACHINE. FIGS. 111 AND 112—SOLID ECCENTRIC SHAFTS

shaft before finish turning or grinding so as to have them in proper alignment. For assembling the shaft in the frame, one of the bushings may be removed, the shaft inserted in the frame, and the bushing replaced. To meet this method of assembling, the pin, connecting bushing to shaft, is shown as going through the flange (which is always outside the bearing and accessible).

For the author's forthcoming book.

The end of the eccentric shaft with its two centers, O_1 and O_2, is shown in diagrammatic form in Fig. 114. It shows that the back gear pinion will approach the face gear whether we move the eccentric along arrow 1 or along 2. However, in the one case, the gears will have a tendency to pull in, and in the other case, they will resist the meshing. The movements should be such as to keep the gears in mesh, and the end of the movement should be close to, but not quite up to, the center.

The tendency to pull the gears into mesh or push them apart is not quite so strong as might be supposed at a first glance. This is due to the fact that, whereas pinion C, Fig. 109, may have a tendency to push the

FIG 113

FIG 114

FIG 116

FIG. 113—ARRANGEMENT OF ECCENTRIC BUSHING. FIG. 114—DIAGRAM OF END OF ECCENTRIC SHAFT. FIG. 116—ESSENTIAL ELEMENTS OF BACK GEAR ARRANGEMENT

gears out of mesh, pinion F has a tendency to pull in. It is true that these tendencies do not equalize each other because the tooth pressure is greater on F than on C; nevertheless, the total effect has been reduced. There should be a stop to prevent further movement under the pressure of the teeth. This stop is sometimes merely a pin butting against the end of a milled groove. This is sufficient for light load, but when this construction of back gears is used for heavy machinery, a more substantial stop should be provided. Besides, it is not safe to depend entirely on the tooth pressure to keep the gears in mesh. Vibration may tend to throw the gears out unless a positive lock is provided. Fig. 115 shows a light construction with stop and locking device. For heavier constructions the shaft is generally provided with eccentric bushings, as was described. This makes it possible to cut away part of

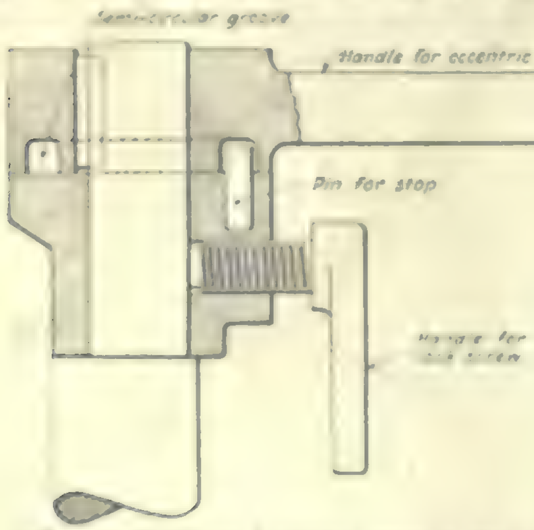


FIG. 115—STOP AND LOCKING DEVICE FOR LIGHT BACK GEARS

the flange of one bushing and make the end butt against a block screwed, and perhaps keyed, to the frame. The bearing may be split and the shaft locked by a binder screw.

Though back gears are best known in combination with a cone pulley, they are by no means confined to this combination, nor is it essential that an eccentric shaft be used or a spring plunger or sliding block to connect face gear and cone. Fig. 116 shows the essential elements of a back gear arrangement. There is a member P, running loose on shaft A and driven from some source, a belt or gear or perhaps a complete speed variator. This member, through its pinion B and the gears C and D, drives a gear E keyed to shaft A. There is further a member Q which can clutch P to E. Finally, there must be some way to make gears C and D inactive when P and E are connected. It is not even necessary that E should be keyed to A. In case E is loose on a shaft, Q is a member which is keyed to A, and which can be clutched either to E or P. It is no longer necessary with this construction to put C and D out of action when the drive goes through E, though it is desirable. Such a construction of the back gear is quite common to screw machines, chucking machines, etc., where quick and handy operation is of prime importance. In such constructions the member Q is generally a double acting friction clutch.

Another construction which permits of quick operation without the disadvantage of idle running gears, is diagrammatically shown in Fig. 117. Here the member P runs loose on the shaft, and E is keyed to the shaft as in diagram 116. E is provided with a clutch (jaw clutch as shown), which can be engaged by the sliding clutch F. This latter clutch slides on, and is keyed to, a sleeve which is part of member P. A lever G moves both the clutch F and the back gears H and I in such a way that the gears are out of mesh before the sliding clutch enters E, and vice versa. It might be impossible to make J and H enter the mating gear simultaneously, because gear E is standing still when this shift is made. For that reason, the other gear J, or its mating pinion, is made with an extra long face so that these gears begin to mesh before H has reached its mating gear. As P is the driving member in this arrangement, it is necessarily running when the shift is being made, so that J can enter K. This causes H to run, thus permitting it to enter E.

FIG. 117—CONSTRUCTION WITHOUT IDLE RUNNING GEARS

There are, of course, many ways, one might say an unlimited number of ways, to construct the arrangement called *back gears*. The foregoing will suffice to show that the essentials lie not in the way the details are arranged but in the fact that a shaft is driven direct from a member located on this shaft or through the intervention of a set of gears located on another shaft.

Referring again to Fig. 116, it will be seen that P might be provided with a number of pinions and that there might be a number of gears E on the shaft. We would then have to provide a number of gears C, each one to mesh with one of the pinions B, and a number of pinions D, each one to mesh with a gear E. Of course there should be some means of selecting the gears C or the pinion D which we wish to use, as only one of a set could be used at one time.

A construction of this nature is the so-called double back gear, which is shown in diagram in Fig. 118. There are two pinions, B_1 and B_2, which we can mesh

either with C_1 or C_2. These two latter gears slide on the quill on which pinion D is located, and they are often made to slide by hand without any mechanical means. The arrangement of the pinions and gears B and C differs somewhat from the ordinary sliding gear arrangement. Ordinarily, a little more than two spaces is required between the pinions B_1 and B_2 so as to make it possible for the gears C_1 or C_2 to get out of engagement with one of the pinions before they get into engagement with another. With the sliding back gear, a single space between B_1 and B_2 is sufficient because, when shifting the gears C_1 and C_2 one can throw the back gear shaft out of action completely by means of the eccentric before making the shift to the other speed.

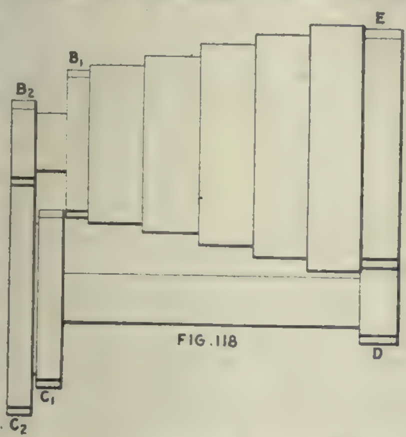


FIG. 118—DOUBLE BACK GEAR

An arrangement such as shown in Fig. 118 has three sets of speeds: all the speeds obtainable by shifting the belt on the cone with back gear out, the cone shifts of belt with the fast back gear in, and, in the third place, these same shifts again with the slow back gear in. Assuming that there are four steps in the cone and that the slow back gear is in, we might call the speeds, a, ar, ar^2, ar^3. Then the speeds will be ar^4, ar^5, ar^6, ar^7 when the fast back gear is in, and ar^8, ar^9, ar^{10}, ar^{11} without back gear. Referring to Fig. 118 we see that $\frac{B_2}{C_2} \div \frac{B_1}{C}$ must be the ratio between slow and fast back gear speeds when the belt is on the same cone step, because in either case, whether slow or fast, the ratio $\frac{D}{E}$ is in use. This shows that it is not possible to have a very wide range between slow and fast back gear, and this makes this arrangement particularly adapted to cases where the total range of speeds is not very wide and where the speeds should be close together. As illustration we will take a machine in which the speeds range from 13 to 351; that is, a equals 13, and ar^{11} equals 351, so that r^{11} is 27, and therefore $r = 1.35$; $r^4 = 3.315$, and this is the ratio between slow and fast back gear. If we should make B_1 and C_1 equal, we would have to make the ratio between B_2 and C_2 equal to 3.315 and make this same ratio between D and E. It is perfectly feasible to do so. If, on the other hand, we should have found that $r^4 = 5$, we would have found it extremely difficult, or rather awkward, to make the pinions B_2 and C_2 with such a large ratio.

It might be remarked that the ratio between two adjoining steps is rather large, namely 1.35; but this is entirely due to the fact that we have only four steps on the cone. If we had more steps, this ratio would be reduced. We can thus reduce that ratio by taking two countershaft speeds, which will have the same effect as if we had eight steps on the cone, in which case the ratio between two adjoining steps would be

$$\sqrt{1.35} = 1.162$$

Though a back gear arrangement, in its typical form, is simple in design and construction, it is gradually being superceded by other arrangements on account of a certain unhandiness in its manipulation which is almost unavoidable. The shifting of the lock is very often awkward, because the wrench must be applied between the frame of the machine and the face gear where there is very little room. If the lock should be in a position where it is not accessible, it becomes necessary to pull the belt around. Furthermore, modern construction requires safeguards for the belts, and such safeguards should be permanent. They should not be removable shields which may be forgotten when they have once been removed. When such permanent shields are used it may become entirely impossible to reach the sliding block. The back gears themselves, also, present a more or less unsightly appearance. They and their guards form large projections on the frame of the machine and detract from its symmetry.

Machinery Quotations for Our Export Trade —Discussion

By L. B. Gerold

The writer has read with interest the points set forth by Mr. Wearin in his article under the above title which appeared on page 174 of *American Machinist*. Although short, the article contains much food for thought for American manufacturers and agents who contemplate carrying on an export business.

A quotation "Free on Board Ship; Freight and Insurance Paid" involves more than is apparent at first glance. Among other things it places the responsibility for the shipment on the shoulders of the manufacturer until the goods have arrived safely at foreign port. Accidents during the voyage, be they due to any causes such as breakages, marine risks or losses of any sort, will involve him in long drawn out controversies and trouble, not only with the transportation companies but with the customer. Besides this such a quotation contains a speculative element as transportation costs are subject to considerable fluctuations.

Why assume unnecessary risks or deal in futures when a simple "f.o.b. American Port" quotation will prove acceptable to all interested. I do not mean to imply that one should quote inflexibly this way for there may be conditions that might modify it at times, but my experience has proved that the average foreign inquirer, who desires to deal direct, understands the steps and costs involved in obtaining his goods; also the channels through which he can obtain the necessary information to enable him to calculate intelligently the ultimate price to him.

As Mr. Wearin remarks, it cannot be reiterated too often that manufacturers should give the gross and net weights and the shipping dimensions. It is also very much worth while that careful study be made of the product with a view of packing it in the least possible cubic space. A very recent case comes to my mind of where, by detaching certain readily removable parts from a machine, there would have been a saving of 35 per cent in the ocean freight. Attention to these details increases the chances of competing favorably against the exceedingly keen foreign manufacturers. Don't create a masterpiece and then put it in the hands of a carpenter and his assistant for the finishing touches unless you know he is doing right. The maintenance and growth of our foreign trade requires that thought be put on the details connected with the work.

SPECIAL AUTOMOTIVE

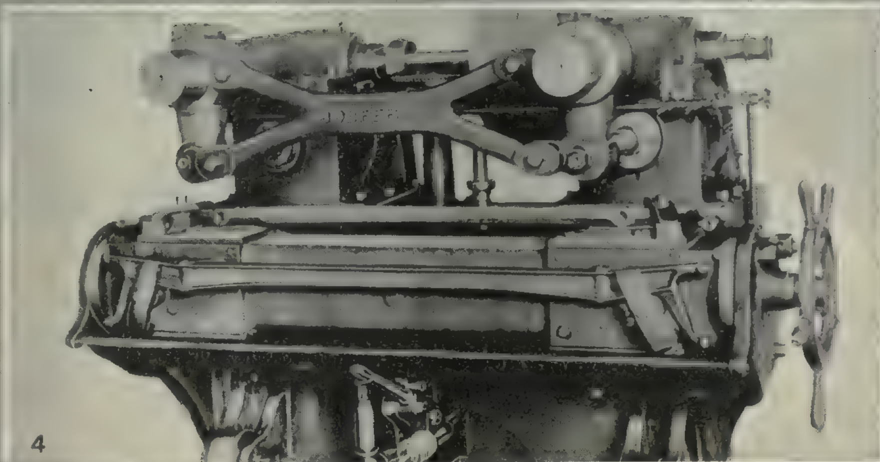
Fig. 1—Special Newton milling machine for tractor front axles. After axle is in place the table moves work in against the vertical milling cutters in the center. Then the heads at each end are fed in, the yokes milled for the steering knuckles, and the heads move out again. The table then moves out for reloading. The movements are cam operated.

Fig. 2—Newton drum type machine milling tops and bottoms of cylinder blocks. Upper mills rough before lower mills finish.

Fig. 3—A Newton milling machine for small work. There are two vertical spindles although the finishing cutters only are shown in position. Work is clamped to a ten-sided drum fitted with proper locating pieces for holding two pieces on each face. Roughs and finishes at one pass of the work past the cutters.

MACHINING METHODS

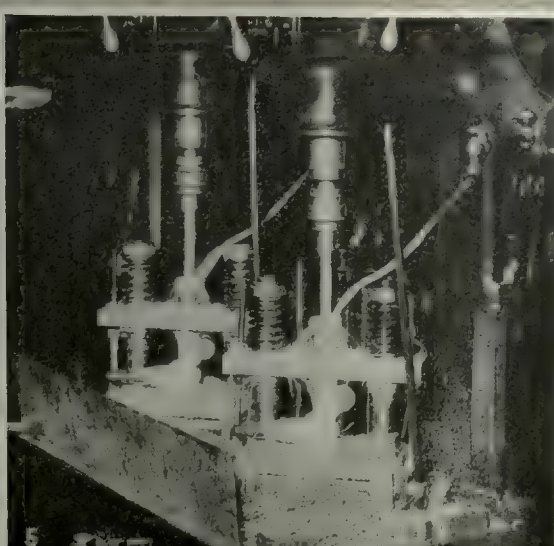
Fig. 4 — Hoefer milling machine for front axles. Forgings are held on a four sided drum which is mounted on a knee that is fed upward to the cutters by cams below the rollers shown. The work drum is indexed by the hand wheel at the right. Can be equipped to mill jaws for steering knuckles. Production time 1¾ minutes.



4

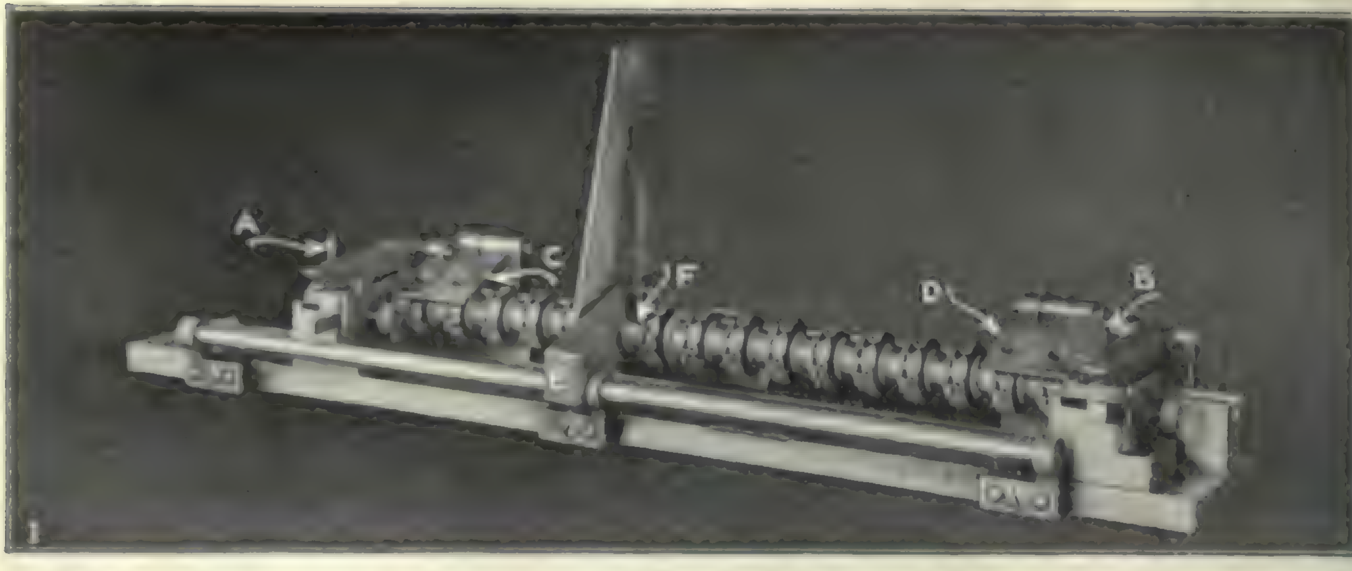
Fig. 6—Another Newton milling machine with a long, horizontal spindle carrying cutters for facing the ends of crankshaft bearings in a motor block.

Fig. 5—A double-spindle Colburn heavy-duty drilling machine drilling and reaming steering knuckles. The knuckles are held in spring-controlled drilling fixtures which allow of easy handling, as it is only necessary to raise the upper bar, remove the drilled piece and put a new one in place. Hole is ¾ in. by 5 in. deep. Production 24 per hour.



5

6



Fixtures for Assembling Calculator Wheels

A Combined Assembling, Testing and Drilling Fixture That Is Convenient and Efficient—An Unusual Staking Fixture

By FRED H. COLVIN
Editor, *American Machinist*

THE Monroe Calculating Machine Co., Orange, N. J., has some very interesting methods of assembling its machine. Among them is one for locating the numbered wheels properly on the shaft that carries them. The dial wheels are positioned by means of hardened steel plungers which locate in depressions in the gears. The plungers are controlled in holes in the flanges of the collars supporting the dial gears and the collars in turn are located in line upon the spline-shaft by means of embossed keys which fit the spline. The combined locating and drilling fixture is shown in Figs. 1 and 2.

The shaft with the wheels already mounted, is placed in the fixture as shown in Fig. 1, and clamped lightly by the thumbscrews *A* and *B*. The sight or window gages *C* and *D* are then swung down and the shaft turned until No. 3 shows in each window. To insure the setting, the gage *E* is put in place on the fixture and the forked, lower end of the pointer, placed over the pin shown at *F*. When this is correct the upper end of the pointer must be between the limit lines shown. The shaft carrying the dial wheels is then clamped tightly, the gage removed, and the shaft is ready for drilling. The fixture is then placed on the table of a multiple-spindle drilling machine.

Only two holes are drilled, one in each end, for the gears which actuate the numbered wheel shaft. The same fixture acts as a drilling jig, utilizing the two end pieces as *A* and *B* in Fig. 2. These end pieces swing down over the shaft and contain bushings to guide the

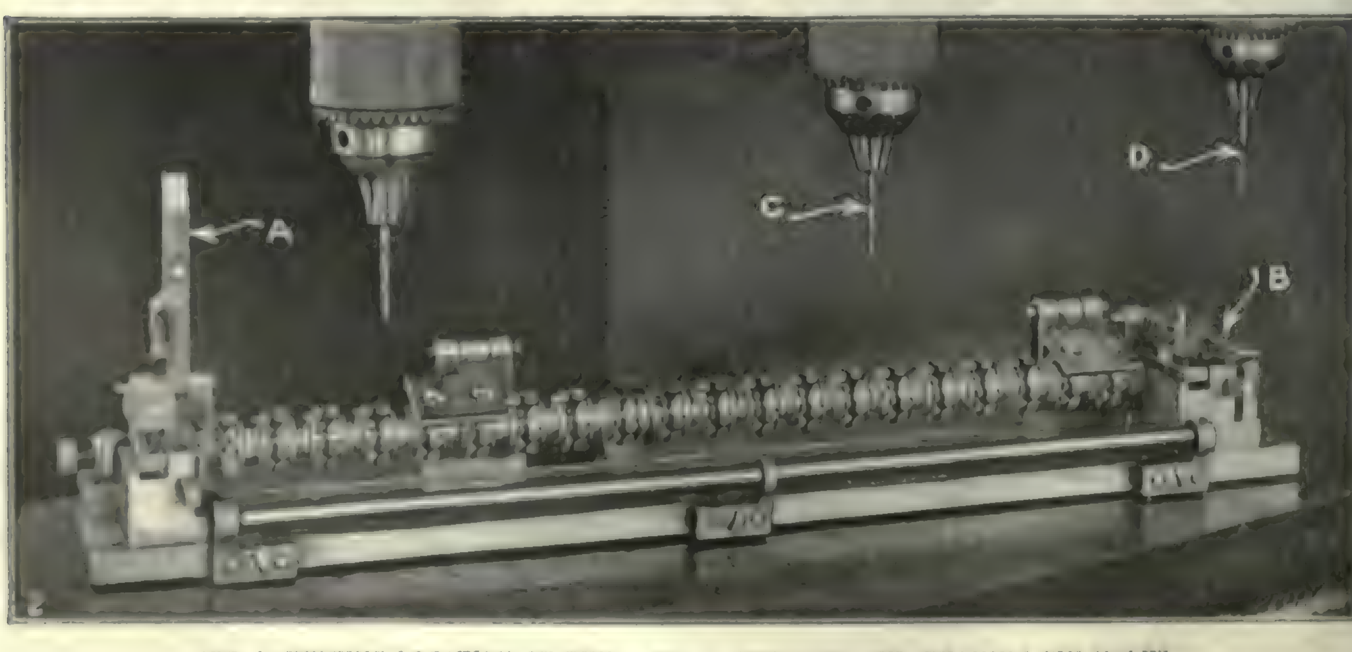


FIG. 1—TESTING LOCATION OF PINS FIG. 2—DRILLING AND REAMING PIN HOLES

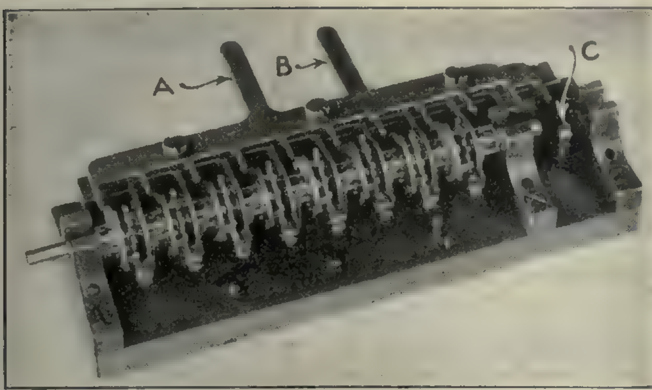


FIG. 3—FIXTURE FOR STAKING PINS

drills. The holes are afterwards reamed for a taper pin, the reamers being shown at *C* and *D*.

Another interesting assembling fixture is shown in Fig. 3 and is for staking the pins in one of the wheel shafts used in the calculator. The wheels are held in position by light springs and in order to stake the pins readily it is easier to hold the wheels apart. To do this easily the shaft is placed in the fixture shown when, by grasping the two handles *A* and *B*, the forks which fit in between the wheels, separate them while the staking is being done.

Beneath each pin is a steel post with a cup or center in the upper end. The pins rest in these cups so that the blow of the staking hammer is taken by the pin and not by the shaft. One of the staking posts which is used for a longer shaft, is shown at *C*. This fixture enables the work to be handled very quickly and insures a good job.

Quack, Quack!

(Reprinted from *Chemical and Metallurgical Engineering*)

Scarcely a week passes without the receipt of printed matter describing some marvelous liquid or powder which will turn merchant bar into finest tool steel, which will double the mileage of a Cadillac if two drops of the stuff are placed in the carburetor, which will convert the purchasable variety of grape juice into extra dry champagne over night, or which will cure warts, corns, sprains, abrasions, cancer and falling hair. Later in the fall we expect to get some more literature advocating the use of some other stuff, "the result of extensive and exhaustive research, experiments, tests and demonstrations by scientists," which will make the mixture of slate and culm to be sold this winter burn like the cleanest anthracite.

That all of these varieties of "Nulife" are sold in large quantity is sure: so many new ones are constantly appearing. And doubtless they are often sold to men who pride themselves with knowing something about their business. A fair share of the purchasers must also be those who have never been victimized before and who must learn from experience, and in no other way, that there is no virtue in nostrums. Furthermore, it is a standing demonstration of the salesman's premise that it is more important to know the psychology of the buyer than anything about his real needs or the nature of the article offered for sale.

Chemical analysis would in most cases show that the largest portion of "Nulife"—and we offer our apology if this pet word meaning all kinds of quack remedies has been previously appropriated—might be water, sand, charcoal, fuel oil or some such cheap ingredient. But not everybody has the opportunity nor the desire for analyzing "Nulife" and finding out whether he could not make it up for himself for about one-tenth the selling price of the "secret composition." Those who have such opportunities ordinarily have wholesome respect for law, and become instantly suspicious of lurid claims, knowing that in the struggle with Mother Nature you can't get something for nothing.

But it would be just as well to spead the word about. There now seems to be a flood of substances on the market by which "wrought iron or bessemer steel of low grade is converted into the equivalent of costly crucible steel as far as physical properties are concerned." A rule-of-thumb or thoughtless heat-treater might easily believe it, remembering the changes he can make in a piece of really high-grade steel by heating and cooling. But he must be warned by more intelligent friends that the metal he has in hand did not appear by merely waving a wand and muttering cabalistic words. It is the result of most extreme care on the part of a hundred men throughout a dozen difficult operations, from the selection of ore and raw materials through steel making, casting, rolling, annealing and inspection. If he will think a little he will agree that all this infinite care, wrapped up in a little piece of flawless metal, cannot be replaced by daubing some dope on some junk and following the printed directions.

Thirty years ago the late Dr. Henry M. Howe was encountering these same ideas, and what he said is very much to the point: "You cannot make a bad beefsteak good by the cooking; you can cook it better or worse, and it will be worse or less bad beefsteak, but always bad. On the other hand, you can easily spoil a good beefsteak by bad cooking. Now, just as cooking is to food, so is heat-treatment to steel."

When you dine at Lung Tong's chop house in Juarez, you use a liberal amount of chili sauce and red pepper, and for a very good reason: but at the Waldorf you do not need to drown one of Oscar's patties in mustard to make it tasty.

Broaching Wristpins

By George E. Hodges

On high-grade automotive work, the wristpin is so heat-treated that there is a hard wearing surface on the outside, but the hole is left soft to give the pin added strength.

One of the best methods of accomplishing this, the writer has noticed, is the following: The pins are made of seamless tubing, the first operation being cutting off to length. The pins are then carbonized and allowed to cool in the carbonizing material. The next operation is to broach the holes to remove the case, after which the pins are hardened and ground.

The advantage of broaching seems to be twofold. First, the case is removed in good productive time with consequent low labor, tool and machine cost; second, the pins are very readily sorted to close limits in weight, the only variable being errors in the outside diameter and length.

Some plants broach the hole a second time after hardening, this being for finish only. The second broaching is not generally considered necessary.

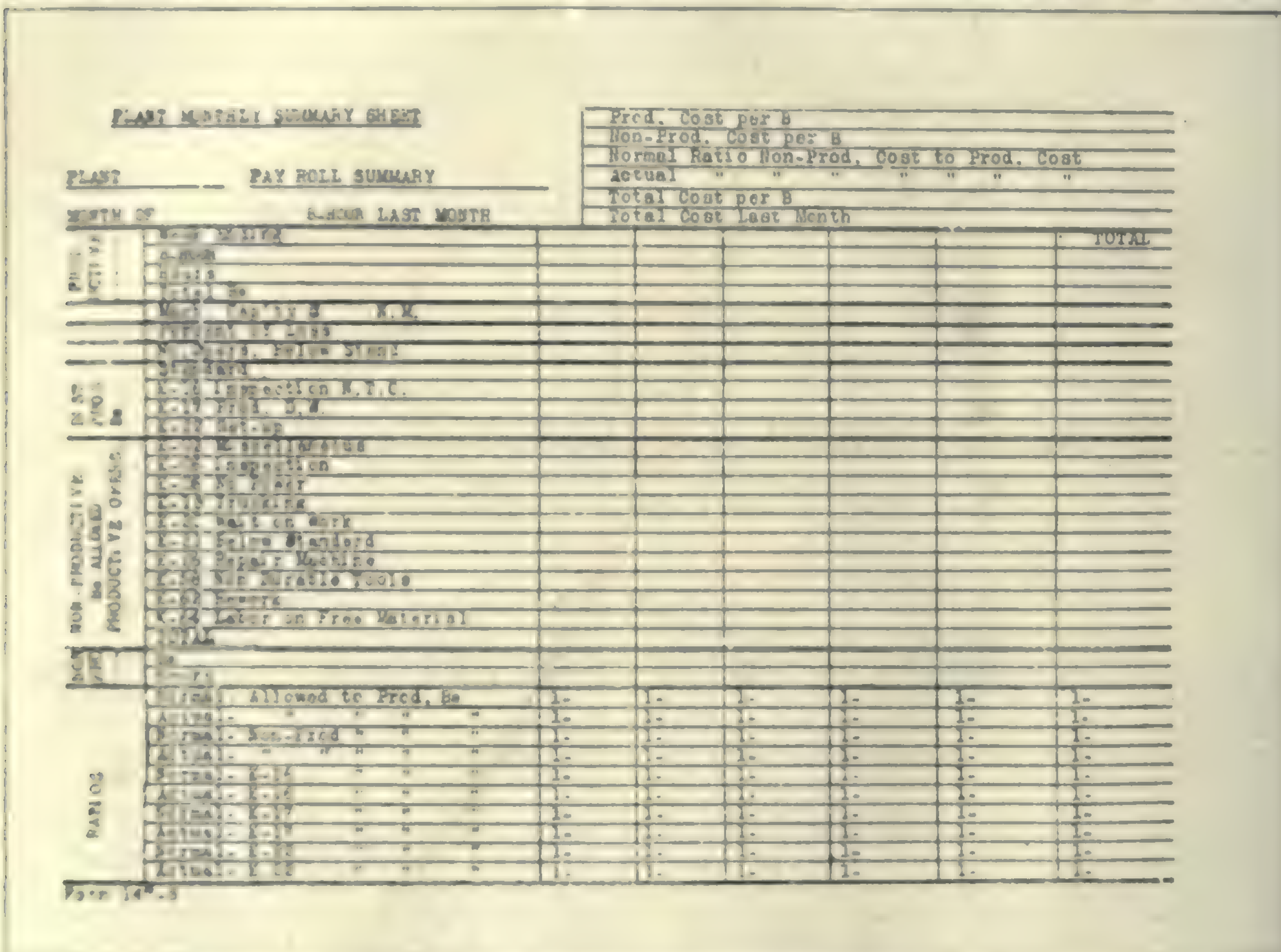
Had none of his jobs shown a loss and the value of the material salvaged remained constant, he would have received

$$30 \times 220 \times \$0.0045 = \$29.70$$

But it is almost certain that the value of the material salvaged would have increased. Had it gone to $8,000 or more the premium would have been $33.

Knowledge of the Bedaux system has induced a desire to see the people at work under it and a trip through the shops is taken. The impression upon entering the machine shop is that it has the appearance of any well-laid-out and efficiently conducted shop. Nor is that impression changed, except in two ways. There is perhaps less material piled around the machines than in the average shop, and there seems to be no visiting among employees. At the same time there are no wild-eyed operators such as may be seen in some piece-work shops, acting as if they were manufacturing money all of which is to be their own. The absence of lost motion is apparent, however, and the closer the observation the greater the conviction that the operators know their own measure and are living up to it, without unduly taxing their strength. The payrolls, previously examined, show that these people are not being underpaid.

The tour includes other departments, which furnish no cause for additional notes and finally brings us to the winding room, where it seems that the work is being done noticeably faster than in other departments. The impression proves to be true. The plant is passing through a business depression and only the best operators have been retained. The interesting fact is brought out that when the plant is running full time there are four classes of winding operators, A, B, C and D. Their hourly rates run say, 36, 30, 27 and 24 cents. But their standards also vary, so that while the Class A operator must do better than 60 Bs per hour to earn a premium, or reward, the Class B operator need do only 50 Bs, the Class C operator 45 Bs and the Class D operator 40 Bs as standards, reward being paid for additional Bs. Class D operators are advanced to Class C as soon as they can hold their own in that class, then to Class B and finally to Class A. The possibilities in this variation of straight B payment are apparent and to be told that it is highly effective causes no surprise.


PLANT MONTHLY SUMMARY SHEET

PLANT ______ PAY ROLL SUMMARY

MONTH OF ______ B-HOUR LAST MONTH

Prod. Cost per B
Non-Prod. Cost per B
Normal Ratio Non-Prod. Cost to Prod. Cost
Actual " " " " " " "
Total Cost per B
Total Cost Last Month

							TOTAL
[illegible]							
[illegible]							
[illegible]							
Total Bs							
[illegible] Capacity B N.M.							
[illegible] by Loss							
[illegible], False Start							
Standard							
K-16 Inspection N.T.C.							
K-17 Prod. D.W.							
[illegible] Set-up							
[illegible] Miscellaneous							
[illegible] Inspection							
[illegible]							
[illegible] Trucking							
[illegible] Wait on Work							
[illegible] False Standard							
[illegible] Repair Machine							
[illegible] Non-Durable Tools							
[illegible] Scrap							
[illegible] Labor on Free Material							
Total							
[illegible]							
[illegible]							
Normal- Allowed to Prod. Bs	1-	1-	1-	1-	1-	1-	
Actual- " " " "	1-	1-	1-	1-	1-	1-	
Normal- Non-Prod " " "	1-	1-	1-	1-	1-	1-	
Actual- " " " " "	1-	1-	1-	1-	1-	1-	
Normal- K-16 " " "	1-	1-	1-	1-	1-	1-	
Actual- K-16 " " "	1-	1-	1-	1-	1-	1-	
Normal- K-17 " " "	1-	1-	1-	1-	1-	1-	
Actual- K-17 " " "	1-	1-	1-	1-	1-	1-	
Normal- [illegible] " " "	1-	1-	1-	1-	1-	1-	
Actual- [illegible] " " "	1-	1-	1-	1-	1-	1-	

Form 14-[illegible]

FIG. 12—PLANT MONTHLY SUMMARY FORM

There is pointed out a job of winding small armatures on which production was increased from 30 to 40 per day. That was during the early months of the installation of the system and the hardest part of that job was to convince the operators that the B value was guaranteed.

Details on a punch scrap baling job are given. Before placing premium on the work, it was thought that a second baling machine would have to be bought. Five men were baling 7½ tons a day but not collecting the scrap or delivering the bales. With premium on the job, the force was reduced from five to three, then increased to five when the operation of gathering the scrap was added, then reduced to three, where it remained. The three now on the job collect and bale

the scrap and haul out the bales. The production is 15 tons per day. There has been no second machine purchased. Asking if the two jobs just described are not "show" jobs invokes the reply that while they are among the best, they are not exceptional.

During the trip through the plant the foremen had shown that they are satisfied with, even proud of their system and the results it is accomplishing. Upon returning to the office we are shown a formula that time and experience have proved to be correct in determining the reward for supervisors and indirect labor. The four factors affecting the computation are:

(1) That part of the cost of the B for which supervision (or indirect labor) is directly responsible.

(2) The theoretical ratings of those participating (*e.g.* foremen of 1st class, foremen of 2nd class, assistant foremen, truckers, job setters, etc.).

(3) The actual accumulation of premium in the pool (money value of 25 per cent of the production above 60 Bs, the 75 per cent having been paid to the operators).

(4) The theoretical rating of the individual participating.

Premium for supervision or indirect labor as well as direct labor is paid by separate check so that it is never confused with the regular salary check.

Reports That Tell the Story

With the examination of plant routine and operation concluded, the next step is a consideration of the several ways in which management follows the progress of the work and knows at all times the costs for both good and scrap parts. It is probably the most interesting phase of the application of the Bedaux system, because ordinarily in many cases cost reports are post mortems —they are too late to benefit the patient, profit.

The only known way to hand cost data to executives is by means of reports. The Bedaux system offers no other method, its principal reports being:

(1) The daily report of operators below standard.
(2) The daily report of the B-hour averages by departments.
(3) The daily scrap tickets.
(4) The weekly scrap report.
(5) The weekly summary by departments.
(6) The monthly summary by departments.
(7) The plant monthly summary sheet.

The function of the daily report of operators below standard is to acquaint the management and foremen with the weak spots in the day's work. The cause for operators being below standard is investigated daily to determine if it is due to incompetency, operator misplaced, lack of knowledge on the part of the operator, or if some adjustment of machines or tools is necessary to meet the daily requirements. Experience has indicated that in the majority of cases where operators are below standard, it was due to some cause beyond the control of the operator. The daily report gives the foremen and superintendents opportunity to correct such conditions daily, if necessary. The form of report is simple and on that account no cut is given.

No illustration of the form used for the daily report of the B-hour average by departments is given, because it likewise is simple, furnishing merely figures showing the Bs for each department and the B-hour values. As there must be a cause for variation from day to day in total Bs and B-hour values, the usefulness of the report is apparent. Ordinarily, it is much easier to locate the cause of a department's falling behind than it is to learn the fact that it is falling behind.

Daily and weekly scrap reports enable precautionary measures to be taken and leaks to be stopped without delay. The daily report invites immediate action, the weekly report prevents unjust action. Likewise an unusual amount of scrap on a weekly report may be found to be justified when the month as a whole is considered.

In Fig. 11 is shown the weekly summary form for one department. Beside its value on account of the information shown, which needs no further explanation, it has a value for later use in making up the plant monthly summary sheets. There are two kinds of monthly summary reports—by department and by plant. The department report is similar to the weekly summary report, although more complete. No example is shown.

The plant monthly summary form is shown in Fig. 12. Careful study of this form will show that it points out in actual figures, and compares with similar figures of the previous month, just those things that it is necessary for management to know. Especial prominence is given to K orders, or non-productive work, as it is on them particularly that profit may be lost.

It is always difficult to compare figures and obtain from them the quickest and best conception of the trend an activity is taking. Like almost all modern concerns engaged in business the Robbins & Myers Co. resorts to the use of graphs. There are four principal ones outlined below. The sources of their information have been described. It is fitting that they hang in the office of the production control manager.

Graph No. 1—Manufacturing Results

This graph reflects the trend of seven factors of the manufacturing division and is made up monthly by plants, a separate graph being made for each plant.

The seven factors are as follows:

(1) Productive operators.
(2) Productive Bs produced.
(3) Cost per B (total labor and manufacturing burden).
(4) Allowed Bs (non-productive Bs produced by productive operators).
(5) Non-productive operators (indirect labor such as foremen, assistant foremen, clerks, repair men, etc.).
(6) B-hour average (average productive Bs produced hourly per man). This figure compares with a thermometer in that it reflects the "temperature" or efficiency of the various departments or the plant as a whole.
(7) Scrap Bs. (This item reflects volume of Bs scrapped by inspection, prior to delivery to the salvage department.)

Graph No. 2—Planning and Material

A graph that consists of seven curves listed below and offers a very efficient method of controlling inventory:

(1) Raw material on hand
(2) Manufactured parts in stock.
(3) Work in process.
(4) Finished motors in stock.
(5) Finished fans in stock.

(6) Branch and consigned stocks (fans and motors).

(7) Purchased tools and shop supplies on hand.

GRAPH NO. 3—LOAD CHART

The following three very important features are shown:

(1) Capacity of plant (shown in Bs computed monthly according to the number of working hours or days in the month).

(2) Sales schedule (reduced to Bs).

(3) Actual production (in Bs).

These curves reflect instantly the gap between the capacity of the plant and sales schedule; also, whether actual production is meeting or exceeding the sales schedule. In a case of the latter, it indicates that parts are being manufactured for stock in excess of sales requirements.

GRAPH NO. 4—INSPECTION GRAPH

A graph that reflects eight factors concerning the inspection department as a whole. All of these curves show money values:

(1) Value of scrap less salvage.

(2) Payroll of inspection department.

(3) Per cent of value of work scrapped in relation to shop cost.

(4) Cost of operating the salvage department.

(5) Savings of salvage department.

(6) Total value of scrap.

(7) Shop cost. (This item covers complete cost of manufacture.)

(8) Free repair cost to customers. (All service cost to customers within guaranteed time limit of company's product.)

High-Speed Rotating Machines

Developed for Testing the Burning Action of Powder Rings in Shell Fuses Under Normal Conditions—Special Chronograph for Recording Elapsed Time

BY H. M. BRAYTON

THE literature pertaining to mechanics and mechanical engineering has during recent years contained many articles on high-speed rotation. It is not the purpose or intent of the writer to develop new theories of balance of rotating parts or to attempt to add to the already well developed science of dynamic balance. It is rather the purpose here to tell the reader what has actually been accomplished along this line by the Army Ordnance Department under the pressure of necessity. No attempt will be made to explain the results obtained. The mathematical treatment will be left for those better qualified, should they be interested.

It is necessary to rotate an artillery projectile at a high speed in order to make it stable and so that it will carry properly in flight. This rotational speed varies widely in the various calibers covering a range from 4,000 r.p.m. in some of the large guns and howitzer to over 38,000 in some of the smaller howitzers. The usual speed, however, is around 17,000 r.p.m. and is accomplished by the rifling in the bore of the gun.

In the development of new types of fuses to meet the needs of the service, it became necessary to study the action of certain moving parts within the fuse that were operated upon by the centrifugal force created by the rotation. It is true that these forces can be calculated with mathematical exactness but it was soon found that the fuse did not perform as it was calculated to do and a more practical method of studying the action was at once needed.

Under the law of necessity the Ordance Department began an intensive study of rotating machines and the best experts were called in for advice. It was desired to rotate a 1½-lb. fuse at 17,000 r.p.m., but some of the experts said it could not be done. Others believed it could be done by the installation of the necessary elaborate apparatus which was to cost $6,000 and take up about 200 sq.ft. of floor space.

This price was of course excessive but the department was in urgent need of a rotating machine for carrying on experimental work and a decision had about been reached to place a contract for the $6,000 apparatus when a dark horse entered the field. This dark horse appeared in the form of a gentleman who had probably never heard that such high speeds are not practical. He was not an engineer or scientist but he had heard that we wanted a high-speed rotating machine and claimed to have produced it. In other words he carried out the well known motto "He didn't know it could not be done so he went ahead and did it." At any rate a demonstration proved his statements to be correct and his machine would actually run at 20,000

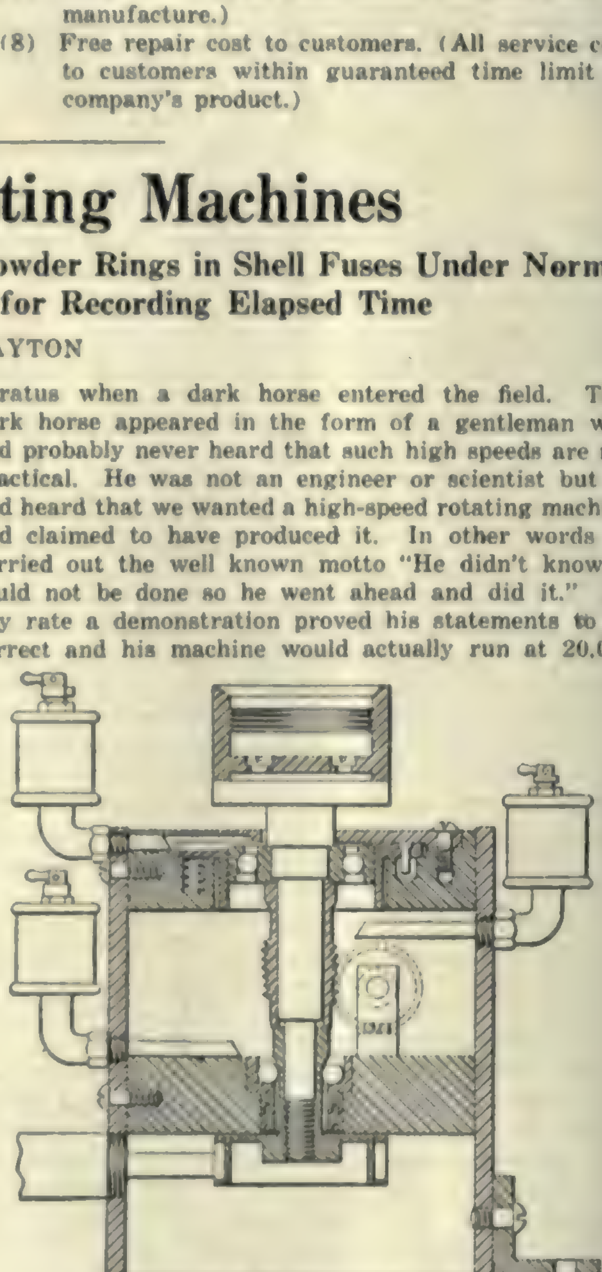


FIG. 1—DETAILS OF THE ROTATING MACHINE

r.p.m. Needless to say the machine was purchased at a price very much under $6,000, and the floor space required for installation of the machine was negligible.

The rotating machine itself is very simple. A sectional view of the assembly is shown in Fig. 1. The machine has a vertical spindle mounted in ball bearings of the usual form. The bottom bearing is a regular thrust ball bearing. The top bearing is mounted in a plate supported on eight small coil springs. This plate

is made with considerable side play in the head. In other words the shaft is not held rigidly and therein probably lies the secret of the success of this machine. The shaft is permitted side play and will thus find its own center. It may vibrate considerably while passing through the critical speeds but it will always smooth out as it goes higher.

The whole interior is mounted as shown in a circular steel shell, and the bearings are lubricated with very thin oil by means of ordinary oil cups. At the bottom of the shaft is mounted a fan designed to operate on air pressure of about 75 lb. On the center of the shaft a worm is cut into which a wheel meshes. A side shaft runs out through the casing of the machine and is arranged to take a speed counter. The speed read on the counter must be multiplied by 25 to get the speed of the shaft which carries the fuse.

At the top of the vertical spindle any special fixture or holder may be mounted to take the fuse which is to be rotated. The more weight put on the shaft the less the speed obtained. It is an actual fact, however, that a speed of 50,000 r.p.m. has been obtained with this machine with a weight of 1½ lb. at the top. With nothing but the bare shaft a speed of 74,000 r.p.m. has been obtained. The values appear to be very excessive to those who are familiar with high-speed rotating devices but they have actually been obtained and what is more these facts can be proved at either the Frankford Arsenal, Philadelphia, Pa., or the Picatinny Arsenal, Dover, N. J., where the machines are installed.

The design shown here has been modified considerably from the one first made. As previously stated the first machine would give 20,000 r.p.m., but it was found possible by certain changes to greatly increase this speed and at the same time greatly increase the life of the machine.

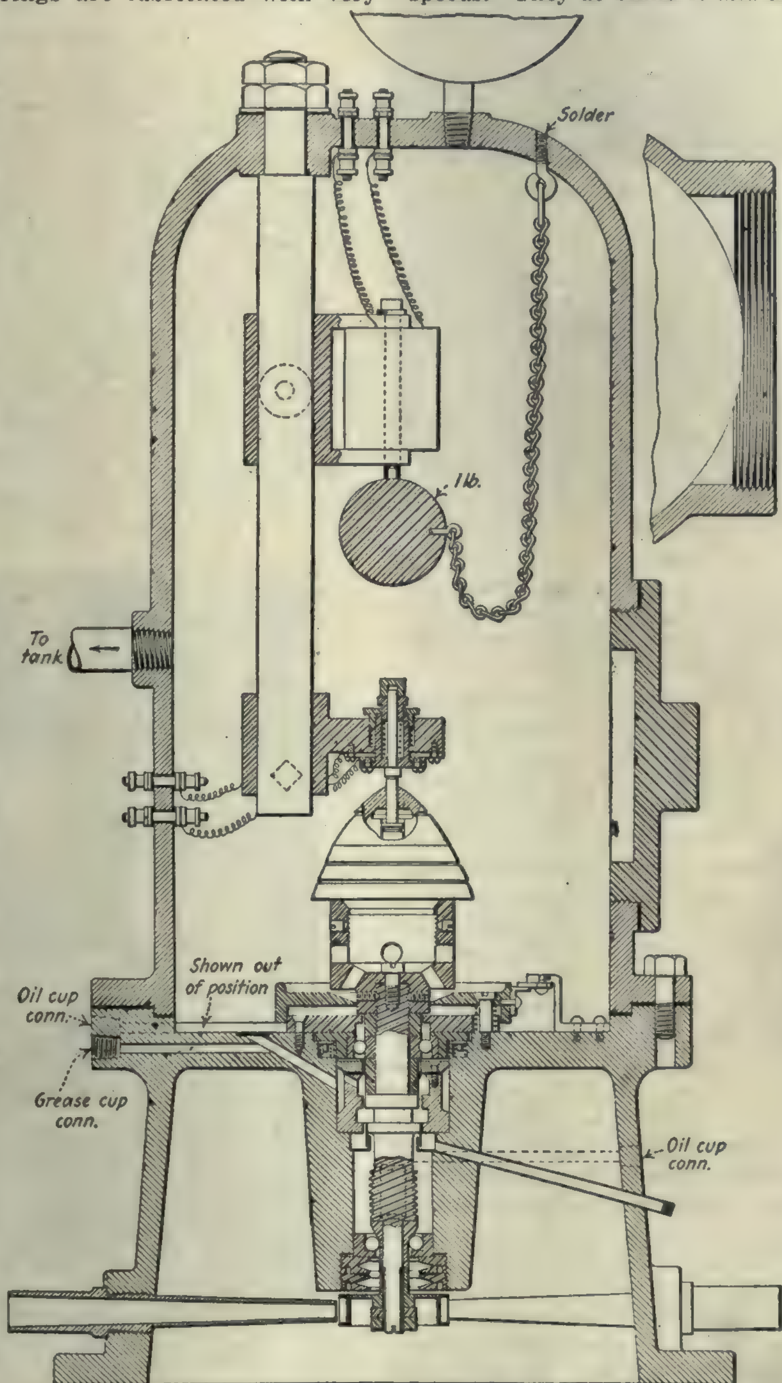


FIG. 2—DETAILS OF MACHINE FOR TESTING BURNING TIME OF FUSES

The reader who is familiar with such machines will at once think that such a speed would very quickly wear out the bearings and shaft. Such is not the case however as one machine at the Frankford Arsenal has been in constant use in experimental work for over a year and still appears to be as good as ever. One of the leading makers of ball bearings stated officially that no ball bearings could be made to stand such speeds. They do stand it and are giving perfect service to the Ordnance Department. Higher air pressure for driving the shaft than 75 lb. has not been tried, due to lack of facilities for obtaining higher pressures where the machines are now installed. The air used must be passed through a separator and all water removed, as any water will choke the rotor and at once reduce the speed. The machine is mounted on a table or bench and a hole is cut under it for the air to pass through after it has done its work on the rotor. Needless to say this machine has been of invaluable assistance in the development of artillery fuses. With it we can study the action of any projectile mechansim under the actual forces which it receives in flight and we are able to reach higher speeds than any gun in our service gives to its projectile. The powder ring time fuse was used almost exclusively during the late war wherever a time fuse was needed. These fuses were quite satisfactory for use in artillery as employed before the advent of the airplane. High trajectories were not common except in certain mortar firing in seacoast artillery work.

It has been a well-known fact for years that the powder ring in a time fuse burns at different rates at different pressures, that is, at different atmospheric pressures or gas pressure of the surrounding medium. To be more specific it was well known that as the air pressure surrounding the burning fuse was increased, the time of burning of the fuse was decreased and vice

FIG. 3—THE ROTATING MACHINE

versa. This means of course that as the projectile which carries a powder time fuse travels upward from the earth's surface into the rarer air it burns slower. With flat trajectories the results are opposite as the fuse would burn faster. Such fuses are timed statically on the bench and if a time in flight of 21 seconds is desired, a time of 22.5 seconds is obtained on the bench. This reduction of time in flat trajectories is probably due to the building up of air pressure at the nose of the shell.

Again it has been well established that the rotation of the shell itself, with no linear movement of the fuse or change of exterior pressure, will affect the timing of a powder fuse. The rotation makes the fuse burn slower apparently by creating a lower pressure inside. This effect varies with the speed of rotation.

When the airplane came into general use for war purposes the anti-aircraft gun was developed to combat it. All shrapnel are equipped with time fuses and practically all with powder time-fuses. With the anti-aircraft gun came high trajectories which carried the shrapnel and fuse up into the regions of considerably reduced atmospheric pressure. In compliance with well-known laws the powder time-fuses failed to perform properly. The higher the angle of fire the slower the fuses would burn with the result that the shrapnel would burst beyond the target without effect.

Intensive study has been put into this problem but much still remains to be done. In order to study the behavior of powder time-fuses under the same conditions of flight, as near as it was possible to duplicate them, a special apparatus or machine was designed and built at the Frankford Arsenal. This machine is unique because it is believed to be the only one in existence. Furthermore it performs perfectly the functions for which it is designed.

In order to obtain definite information on the rate of burning of a powder ring in a time fuse in flight, it is necessary to duplicate all conditions and at the same time take the "time of burning" accurately. These conditions are first: to rotate the fuse at the same speed as when the projectile is in flight; and second to establish a pressure around the fuse equal to that obtained in flight. In other words a machine has been designed and built by which it is possible to take the time of burning of a powder time-fuse while being rotated at the same speed as when the projectile is in flight and while surrounded by air pressure or partial vacuum equal to that in flight. Of course the air pressure varies throughout the trajectory and we have to run tests at definite pressures for each increment of travel. These pressures at different altitudes are quite well known. Tests at different rotational speeds are needed only to study the effect in different guns, as a projectile in flight slows down but very little throughout its travel. This statement does not apply to gas shells in which the rotational speed is considerably reduced. This reduction in speed is due to the liquid inside of the shell acting like a brake trying to catch up to the speed of the shell.

Description of Machine

A sectional view of this machine is shown in Fig. 2. It consists of a casting mounted over the regular high speed rotating machine previously described. This machine is driven by two air nozzles. The idea in using two nozzles was to equalize the thrust on the lower end of the shaft and incidentally to learn if the two nozzles would give more speed. It was found that no greater speed was obtained.

The illustration shows a regular powder time fuse mounted in the upper part of the vertical shaft. Just underneath the special fuse holder is a plate which carries at its edge, at the extreme right, a bracket contact which establishes an electric circuit. These wires lead to a chronograph outside the machine. When the base charge in the fuse explodes after the rings have burned through, the gases from the black powder force the plate down and break the electric connection

FIG. 4—MACHINE FOR TESTING BURNING TIME OF FUSES

at the right. The breaking of this circuit is recorded on the paper of the chronograph and thus registers the time when the fuse finished burning.

From the top of the casting a large steel rod hangs vertically downward. This rod carries an adjustable bracket which is part of an electromagnet. Wires lead from this magnet outside the casting through two binding posts. The magnet holds up a steel ball the dropping of which functions the fuse as follows:

At the lower end of the vertical steel rod is another bracket used to support a firing pin and another breaker mechanism. The ball is dropped by opening the magnet circuit and strikes the top of the firing pin driving it down and firing the concussion primer of the fuse. At the same time it breaks the circuit incorporated in this mechanism. This circuit is connected to the same chronograph as the circuit at the base of the fuse. This upper circuit registers the time when the concussion primer fired and ignited the top ring of the fuse. The distance between these two marks on the chronograph is a measure of the time in seconds taken by the fuse to burn through.

The casting is arranged with a hand hole in the side through which a fuse may be placed in the holder. Both brackets on the rod are adjustable for height, thus making it possible to test any time fuse, and also to drop the ball upon it from any reasonable height.

This machine is arranged for either internal pressure or vacuum. If pressure is required it is fed in through a pipe line at the left from a tank which in turn is supplied from a pump. The tank is interposed between the pump and machine to reduce pulsations. Similarly we can obtain vacuum inside the case by pumping out the air. As this machine is now installed it is possible to obtain either 25-lb. pressure or 21 in. of vacuum (less than 5 lb. absolute pressure) with the same small pump. This is done by an arrangement of valves.

It was comparatively easy to make this apparatus air tight to these pressures except for the space around the rotating shaft. Any of the ordinary forms of packing would not do because they would bring so much friction on the shaft that the desired speed could not be obtained. At first it was attempted to obtain an air seal around the shaft by means of oil under pressure. This was not at all satisfactory as the oil would all be thrown out. Due to the high speed desired as in the earlier rotating machine it was necessary to leave considerable clearance around the shaft. This clearance was not conducive to easy sealing against 25 lb. air pressure.

After many difficulties the problem was finally solved by the incorporation of a soft leather washer formed into a cup as shown. This washer caused very little friction on the shaft and did not prevent obtaining the desired high speed. The washer is for use either with pressure or vacuum. With pressure inside, the washer pushes down against the surface underneath and the greater the pressure the greater it will bear. The leakage is very small and easily taken care of by the small pump.

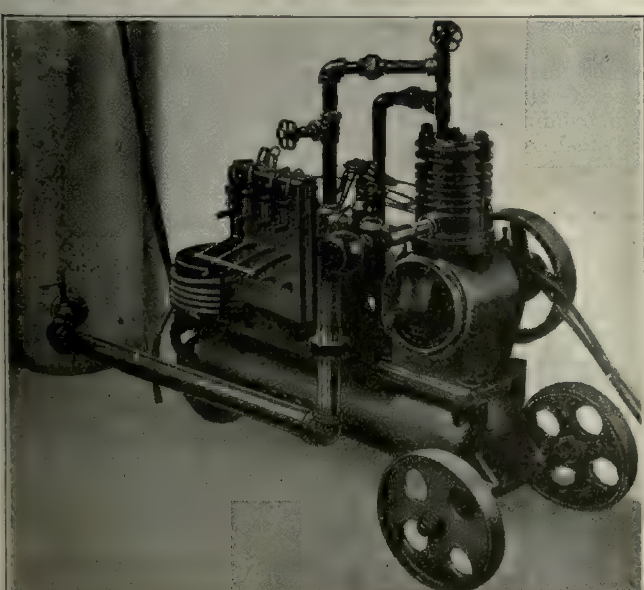


FIG. 5—THE PUMP AND TANK

The apparatus in its present form lends itself to rapid manipulation and it is possible to conduct tests quickly. A vent is arranged to carry all the burned gases from the fuse outdoors so that prolonged testing will not injure the operator.

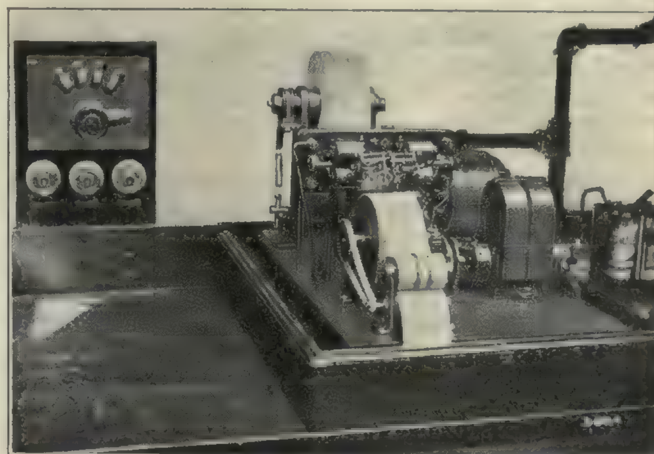


FIG. 6—THE CHRONOGRAPH

Some photographs are also given which show the actual machines discussed in this article. Fig. 3 shows the small machine first described with the safety cap beside it on the bench. It is shown with a time fuse screwed into the head. With this weight it will give a speed of 50,000 revolutions per minute.

A view of the combination machine is shown in Fig. 4. The hand plate that closes the opening through which the fuse is inserted has been removed and is lying on the bench. The tachometer is also to be seen. The air enters through the vertical pipe at the left and the speed is controlled by the valve shown in the front view. The pipe leading to the chamber shown at the rear either conducts air to or from the machine, depending on whether pressure or vacuum is used. The pressure or vacuum is also regulated by a valve plainly shown in both views.

The galvanized iron tank and combination pump used in connection with the machine are shown in Fig. 5. The tank is used to prevent pulsations in the machine itself and to create a reservoir of pressure or vacuum if suddenly needed.

The chronograph, Fig. 6, specifically designed for testing fuses was extensively used during the war. Two records are made on the strip of paper. One records and marks off seconds and the other registers when the fuse started burning and when it finished.

Retaining the Worker's Interest

By Robert Grimshaw

Interest of the worker in his work may be retained by the same means used to awaken it, although a trifle more psychology, perhaps, is brought into play. Monetary incentive is not enough. Pride in the quantity and the quality of the work may not merely be awakened, but it may also be kept alive by friendly competition.

Drafting Room Efficiency

Printed Instructions for Draftsmen — Specifications for Kinds of Fits and Finishes — Designating Tolerances — Eliminating Friction Between Draftsmen and Checkers

By CHARLES SORENTRUE

IN A LARGE number of drafting rooms of manufacturing organizations, considerable time and money could be saved if more attention were given to certain details of system and standardization work. At the same time when proper methods are followed by the drafting room, the cost of executing the drawings by the shop is automatically reduced.

Herewith are some of the more important drafting room methods which were put into practice and found to be very satisfactory by one of the largest manufacturing plants in the country. The methods outlined were adopted primarily to increase the efficiency of the engineering department and at the same time to produce complete drawings at a minimum cost.

One of the first steps taken was to write a book of drafting room instructions, a copy of which was furnished to each draftsman. In this book was incorporated general instructions such as standard methods for dimensioning, the tolerances allowable for different kinds of fits, finishes and symbols used, lists of various stock sizes of material carried in stores, and also photostatic copies of typical drawing of fixtures, gages and so forth.

It is surprising how much more time the drafting room squad leaders had to devote to design supervision after these books were issued. Previously most of their time had been taken up in explaining points covered by these instruction books. In addition to this advantage each squad leader could efficiently supervise from 20 to 25 draftsmen, whereas before he could only supervise from 12 to 15 men.

An assembly sheet and part of a detail sheet for a typical fixture drawing, copies of which were in each instruction book, are shown in Figs. 1 and 2. By referring to these sheets it will be seen that the drafting room furnished complete information to the shop and, by making the detail drawings as shown, a job could be divided among a number of men in the shop by simply cutting out the details along the ruled lines on the print in Fig. 2, the information for each detail being complete in itself. This was often found necessary in order to expedite the work.

Another important point to be noted on the detail sheets is the finish marks f_1, f_2, etc. Upon investigation it was found that parts of fixtures and machines were very often being highly finished by the shop when it was not necessary. This was especially true in cases where the different parts for the same fixture were given to different toolmakers. This unnecessary extra machining was very costly, so the practice was established whereby each surface to be finished was marked f_1, f_2, etc., on the detail drawing according to the kind of finish required. In addition to unnecessary finishes, it was also found that very often the toolmakers were working entirely too close in cases where no tolerances were specified on the drawing, therefore the following was decided upon to remedy this trouble, viz.: a tolerance of $\frac{1}{64}$ in. was allowable for all common fractional dimensions. Allowable tolerances for decimal dimensions were always to be specified. Herewith is a copy of sheet No. 6 from the drafting room instruction book, which explains fully to each draftsman the symbols for finishes and methods of dimensioning drawings. To eliminate any misunderstandings between shop and drafting room, the shop was also furnished with this same information regarding finishes and tolerances.

Tolerances and Finishes

Express dimensions in common fractions if not essential or where accuracy is not necessary.

Scale is used in shop for common fractional dimensions.

Express dimensions in decimals if essential or where accuracy is necessary.

Micrometer is used in shop for decimal dimensions.

Permissible tolerance should be noted for *each decimal* dimension used in connection with machines, jigs, fixtures, tools, gages or other mechanical equipment.

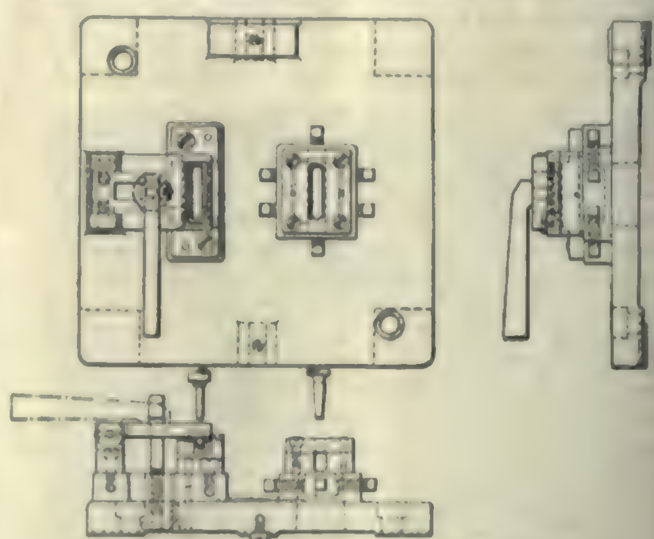


FIG. 1—TYPICAL DRAWING OF A FIXTURE

Never combine two or more tolerances to make a total tolerance dimension. Always leave one dimension blank, in a case of this kind.

For building and machinery layouts, ventilating or structural steel, or other classes of drawings for which no degree of accuracy is required, it is not necessary to note tolerances.

Four classes of fits should be noted on drawings wherever necessary: Drive fit, light drive fit, running fit and slide fit.

The dimension should be given for the hole or part into which the pin or other part fits.

The dimension for the pin or part which fits into another part should also be given; but in addition to the dimension, the class of fit and piece number of the part into which it fits should be noted, thus: Drive fit, No. 2.

When it is necessary for a part to fit close to a model, the dimension is given thus: 0.345 = Mod. $\pm$ 0.0005 or 0.625 = Mod. + 0.0005.

It is not necessary to give a dimension of a radius which is shown on a detail, when the radius is not important and is not governed by any other details.

Finishes

F1—*Polishing Finish:* This finish is obtainable by careful grinding, lapping or scraping. Used for gages, tools, shaft

journals, and other sliding surfaces for the best class of machinery, especially on high speed machines.

F2—*Ordinary Grinding Finish:* This finish is obtained by grinding. Used for surfaces which slide at low velocities with a limited travel; for shafts between bearings; for machine parts which must be kept clean and free from oil, powder, dust, etc.

F3—*Smooth Machine Finish:* This finish is obtained by milling cutters, finishing lathe, or planer tools. Used for surfaces which do not slide, except occasionally, as parts used for adjustment; for parts bolted together; for cams, gears, pulleys, levers and other parts which require a true surface for squaring up and locating and attaching other parts.

F4—*Rough Machine Finish:* This finish is obtained with ordinary roughing tools. Used for surfaces which are needed only for lining up and locating and which are painted after the machine is completed.

F5—*Smooth Forge Finish:* (No machining required.)
Note:—*Surfaces will not be finished by the shop, unless marked*, excepting when it is noted in the heading of the detail that the piece is to be finished all over.

It was also found to be quite a saving to furnish the draftsmen with a list of all sizes of tool steel, drill rod, angle irons and other materials which were in stock. Previous to this a draftsman would often figure on certain sizes of material which were not in the storeroom, whereas if he had known what sizes were on hand he could just as conveniently have used one of the stock sizes. Of course it is necessary to bring a list of this kind up to date as often as possible.

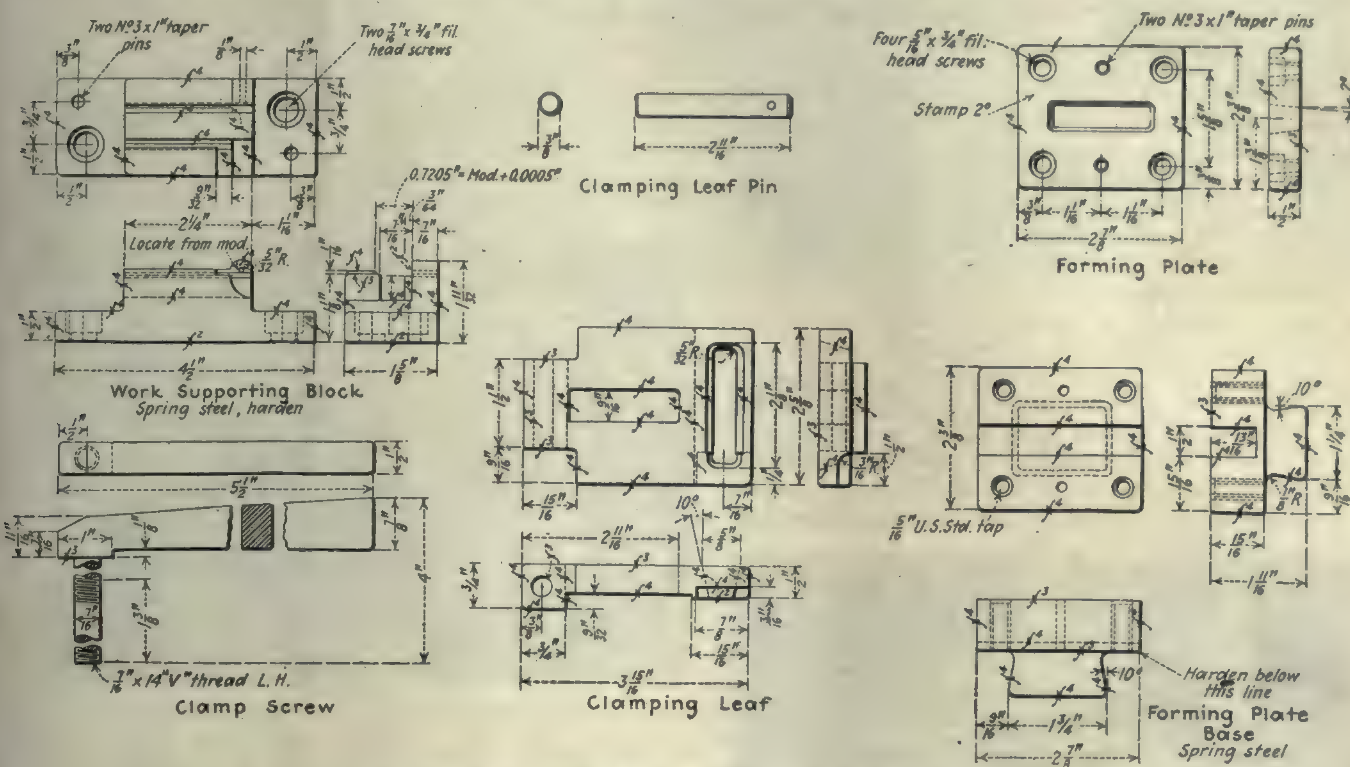
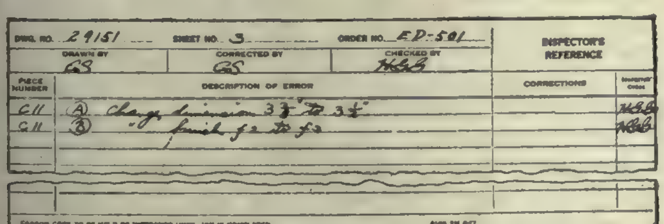


FIG. 2—SOME DETAILS OF FIXTURE SHOWN IN FIG. 1



DWG. NO. 29151 SHEET NO. 3 ORDER NO. ED-501 | INSPECTOR'S REFERENCE
DRAWN BY GS | CORRECTED BY GS | CHECKED BY HGB

PIECE NUMBER	DESCRIPTION OF ERROR	CORRECTIONS	INSPECTOR'S O.K.
C11			
C11			

CARBON COPY TO BE HELD BY INSPECTOR UNTIL JOB IS COMPLETED

FIG. 3—CHECKER'S RECORD OF CORRECTIONS

There is one more point which might be worth while to bring out in connection with drafting room procedures. When I took charge of the drafting room I found that there was considerable friction between draftsmen and checkers. Upon investigation I found the main cause for this friction was the marking of the drawings by the checkers with a colored pencil showing the corrections to be made. Many concerns use this method and in most cases the colored pencil is used without much discretion, thereby causing considerable extra work in cleaning the drawing after the corrections are made. To remedy this trouble a printed form as shown in Fig. 3 was developed and made up in pads in duplicate as shown. By using this form the checker simply put a letter as *A*, *B*, etc., on the drawing alongside of the error and on the correction sheet explained fully all corrections to be made according to letters noted on drawing. The original copy of the correction sheet was attached to the drawing and returned to the draftsman for correction, the checker retaining the carbon copy for rechecking after corrections were made. This method proved to be a very satisfactory one both in time saving and reducing the friction between checkers and draftsmen. In addition this procedure eliminated the possibility of the draftsman erasing the corrections when making the changes, as noted by the checker, under the old system.

The above are only a few of the methods put into practice which helped to increase the efficiency and expedite the work of the entire engineering and tool departments. Similar results can be accomplished in any engineering organization if a certain amount of time and study is devoted to the work, and thought is given to the convenience of all men on the staff.

Rear Axle Making and Testing

Boring Housings — Automatic Switch Returns Assembly Trucks to Starting Point— Rear Axles Tested with Motor and Under the Car's Own Power

By FRED H. COLVIN
Editor, American Machinist

THE Reo Speed Wagon uses a pressed steel rear-axle housing with the two halves riveted and welded as can be seen in Fig. 1. The central space for the differential housing is bored with a special boring head having inserted teeth which also faces the surface for the cover plate. The fixture holds the housing by the turned ends and supports the central portion on pins, one of which is shown at *A*. These ends can be adjusted up against the under side of the housing by the handwheel *B*. The angle pieces *C*, with their screw clamps, prevent side or end motion under the action of the cutting tool. The cutter is piloted below and driven by the substantial key *D*. The work is done on a Baker heavy-duty drilling machine.

A clever time-saving device for handling axle-assembly trucks is shown in Fig. 2. This shows a passenger

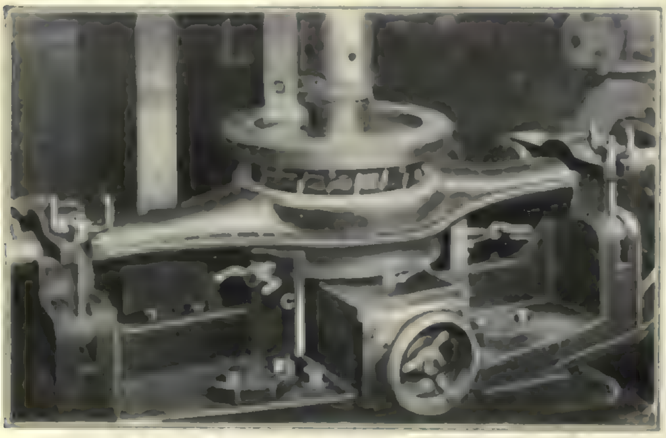


FIG. 1—BORING REAR-AXLE HOUSING

car axle mounted on the assembly truck *A*. The axle is now ready to be removed from the truck, which is then pushed to the right on the movable rails *B* and *C*. These rails are hinged and the weight of the truck throws them downward into contact with the lower, inclined rails. This gives the truck impetus and it rolls up the incline, clearing the swinging rails *B* and *C*. As soon as the truck is off these rails, the springs D and *E* lift the rails and the truck rolls back underneath and goes back to the beginning of the assembly line. The swinging rails are guided at the outer ends as at *F*.

Each pair of bevels for the rear-axle drive is tested

FIG. 3—MATING AND TESTING BEVELS

on the machine shown in Fig. 3. Both the bearing and the noise are carefully noted and selections made to secure the best results. The pinion is driven by power, as in the car, and the ring gear can be loaded by the brake at *A*. The meshing of the teeth is adjustable in both directions, micrometer graduations being provided on the handwheels.

After the axle is assembled it is mounted on the testing stand shown in Fig. 4 and large special wheels or pulleys mounted on the ends. The axle is then driven by the large electric motor shown, the load being taken by the belts which drive a shaft overhead. In this way the axle is made to do useful work during the test and it also works under almost road conditions. The method of holding the axle is of interest as it allows it to be readily handled. The arm A is hinged at *B* and when the locking yoke *C* is thrown up, the arm can be pulled forward. The arm also carries a bar which supports the axle when in the position shown. With the arm thrown forward the wheels can be rolled over the arm, and as it is lifted it raises the axle into position for testing.

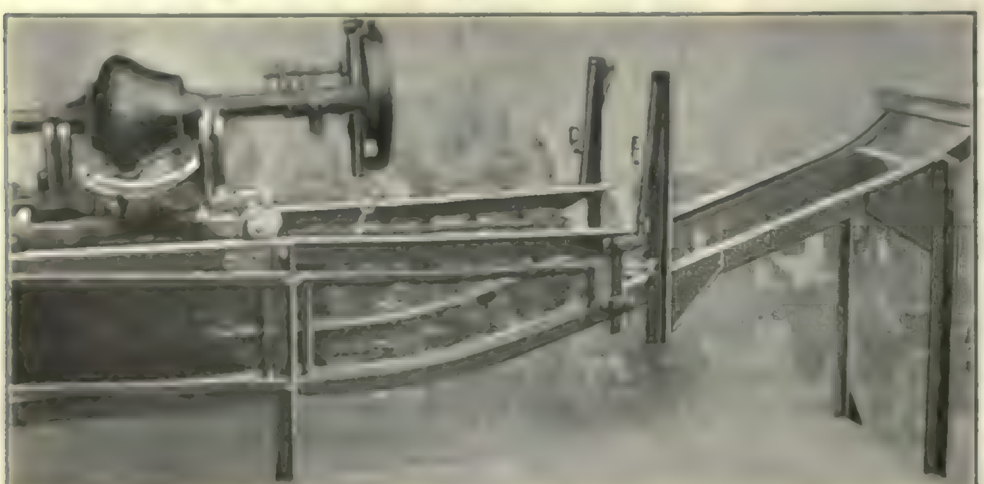
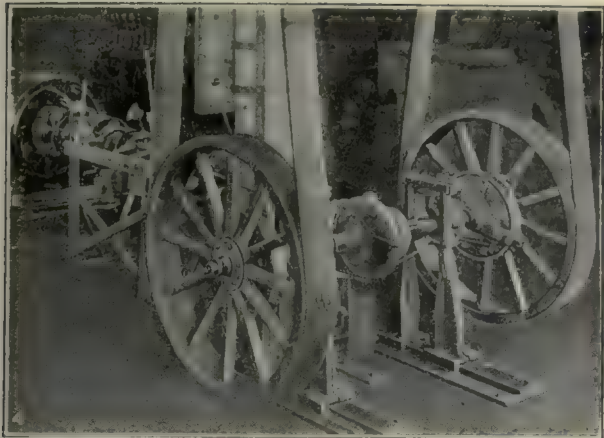


FIG. 2—RETURNING ASSEMBLY TRUCK AUTOMATICALLY

When the chassis is completely assembled it is run to the test room shown in Fig. 5. Here it is backed into place, the rear end jacked up so as to slip the belts over the rear wheels, and the motors are started for their final test. This does not injure the tires in any way and allows the



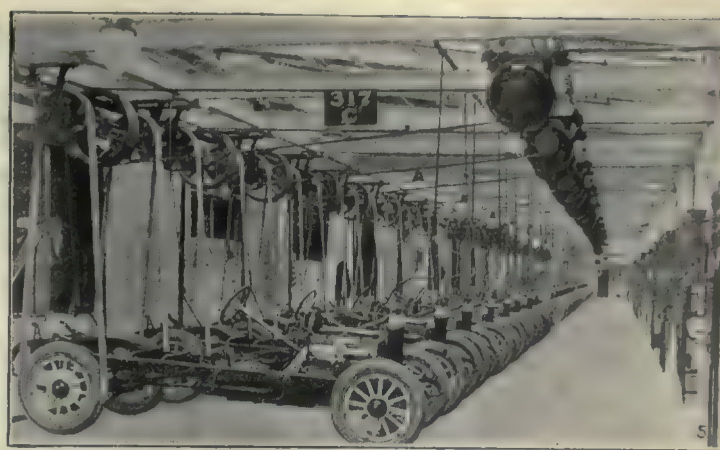


FIG. 4—TESTING AXLES UNDER LOAD. FIG. 5—FINAL TEST OF COMPLETE CHASSIS

wheels to be equipped with their regular tires before this test is made. With the chassis suspended by the chains shown the motor is run at varying speeds and the power delivered drives the generators shown overhead. Provision is made for carrying away the burned gases from the motors. This makes an unusual and interesting method of giving the final test before shipment.

As Not Told by the 1919 Census of Manufacturers

By T. Harrison

I notice on page 192 of *American Machinist* a little tabulation of the wages per wage earner and the profit and overhead in various kinds of industries. Everything is all right up to the end of the tabulation, but then the trouble begins in the form of certain things and remarks. For instance, it says: "From the above it would seem that it pays better in the matter of tools to make shovels and scoops and saws than it does machine tools. Also that it is an expensive luxury to run a foundry."

How a man can see all this from the tabulation is beyond me. When the profit and overhead for the foundry is $998, it may very well be that $8 is overhead and $990 profit and it is quite possible that it may be the other way. Similarly, when machine tools show for profit and overhead $1,643, we are still left in the dark as to how much is profit and how much overhead. To be short about it, profit and overhead together tell nothing in themselves.

Even the wage per wage earner tells very little for we do not know what is the percentage of highly skilled, ordinarily skilled and unskilled labor; the percentage of grown ups, boys and girls. To me it seems that the whole tabulation is a beautiful example of statistics gone astray. It may be said of all statistics that they are all right until somebody begins to draw conclusions. But, when they are as incomplete and as undeveloped as the tabulation given in the little article mentioned above, it would seem that they are without any merit or meaning.

Do Gear Speeds Vary?—Discussion

By Fred Ross Eberhardt
Gear Department Manager, Newark Gear Cutting Machine Co.

The questions brought up by A. L. DeVinne in the article under the above heading on page 72 of *American Machinist*, are natural and are easily answered. What is meant by the tooth curves being placed too high or too low, is the position of the curve produced by a formed milling cutter, if the cut is too deep, not deep enough, or off center. It is readily apparent that the involute curve may be put in the wrong place and rendered valueless as a gear tooth form.

If the tooth curves are not correct, "the relation of the gears will be intermittent or at least irregular—alternately fast and slow." This does not mean that the gears will perform acrobatic stunts visible to the naked eye. Even if the driver is revolved at a constant speed, it will transmit an uneven angular motion to the follower. This may be measured on the various types of gear testing machines which employ recording pens. An exaggerated example would be the motion imparted to a spoked wheel, without the rim, driven by a similar wheel, with the spokes acting as teeth. If a driving gear of great weight, running at a high speed, drives another gear of great weight, at a high speed, the flywheel action of the two gears will tend to prevent uneven angular motion. However, the incorrect tooth forms would cause some portions of the teeth to do all the work, and would induce rapid wear, vibration, noise, and tooth breakage.

With reference to the number of teeth in contact, the *maximum* number possible with the 14½-deg. standard tooth is 2.46. In gearing of the usual proportions, the number of teeth in contact may be two or less. If the tooth curves are incorrect, there will be less than 2.46 teeth in contact, and if they are very bad indeed, there may be only one tooth or less in continuous contact. If excessively incorrect, the teeth will break off as soon as the gears are set in motion and the teeth run with each other.

In his last paragraph, Mr. DeVinne mentions herringbone gears. If made with a sufficient face width to give continuous helical contact, these gears would run with an even angular velocity with teeth of almost any form, which explains why they are used for high-speed work. The helical contact, in addition to the regular involute action in the plane of rotation, tends to counteract any inaccuracies, and gives a greater smoothness of action. In selecting pressure angles for herringbone gears, the same rules may be applied as for spur gears.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Some Examples of Cam Cutting

By Milton Wright

Some examples of cam cutting that are of interest because of their exceptional size and weight are shown in the accompanying illustrations. In each case the cam grooves were cut from solid metal, the cutting being done upon a standard Rowbottom cam-cutting machine,

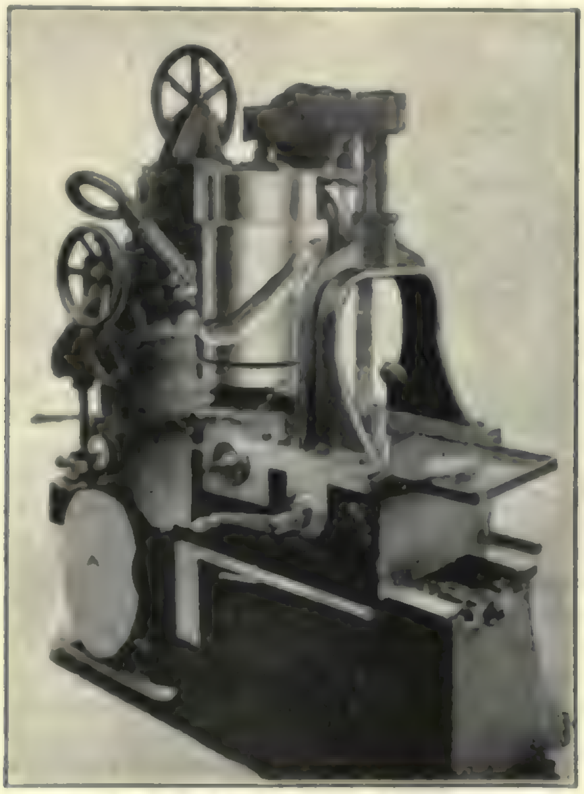


FIG. 1—THE CAM CUTTING MACHINE

in which the cutting tool is guided entirely by a master in the form of a flat plate cam.

This machine is shown in Fig. 1, where it has just finished cutting one of the cams, which, by-the-way, was one of an order of seven. The master cam appears at *A*, just below and to the left of the operator's position.

The completed cam as shown in place on the machine weighs approximately 500 lb., is about 3 ft. long and its largest diameter is 14 in. The central part is an arbor of cast iron over which is forced a shell of mild steel 22 in. long, 14 in. outside and 11½ in. inside diameter. Besides the force fit, the shell is secured to the arbor by numerous fillister head screws.

No preliminary lay-out of the cam surfaces upon the work is needed, though the points of reversal or change of direction of the groove are sometimes prick-punched thereon as a means of checking up as the work progresses. The cut is started with a cutter of small diameter which is fed radially into the work, as if drilling a hole, to a depth of about $\frac{1}{8}$ in., depending upon the nature of the material. The table movement is then started and the master cam and work revolve in synchronism, completing a revolution, in this case, in about 40 min. As each turn is made the cutter is advanced, and this is repeated until the full depth of the cut is reached.

Shifting the work endwise with relation to the cutter for a distance equal to nearly one-half the required width of groove less the radius of the cutter, the metal is cut away first from one side and then from the other of the line of action, leaving a groove that is from $\frac{1}{32}$ to $\frac{1}{16}$ in. less in width than the finish dimension, but conforming in all other respects to the requirements of the cam contour.

The final operation is performed with a cutter of exactly the same diameter as the follower roll to be used with the cam—in this case 2½ in. This is of prime importance, as is also the diameter of the follower, or guiding, roll used in connection with the master cam. Any discrepancy with respect to either would result in an incorrect contour.

The finishing cutter is fed in radially to the full depth of cut exactly at the center of the line of action of the cam, and cuts both sides of the groove simultaneously, removing a small amount of metal from each side and finishing the groove in one revolution of the work.

There must, of course, be a master cam for each *different* cam to be cut, and the laying out of this master is the work of an expert, though the actual making is simple. Disks of cast iron of the requisite diameter and about ½ in. thick are used for this purpose. The actual diameter of the master need bear no special relation to the dimensions of the cam to be cut, though the larger it is the less chance will there be for error.

A development of the line of action is first laid off on a drawing, circles corresponding in diameter to the size of the follower roll struck at intervals along this line, and the line of the two working surfaces drawn in to touch these circles. A straight line is then drawn at a convenient distance below the contour lines of a length to equal the circumference of the work and this line is divided into a number of equal spaces, the number of divisions corresponding to some number of

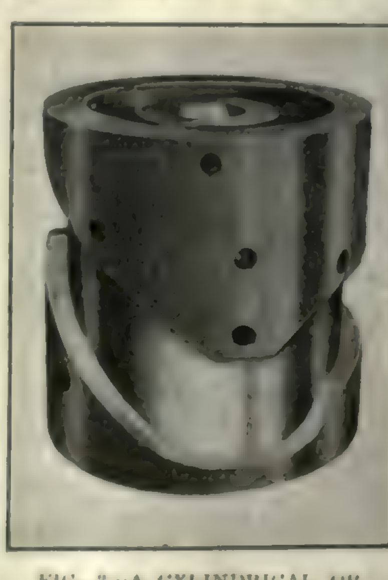


FIG. 2—A CYLINDRICAL OR "BARREL" CAM

degrees that will divide into 360 without a remainder.

Upon a heavily coppered or painted disk of thin sheet metal a circle is struck and divided into a number of sectors to correspond with the number of divisions upon the drawing. Assuming a definite length of radial line upon this templet as a starting point, the distance between the horizontal line and the line of action is measured upon the drawing at two adjacent division and the *difference* laid off along the next radial line upon the templet.

Proceeding in this manner a series of points are established upon the templet through which a line is drawn that represents the contour of the master. This contour may seem to the uninitiated to bear little resemblance to the contour of the cam to be cut, but it may be depended upon when in the machine to produce it. Having cut and filed the templet to match the line it is then turned over to a workman who, with drill and file, soon produces from one of the cast iron disks a master cam to correspond.

FIG. 3—TWO EXCEPTIONALLY LARGE CAMS

An interesting device is used in the lay-out department for laying out and checking the templet and also for checking the master after the latter has been completed. It consists of a bed, somewhat like the bed of a small lathe, at one end of which is mounted a freely revolving hub to turn about a vertical axis. Sliding upon the shears of the bed is a head that carries the barrel and thimble of a micrometer measuring instrument. The stud of the hub is of the same diameter as the stud of the cam cutting machine upon which the master cam goes, and having a keyway to correspond.

To check the templet or master cam it is laid flat upon the hub, the center hole fitting over the stud, and the radial position of the working line is determined at a given point. Turning the templet to the next division the radial position is again measured and the difference noted. Actual radial distances are unimportant; it is the difference that counts.

A "keyline" is struck radially upon the templet (which line may or may not correspond to one of the divisions) and this keyline is usually the point of departure from which measurements are taken. The position of the keyline with reference to any given point upon the line of action is established by conditions in the machine upon which the finished cam is to be used, and this relationship must be rigidly observed in all work upon the templet or master.

Given a correct master, any number of cams of corresponding contour may be cut upon the cam cutting machine with little attention from the operator, who may devote most of his time to other work or may handle a battery of similar machines. An air blast upon the cutter keeps it cool and removes chips as fast as they are formed.

In Fig. 2 is shown a cam similar to that shown upon the machine in Fig. 1, but having a groove for a 6-in. diameter roll. In Fig. 3 two larger cams are shown, both cut upon the same machine. They are each 28 in. in diameter; one being 23¼ and the other 13 in. long, and weighing 1,575 and 1,075 lb. respectively. The roll grooves are all 3 in. wide by 1½ in. deep, being cut through the full thickness of the steel shell. In the larger cam 350 lb., and in the smaller one 220 lb. of metal were removed in cutting the grooves. The reader will realize that these were machining operations of considerable size, so that they were not easy to perform.

Catching the Thread by the "Jump" Method

By John Hansen

On page 970, Vol. 56, of *American Machinist*, appeared an article by B. A. Donley entitled "Catching the Thread by the 'Jumping' Method," and in this article is a statement to which I want to take exception. The statement is: "In any event it is far quicker than stopping the lathe and scaling for position, which is the only other method possible under the conditions."

As to speed, the method that the writer uses might be slower under certain conditions than the one described by Mr. Donley; but it is faster under the majority of conditions.

Years ago, while serving my time as apprentice, a job of cutting 31 threads per in., 19 in. long, and 7 threads per in., 30 in. long was frequently given me. We did not have a dial on the lathe, but a reverse belt. The time required to bring the carriage back to the starting position was too long a wait and the problem was reasoned out this way: That, if the tool could be brought back to a fixed starting point every time and the spindle and leadscrew to the same relative position, the tool would be right in the lead.

Actually, the problem was worked out as follows: The carriage was run back against the tailstock, the spindle was then turned until the locknut would engage the leadscrew without side motion of the carriage. A chalk mark on the top of the faceplate and top of the leadscrew would then indicate this position and everything was set for cutting the thread without using the reverse belt for bringing the carriage back. A cut would be taken the desired length, locknut disengaged and carriage brought back with the left hand while the right hand was working the shifter to bring the marks on the faceplate and leadscrew up again.

By the time the carriage was back against the tailstock the marks would coincide and the locknut could be engaged to the leadscrew and the next cut would be taken. This continued until the thread was finished. The number of threads to be cut and the number of threads on the lead screw are immaterial. The method works under all conditions. It does not require any skill. It is positive, and it also shows that the method described by Mr. Donley is not the only one possible under the circumstances. If the nature of the work does not permit using the tailstock as a stop, a clamp can be attached to the ways or a line drawn to indicate the starting point of the threading operation.

Multi-Drilling in the Turret Lathe

By Irving Lake

Having on numerous occasions been required to lay out tools to machine such parts as wheel hubs, flywheels, pipe flanges, ring gears and other numerous turned parts that required multi-drilling operations, I came to the conclusion that in a good many cases the multi-drilling could be accomplished with greater speed and accuracy if it could be done in the chuck in which the work was turned.

The particular problem was to find a drilling head that could be attached to the turret and would drill six ½-in. holes, equally spaced on a 2¼-in circle. The piece was a cast-iron disk, ¾-in. thick, 2¾ in. outside diameter, bored and tapped 1¾ in. 11 threads per inch and machined all over. After searching widely for such a drilling head and being laughed at, (either openly or after leaving) and told it couldn't be done, I decided to build one myself. After several trials I got together a head that would drill the required holes without stopping the machine which ran at 150 turns per minute. The drills are geared 4 to 1 which gives them a speed of 600 r.p.m.

This multi-drill head works on the same order as a collapsing tap or die, being pushed up against the re-

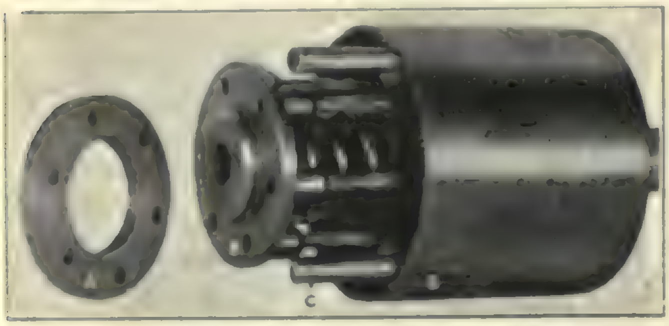


FIG. 1—THE DRILLING HEAD AND THE WORK

volving piece of work and withdrawn when its job is done. This method of drilling uses a standard 6-in. Cushman three-jawed universal chuck. The drills pierce the work so as to miss fouling the jaws. With the jaws recessed it is possible to drill twelve holes on the same circle of 2¼ in. at one contact.

Of course there are limits to the size of head which can be used on the different turret machines, such as the swing over the cross-slide and the clearance over the top of the turret slide. On the upright multiple station type of machine, the size of multi-drill head can be greatly increased. It is possible to build a head to drill a set of holes in the rims or hubs of flywheels, as there is no overhang to cause any trouble and the full diameter capacity of such machines is available at each station.

It is sometimes necessary with the present equipment to make two operations of the drilling where the holes are very close together. In this case six or more holes are drilled through the piece, the piece is then indexed and drilled again between the previous set of holes. This procedure is made necessary by the type of gearing used and the size of the spindles on the multi-drill preventing a closer nesting of the drills. With the head as shown all of the necessary holes can be drilled at one contact, with the work running at whatever speed proves proper for the facing or forming tools. Owing to the fact that this drill head revolves with the work the resulting chips are thrown away leaving the drill head and work-holding chuck of the fixture clean.

The flange to be drilled is shown at *A* in both Figs. 1 and 2. The friction flange *B* contacts with the work and revolves with it, the pins *C* go between the chuck jaws and give a positive drive to the drilling head *D*.

FIG. 2—DETAILS OF THE DRILLING HEAD

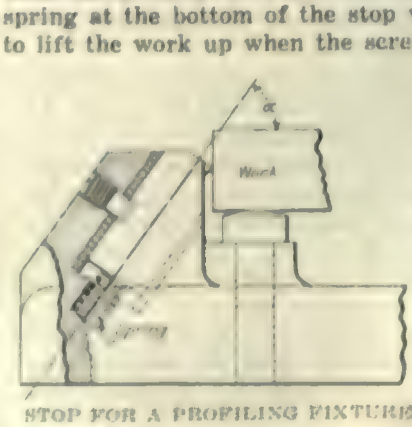
The gears on the drill spindles mesh into a stationary internal gear *E*, Fig. 2 fixed to the back portion of the head. As the head revolves, each spindle turns, and is guided into the work by the bushings in *B*. Advancing the turret feeds the drills through the flange, and the work is done.

Stop for a Profiling Fixture

By Edward H. Tingley

The illustration shows a stop for a profiling fixture that was developed and used successfully by the Delco-Light Co., Dayton, Ohio. In the past, solid stops have failed to hold the work down in all cases and fulcrum finger stops had the fault of coming up above the face of the work to be profiled, except on thick work. The stop embodies the good points of both other styles as the top of the stop comes below the face to be machined and also holds down the work in a very positive manner.

Experiments were made to determine the limits of the angle α that the stop must have with the work and it was found that the stop worked equally satisfactory with any angle from 25 to 45 deg. The stop itself and the bushing in which it slides are both tool steel hardened and ground. It will be noted that there is a small spring at the bottom of the stop which allows the stop to lift the work up when the screw V-block is released and permits it to drop down to lock the work. A screw in the side of the stop keeps it from lifting out or being lost and as the end of the screw is smaller than the slot in the side of the stop, sufficient play is allowed so that the work can lock on the plug.



STOP FOR A PROFILING FIXTURE

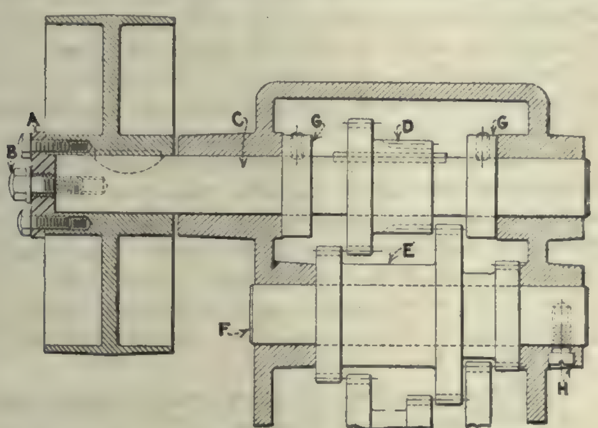
Holding Pulleys and Shafts

By Leroy M. Curry

A pulley fastening devised to meet certain conditions is shown in the accompanying illustration. Shaft *C* was made of cold-rolled or ground shafting without turning or grinding. The sliding gear *D* meshes alternately with gears on sleeve *E*, which turns on stationary shaft *F*. Retaining collars are shown at *GG*.

The cap *A* serves the purpose of holding the pulley firmly in the correct position on the shaft, the actual driving being through the key. The cap is also an aid in removing or replacing the pulley. The central hole in the cap is drilled larger than the ½-in. screw *B*, and tapped with a standard thread. The pulley can be removed by unscrewing *B* and screwing a larger screw into the cap, thus forcing the pulley off the shaft. In replacing, a ½-in. screw of extra length would be used to reach through the hub of the pulley and into the shaft. If used in an exposed location, a metal cap can be used to cover the screw heads, or the design modified so as to use fillister-head instead of hex-head capscrews.

A setscrew is often a very undesirable method of holding a stationary shaft in a machine frame, especially when it must be placed on the outside, and the boss must have a rather thin wall of metal surrounding the shaft.



METHOD OF FASTENING PULLEY AND SHAFT

Besides being unsightly, there is always the probability of the screw stripping the threads in the hub or boss, or of cracking the casting. This can be obviated by using a fillister-head screw tapped into the shaft as shown at *H*. Of course, this method cannot be used on very small shafts or rods.

Fixture for Drilling Round Shafts

By Robert Tait

In automotive repair work it is often necessary to make valves with slotted stems as shown in Fig. 1, and unless a shop has special equipment it is not an easy task. The fixture shown in Figs. 2 and 3 is easily made. It is convenient, not only for valve work but also as a V-block for use in drilling small holes centrally through round stock of any kind. The drill bushing can be clamped in position close to the work thereby giving maximum support and rigidity to the drill.

This particular fixture is 4 in. long by 3 in. wide and will accomodate ⅝-in. round stock. Details can easily be modified to suit requirements.

The work holding member *A*, which is swung down in Fig. 2 to show the details more clearly, has its shank graduated with a series of annular lines $\frac{1}{16}$ in. apart as at *B*, Fig. 3; this acts as an aid in spacing holes. The work holder is hinged in a block *C*, Fig. 2, so that

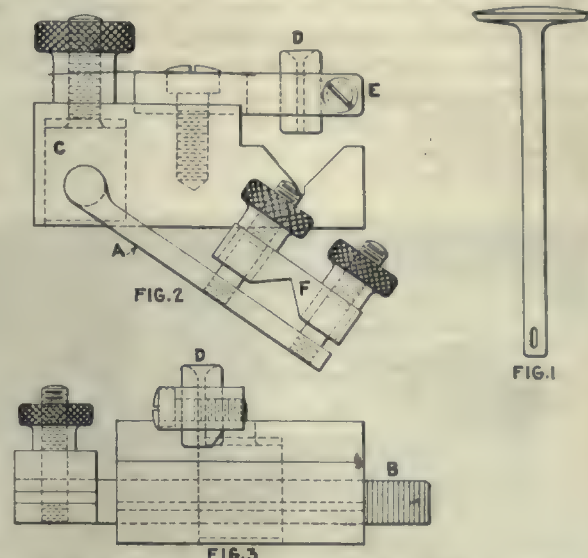


FIG. 1—THE VALVE TO BE DRILLED. FIG. 2—DETAILS OF DRILLING FIXTURE. FIG. 3—SIDE VIEW SHOWING GRADUATIONS

it can be moved to get the work in the desired relation with the bushing *D*. The locking member *C* which is omitted in Fig. 3, is the same as that usually found on surface gages and similar devices. The drill bushing *D* slips through the plate *E* and can be readily removed or adjusted as to height. It is clamped by a screw as shown.

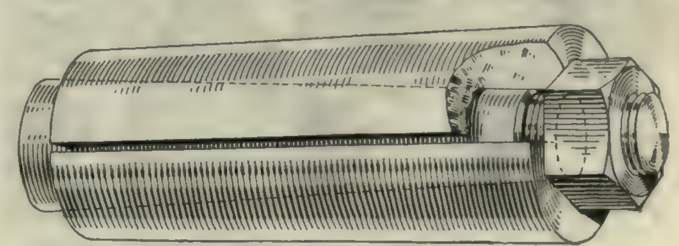
In use the work is clamped by the strap *F* and brought to the proper position for the first hole. Block *C* is tightened, and the hole drilled. After enough holes have been drilled to get the required length of slot the work is moved to such positions as will admit of drilling out the remaining stock between the holes. It will be found that a neat job can be done quite rapidly.

Crosshead Pin That Will Stay Tight

By C. D. Michener

It is the general practice in some shops to make crosshead pins with a taper at each end. Pins so made will sooner or later work loose.

To make a pin that won't work loose, make the outside parallel the whole length, bore a taper hole in it and cut a slit through one side. Fit a pin in the taper hole and cut a thread on the small end for a nut. The



CROSSHEAD PIN THAT WILL STAY TIGHT

accompanying sketch shows the idea. Put the crosshead pin or "bushing" in place and expand it by driving in the taper pin and screwing the nut up tight. This kind of a repair job never comes back.

Grinding Valve Seats and Cutting Oil Grooves

By I. B. Rich

The use of air tools, has long been one of the noticeable features of railroad shopwork. Fig. 1 shows a small independent air drill mounted vertically on a bench and connected by piping to the shop air supply. This is used for grinding the seats of safety valves. The ball shaped lap *A* is mounted on the spindle nose of the air drill and the valve seat is held in place by hand,

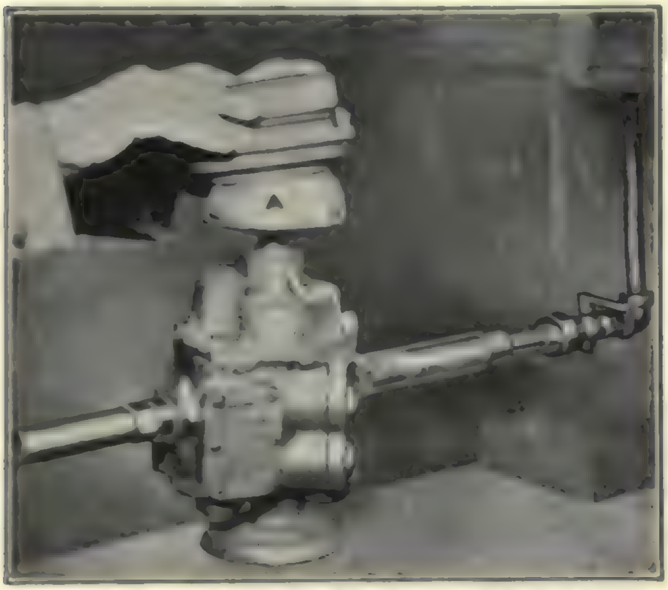


FIG. 1—AIR GRINDER FOR VALVE SEATS

being moved around on the ball to prevent grinding rings in the seat. This makes a rapid as well as an easy method of doing this work.

The use of electric headlights involves motor and generator bearings which require renewing at fairly frequent intervals. Fig. 2 shows a method of cutting the oil grooves in these bearings that is interesting and also a time saver.

The head *A* is mounted on the Fox lathe shown and

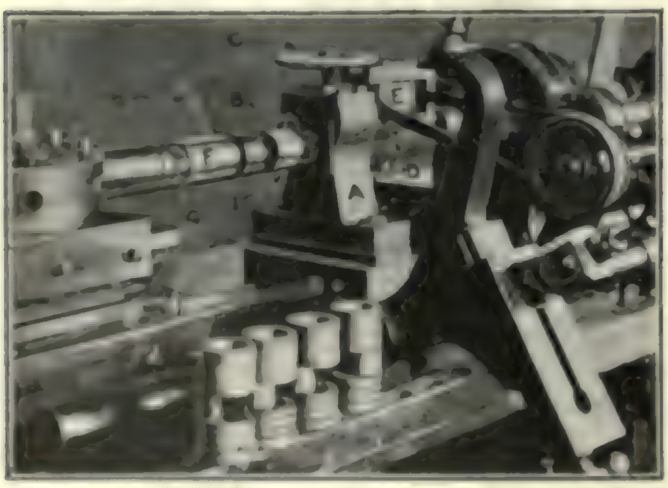


FIG. 2—CUTTING OIL GROOVES IN BEARINGS

carries a small milling spindle in the front end of the bar *B*. This spindle can be moved vertically by the handwheel *C* to regulate the depth of the cut. The milling spindle is driven by a small chain *D* which gets its motion in turn from the belt-driven pulley *E*.

The bearing to be grooved is placed on the holder *F* which is in the turret of the lathe. This holder carries a pin fitting into the groove *G* so that when the holder is turned by the handle *H* the holder and the bearing *I* are moved in the same path as the groove shown. This gives just the oil groove desired, which can, of course, be varied by using bars with different grooves. As shown this device cuts a sort of figure 8 groove which does not run out at the ends. A little practice enables an operator to groove these bearings very rapidly. Both these kinks are from the Readville, Mass., shops of the New York, New Haven & Hartford Railroad.

Formula for Tap Drill Size—Discussion

By H. W. Bearce

Executive Secretary, National Screw Thread Commission

A simple and easily remembered rule for calculating the tap drill size was given by J. R. Owens on page 935, Vol. 56, of *American Machinist*. The rule was: "Subtract the fraction represented by the pitch from the nominal size of the tap." Mr. Owens stated that this rule was recommended for the ordinary run of work that does not require exact figuring.

I should like to point out that not only is the rule simple and easily applied, but that it is also exact. It is adaptable to all threads of the U. S. form, that is, to both the U. S. Std. and S. A. E. series, or to the National coarse and National fine, as established by the National Screw Thread Commission.

The specification of the commission as to the minor diameter of the nut, is that the thread in the nut shall be cut off below the basic flat by an amount varying from ¼ to ⅙ of the basic thread depth. This results in a thread depth of from 75 to 83⅓ per cent full.

The limits of the minor or core diameter of the nut, and, therefore, the diameter of the tap drill, in order to be within the limits set are:

(1) Maximum minor diameter $= D - 2(h - \frac{1}{4}h)$

(2) Minimum minor diameter $= D - 2(h - \frac{1}{6}h)$

(3) Maximum minor diameter $= D - 1\frac{1}{2}h$

(4) Minimum minor diameter $= D - 1\frac{2}{3}h$

$D =$ basic diameter of tap

$h =$ basic diameter depth

$h = 0.649519p$

$p = \frac{1}{n}$

$p =$ pitch

$n =$ number of threads per inch.

Substituting for h in (3) and (4), the equivalent value $\frac{0.649519}{n}$, equation (3) reduces to:

$$\text{Maximum tap drill} = D - \frac{0.97428}{n}$$

equation (4) reduces to:

$$\text{Minimum tap drill} = D - \frac{1.08253}{n}.$$

It is therefore seen that the equation given by Mr. Owens:

$$\text{Tap drill diameter} = D - \frac{1}{n}$$

lies between the maximum and minimum permissible minor diameter. Since this value is somewhat nearer the maximum than the minimum size, the power requirements and the tap breakage should not be excessive, and the drill size should be as satisfactory as any that could be selected.

Editorial

Eliminating Unnecessary Machine Sizes

THERE seems to be a growing feeling among engineers and machine-tool builders that there are too many sizes of machines in various lines to make it possible to manufacture or sell economically. For, while slight variations in size may occasionally aid in securing an order from a competitor, it is very probable that if all the costs were carefully kept, the sale would prove unprofitable.

The bad feature of this practice of overlapping sizes is that it adds greatly to the shop overhead in the way of tools, fixtures and gages and also that it swells the inventory of machines in process or in stock. When improvements are made they must be applied to a needlessly large line, all of which adds to the cost of doing business.

In too many cases these odd-sized machines are designed simply to secure orders which would naturally go to the next standard size if there were none in between. Extended capacities are too often subterfuges for price cutting, and while no one questions the right to do this, there are many doubts as to its being really profitable in any way.

The advantages of having a few sizes of machines is particularly noticeable during a depression or a deflation period. Money tied up in twenty sizes of machines instead of ten, is harder to get out and is of little assistance in meeting the payroll. The present movement toward standardizing on fewer sizes is a step in the right direction.

Varied Equipment for Shop Schools

TRADE schools, and others under whatever name, using machine tools, will soon be considering new equipment of lathes, drilling machines and the like. As the selection of these machines has a direct bearing on the education of the boys who will use them, great care should be used in picking this equipment.

In many cases, owing both to a lack of funds and also a lack of realization as to the effect on a boy's training, machine tools for schools are selected solely on a price basis. The idea seems to be that "anything is good enough for a boy to learn on." Nothing could be more erroneous.

The school is simply a preliminary to the boy's life of usefulness after he goes out into the world. It should teach him to handle the kind of machines he will find when he goes into the average shop. There he will find cheap lathes and expensive lathes, lathes poorly designed and built, side by side with the best. He should know how to get the best work possible out of each kind.

It might even be well to have one machine in which the bearings were a trifle worn, the ways out of line and with a few other defects which are fairly common in many shops. This could be used as a horrible example to show the effect of these conditions on the work. There is nothing like knowing what to look for when any machine gives signs of trouble.

Instructors in shop schools should give the question of selecting machine tools and other equipment very careful consideration. They should always bear in mind that instruction in shop work, and especially in work under shop conditions, is the prime fact to be considered. No small part of their success as instructors depends on the equipment with which the boys are taught. It need not be extravagantly expensive but it should be good and it should be representative of shop conditions; which means that it should be varied.

What About Machine Tool Prices?

EVERYBODY wants to buy at the bottom of the market and sell at the top, but not everybody knows enough about the market to recognize either the top or the bottom when he sees it. It makes little difference what the market is, potatoes, beaded bags or machine tools, the statement holds good. The sensible citizen is content if he can buy somewhere near the bottom and sell within a reasonable distance of the top.

As to potatoes or beaded bags we do not pretend to any market knowledge, but when it comes to machine tools we are convinced that for most lines the bottom was passed some weeks ago. In fact, increases have been announced in some of them already and other such announcements must come soon.

Let's see why. Machinists the country over have read with interest the display advertisements of the railroads offering seventy cents an hour for railroad shopmen. The railroad shopmen say they cannot live on their reduced wages but other machinists doing equally good or better work have had to live on as low as forty cents an hour and are still doing so. Here is a situation that cannot continue. Not only will there be a protest from the machinists in the machine tool industry but the builders themselves will be glad to take the first opportunity to raise the wages of their men. Nothing can be done until prices go up, but one increase will follow the other closely.

Coal is going to be scarce this winter and at least as expensive as it was last winter, probably more expensive. The administration's rationing plan may serve to keep industry going but will not supply cheap fuel.

Keen competition has kept prices of machinery castings low but increases in costs of pig iron and fuel are bound to be reflected in the cost of castings to the machine tool builder. Other raw material is increasing rather than diminishing in cost.

Selling expense is likely to increase because of keener competition and overhead has been pared to the bone.

The obvious conclusion from a survey of the facts just mentioned is that the next price announcements as regards machine tools will be increases and not cuts. Not only is the machine tool builder up against rising costs, but he is also waking up to the fact that he never has charged enough for the product of his brains and skill.

On a rising market far-sighted men buy in advance of their needs.

Shop Equipment News

Cleveland Double-Ended Automatic Threading Machine

A fully automatic machine having two heads and adapted to high-speed threading has just been placed on the market by the Cleveland Automatic Machine Co., Cleveland, Ohio. The outstanding feature of this machine is its ability to thread simultaneously both ends of a forged or rolled staybolt, so that both threaded ends are in line and the lead is continuous from one threaded portion to the other. The fact that the center part of the bolt is always more or less out of line with the ends, does not affect the action of the machine.

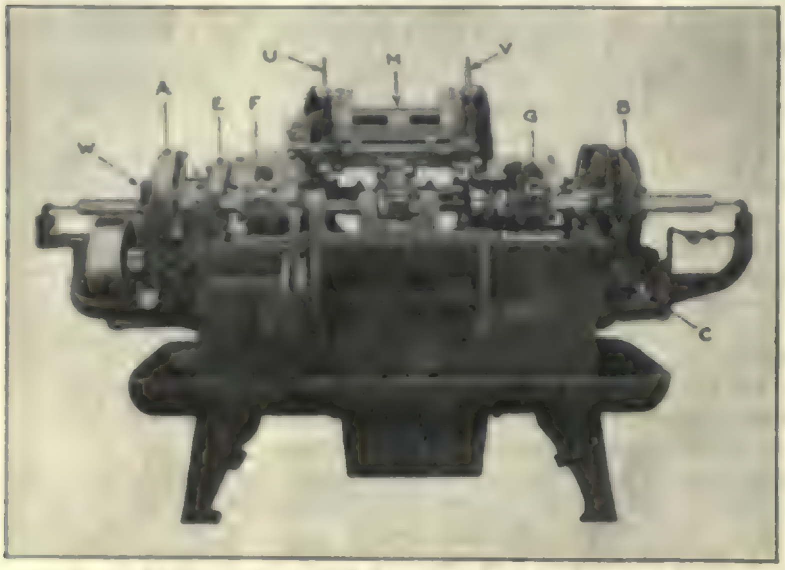


FIG. 1—CLEVELAND DOUBLE-ENDED THREADING MACHINE

The machine, a general view of which is shown in Fig. 1, consists primarily of a hopper which holds a supply of staybolt blanks sufficient to keep the machine busy from 40 to 55 minutes; a work-feeding mechanism, a pair of floating jaws which hold the staybolt and present it to the dies so that both ends are in exact alignment; two substantial spindles carrying the die-heads; a large lead screw with long bronze nuts; and suitable cams and connections for operating the various parts automatically.

The spindles are driven from the main driving shaft by gears at *A* and *B*. The feed shaft *C* is driven by helical gears and, in turn, drives the camshaft through change gears conveniently located in the box *D*, Fig. 2. These gears regulate the speed of the camshaft to suit different lengths of threads to be cut. The lead screw is mounted directly back of the die spindles and is driven by gears at *E*. Two die slides *F* and *G* are controlled by the lead screw during the cut, after which the heads are opened by stops at *H* (see Fig. 3), the lead screw nuts are tripped by cams *I* and *J* (Fig. 2) and the slides are returned rapidly by means of cams on the cam drums *K* and *L*. When the dieheads are just clear of the work, the work-holding jaws open and move backward, ejecting the finished staybolt, which drops into the pan. The mechanism then operates to place a rough staybolt in position for threading.

Part of the backward movement of the toggle mechanism for controlling the work-holding jaws withdraws the slide on which the jaws are mounted, and allows another staybolt to drop from the magazine *M* into the lower end of the carriers *U* and *V* in Fig. 1. These carriers then move down, bringing the blank in line with the dies. The toggle mechanism advances the slide with its jaws open until the latter are ready to close on the staybolt, at the same time seating the bolt against two V-blocks which line it up correctly. The jaws then close on the bolt, the two carriers return to their upper position, and the die moves forward.

The bearing spring shown in the upper jaw *N* in Fig. 3, allows for any variations existing in the diameters of the centers of the bolts. The two parts of the gripping jaws are pivoted on the stud *O*, and operated by the toggle *P*, which is moved by the lever *Q*. The lever in turn is controlled by cams at *R*, Fig. 2, through the lever *S* and bar *T*. The lower end of the slot in lever *Q*, Fig. 3, is enlarged to give a slight movement, allowing the jaw slide to shift forward or back and the jaws to oscillate or float on stud *O*, to accommodate a bent staybolt, which is frequently encountered.

In setting up a job a master staybolt or long-thread gage is inserted in the dieheads, one of which is then closed on the threads of the master or gage. Then, by a fine adjustment provided for the purpose, the other diehead is brought to a position where it will also close on the threads. Thus the heads are set so as to produce threads at each end that are continuous in lead.

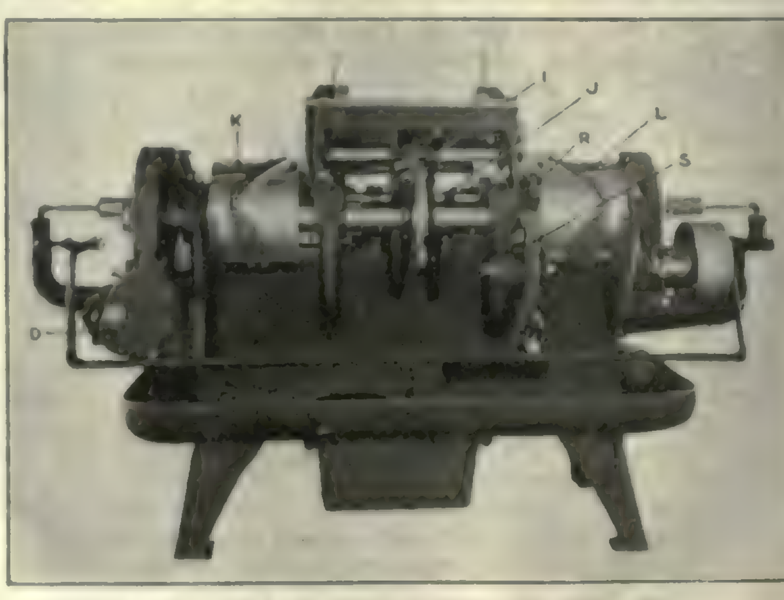


FIG. 2—REAR VIEW OF CLEVELAND AUTOMATIC

A safety or shearing pin is provided to prevent damage should a blank be too much out of shape. A heavy stream of cutting oil is pumped through each spindle to wash out chips and cool and lubricate the chasers. Starting and stopping is controlled by handle *W*, shown in Fig. 1, which operates the friction clutch.

The machine threads staybolts up to $1\frac{3}{8}$ in. in diameter and from 7 to 18 in. long. The time is from 35 to 60 seconds per bolt, depending on the diameter and length of thread. Practically no time is required for chucking the work, as compared to that taken when chucking by hand, and the time of cutting a bolt is that needed for threading the longest end.

One man can operate five machines, as all that is required is to keep the magazine full, keep the chasers sharp and remove the finished bolts. Although designed for staybolts, the machine is equally useful for all double-ended turning and threading work such as on studs, pipe nipples and short shafts.

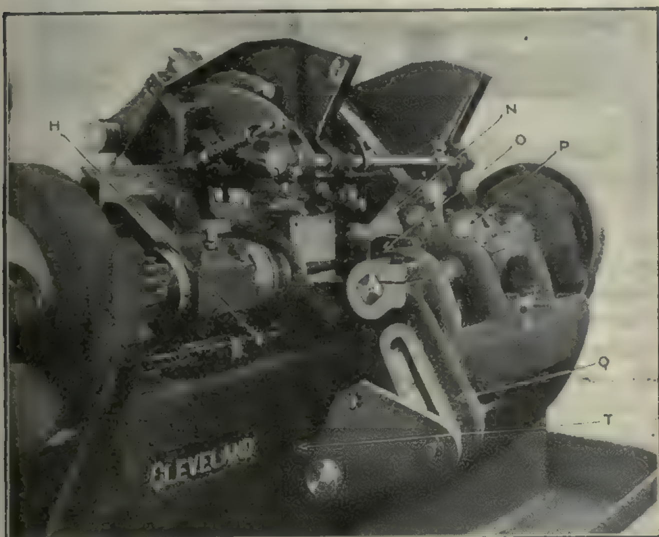


FIG. 3—DETAILS OF THE CLAMPING JAWS

"Duwell" Motor-Driven Bench Grinder

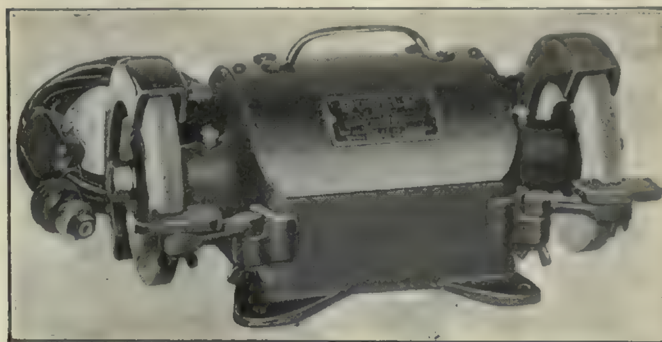
A motor-driven bench grinder designed for service in machine shops and such shops as garages, where a light, strongly driven machine is needed for tool grinding, polishing, wire-brushing and general utility purposes, and where it may not be convenient to provide a countershaft and belt drive, has just been placed on the market by the J. A. Finley Co., Grinder Division, 20 Braintree St., Allston, Mass.

The device carries two grinding wheels 5 in. in diameter by $\frac{1}{2}$ in. face and runs at a speed of 4,500 r.p.m., giving a peripheral speed of approximately 5,900 ft. per minute. The wheel spindle is of steel, is ground, and runs in dust-proof parallel bronze bearings.

Power is supplied by a universal motor of special construction, which drives the spindle through reduction gearing consisting of a steel pinion on the rotor shaft meshing directly with a fiber gear on the spindle. Because of the geared drive the wheel spindle is mounted well toward the front of the machine, thus rendering the wheels accessible for grinding long pieces without interference with the frame.

The case in which the motor and reduction gearing are contained is closed by a tightly fitting cover that excludes dust, yet is easily removable to facilitate inspection and adjustment. The universal motor runs equally well upon either direct or alternating current, and is wound for 110 or 220 volts as may be specified.

The height of the machine from base to wheel center is 3 in. and the distance between wheels is $9\frac{3}{4}$ in. The machine as shipped is provided with cord, switch and attachment plug, ready for connecting to any convenient lamp socket. Detachable wheel guards and toolrests for each wheel are also furnished. Four bolt holes in the base provide means for permanently attaching the machine to a bench or pedestal. The weight is 25 pounds.



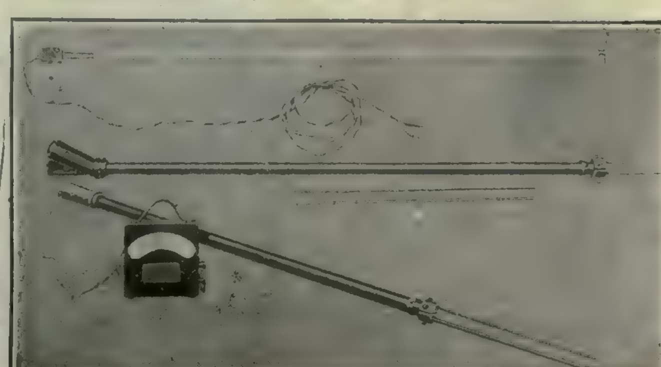
"DUWELL" MOTOR-DRIVEN BENCH GRINDER

Hoskins Portable Pyrometer for Molten Metals

A pyrometer outfit capable of giving instantaneous temperature measurements of molten metals and having renewable thermo-couple ends is shown in the accompanying illustration. It has recently been placed on the market by the Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich. The apparatus consists essentially of a standard Type-PA portable meter and a specially constructed thermo-couple.

The two bare wires on the end of the couple are renewable. They are ordinarily furnished in lengths of 16 in. and can be used until only a few inches in length. They are inserted bare into the molten metal, such as brass, bronze, aluminum, copper or babbitt, and the temperature can be read almost instantly on the meter. The upper temperature limit at which the equipment should be used is about 2,200 deg. F. Since setscrews hold the wires in the brass fixture on the end of the tube, replacement requires but a very short time.

The scale of the meter used is graduated directly in degrees from 32 to 2,500. The case is made of cast aluminum and has a black enamel finish. It is approximately $6\frac{3}{4}$x6x3 in. in size and weighs 5 lb. Twenty feet of flexible copper cord connect the couple and meter.



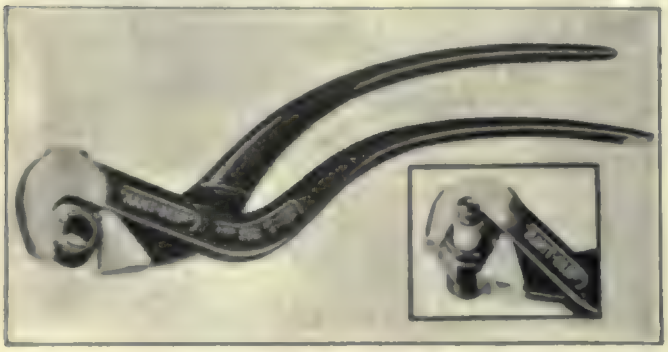
HOSKINS PYROMETER FOR MOLTEN METAL

Allan-Diffenbaugh "Kant-Slip" Wrench

The wrench illustrated herewith has recently been placed on the market by the Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.

The wrench will grip work of any shape and readily adjust itself as to size. The sliding fulcrum is close to the load and there are no screws, pins or springs to wear out or break.

On top of the stationary jaw is a raised flat, forming a hammer head and enabling the wrench to be used as a hammer for light blows. The opposite end of the stationary member is formed into a screwdriver. The maker claims that when used as a pipe wrench, it will not crush the pipe; also that the wrench will perform all the functions of a monkey wrench.



"KANT-SLIP" WRENCH

De Bats Metal No. 4

De Bats Sales Inc., 60 South St., Boston, Mass., is marketing a non-ferrous alloy of the tungsten-chromium-cobalt class for which remarkable claims are made in the way of speed and endurance cutting on cast iron and the higher alloy steels.

De Bats metal has the appearance of steel, though it contains no ferrous compounds and is non-magnetic. It is melted in electric furnaces and cast in molds of steel in the form of toolbits, inserts for built-up milling cutters, twist drills, reamers, etc., as shown in the accompanying illustration.

The metal cannot be forged, nor can it be annealed; the only means of working it being, therefore, by the grinding process. It may be produced in the simple forms referred to with little need for finishing operations.

The metal is very dense, is claimed to be free from blow holes and internal strains, and to possess a high resistance to impact that renders it particularly adaptable to the purpose of a cutting tool. Because of these properties it may be given rake and clearance angles approaching those of high-speed steels.

Standard sizes of toolbits are furnished to be held in Armstrong holders, while for more severe duty slabs or blocks are welded to carbon steel backings. In the above illustration all the pieces shown except the two larger lathe tools are entirely of De Bats metal. The inventor is Jean H. L. De Bats.

DE BATS METAL NO. 4

Crescent Metal-Parts Washing Machine

A large machine for washing metal parts that are handled in quantities of 50,000 to 100,000 or more per day, is shown in the accompanying illustration. It has recently been placed on the market by the Crescent Washing Machine Co., New Rochelle, N. Y., the machine shown being installed in the plant of the Crane Co., Chicago, Ill.

The machine is arranged to care for both the washing and rinsing, as well as drying when that is required. In this respect it is somewhat different from the machines formerly made by the concern, as small, compact, self-contained units that could be grouped as required by the work were built. Thus, separate machines were

LARGE CRESCENT METAL-PARTS WASHING MACHINE

formerly used for washing and rinsing when these two operations were necessary at the same point.

The large machine is well adapted to the manufacture of automobile parts. It is fitted especially to cleaning that class of work requiring great force and volume of water, the volume being more important that the force for quick and effective cleaning of metal.

The machine will clean objects 24 in. high, 40 in. wide, and if necessary, as long as the machine itself. It is 16 ft. long, 4½ ft. wide, and 5 ft. 3 in. high. The work level is 34 in. above the floor. The body of the machine is made of 10-gage steel plate that is supported throughout its length by 6-in. channels.

The chamber into which the work is first introduced has four sets of two-arm upper and lower revolving washing units for spraying the water on the work. The upper and lower arms of each set rotate in opposite directions; the solution which is thrown from each thus strikes the work at an angle, so as to strip the dirt and oil from the surface. These revolving washing arms are the same as employed in the former models of washing machine made by the concern. The pump feeding the wash arm supplies 1,200 gal. of water per minute, and is driven by a 15-hp. motor. It can be seen along the side of the machine in the illustration.

Located at about 6½ ft. from the washing chamber are two sets of upper and lower revolving washing units that are equipped to throw 400 gal. of fresh rinse water or rinse solution per hour, so as to thoroughly clean the parts. A 3-hp. motor is sufficient to drive the pump for the rinse water.

When washing small objects, such as stampings and screw machine products, the parts are placed in racks made of wire mesh laid over pressed steel frames. Two racks 18x24 in. in size can be fed into the machine, side by side. They are carried continuously through the machine on the conveyor, so that they pass under both the washing and rinsing sprays. Larger parts can be placed in racks, which can be brought to and taken from the machine on conveyors.

"Duwell" Self-Guiding Scriber

A self-guiding scriber intended for the use of mechanics, particularly toolmakers, is being introduced by the J. A. Finley Co., Grinder Department, 20 Braintree St., Allston, Mass. The feature of this tool is the double point, as shown in the accompanying illustration, by means of which the operator is enabled to lay out an outline at the bottom of a small, irregular-shaped hole,

"DUWELL" SELF-GUIDING SCRIBER

as in transferring or "setting-off" a punch blank from the finished die.

One of the points is made sharp to do the scribing, while the other one is slightly rounded and is a trifle shorter than its mate. The tool is introduced in a small hole by pressing the points together, and is then twirled between the thumb and fingers, the spring point causing the scribing point to follow the outline of the hole. For larger holes the single point at the opposite end of the tool is used in the regular manner.

Starrett 1-Inch Micrometer

The L. S. Starrett Co., Athol, Mass., has added to its line the 1-in. micrometer illustrated herewith and designated as No. 435.

The frame is drop forged and the ribbed section adds greatly to its rigidity. The finish is in black enamel. As the diameter of the screw is 0.312 in. and that of

STARRETT 1-INCH MICROMETER

the contact points 0.270 in., large wearing surfaces, insuring long life, have been provided. Decimal equivalents are marked on the thimble. The micrometer can be furnished either with or without a ratchet stop.

"Duwell" Centering Device

A tool for center-marking round stock rapidly and accurately has recently been placed on the market by the J. A. Finley Co., 20 Braintree St., Allston, Mass., under the name of the "Duwell" centering device.

The hub of the device has a reamed hole through its axis to which is fitted a ground center punch. Extending radially from the hub are three steel posts, equi-

"DUWELL" CENTERING DEVICE

distantly spaced around the periphery, and upon each post is a sliding jaw. A bushing, or spider, having an equal number of radial bosses fits over the hub in such a way that it may be rotated without endwise movement.

Connecting rods join the radial bosses to the jaws upon the hub, so that when the bushing is rotated relative to the hub the toggle action of the rods causes the jaws to slide simultaneously inward or outward, according to the direction of rotation.

The illustration shows the manner of using the device. After centering, a light blow with a hammer on the outer end of the punch finishes the operation, leaving a mark exactly in the center of the bar.

News Section

Wire Companies Form Merger

According to reports received during the past week the Wire Goods Co., Worcester, the Cassady-Fairbank Co., Chicago, and the Andrews Wire and Iron Co., Rockford, Ill., and Waterford, Canada, have consolidated as a $1,000,000 corporation, with headquarters in Worcester. Eventually the business probably will be conducted under the name of the Washburn Co., the other corporation names disappearing.

The officers of the new corporation are: president, Charles G. Washburn; vice presidents, Arthur G. Andrews, Rockford; Perry M. Shepard, Chicago, and William L. Walker; treasurer and general manager, Reginald Washburn; secretary, Irving A. Green; directors, Charles G. Washburn, Reginald Washburn, Arthur G. Andrews, Perry M. Shepard and William L. Walker.

The business of the Wire Goods Co. was established in Worcester in 1880, and its growth has been large and steady ever since. In addition to the Cassady-Fairbank and the Andrews Co., the company has absorbed several other firms, including the Ayres Manufacturing Co., the E. Jenckes Manufacturing Co., Pawtucket, R. I., manufacturers of wire hardware, and the Woods-Sherwood Co., Lowell, the oldest concern in the country making kitchenware.

Industrial Foundation for Indianapolis

The trade in Indianapolis, at the present time, is becoming very much interested in the proposed formation of what will be known as the Indianapolis Industrial Foundation, with a capitalization of more than $1,000,000, which will be used to provide financial and advisory service to both old and new industries in the city. Some of the most prominent men in the trade here are backing the movement, which promises to be of vast importance to the industrial health of the city.

While not so important to the retail end of the trade, the fact remains that in order to further the cause, the retailers are coming forward almost in a body with their moral and financial support toward the formation of the organization.

The Foundation will be sponsored by the Indianapolis Chamber of Commerce and will function through the Bureau of Industries of that body. It is the intention of those behind the movement to create such a large reserve fund in the capital stock issue that industries may be aided financially at a nominal rate of interest, when an investigation of the organization, its product and its market area show that by the aid of capital and some good sound advice, the industry can keep its head above water. In this way the older industries of the city will be benefited as well as the new. One prominent man in the trade here said when talking of the wholehearted support the trade was giving the movement, that it was the intention to keep failures in Indianapolis down to a minimum. He said many failures were due to lack of financial assistance at the right time and also lack of proper co-operation on the part of other executives who might have the solution of that particular problem if they were appraised of the situation. It is planned to make the foundation self-sustaining through the rate of interest charged.

Steel Treating Society Expects Record Attendance at Detroit Convention

Final arrangements are being made for the fourth International Steel Exposition and Conventions of the American Society for Steel Treating and the American Drop Forging Institute to be held in the General Motors Building, Detroit, Mich., Oct. 2-7.

The exposition will be the largest ever held, as 99 per cent of the floor space has been sold and many exhibitors who desired to be present will be unable to be accommodated. There will be quite a number of exhibitors who have not been present at previous shows due to the fact that the Drop Forging Institute is holding its Annual Convention simultaneously and in the same building with the American Society for Steel Treating, and many members of the Drop Forging Supply Association are accepting the opportunity to exhibit.

The General Motors Building is especially adapted for exhibition purposes. In the large exhibition hall, there are 30,000 sq.ft., while the two wings on the same floor leading to the exhibition hall has 20,000 additional square feet of display space. All but a few booths have been sold. Arrangements have been made so that in one section of the hall gas furnaces will be in operation, while electrical furnaces and other equipment requiring power will be displayed throughout the hall. Practically all of the exhibits will be in operation. With Detroit as a steel market an attendance in excess of 15,000 is expected.

The railroads have granted fare and one-half for the round trip to Detroit on account of the conventions. In order to be able to take advantage of this reduced fare which applies not only to the holder of the certificate but to the members of his family as well, it is necessary that one should have an identification certificate. These may be obtained by addressing the National Secretary of the American Society for Steel Treating, Mr. W. H. Eisenman, 4600 Prospect Avenue, Cleveland, Ohio. Reduced fare tickets may be purchased from September 28, return limit being October 13th.

Philadelphia Industrial Conditions

According to statistics compiled by the Metal Manufacturers' Association of Philadelphia, a further improvement during July is revealed, the 132 plants canvassed having added 1,084 employees to their payrolls during that month. This was an increase in employment of 2.3 per cent compared with the month of June, bringing the numbers employed to 48.1 per cent of what they were in the same shops in July 1920. Group No. 1, the shipbuilding industry, is now employing 21 per cent of the employees that were on their payrolls in July, two years ago, while Groups 5, hardware and plumbers supplies; Group 6, auto and accessory manufacturers; and Group 11, miscellaneous industries, have approximately 80 per cent of the number of employees that they had two years ago.

There is very little change in the average weekly operating week though the tendency seems to be to a slightly longer week, which may be more evident after the summer months are over as a few companies make it a practice during the hot months to operate only five days a week.

No wage reductions have been reported since February and it is very unlikely that there will be any within the next few months unless there is some radical change in conditions which cannot now be foreseen. It is more probable that the tendency is toward slight increases to be granted to individuals on the basis of their production and ability.

It is not unlikely that the building trades which have utilized much of the common and semi-skilled labor will demand fewer additional workers in the future, and toward fall this should be felt in an easier market for common labor especially, as it usually is.

The Midvale Steel and Ordnance Co. made a wage increase on Aug. 1 from 25c. to 28½c. per hour for common labor at its plants at Johnstown, Pa.

Alabama Pig Iron Output Increased in July

Official figures on pig iron production in Alabama during July give the tonnage at 194,300, almost three times the production of July, 1921, in which month 66,578 tons were produced. In June, of this year the production totaled 189,008 tons, showing a steady upward movement each month since the first of the year. With more furnaces now operating in the district than at any time in the past two years, August production is expected to be around 215,000 tons in spite of the railroad strike which is retarding operations slightly. There were 22 blast furnaces in operation during July, as compared with five in July of last year. The pig iron market holds firm at around $20 to $20.50 for No. 2 foundry iron.

Labor and Wage Conditions in Austria

The Workman and His Status—Position of Labor Unions—Health, Accident and Life Insurance Compulsory

By A CORRESPONDENT IN VIENNA

CONDITIONS under which the Austrian workman performs his work are largely governed by federal laws. His safety is a matter of Austrian federal legislation. In fact such questions as life insurance, sick benefit, pensions and working hours are all fixed by law. The question of wages is settled between the factories or other employers and the labor unions, who are very strong in the country. Where the workman lives in a company owned house the federal law makes certain provisions, but otherwise leaves matters to local authorities.

Just now the Austrian workman is living in the "silk shirt era" as it was called in America. He does not literally buy silk shirts and automobiles, as they are in most cases more expensive than in America, but he throws his money away on other luxuries. Formerly the workman was satisfied if he could have a place to live, buy three meals a day and put something aside for a rainy day, but that time has passed. Now he drinks wine instead of beer. He buys fine clothes. He spends a lot of money at the candy shops and confectioners. He has better meals than formerly, but he saves nothing, which, however, is easy to understand.

Era of Free Spending

Saving money in Austria in these days is out of the question for the average person. If one deposits a certain sum of money in the bank today it may be worth only half as much 30 days hence, because of the steady depreciation of Austria currency. For instance, early in June it took 10,000 kronen (Austrian crowns) to equal one dollar. By the middle of July it took 35,000 crowns to equal one dollar. In other words, a given sum deposited early in June, depreciated in a little over a month to a point where it was worth less than one third. The only possible way for people to put aside money and not have it become worthless is to buy stocks and bonds, although even this method of saving is far from safe. Most people, including the workmen, either spend their surplus funds or buy useful articles before the currency goes down and the price of the goods goes up.

The scale of wages for the workman is a sliding one. If the crown falls in value, the wages go up, although they do not keep pace one with another. The wages are always two weeks or a month behind nothwithstanding the fact that each factory has clerks doing nothing else but correcting the scale of wages. On July 18, 1922, the scale of wages for metal and rubber workers averaged 400,000 crowns a month. These two classes constitute about the highest paid workmen. The sum of course sounds enormous, but expressed in dollars it was only about $12.00 per month. The unions fix the scale of wages and do not allow a good workman to be paid a higher hourly rate than a poor one, so the factory management endeavors to give the good workman the best paid work. In this way the objections to a fixed scale of wages is largely overcome.

In connection with the labor unions it is interesting to note that they are both a labor an a political organization. The workmen are all socialists and formerly controlled the government absolutely, but in the reecnt elections a more conservative and capable government was elected by the Christly-Socialist Party. Communism among the workmen seems to be a thing of the past. Vienna, with a population of 2 million inhabitants and the largest industrial city, formerly had quite a few communists among the workmen, but they have all since been thrown out by the men themselves. This is true of most industrial centers of Austria, although in the Wiener-Neustadt district there is still a great deal of radicalism. However, the Austrian workman, in general, is a good natured, intelligent individual, who is not given to radicalism, although he calls himself a socialist and, without exception, belongs to a labor union.

Safety regulations and appliances are required by law and are very strict, but, as is the case with American workmen, the men themselves often do not observe them. Such things as guards over exposed gears or chains are to be found on all machine tools. Large driving belts, such as are used to operate tin plate rolling mills, are enclosed and in every possible way the safety of the workman is provided for. Where necessary, the men are provided with goggles or masks, but as a rule it is hard to make them wear such articles. When, however, a workman is injured in a factory, the case does not go to court, because the insurance takes care of accidents and definite amounts are allowed for various injuries. This avoids litigation which is often expensive for the employer, workman, or both, to say nothing of the hard feeling it creates, and everyone knows what to expect, if a given accident occurs. The question of how an accident has happened has nothing to do with the amount paid, provided the manufacturer has lived up to the law regarding safety appliances.

Insurance Compulsory

The workman must take out both sick benefit and life insurance. His employer pays one-third and he pays two-thirds of the premium. This is deducted from his pay. Any taxes, such as income, are also deducted and paid to the state by the employer. If a workman becomes incapacitated for work through age or any other reason he receives a pension from the state, but it is so small at present that he would starve to death without any other source of income. During his period of employment each workman receives free medical attendance and if, necessary, all his hospital expenses are paid by his employer.

Welfare work as developed in the United States is not popular with factory owner or worker. A workman's council handles all matters which may arise between the factory management and the men, whether they involve individuals or groups of employees. Should a given workman have a grievance of any sort he must lay it before his council. The council decides whether the grievance is justified and, if so, lays the matter before the factory management. Questions of a collective nature are handled in the same way. This method of handling disputes has been found satisfactory by both sides.

Efficiency Is Improving

To provide suitable midday meals, the factories operate lunch rooms and cafes which, needless to say, are operated at a loss. The patronage given these places is very large because it is the most inexpensive way to secure a satisfactory meal. The management does not furnish entertainments during the noon hour, but in many instances places an auditorium at the disposal of the workmen. The men themselves furnish and pay for the amusements, which range from music rendered by their own band to that of famous opera singers and include other forms of entertainment. The present day audiences at the opera in Vienna could learn a great deal regarding silence and general good behavior from the workmen. Children's playgrounds, day nurseries, and visiting nurses are all provided, not by the factory management by by the workmen themselves and this method of welfare work has proven most satisfactory. The workmen do not feel that the management is always "butting in" on their own affairs, yet the same benefits are obtained without a certain paternalism on the part of the employer.

The eight-hour day and the forty-four week are universal in Austria and even extend to the stores and shops. In the steel industry also the eight-hour day is used and has been found perfectly satisfactory. The efficiency of the workman is much higher than in the period immediately after the war, but has not reached the pre-war standard. The Taylor and other similar systems have aroused a great deal of interest and factory managers have given them a great deal of thought.

According to a law recently passed an individual receives 80 per cent of what he would get if he were employed at his trade. This law was obtained by the socialists in return for their help in passing the new financial reorganization laws.

In conclusion, it might be said that most plants are operating at from seventy-five per cent to one hundred per cent of their capacity and that the workmen are causing little or no trouble. Should, however, the value of the Austrian currency suddenly increase, the factories will be unable to export their products and widespread unemployment will ensue. What result such a condition would bring about no one is willing to state, but all believe it would cause a revolution.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

YELLOWSTONE PARK, Aug. 20.

I wish that all Americans might travel the route that brought me here. It traverses Minnesota, North Dakota and Montana, where the wheat grows and the people are receptive to new ideas, both political and economic. In so far as business conditions are concerned the feeling is aggressively optimistic. The crops are good, credit is readily obtainable and every one is looking forward to an autumn of activity and prosperity. There is, however, some dissatisfaction at the low price at which wheat is selling and the probability is that a large portion of the year's yield will be held in the hope of an advance and because it is becoming plain that the railroads cannot move it promptly. In this holding movement the War Finance Corporation is assisting by promising large loans to the various co-operative associations that have been formed among the farmers.

A coal famine this winter is generally and indignantly expected. The settlement adopted at Cleveland will add only about a million tons weekly to the present output and though it undoubtedly will be extended to many other fields probably several weeks will elapse before production gets much above 6,000,000 tons. This is less than consumption, whereas at this time of the year at least 4,000,000 tons weekly should be moving into stocks.

The local newspapers, including the Chicago *Tribune*, are encouraging the belief that the coal strike and the delay in settling it were successive steps in a plan deliberately designed to mulct the public by raising the price of coal. For this the coal mine operators and the Government, which has permitted the profiteering alleged, are held responsible, and it is, I think, almost certain that the displeasure felt will be vigorously expressed at the autumn election.

In North Dakota an effort is being made to strip some of the lignite coal beds that the state possesses in time to provide fuel for the coming winter, but success is doubtful and even if the railroad strike should be settled immediately and if the Cleveland settlement should be extended to the fields from which the Lake traffic is supplied it will be exceedingly difficult to provide the Northwest with the fuel it needs before cold weather sets in.

Meantime and despite the fact that the railroads have put many clerks and station hands at work in the shops the rolling stock is manifestly deteriorating and getting in bad shape to handle the traffic that is offering and accumulating. Car loadings, with the exception of coal, are very close to records, and as coal production increases movement of other goods will be handicapped. The surplus of freight spells prosperity for the railroads, but the deficiency of transportation will restrain autumn industrial activity, and we cannot dismiss the effects of the strikes from our calculations as soon as they are over.

One of the officers of a large bank serving this region told me that he was selling out all the Liberty Bonds and Treasury Certificates that he held that he might be prepared to meet the demand for money that would be caused by an inevitable freight blockade, and that he knew that several other bankers were doing likewise.

But the prospective railway congestion and coal scarcity are the only shadows that bedim the sunshine of optimism and prosperity in this section, and as often happens it may be that their effect will be less serious than expected now that they are being vigorously prepared for.

The prices which producers are receiving for their crops, and for their wool, livestock and hides, are on the whole higher than a year ago. Whatever is lacking in Western buying power will be made up in the South, and trade during the New Orleans Fall Buyers' Week has been extraordinarily good. Undoubtedly in many sections the bludgeoning of deflation was so severe that the farmer has not yet recovered, but, to quote an Iowan, "The West is neither broke nor blue," and the improvement in the mail order and automobile businesses is an indication that the 50 per cent of our purchasing power represented by the rural districts intends to give a good account of itself.

The commodity markets have shown a general downward trend all week. As usual this is ascribed to specific influences in each market, but the probability is that the prevalent optimism had discounted business improvement a little too rapidly. In sugar the almost miraculous disappearance of the surplus started everyone talking about a shortage, whereas there is still a plentiful supply, and the too rapid advance in prices has been followed by a decline. Coffee is dull and unsteady because the trade is afraid Brazil will depress the market by selling some of the stock she has been withholding. Rubber, under pressure of a surplus such as there was in sugar six months ago, has dropped to a new low record. Cotton is sensitive to unfavorable foreign news one day and to crop killing dispatches the next. It has never regained the peak it reached on the August 1 report and the chief influence in the market seems to be the fear of mill men that they will not be able to sell goods at a profit when the cotton in them costs more than 20 cents.

Hides have reacted a little after their steady advance, but wool is still strong and despite the occasional pessimism which has been noticeable in the woolen goods trade the American Woolen Co. has easily sold all the material it can manufacture. Petroleum and its products, of which huge stocks have been accumulated, are weak.

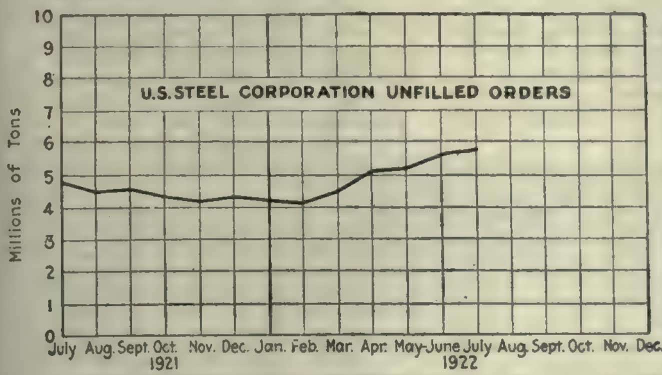
Most industries are beginning to feel the effects of fuel shortage. Iron and steel output has been further curtailed and probably will decline still more, and the Detroit automobile manufacturers, who have been making astonishing records in production and sales, say they will have to stop work entirely unless coal is soon available. From some of the chief industrial centers is reported a scarcity of skilled labor, which may become more aggravated later in the fall.

Stocks and bonds have been sluggish but firm, and railway bonds have made new highs. While credit is abundant and industrial and trade confidence persists there is no reason to expect any setback. The changes in the Federal Reserve System's report for the week were unimportant. Gold holdings declined and the reserve ratio was slightly lower at 80.2 per cent. The Kansas City and Minneapolis banks, in the grain districts, have cut their rediscount rates to 4½ per cent, but the reserve banks have voted overwhelmingly against a proposal to establish a special rate of 3½ per cent on agricultural paper.

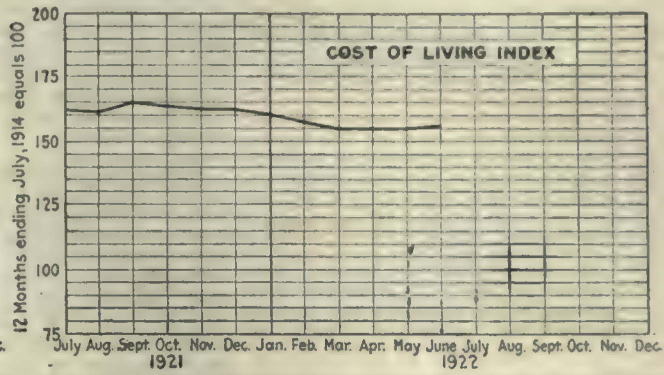
The thirteenth conference of the Allies on German reparations broke up last week without accomplishing anything and the mark declined until on Thursday a thousand could be bought in New York for 95 cents. Except as it represents faith that Germany will pull out, or be helped out, of the financial mire, the mark is worthless. The people seem to have work to do and enough to eat, but their surplus production is practically confiscated to pay reparations and not enough of it can be used to buy food and raw materials. Her industry cannot permanently function on such a one-sided basis. Left to herself, with ability to trade her surplus for the things she needs, Germany might go on as Poland is, and improve her agricultural and industrial position despite financial demoralization. Unless she obtains at least the aid of a moratorium her case would appear hopeless. This seems so apparent that it is my chief reliance in predicting that a way will be found to grant it.

Many Senators have invited their political destruction by putting through a highly sectional tariff which there is no doubt the American people do not want. How much harm it, and the soldiers' bonus and ship subsidy if they should be passed, will do to business can only be guessed at present. Meantime not even strikes and high taxes can keep the wheels from revolving and though they creak and jerk a little they are likely to move with increasing smoothness during the autumn. Confidence prevails that strike troubles will be settled soon and in all quarters there is to be found optimism for the future. A clearing of European skies will give added stimulus.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



DIVIDEND disbursements by industrial companies to stockholders in September, according to forecasts just made, will amount approximately to $37,400,000 a slight decrease as compared with the corresponding month of last year. This brings the total dividend disbursement by industrial companies for the current year to date to $388,700,300. Steam railroads will pay out $14,750,000 while street railways will disburse $3,025,000, a grand total of $55,175,000, as compared with $56,200,500 paid out by companies in these three classes in 1921. Interest payments will aggregate $180,600,000.

British living costs, according to the index figure for July just announced by the Labor Ministry, is 81 above the pre-war level, a drop of three points from that of June. British unemployment figures, though still bad, show a further slight improvement. The number of unemployed on July 31 is given as approximately 1,400,000 as compared with 1,455,000 at the end of June.

Cost of food and other commodities, wholesale and retail, in the United States, took an upward jump during the month of July, retail prices averaging a 1 per cent increase, while wholesale prices registered a gain of about 3¾ per cent as compared with June prices. Comparison of wholesale prices in June with those of a year ago indicated, the department said, that the general price level had advanced about 10 per cent, with fuel and lighting materials registering an increase of 36½ per cent. The average retail price is based on forty-three items in fifty-one cities.

Surplus freight cars—that is, cars in good repair and immediately available for service if transportation conditions warranted—totaled 174,927 on July 31, or a decrease of 28,395 cars since July 23. Surplus coal cars stood at 131,267, a decrease of 10,163 within that period. There was a reduction within the same time of 13,778 in the number of surplus box cars.

Steel ingot production in July according to the reports issued by the American Iron & Steel Institute, showed a decrease of 147,373 gross tons for 30 steel plants which produced 87½ per cent of the total in 1921. This is the second month of the current year to show a decrease, June production having dropped off 76,664 tons. July production totaled 2,487,104 tons, bringing the tonnage for the current year to date up to 15,986,490 as compared with 16,826,946 tons produced during the entire twelve months of 1921.

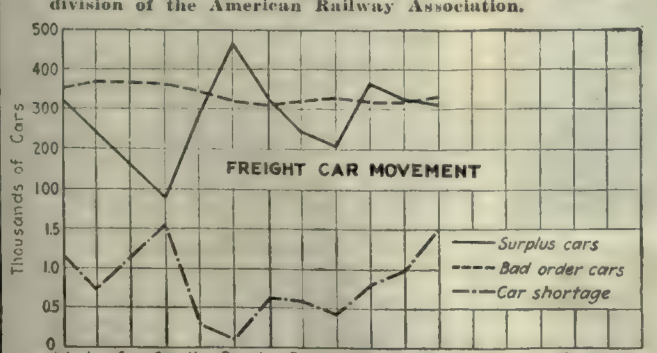
Loadings of revenue freight on American railroads for the week ending August 5, totaled 851,351 cars as compared with 859,733 in the week previous. Compared with the corresponding week of last year there is an increase shown of 65,173 cars, but the figure shows a decrease of 84,379 as against the same period of 1920. Coal loadings increased 2,872 cars over last week but decreased 66,849 cars as compared with 1921.

Comparative Prices of Shop Supplies

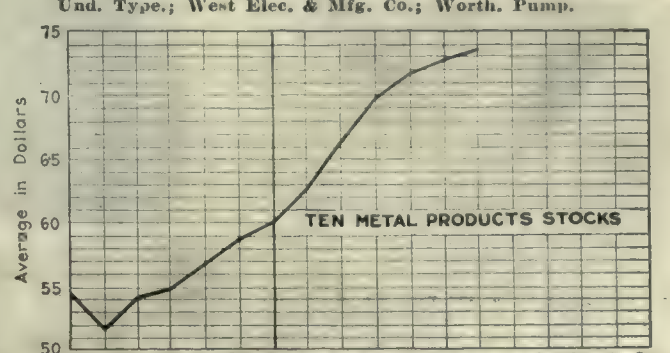
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0273	$0.0252	$0.0278
Cold finished shafting	per lb.	0.0365	0.0335	0.0428
Brass rods	per lb.	0.165	0.1550	0.159
Solder (½ and ½)	per lb.	0.22	0.213	0.18
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.00	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

Monthly average of car shortage, surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West Elec. & Mfg. Co.; Worth. Pump.



Washington Notes

By Paul Wooton

If control over coal prices and distribution is maintained, Secretary Hoover said this past week, Congress must provide legislation. It is impracticable, he said, to try to continue control indefinitely on a voluntary basis. While sixty or seventy per cent of the operators are willing to do the square thing, it is not fair to them to allow the remainder to occupy a position in which they can take advantage of the situation to their own profit.

The type of legislation best suited to the purpose has not been worked out. Several alternatives are under consideration but no decision will be reached until the depth of the problem is known.

In discussing the extent to which the coal operators had co-operated with him in the control of prices and distribution, Secretary Hoover said that he had been given 100 per cent co-operation in the smokeless field with almost as good performance in Virginia and parts of West Virginia.

Advices reaching Washington are to the effect that British coal arriving in New York is not finding a ready market. It also has been found that no coal rates are in effect on the railroads from New York to inland points.

Wide publicity has been given a news article to the effect that Commerce Secretary Hoover has endorsed the metric system. Secretary Hoover states that he is at a loss to understand how such a report originated. He has not endorsed the compulsory use of the metric system, he says.

Establishment of foreign trade zones at a number of American ports practically is assured by the action of the Senate on Aug. 16 in adopting, with practically no opposition, an amendment to the tariff bill which would authorize the creation of such zones. The plan for the so-called freeports has been denounced by ultra-protectionists as a free-trade scheme. To meet some of the objections voiced against the proposal, the Senate committee eliminated from the original amendment the authority to establish manufacturing enterprises within the free-zone. It will be possible, however, to store, exhibit, break-up, repack, assemble, distribute, sort, refine, grade, clean, mix, and otherwise manipulate foreign or domestic merchandise in an area where no compliance with the laws and regulations governing the entry of merchandise will be required.

Under existing law any goods landed in this country must pass through the Custom House. If they are re-exported 99 per cent of the duty paid is refunded. In addition to the loss of one per cent of the duty, there is the more important consideration of vexatious and costly delays in complying with the red-tape which accompanies entry through the Custom House and the subsequent dispatch of the foreign goods after they have been mixed with domestic merchandise or assembled in different forms. The delays and annoyances of this procedure were such as to discourage almost entirely any handling of foreign merchandise in transit. By making this possible it is believed that substantial advantages will ensue to American industry and to American shipping. Many ships come to the United States in ballast, it is declared, which would bring cargoes for trans-shipment to various other countries were it not for the difficulties of our customs regulations. One of the great advantages of allowing transit privileges on foreign cargoes is the fact that on their re-assembly at American ports, domestic merchandise will be mixed with the shipments of foreign origin.

There has not been the slightest surrender on the part of the administration of its intention to bring about practical reorganization of the executive departments of the Federal Government. A tentative report was laid before the President several months ago. It has not been made public due to the fact that the report as submitted is not acceptable to all the department heads. It is believed, however, that certain changes in the plan can be made so as to secure for it the unanimous support of the department heads or at least any dissenting opinions that may be offered will be of minor importance.

Were the report to be sent to Congress without the endorsement of certain of the department heads, it is recognized that the possibility of securing the legislation would be lessened. Moreover the legislative situation, since the report was submitted to the President, has been such as to preclude action on reorganization. In addition if the report were made public in its tentative form and before unanimous endorsement by department heads has been secured, there is a feeling that it would invoke non-constructive criticism and arouse agitation which would serve no good purpose.

It can be stated authoritatively that the reorganization proposal has not been laid aside indefinitely.

Frank Burr Smith Dead

Frank Burr Smith, works manager of the Bullard Machine Tool Co., Bridgeport, Conn., died Aug. 16th, as the result of an acute attack of appendicitis. Born in Fairfield in 1872 and educated in Bridgeport, he entered the employ of the Bullard Machine Tool Company in 1890 as a machinist apprentice, going to the engineering department on completion of his apprenticeship. Leaving in 1894 because of bronchial difficulty, he went to Colorado and did prospecting and mining, which he followed in various capacities for several years.

In 1903 he joined the De La Vergne Machine Company as engineer for the installation of their refrigerating machinery, traveling extensively throughout the country, particularly in the South and Southwest. In 1911 he returned to the Bullard Company in a sales capacity with headquarters successively in Chicago, Cleveland and Philadelphia. His last year in sales work was spent in England, this being 1914 and coincident with the beginning of the world war.

On his return to Bridgeport he became manager of Employment and Industrial Relations at the Broad Street plant. His work here was so successful that the Bullard shop was noted for the way in which it was steered safely through the rocky channels of industrial difficulties which beset most Bridgeport manufacturers during the war years. Frank Smith had the personality, the vision and the knowledge of human nature which made his dealings with men of all kinds successful from every point of view.

With the moving of the Bullard shop to the Black Rock plant in 1920 he became works manager, occupying the position until his death. Mr. Smith was also active in the mechanical development of Bullard products and he also patented a number of mining and automotive devices. He was a member of the Algonquin Club and also of the Masonic order. He leaves a widow and brother as well as a host of friends who will miss his genial welcome at the Bullard plant.

Business Items

The Ohio Electric and Controller Co., Cleveland, Ohio, announces the appointment, effective September 1, of C. J. Pagel, as sales representative. Mr. Pagel has been associated with the Robbins & Myers Co. in the Cleveland district.

The Ohio Electric and Controller Co., Cleveland, Ohio, announces the appointment of Paul H. Diver as manager of sales. Mr. Diver has been associated with this company four years as sales representative.

The Atlantic Coast Line Railroad Co., Savannah, Ga., will enlarge its Southover machine shops, the present plan being to invest about $100,000 for this purpose, including new equipment and improved machinery.

The Elliott Co., Jeannette, Pa., manufacturer of power accessories, will open a branch office in Atlanta in the latter part of August, according to an announcement by James E. Watson, vice president of the company. H. A. Hoffman, formerly of Philadelphia, has been named manager for the Atlanta district.

The Loshbough-Jordan Tool and Machine Co., Elkhart, Ind., through J. C. Jordan, announces that the company will, in the future, be operated as a partnership with a broader scope to its activities and interests.

The Groton Iron Works, Groton, Conn., according to reports, will be leased by the New York, New Haven and Hartford Railroad Co. An official of the railroad company stated that inability to get certain grades of work

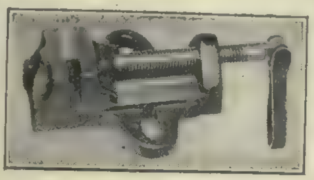
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Vise, Drilling Machine

J. L. Austin Manufacturing Co., 419 Van Buren St., Milwaukee, Wis.

"American Machinist," May 4, 1922

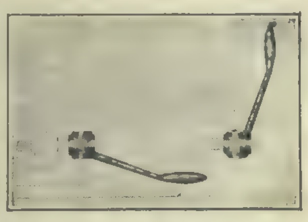


The vise is used in place of special jigs and fixtures for quickly securing small parts which require drilling. It is made of cast iron and has two flanges on the base for attachment to the table of the drilling machine. The handle is so secured to the end of the operating screw that it can be swiveled for operating in cramped positions. The jaws are 3 in. wide and $1\frac{1}{2}$ in. deep, and open 4 in. The $\frac{5}{8}$-in. screw has an Acme thread. Weight, 10 pounds.

Handle, Vise

Bentley & Holmgren, 406 Court Exchange Bldg., Bridgeport, Conn.

"American Machinist," May 4, 1922

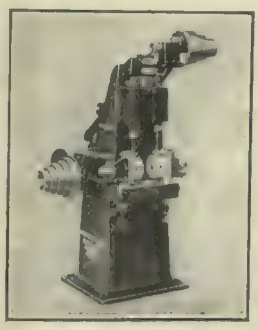


The vise handle is used for positioning the movable jaw of a screw-type milling machine vise, as the ordinary handle sometimes interferes with the table or the setting. The handle has two square holes at right-angles to each other in the boss. When the handle is applied in one position, as shown at the left, it clears the table and can be revolved. Applied as shown at the right, it gives a long lever to tighten the screw. The handle is made in a range of sizes, having holes from $\frac{1}{2}$ to $\frac{5}{8}$ in. The smallest size has a $1\frac{1}{4}$-in. radius of swing with the short leverage, and a 5-in. radius with the long leverage. The swings of the largest handle are $2\frac{7}{8}$ and $9\frac{1}{2}$ inches.

Drilling Machine, Upright, Automatic, Duplex, "Autoplex"

H. Edsil Barr, Erie, Pa.

"American Machinist," May 11, 1922



The machine is intended for high-speed drilling, reaming, facing and polishing, drilling automatically and dropping the parts into a chute. Two spindles, mounted on the face of the column, each rotate in a square guide block or quill and are driven by a three-step pulley. The feed and the work chuck are operated by a five-step cone pulley at the rear. Each fixture head is removable, has four pockets to hold the work, and can be adjusted vertically by the handwheel beneath it. The work is usually carried on a sheet-metal container, and the operator feeds one head with each hand. Drills or reamers up to $\frac{5}{8}$ in. in size can be handled.

Cutter Holder, Angle, Adjustable

Warner & Swasey Co., Cleveland, Ohio

"American Machinist," May 11, 1922

With the device cutters can be adjusted to limits as small as 0.0005 in. A graduated adjusting screw operates a small cutter slide. The lock screw is ordinarily drawn up lightly and kept in that position, so that the adjustment can be made without changing the tension of the screw. The exact size of the work can be maintained as the cutting edge wears down and as the machine warms up.

Die, Screw-Cutting, Two-Part, "Reliable"

Conant & Donelson, Conway, Mass.

"American Machinist," May 4, 1922

The die is made in all commercial sizes from $\frac{3}{16}$ in. upward and fits the same collets that the corresponding sizes of the regular product fit. The special feature of the die is the way in which the face is ground to curl the chips ahead of itself, instead of allowing them to fill and clog the clearance spaces. This is accomplished by undercutting the edges in a sharp diagonal.

Headstock, Lathe, Lapping and Filing

Marvin & Casler Co., Canastota, N. Y.

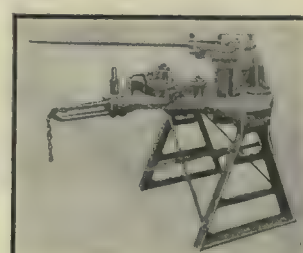
"American Machinist," May 4, 1922

This lathe headstock is used when lapping and filing small parts. It is shown equipped with a guard for the driving belt. The headstock is fitted with ball bearings at each end of the spindle. It may be equipped either with a twin-screw drill chuck or a three-jaw chuck. The base of the headstock is $10\frac{3}{8}$ in. long, and the distance from the pulley to the drill chuck is $14\frac{5}{8}$ inches.

Bending, Forming and Shearing Machine, Universal

Bussel Machine Co., El Paso, Texas

"American Machinist," May 11, 1922



The machine is hand-operated and furnished in three sizes, the smallest size being intended for bench mounting. The medium sized or No. 2 machine has only one bending post and no shearing plate or compound ratchet; but the No. 3 size, as illustrated, is equipped for forming and shearing and has a compound ratchet lever and two bending posts for light and heavy work. No extra dies are required. The machine operates either right- or left-handed. Bending capacity of No. 3 model: small post, cold $\frac{3}{4}$ x 6 in. and $\frac{7}{8}$-in. round or square steel, and hot $\frac{5}{8}$ x 6 in. with a sharp corner; large post, cold $\frac{5}{8}$ x 6 in., hot 1 x 6 in. with a sharp corner, and $1\frac{3}{8}$ x 6 in. with a round corner, and pipe up to 2 in. in diameter. Weight, 840 pounds.

Belt Shifter, Automatic, "Kleckler"

Keuka Industries, Inc., Hammondsport, N. Y.

"American Machinist," May 11, 1922

The device is for use on all machines operated by belts running on cone pulleys. The belt does not slacken to a great extent during the shifting, and only one hand is necessary to operate the device. A loop fits the belt at both the countershaft and the machine pulley, and is so pivoted that its sides remain parallel with the belt for all movements. Near each end of the mechanism is a weighted pendulum pivoted to the outer ends of the belt actuating levers. Belts from 2 to 5 in. in width on any standard machine can be handled, and the device can be applied to most lathes by securing it under the rear cap bolts. For long and heavy belts, heavier pendulums are provided.

Clip, paste on 3 x 5-in. cards and file as desired

done at repair shops is a prime factor in the move. The railroad plans to employ between 600 and 800 men at the Groton plants.

The Thomaston Knife Co., Thomaston, Conn., has recently been incorporated under the laws of Connecticut, to manufacture cutlery, small tools, hardware, etc. The capital stock of the company is $60,000, and the incorporators are: Howard S. Hitchcock, I. W. Wedgewood and Florence Wedgewood, all of Woodbury, Conn.

The Bridgeport Bronze Co., Bridgeport, Conn., has been incorporated under the laws of Connecticut, to engage in the bronze foundry business. The concern will be capitalized at $200,000, and the incorporators include: Jonathan Grout, 1115 Main St., Bridgeport; Howard L. Schaff and Hilda M. Trainor, also of that city.

The Delaware, Lackawanna and Western Railroad Co., one of the railroads which depends to a large degree upon the movement of coal for its revenues, reports a June gross of $5,501,267, a drop of $2,064,865, compared with the corresponding month a year ago.

The Marlin Rockwell Corporation reports a net loss of $34,480 for the six months ended June 30, 1922, after all charges. The gross income was $[illegible], but deductions were $973,449, including general expenses, interest charges and idle plant expenses.

The International Machine Tool Co. has been organized in Indianapolis for the purpose of manufacturing tools and machinery. Orlando B. Iles, president of the Indianapolis Chamber of Commerce, and a well known manufacturer is one of the organizers. Among the others are Esther D. Iles and T. F. Dickinson. The company will have a capital stock of $45,000.

The Walsh Boiler Works, Holyoke, Mass., has been enlarged in accordance with requirements for the repairing of Boston and Maine Railroad locomotives, so that twenty may now be repaired there at one time.

The American Refrigerating Machine Co., Inc., Hartford, Conn., recently incorporated to make refrigerating machinery, etc., organized the company during the past week, electing officers as follows: President, Edward Carlson, West Hartford, Conn.; vice-president and general manager, Eric S. Sandberg, 25 Brown Street, Hartford Conn.; secretary and treasurer, Joseph H. King, also of West Hartford.

The Clifton Manufacturing Co., Newark, N. J., has filed notice of organization to operate a plant at 189 Market Street, for the manufacture of radio equipment and parts. The company is headed by Charles B. Whipple.

The Van Dresser Brothers, 1157 Concord Ave., Detroit, Mich., announces that the sale and distribution of Van Dresser cylinder reboring tools, until recently handled by the International Purchasing and Engineering Co. of that city, will, from now on, be handled direct by themselves.

The Remington Cutlery Works, Inc., Barnum and Seaview Aves., Bridgeport, Conn., recently incorporated with a capital stock of $1,500,000 under the laws of Connecticut, to manufacture cutlery in all its branches, organized the past week by the election of the following officers: President, C. L. Rierson, Bronxville, N. Y.; vice-president, I. S. Betts, New York City; treasurer, Charles W. Many, West Brooklyn, N. Y., and secretary, George Bingham, Plainfield, N. J.

Personals

GEORGE E. TITCOMB of the McMyler Interstate Co., 50 Church Street, New York City, has just returned home from a five months' tour of inspection of European ports.

A. L. ROBERTS, formerly master mechanic of the Lehigh Valley Railroad and more recently chief engineer of the Atlas Crucible Steel Co., Dunkirk, N. Y., has been appointed sales engineer of the railroad department of the United Alloy Steel Company, Canton, Ohio.

SEVEREN P. KERR, JR., identified for the past two years with the Sharon Steel Hoop Co., Sharon, Pa., has been made general manager of sales of the Ashtabula Steel Co., Ashtabula, Ohio.

GEORGE T. CHRISTOPHER, formerly assistant superintendent and production manager of the Dayton Laboratories Co., Dayton, Ohio, has been appointed general superintendent of that company.

SAMUEL F. LONG, of Canton, Ohio, has been appointed sales representative of the National Roll and Foundry Co., Avonmore, Pa.

JOHN F. KALK, formerly with the Dunham Co., Berea, Ohio, and for the last three years superintendent of the Muskegon Castings Co., Muskegon, Mich., has been appointed superintendent of the Eagle Foundry Co., of Muskegon.

THOMAS STEWART, until recently with the Inter State Foundry Co., Cleveland, has just been made superintendent of the Muskegon Castings Co., succeeding John F. Kalk.

ARTHUR WHITCRAFT, manager of steel sales, Hadfield-Penfield Steel Co., Bucyrus, Ohio, in addition to his previous duties has also been placed in charge of all foundry operations at the south works of the company, Bucyrus, Ohio.

HARRY W. HULTGREN, salesman for the Skinner Chuck Co., New Britain, Conn., resigned his position Aug. 1.

M. A. ANTOINE of France, engineer of roads and bridges, is in this country on a mission relating to the study of housing and building construction generally, and problems of industrial management. He represents the French Department of Public Works, the Comité Michelin, and the Association of French Contractors. The Comité Michelin corresponds somewhat to our Taylor Society and is engaged in studying the possibilities of efficiency management as applied to French industries. Mr. Antoine's headquarters, while in this country, are in the offices of the Taylor Society, 29 West 39th St., New York City.

JOSEPH PENDER, for a number of years past associated with the U. S. Steel Products Co., has been appointed sales representative of the Weaver Manufacturing Co., Springfield, Ill., manufacturers of garage and shop equipment, and will cover the States of Texas, Oklahoma, Arkansas, and Louisiana with the exception of the cities of El Paso and New Orleans. He will make his headquarters in one of the Texas cities at an early date.

DEL LANG, for the past five years associated with the Champion Spark Plug Co., has been appointed sales representative of the Weaver Manufacturing Co., Springfield, Ill., manufacturers of garage and shop equipment and will cover the states of Wisconsin, Minnesota, North and South Dakota and Illinois with the exception of the City of Quincy. He will make his headquarters at 3508 Eleventh Ave., South, Minneapolis, Minn.

W. CLAYTON FARRIS, for several years associated with the Horne Co., Ltd., of Japan and, for the past year, manager of the company's branch in Osaka, has recently returned to the United States to spend his vacation. During his stay in the United States he will make his headquarters at the New York offices of the company, 51 Chambers Street, New York City.

ALBERT J. WOODRUFF, president of the Woodruff Machinery Co., Atlanta, jobber of machinery and supplies, is a candidate for the Georgia state legislature at the primaries to be held in September.

Obituary

COLEMAN SELLERS, JR., president of William Sellers & Co., Philadelphia, died August 15th, after an illness of three months, in his seventieth year. An appreciation of his work in carrying on this pioneer machine tool building firm will appear in a later issue.

DAVID WADSWORTH, one of the leading manufacturers of central New York, died at his home August 15 at 74. He was head of the David Wadsworth and Son plant, manufacturing scythes and knives for agricultural implements. He was Alderman, Water Commissioner and twice Mayor of Auburn. His industry is one of the oldest in America, having been founded more than a century ago at Grafton, Mass.

GEORGE BICKNELL, secretary and treasurer of the Meriden Machine Tool Co., manufacturer of tools, etc., Meriden, Conn., died August 15 at his home after a long illness. Mr. Bicknell was well known in industrial circles throughout the east. He was born in Belfast, Maine, November 25, 1861.

THOMAS E. DEELEY of Robert Deeley and Co., maker of sugar refining machinery, New York City, died August 13, 1922, at his residence in the New York Athletic Club.

JAMES KENNEDY, engineer, editor and author, died suddenly on August 14th, 1922, at his home, 128 West 129th Street, New York City. He was at the time of his death editor and president of the Angus Sinclair Publishing Company. Mr. Kennedy was 72 years old. He learned the machinist trade and worked at locomotive construction and repair work while studying at night. He was in charge of the locomotive

shops of the New York Elevated Railroad from 1879 until 1902. Mr. Kennedy was chief cashier in the Water Department of the city in 1903 and deputy superintendent of elections in 1904. In the following year he became associate editor of *Railway and Locomotive Engineering*. He was made managing editor in 1910.

WILLIAM TAYLOR, superintendent of the Walden Knife Works, Walden, N. Y., died August 15, 1922, at his home in Walden, aged 45.

Book Reviews

Official report of the Ninth National Foreign Trade Convention at Philadelphia, May 10, 11 and 12, 1922. 8 x 9-in. 621 pages. Issued by the Secretary of the National Foreign Trade Council, New York, N. Y.

If one needed to be convinced of the general interest in foreign trade, a perusal of this volume would surely dispel any illusions to the contrary. The volume contains the addresses and discussions of the convention, which were given by title and outline at the time in these columns. The addresses cover foreign loans, depreciated currency, need of foreign trade, effect of high taxation, teaching of economics, credits and acceptances, net prices and discounts, merchant marine, insurance, bonded service, arbitration; European, South American and Far Eastern business, agriculture, exchange, financing, exports, co-operation, use of information and advertising, foreign trade policies, and such matters.

One of the most impressive addresses, and one which should be studied by business men generally, whether they are directly interested in export or not, was delivered by Walter Lichtenstein, Ph.D., of the First National Bank of Chicago, Ill. Under the title of "Need for Imports to Pay for Exports" he points out many obvious truths which are too often overlooked by business men as well as legislators. He shows plainly that exports must mean imports as well, and that artificial barriers to import make export more difficult, if not impossible. This address alone will well repay securing a copy of the volume for one's reference library.

Aircraft Year Book, 1922. 6 x 9-in. Two hundred and forty-six pages. Published by the Aeronautical Chamber of Commerce, New York, N. Y.

The year book of the aircraft industry has become an institution which chronicles the progress of our latest method of transportation, a method which is soon to be much more prominent than at present. The book reviews the advance of commercial aviation, the status of laws governing aviation and the need for others, accomplishments of other nations and many other subjects. The achievements of the air force in bombing the battleships is given in detail and with illustrations.

There are six chapters in the book, which occupy the first 160 pages. The appendix which follows includes data on the activities of the War and Navy Departments, the Marine Corps, Air Mail Service, Forest Fire Patrol and many other departments and committees. Details of performance are of interest, such as 6,500,000 miles flown during the year, with 250,000 passengers. Twice each day planes fly from coast to coast. The four new records made in America are of interest: Altitude, 35,563 ft.; seaplane with four people, 19,500 ft.; plane remains aloft over 26 hours; and a speed record of 174.77 miles per hour on a closed course. Those who want to know what has been done, and who can gather from the past what the future may have in store, need this book at hand as a reference. It is well written and fully illustrated, including outline drawings of many planes and motors.

Radiators for Aircraft Engines. By S. R. Parsons and D. R. Harper, 3rd, physicists. One hundred and eighty-three pages, 150 illustrations and tables. Published by Bureau of Standards, Washington, D. C. Price, 50 cents.

While this forms Technologic Paper 211 of the Bureau of Standards publications, it is in reality a handbook on radiators, based on extended experiments during the war and since. In addition to recording these special investigations, the paper contains a full description of laboratory methods and instruments for those tests of radiator cores which can be made in the laboratory. Results are tabulated giving the physical properties and geometrical characteristics of the various cores tested. Performance characteristics of sixty-six types of core are given in graphical form, and empirical equations for relating the heat dissipating power of a radiator to the air flow through the core, for computing the performance of a core of any depth from that of a core of exactly similar construction but different depth, and for computing heat dissipating power of such cores from their geometrical dimensions, are included.

The effectiveness of indirect cooling surface, that is, cooling surface not backed by flowing water, is developed mathematically, reduced to a practical working equation and applied to computation of the best fin dimensions for given conditions. Also, the equations of thermal conductivity are applied in order to produce a table showing temperature drop through metallic water tubes of radiators having various wall thicknesses of different kinds of material. The effect upon heat dissipation of varying the rate of water flow is considered in detail, also a comparison of different methods of testing radiator cores calorimetrically; and a great many other topics having to do with the performance of the radiator in different positions and at different altitudes are discussed.

Pattern Making. By Sampson and McCracken. Published by D. Van Nostrand & Co., 8 Warren St., New York, N. Y. One hundred and eleven 8 x 10¾-in. pages. Thirty full-page plates and 85 halftone illustrations.

This book was written to fill the need for a text that would give students such a knowledge of pattern making as to enable them to make a pattern of any usual type. Beginning with general information as to kinds of patterns generally used, and defining such subjects as shrinkage, finish, draft, cores and core prints, a chapter on pattern details follows. Here pattern lumber is thoroughly discussed and a full explanation given of the way it should be sawed and glued in building up patterns.

In a section devoted to tools, all the hand tools and machines used by pattern makers are illustrated and described. Molding is taken up in such a way as to give the student a fair idea of how a pattern is to be used in the foundry, together with a full description of foundry equipment and its use.

The foregoing chapters are followed by thirty exercises for students, in which detailed drawings of a variety of articles are given with full instructions for making patterns for them. In the plates with the drawings are many illustrations showing how the patterns are to be molded. Students finishing the course prescribed in this book should have attained a good working knowledge of the general principles of pattern making.

Pamphlets Received

250 Lacquer Questions Answered. Zeller Lacquer Manufacturing Co., Inc., 342 Madison Ave., New York City. An interesting pamphlet of 28 pages with a complete index. It contains as its title implies, 250 questions regarding lacquer, its composition, use, methods of application and other points of interest. These are clearly answered in language easy to understand. To the great numbers of people who desire information on lacquers this pamphlet should fill a long felt want.

Engineering Service. Ford, Bacon & Davis, Inc., 115 Broadway, New York City. Pamphlet No. 46 describing in detail this company's engineering organization and the broad scope of its service.

How Electric Riveting Was Made Commercial. A pamphlet and catalog combined, containing sixteen pages by Frank P. Kobert, published by the Kobert Machine Co., Inc., 50 Church Street, New York City. The pamphlet is a detailed discussion of the process of electric riveting with illustrations of the machinery used in the operation.

Establishing Branch Factories in Germany. Trade information Bulletin No. 52 published by the Department of Commerce, being a report to the Secretary of Commerce by the Western European Advisory Committee consisting of Fred I. Kent, Rudolph S. Hecht, Clyde L. King, Alexander Legge, George M. Verity. Distributed by the U. S. Department of Commerce, Washington, D. C.

Trade Catalogs

Insulating Compounds. The Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. A booklet of sixteen pages, known as Publication No. 4249-A describing the company's line of insulating and soldering compounds. Some of the materials treated in the publication are baking varnishes, air-drying varnishes, insulating compounds, finishing materials, insulating glue, soldering flux, and lubricating oil.

Heat Treating Furnaces. The Chicago Flexible Shaft Co., Chicago, Ill. An illustrated folder showing the numerous types and sizes of the Stewart heat treating furnaces, with dimensions and other data on each size.

Micarta Gears. The Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. An illustrated folder, known as Folder No. 4453, enumerating the points of superiority claimed for micarta gears and showing the advantages to be derived from the use of Micarta in place of their non-metallic gears.

Electric Hoists. The Northern Engineering Works, Detroit, Mich. Bulletin No. 544-DD, just issued, describing in detail the company's electrically operated portable hoists in sizes ranging from ½ to 1 ton. The hoist is made for either direct or alternating current and complete specifications are set forth in tabular form in the bulletin.

Measuring Instruments and Tools. The Van Keuren Co., 362 Cambridge St., Allston, Boston, Mass. A new catalog of 8 pages, just issued, and known as catalog No. 25. The catalog contains a foreword on the Van Keuren Service, quality and guarantee, and gives detailed information with cuts on the company's line of gage blocks, plug gages, measuring wires, surface plates and outfits for measuring light waves.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society of Mechanical Engineers, regional meeting, Sept. 25, 26 and 27, 1922, Hotel Kimball, Springfield, Mass. Secretary Calvin W. Rice, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co., Building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, **M. B. Dean, 160** Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Buck Falls, Pa., (Delaware Water Gap).

National Machine Tool Builders' Association, annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922. Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Shapes, plates and bars up 10c.; cold rolled steel, 15c.; floor plates, 20c.; hoops and soft steel bands, 25c. per 100 lb. in New York warehouses. Chicago quotes advance of 10c. on shapes, plates, bars and soft steel bands; 20c. on floor plates; 22c. on hoops and 30c. on cold rolled steel. Mill price of shapes, plates and bars, $1.80@$2 per 100 lb., f.o.b. Pittsburgh. Bars quoted at $2 and plates at $2@$2.25 per 100 lb. on small tonnages for quick deliveries. Wrought steel pipe discounts reduced in New York warehouses; no change, as yet, on Pittsburgh basing card of leading interest. Price advances due to further reduction in output and higher production costs, caused by scarcity of coal and coke.

Tin up ½c. in New York warehouses. Copper demand better; prices firm. Aluminum ingots advanced 1c. and antimony ½c. per lb. in Chicago. Lead quiet; prices higher, however, in St. Louis.

Declines—Dealers' purchasing price of old copper, heavy, and crucible, down ½c. per lb. in Chicago. Zinc market easier; St. Louis quotes 6.15c. as against 6.30c. per lb. Linseed oil down 4c. per gal. in Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.55
Northern Basic	28.27
Southern Ohio No. 2	27.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.44
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	30.17
Basic	27.25
Grey Forge	31.50
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.00
Basic	26.00
Bessemer	27.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	8.75	6.5	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill.

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]@2.[illegible]	3.78	3.50	3.90
No. 12	2.[illegible]@2.[illegible]	3.83	3.55	3.95
No. 14	2.[illegible]@2.70	3.88	3.60	4.00
No. 16	2.[illegible]@2.[illegible]	3.98	3.70	4.10
Black				
Nos. 17 and 21	3.00@3.25	4.15	3.80	4.60
Nos. 22 and 24	3.[illegible]@3.3[illegible]	4.20	3.85	4.60
Nos. 25 and 26	3.10@3.35	4.[illegible]	3.90	4.65
No. 28	3.15@3.40	4.35	4.00	4.75

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.15@3.40	4.35	3.85	5.60
Nos. 12 and 14	3.25@3.50	4.45	3.95	5.70
Nos. 17 and 21	3.55@3.80	4.75	4.25	6.00
Nos. 22 and 24	3.70@3.95	4.90	4.55	6.15
No. 26	3.85@4.10	5.05	4.70	6.30
No. 28	4.15@4.40	5.35	5.00	6.60

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	63%	49%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	60%	46%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	4.03	3.50	3.70
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	5.00	4.91	5.28
Cold finished shafting or screw	3.65	3.30	3.70
Cold finished flats, squares	4.15	3.80	4.20
Structural shapes (base)	2.93	2.66	2.80
Soft steel bars (base)	2.83	2.56	2.70
Soft steel bar shapes (base)	2.83	2.56	2.70
Soft steel bands (base)	3.63	3.06	3.45
Tank plates (base)	2.93	2.66	2.80
Bar iron (2.25 at mill)	2.83	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	33.25
Lead (up to carlots), St. Louis 5.55; New York	6.10
Zinc (up to carlots), St. Louis 6.15; New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	19.00
Antimony (Chinese), ton spot	5.50	7.50	6.50
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	19.50	18.75
Brass tubing (100-lb. lots)	21.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.25	17.50	15.75
Brass wire (carlots)	18.25	19.50	.....
Zinc sheets (casks)	8.50	9.00	.....
Solder (½ and ½), (caselots)	23.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.00	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	11.50
Copper, heavy, and wire	11.75	11.00	11.25
Copper, light, and bottoms	9.75	9.50	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6.25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.25	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.17	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville		per net ton	14.00
Coke, prompt foundry, Connellsville		per net ton	15.00

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50-10%
1⅛ and 1¼x3 in. up to 12 in.	25%	65%	60-10%
With cold punched sq. nuts	30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	.....	$4.00 off
Button head bolts, with hex. nuts	20%	$3.90 net	.....
Hex. head and hex. nut bolts	25%	....	65-5%
Lag screws, coach screws	45%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	....	55%
Tap bolts, hex. head, list plus	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70-10%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.00	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	55%	65%	60-10%
Rivets, tinned	55%	65%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$4.50	$3.50	$3.35
Cone heads, ditto (net)	4.60	3.60	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	30-5%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Norwalk—[illegible] Garage, [illegible] Commerce St.—one drill press (used).

Fla., Sebring—J. O. Adams—equipment for machine and repair shop.

Ind., Indianapolis—Rockford Mfg. Co., [illegible] English Ave.—equipment for proposed 1 story machine shop.

N. J., Wildwood—W. Butterfield—machine shop equipment, including lathe, drill press, etc.

N. Y., Buffalo—D. Patton, 498 Elk St.—tools for proposed repair and plumbing shop.

N. Y., Buffalo—A. Schmidt, Doat St.—equipment and machinery for garage, service station, and repair shop on Genessee St. and Haigh Pl.

N. Y., Chautauqua—C. S. Arnold, Colonnade Bldg., machinery and equipment for proposed garage, capacity 500 cars.

N. Y., Elmira—Eliot-Stemple Co., 112 Lake St.—equipment for proposed repair and plumbing shop.

N. Y., Jamestown—S. B. Robbins, 303 Lafayette St.—machinery and tools for proposed garage and service station on North Main St.

N. Y., Rochester—Auto Sales & Service Corp., 224 Williams St.—mechanical equipment, machinery, and tools for proposed ($150,000) salesroom and service station on Monroe Ave.

N. Y., Rochester—J. Cullinan, 29 Thorndale Terrace—machinery, tools and other [illegible] equipment for proposed garage and service station on Lake Ave.

O., Celina—Hermann Mfg. Co.—metal working machinery, including grinder, shaper and polisher.

O., Massillon—The Standard Steel Rolling Mill Co.—grinder.

Okla., Madill—Woody Motor Co.—equipment for machine shop and service station.

Pa., Chester—G. Silver, 4th and Edgemont Sts.—welding outfit, set of tinners' and sheet metal workers' tools.

Pa., Morrisville—Free Bridge Motors Co.—lathes and other machinery for proposed machine shop and garage on Bridge St.

Pa., Phila.—Commercial Truck Co., 27th and Brown Sts.—one 36 in. Bullard vertical lathe.

Pa., Phila.—De Frain Sand Co., Beach and Berks Sts.—one 20 in. x 14 ft. lathe, one 24 in. shaper and one 20 in. drill press.

Pa., Phila.—Sayre Level Radio Co., 41 North 10th St.—drill pressed lathes, etc., for new factory.

Pa., Phila.—A. Schriver, 1013 Cherry St.—one 6 in. swing 5 ft. bed power lathe.

Wis., Menasha—C. A. Westberg, 644 Paris St. (manufacturer of printing machinery)—lathe, millers, shapers, drill presses and grinders.

Ont., Dresden—O. & W. McVean, Ltd.—12 in. [illegible] lathes, back geared, with compound rest.

Ont., Walkerville—Gotfredson Joyce Co., Walker Rd. (manufacturer of auto trucks)—metal working machinery, special equipment and tools for proposed addition to factory.

Machinery Wanted

Ala., Bessemer—J. P. K. Harless, Box 227—one 12 x 18 ft. power press and other printing equipment.

Ala., Montgomery—Atlanta Ice & Cold Storage Co.—complete machinery and equipment for addition to ice and storage plant.

Ark., Hot Springs—Missouri Lumber Co., Gaines Ave.—machinery and equipment for mill.

Calif., Long Beach—Long Beach Paper Box Co.—machinery and equipment for proposed factory on Cherry Ave.

Conn., Bridgeport—The Raybestos Co., Railroad Ave. and Bostwick Ave. (manufacturer of asbestos brake linings, etc.), A. D'Louhy, Purch. Agt.—one belt press.

Conn., Bridgeport—M. J. Dowling & Co., 576 Gurdon St. (building specialties, equipment, etc.), J. H. Southey, Purch. Agt.—one 3 ton capacity chain hoist block (used).

Conn., Fairfield—G. Grenier, 140 Grasmere Ave. (novelty and mechanical work)—small tools, also one ¼ hp. electric motor.

Conn., Poquonock Bridge (Groton P. O.)—H. E. Thurber—one band saw (used).

Del., Wilmington—Bd. of Harbor Comrs., Public Bldg., will receive bids until Sept. 8, for one railroad track scale, 200 ton capacity.

2 steam locomotive cranes, 20 ton capacity, 50, 60 and 70 ft. boom.

2 light duty traveling electric portal cranes, 2½ ton capacity.

4 portable electric dock winches, 2 ton capacity.

1 mechanical cargo ramp.

6 electric tractor trucks, with two spare batteries.

3 load carrying trucks.

50 trailers for electric tractors.

50 stevedore hand trucks.

Ga., Rome—Battery Machine Co., A. Butler, Purch. Agt.—1 self feed rip saw with 2 saws spaced 11 in. apart.

Ga., Waynesboro—J. D. Sanders—one tenoning machine, single head, to use for cutting tenon on wagon crossbars (used).

Ill., Chicago—Western Newspaper Union, 210 South Desplaines St.—one No. 14 linotype.

Ill., Rockford—Andrews Wire & Iron Works, 1802 Preston St.—special iron and wire working machinery for use in the manufacture of ornamental wire work.

Ia., Bloomfield—Bloomfield Messenger, Box 566, F. R. Sullivan, Purch. Agt.—newspaper and job press, power.

Ia., Grundy Center—J. Rosekamp—syrup and sugar making and mixing machinery.

Kan., Wichita—Wichita Trunk Co., South Lawrence St., E. Rose, Purch. Agt.—power planer and drill press.

Ky., Augusta—Ohio Valley Publishing Co., P. O. Box 121—two news presses, 2 job presses, 1 linotype machine, belting, shafting, hangers, pulleys, and other printing equipment.

Ky., Cynthiana—Cynthiana Carriage Co., J. W. Leck, Pres.—machinery and equipment for proposed plant at Covington, Ky.

Ky., Madisonville—Kentucky Tire Pump Co.—machinery and equipment for proposed plant at Evansville, Ind.

La., New Orleans—Kotteman Furniture Co., 4101 Magazine St.—machinery and equipment for the manufacture of window shades.

La., Shreveport—Sunshine Soap Co., Inc.—machinery and equipment for the manufacture of soap and soap products.

La., Tier—Lee Lumber Co.—machinery and equipment for $100,000 saw mill.

Mich., Detroit—The City, Herman Kiefer Hospital, Byron Ave.—coal hopper, grinder, traveling weigh larry, pivoted belt conveyor, capacity 40 ton per hour.

Minn., Albert Lea—Central Clay Wks.—full equipment for modern tile plant.

Minn., Duluth—Duluth Burial Case Co., 218 West 2nd St.—machinery for proposed burial casket factory.

Mo., Joplin—C. McManamy, 2220 Pearl St. (mine operator)—Keystone drill.

Mo., Kansas City—Central Printing Co., 124 West 13th St.—cylinder press.

Mo., Marshall — International Shoe Co.—machinery and equipment for proposed $350,000 addition to factory.

Mo., St. Joseph—Aunt Jemima Mills Co., 2nd and Edmond Sts. (food manufacturing)—testing machinery (Mullens preferred).

Mo., St. Louis—Julius Meyer Printing & Publishing Co., 2107 East Prairie St.—one type caster.

Nev., Sparks—I. G. Wagner—refrigerating and ice manufacturing machinery for proposed plant at Marysville, Cal.

N. Y., Attica—W. Ranger—one hollow chisel mortising machine, to mortise ⅛th to ⅞th.

N. Y., Buffalo—Jewett & Co., Military Rd., S. S. Jewett, 563 West Ferry St., Pres.—machinery and equipment for stove and range factory.

N. Y., Buffalo—Wood & Brooks Co., Military Rd. (manufacturer of mechanical players)—machinery and equipment for proposed addition to plant.

N. Y., Frewsburgh—F. Gurnsey, Route 86—large power threshing machine separator with side stacker.

N. Y., Ithaca—Morse Chain Co., South Tioga St.—machinery and equipment for proposed factory in Detroit, Mich.

N. Y., Jamestown—Emerson Glass Corp., 148 Blackstone Ave., manufacturer of mirrors, glass products, etc.—equipment and machinery for silvering mirrors.

N. Y., Jamestown—International Casement Co., 84 Hopkins Ave., manufacturer of steel window screens and frames—machinery and equipment for factory addition now in course of construction.

N. Y., LeRoy—Ralph Gypsum Co.—machinery and equipment for mining and development of gypsum field.

N. Y., Long Island City—Wengraf Mfg. Co., 29 Prospect St., (manufacturer of cranes)—chain blocks, 1 ton and 2½ ton.

N. Y., New York City—Continental Paper & Bag Mills, 16 East 40th St.—one 36 x 40 two column printing press for power equipment.

N. Y., Niagara Falls—P. Lonberger, 1623 8th St.—one 2 ton hoist for truck.

N. Y., North Rose — North Rose Cold Storage Plant, Orchard St.—machinery and equipment for addition to storage plant, capacity 30,000 barrels.

N. Y., Seneca Falls—Seneca Falls Rule & Block Co., 19 Water St.—10 x 15 or 12 x 18 job presses.

N. C., Concord—A. B. Pounds—electrically operated 25-ton ice machine, and other equipment, for ice manufacturing plant.

N. C., Gastonia—Art Cloth Mills, Inc., H. H. Gagner, Pres.—textile machinery for proposed large plant.

O., Cleveland—The City of Cleveland—one 10 ton gasoline driven locomotive crane.

O., Cleveland—The Crucible Steel Castings Co., Champlain and Canal Rd.—one 5 ton electric crane, sand blast equipment, cupola and motors, for proposed plant.

O., Columbus—Amicon Fruit Co., 31 East Naghten St.—machinery and equipment for 3 story cold storage and refrigeration plant at Williamson, W. Va.

O., Columbus—Clark Grave Vault Co., 344 West Town St., A. F. Beck, Pres. and Genl. Mgr.—1 breaker for steel, and other equipment for proposed plant.

O., Lima—The Lima Locomotive Co., South Main St.—$500,000 worth of various equipment for new plant.

Okla., Barnsdale (P. O. Avant)—C. A. Runyan—power job press, paper cutter, and other printing equipment.

Okla., Cushing — Cushing Refining & Gasoline Co.—machinery and equipment for proposed extension to refinery at Ingall, Okla., also equipment for new gasoline producing plant.

Pa., Allentown — Channock & Senderowitz—machinery and equipment for proposed 3 story cigar factory.

Pa., Hazleton—D. Markle—machinery and equipment for development of coal mining properties near Tremont, Pa.

Pa., Ice Lake (White Haven P. O.)—Miller Powder Works (manufacturer of explosives)—machinery and equipment for proposed enlargement of plant.

Pa., Phila. — Branch — Crawford Co., (metal manufacturers) 27 South 4th St.—punch press, inclineable table, 4 in. stroke or over.

Pa., Phila. — Fennessey & Kobler Co., 26th and Parrish Sts., A. Fennessey, Purch. Agt.—wood and metal working machines for the manufacture of automobile bodies.

Pa., Phila.—R. Krook, Main St. and Walnut Lane, manufacturer of yarn—additional mule spindles and sets.

Pa., Phila.—Montgomery & Snow, Montgomery and Moscher Sts., A. Snow, Purch. Agt.—Textiles—drying machines for dyeing plant.

Pa., Phila.—A. J. Reach & Co., Tulip and Palmer Sts., A. Gamble, Purch. Agt.—mule spindles, belts, shaftings, etc., for the manufacture of yarn.

Pa., Phila.—F. C. Sneadaker & Co., 9th and Tioga Sts., mill work—additional woodworking machinery.

Pa., Phila.—United Lutheran Publication Co., 9th and Sansom Sts.—machinery for printing plant (new).

Pa., Pittsburgh—D. N. Carlin Co., 125 Dennison St. (manufacturer of toys)—machinery and equipment for proposed addition to factory.

Pa., Pittsburgh—Du Roth Steel Truck & Car Wheel Co., 611 Keystone Bldg. — equipment for new plant at Osgood, Pa.

Pa., Pittsburgh—Kund & Eiben Co., 204 Warrington Ave.—1 self feed rip saw, 3 cut off saws, and 1 band saw, 1 planer, 2 moulders, 1 jointer, 1 sander, 1 tenon and 1 boring machine, 1 shaper, 1 concrete mixer, 1 cement block machine, and 1 Ford tractor, for cabinet works at Bedford.

Pa., Wilkes-Barre—A. L. Reilly, Archt., Bennett Bldg.—vocational equipment for proposed high school at Plains, Pa.

Tex., Dallas—Edwards Wheel & Body Works, 2801 Main St.—power polishing machine, belt sanding machine, and a 20 to 25 hp. motor.

Tex., Stamford—Jay Cotton Oil Co.—machinery for cotton oil mill.

Va., Lynchburg—Apex Coal Co.—machinery and equipment for proposed coal tipple and other coal mining plants at Sargent, Ky.

Wash., Chehalis—Coy Valve Co.—complete machinery and equipment for proposed plant.

W. Va., Wheeling—Bd. of Educ., 2105 Chapline St., C. E. Githens, Supt.—equipment for vocational departments of schools.

Wis., Appleton—The Valley Dairy Products Co.—machinery for proposed dairy.

Wis., Carrollville (P. O. Otjen)—U. S. Fertilizer Co.—special machinery to extract fumes and gases from commercial fertilizer while in process of manufacture.

Wis., De Pere—The City, W. R. Mathews, Clk.— manual training equipment for proposed vocational school.

Wis., Kenosha — The Nash Motors Co., Edward St., C. W. Nash, Pres.—iron and woodworking machinery for the manufacture of automobiles.

Wis., Lake Geneva—J. Nutini—dairy machinery for proposed ice cream factory.

Wis., Madison—Madison Gas & Electric Co., 120 East Main St.—mono rail crane.

Wis., Marshfield — Cahill & Douglas, Engrs., 216 West Water St., Milwaukee, are receiving bids for bucket conveyor, 40 ft. long, belt or chain type, for Roddis Lumber and Veneer Co., Marshfield.

Wis., Medford — Medford Marble & Granite Works, F. J. Barry, Purch. Agt.—cutting machinery for monument working.

Wis., Menasha—Jaeger-Wheeler Co., 417 2nd St.—machinery for auto repair shop at Neenah (proposed).

Wis., Milwaukee—Seaman Body Corp., 1732 Richards St.—woodworking and iron working machinery.

Wis., Milwaukee—Standard Oil Co., 68 Wisconsin St.—gasoline storage tank and pump for garage at Green Bay.

Wis., Milwaukee—L. Windler, 1218 23rd Ave.—trim saw and pulling machine for wood working.

Wis., Oshkosh—Kaewer Auto Co., Main and Irving Sts.—air tank, complete with pump, for proposed addition to garage.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St.—annealing ovens.

Wis., Racine—V. E. Christiansen, 1242 Goold St.—one electrically driven floor surfacing machine.

Wis., Wauwatosa—Milwaukee County Bd. of Trustees, Watertown Plank Rd., W. L. Cuffey, Mgr.—receiving bids until Aug. 28 for refrigerating machinery.

Wis., West Allis—Allis Chalmers Mfg. Co.—one 10 ton traveling crane.

Ont., Georgetown—Smith & Stone Electrical Co., College View—equipment for porcelain kilns.

Ont., Guelph—McArthur Engineering Co. —latest modern gravel and sand handling and washing equipment, for gravel pit.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. Everything possible is done to insure authenticity and timeliness. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving. Your co-operation is invited.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Ont., Hamilton—Libbey Owens Sheet Glass Co.—equipment for proposed extension to plant.

Ont., London—McCormick Biscuit Co., Dundas St. E., F. McCormick, Mgr.—electric ovens and baking equipment. Estimated cost $30,000.

Ont., St. Thomas—St. Thomas Metal Signs, Ltd.—cylinder press for sheet metal 36 x 60 in., 9½ in. between table and ram.

Ont., Scarboro Junction—Kingston Road Lumber Co., 828 Kingston Rd.—complete machinery and equipment for proposed planing mill.

Ont., Sudbury—Cochrane Hardware Co. —electric floor scrapers.

Ont., Woodstock—The Oxford Knitting Co., Ltd. (manufacturer of underwear)—W. A. Gray, Secy.-treas.—latch needle machines in 10-cut with different sized cylinders, (Scott and Williams, also Wildman); 28 gauge spring needle machines different sized cylinders (Tompkins).

Metal Working Shops

Calif., Oakland—Hebern Electric Code, Inc., Bank of Italy Bldg., had plans prepared for the construction of a 3 story factory on Harrison St. between 8th and 9th Sts. Estimated cost $200,000. Reed & Corlett, Oakland Bank of Savings Bldg., Archts.

Calif., Santa Rosa — B. Hildebrand, Archt., Santa Rosa, is receiving bids for the construction of a 2 story, 75 x 150 ft. garage for Tilden & Tilden. Estimated cost $40,000.

Ill., Chicago—B. H. Gwathmey, 1508 East 66th Pl., awarded the contract for the construction of a 1 story, 91 x 127 ft. garage at 1947-53 East 57th St. Estimated cost $40,000.

Mass., Boston—Fisher Hill Co., 18 Tremont St., will build a 3 story, 80 x 170 ft. garage, repair shop and service station, on Commonwealth Ave. Estimated cost $100,000.

Mass., Nantasket—L. Damon, Jr., Hull, awarded the contract for the construction of a 1 story, 100 x 110 ft. garage and warehouse, on Atlantic Ave. Estimated cost $40,000.

N. Y., Buffalo—Jewett & Co., Military Rd., plans to build a plant for the manufacture of stoves and ranges, to replace one destroyed by fire. Estimated cost $150,000. S. S. Jewett, 563 West Ferry St., Pres. Architect not announced.

N. Y., Chautauqua—Chautauqua Institution—The Colonnade plans to rebuild its garage destroyed by fire, capacity 500 cars. Estimated cost $50,000. A. E. Bestor, Pres. C. A. Arnold, Colonnade Bldg., lessee.

N. Y., Jamestown—S. B. Robbins, 303 Lafayette St., has purchased a site on North Main St. and plans to build a garage and service station. Estimated cost $45,000. Architect not announced.

O., Cleveland—W. B. Gongwer, Federal Bldg., is interested in a syndicate which plans to build a 3 and 6 story garage, commercial and office building at 3328 Euclid Ave. Estimated cost $400,000. W. S. Lougee, 500 Marshall Bldg., Archt.

O., Cleveland—Pollock-Davis Co., 11628 Euclid Ave., had plans prepared for the construction of a 1 story, 72 x 74 ft. garage. Estimated cost $40,000. H. P. Whitworth, 526 Hickox Bldg., Archt.

O., Cleveland—G. S. Rider & Co., Archts., Century Bldg., is receiving bids for the construction of a 1 story, 100 x 240 ft. foundry on Almira Ave. and East 82nd St., for the Crucible Steel Castings Co., Canal Rd. Estimated cost $100,000. W. H. Shepard, Pres. Noted July 6.

Okla., Madill—Woody Motor Co. plans to build a service station and garage to replace the one destroyed by fire. Estimated cost $60,000. Architect not announced.

Pa., Ambridge—Standard Seamless Tube Co., plans to build a 1 story, 80 x 480 ft. addition to its plant. Private plans.

Pa., Johnstown—J. Walling & Co., 518 Washington St., is having plans prepared for the construction of a 3 story, 74 x 132 ft. garage, on Railroad St. Estimated cost $15,000. S. E. Dickey & Co., Johnstown, Engrs. Noted June 22.

Pa., Morrisville—Free Bridge Motors Co. plans to build a 2 story, 86 x 86 ft. machine shop and garage on Bridge St. Estimated cost $10,000. O'Rourke & Haig, 87 Liberty St., Trenton, Archts.

Pa., New Kensington — National Auto Service Co. plans to build a 1 story, 60 x 70 ft. and 25 x 60 ft. garage and service station, on 5th St. Estimated cost $50,000.

Pa., Phila.—J. T. Finnessey, Taney and Parish Sts., awarded the contract for the construction of a 1 story, 25 x 80 ft. shop for the manufacture of automobile bodies. Estimated cost $17,000.

R. I., Providence—United Electric Railways Co., Union Station, plans to build a 1 and 2 story, 88 x 250 ft. garage and service repair station on Melrose St. Estimated cost $100,000. Private plans.

Wis., Appleton—G. R. & S. Motor Co., 738 Washington Ave., awarded the contract for the construction of a 1 and 2 story, 30 x 75 ft. garage. Estimated cost $50,000. Noted Aug. 10.

Wis., Milwaukee—Seaman Body Corp., 1732 Richards St., is receiving bids for the construction of a 5 story factory for the manufacture of auto bodies. Private plans.

Wis., Neenah—Jaeger-Wheeler Co., 417 2nd St., Menasha, is having plans prepared for the construction of a 2 story, 60 x 120 ft. garage and repair shop, on Commercial St., here. Estimated cost $50,000. E. A. Wettengel, 578 Pierce Ave., Appleton, Archt.

Wis., Oshkosh—Kaewer Auto Co., Main and Irving Sts., awarded the contract for the construction of a 1 story, 64 x 130 ft. garage addition. Estimated cost $40,000.

Wis., Oshkosh—Winnebago County Road and Bridge Comm., 123 7th St., is receiving [illegible] for the construction of a 1 story [illegible] x 150 ft. garage on Wisconsin Ave. [illegible] Estimated cost $40,000.

Wis., Waukesha—Waukesha Fdry. Co., Lincoln Ave., has selected a site and plans to build a 2 and 3 story 90 x 150 ft. steel factory and foundry on Lincoln Ave. Estimated cost [illegible]. Architect not selected.

Ont., Walkerville—Gotfredson Joyce Co., Walker Rd., manufacturer of auto trucks, awarded the contract for the construction of a 72 x 150 ft. addition to its factory. Estimated cost $50,000.

Ont., Windsor—Gray Dort Motors, Ltd., 1 William St., N., Chatham, plans to build a new auto factory here. Estimated cost [illegible]. Private plans.

Que., Lachine—Linde Canadian Refrigeration Co., St. Peters St., Montreal, awarded the contract for the construction of a factory here, for the manufacture of refrigerating machines. Estimated cost [illegible]. Architect not announced.

General Manufacturing

Ark., Hot Springs—Missouri Lumber Co., Gaines Ave., plans to rebuild its lumber mill which was recently destroyed by fire. Estimated cost $75,000. Private plans.

Calif., Dinuba — The Sun Maid Raisin Growers, Holland Bldg., Fresno, awarded the contract for the construction of an 80 x 140 ft. packing plant, here. A. V. B. Klein, asst. operating mgr. Noted June 22.

Calif., San Francisco—A. M. E. Danner, c/o J. H. Hjul, Engr., 1342 Mission St., awarded the contract for the construction of a 1 story, 25 x 55 ft. printing plant on 7th St., near Howard St., to be occupied by C. F. Danner Publishing Co., 45 Fisher St. Estimated cost $8,000.

Conn., Hamden—Safety Car Heating & Lighting Co., Dixwell Ave., awarded the contract for the construction of 2 one story, 104 x 115 ft. and 100 x 195 ft. factory additions. Estimated cost $100,000.

Conn., South Norwalk—J. and J. Cash, Ltd., Chestnut St., will soon award the contract for the construction of a 1½ story, 60 x 132 ft. weave shed, for the manufacture of textiles. Estimated cost $40,000

Ill., Chicago — P. Gerhardt, Archt., 64 West Randolph St., is receiving bids for the construction of a 3 story, 120 x 240 ft. printing plant on La Salle St. near 26th St., for the Illinois Publishing and Printing Co., Hearst Bldg. Estimated cost $500,000.

Ill., Chicago — F. Mack, 1914-16 Milwaukee Ave., manufacturer of leather goods, awarded the contract for the construction of a 3 story, 25 x 50 ft. factory addition. Estimated cost $25,000.

Kan., Salina—H. D. Lee Flour Mills, had plans prepared and soon receives bids for the construction of a 22 x 63 ft. cleaner house, 95 ft. high, and a grain elevator, on Santa Fe Ave. Estimated cost $150,000. [illegible] L. Zerbe, Salina, Archt. and Engr.

La., New Orleans—Bd. of Port Commrs., [illegible] Canal St., plans to build a 2 story, 140 x [illegible] ft. grain sacking plant, adjoining [illegible] warehouse. Estimated cost $180,000.

Mass., Holyoke—Holyoke Supply Co., 210 [illegible] St., manufacturer of [illegible] goods, awarded the contract for the construction of a 2 story addition to its plant. Estimated cost [illegible].

Mass., Southbridge—Hamilton Woolen Co., [illegible] St., awarded the contract for the construction of a 1 story, 100 x 120 ft. [illegible] addition to its plant on West St. Estimated cost $40,000.

Minn., Albert Lea — Central Clay Wks. plans to build a tile factory to replace one recently destroyed by fire. Estimated cost $40,000. A. L. Severin, Mgr. Engineer not selected.

Minn., Duluth—[illegible] Burial Case Co., 218 West 2nd St., will soon award the contract for the construction of a 2 story, 41 x 123 ft. casket factory at 202 West 2nd St. Estimated cost $30,000.

Minn., Winona — Pepin Pickling Co. awarded the contract for the construction of a 1 and 2 story, 74 x 141 ft. canning factory and warehouse. Estimated cost $50,000. Noted June 1.

N. J., Trenton—Freeman Electric Co., 509 East State St., awarded the contract for the construction of a 1 story, 32 x 100 ft. addition to its porcelain plant. Estimated cost $20,000.

N. Y., Boonville—Bd. of Educ., awarded the contract for the construction of a 3 story, 109 x 142 ft. school on Ford and Post Sts., to replace one destroyed by fire. Estimated cost $185,000.

N. Y., Buffalo—D. Patton, 498 Elk St., plans to build a repair and plumbing shop at 470 Elk St. Estimated cost $6,000. Architect not announced.

N. Y., Buffalo—A. Teachout & Son, 52 Leslie St., plans to rebuild that portion of its planing mill which was destroyed by fire. Estimated cost $15,000.

N. Y., Jamestown—Emerson Glass Corp., 146 Blackstone Ave., manufacturer of mirrors, glass products, etc., plans to build an addition to its factory. Estimated cost $5,000. Private plans.

N. Y., Jamestown—Ulrich Plan File Co., 516 West 4th St., awarded the contract for the construction of a factory for the manufacture of vertical filing equipment for offices, etc., on Murray Ave. Estimated cost $18,000. Noted June 29.

N. Y., Newburgh — W. R. Crabtree awarded the contract for the construction of a yarn mill. Estimated cost about $150,000.

N. C., Gastonia — The Art Cloth Mills, Inc., plans to build a weave mill, to be equipped with seventy-two 30 harness novelty looms. Estimated cost $195,000. H. D. Gayner, Pres.

N. C., Granite Falls—A. A. Shuford Mill Co., Highland, plans to build a cotton mill, here. Estimated cost, exclusive of machinery and equipment, $100,000.

O., Cleveland — Christian, Schwarzenberg & Gaede, Archts., 1900 Euclid Ave., are receiving bids for the construction of a 1 story factory addition, for Wolf Envelope Co., 1749 East 22nd St. Estimated cost $50,000. Noted Aug. 17.

O., Cleveland — The Lincoln Heights Dairy Co., c/o J. Terencz, 755 Starkweather Ave., had plans prepared for the construction of a 2 story, 35 x 78 ft. factory at 2504 Professor Ave. Estimated cost $40,000. W. Markowitz, 1836 Euclid Ave., Archt.

O., Cleveland—G. Rackle & Sons Co., Stop 5, A. B. C. Line, manufacturer of artificial stone, had plans prepared for the construction of a 1 story, 50 x 120 ft. molding shop on McCracken Rd. Estimated cost $40,000

O., Cleveland—A. Sogg, Archt., Hippodrome Bldg., is receiving bids for the construction of a 2 story, 35 x 50 ft. factory and store building, on East 105th St. and Superior Ave., for J. O. Stein, 822 Leader-News Bldg. Building to be leased to Hoffman Candy Co., c/o architect.

O., Cleveland—D. D. Wessels & Son, 1785 East 17th St., manufacturer of sanitary tubs, are receiving bids and will open same about Aug. 30, for the construction of a 2 story, 100 x 102 ft. factory at 2000 Oregon Ave. Estimated cost $60,000. Private plans.

O., Middletown—The Gardner Harvey Paper Co., West 3rd St., is receiving bids for the construction of a 1 story, 200 x 295 ft. paper manufacturing plant. T. H. Scott & Son, Middletown, Archts.

Okla., Duncan—Pauline Oil & Gas Co. plans to build a refinery, capacity 700 bbls., on site 6 miles from here. Estimated cost $65,000.

Pa., Arnold—Amer. Window Glass Co., Farmers Bank Bldg., Pittsburgh, awarded the contract for the construction of a 1 story, 120 x 142 ft. box factory.

Pa., Bedford—Kund & Eiben Co., 204 Warrington Ave., Pittsburgh, will build a 1 story, 60 x 170 ft. cabinet works here. Private plans

Pa., Glenshaw—Ball Chemical Co., Fulton Bldg., Pittsburgh, is having plans prepared for the construction of a 2 story, 84 x 113 ft. manufacturing and storage building, on Butler Plank Rd., here. Estimated cost $50,000.

Pa., Kaipmont—W. L. Connell Coal Co., 416 Lacka Ave., Scranton, Pa., is having plans prepared for the reconstruction of its coal washery, here. Estimated cost $30,000. Engineer not announced.

Pa., Phila.—C. D. Heavey, 1110 North Front St., awarded the contract for the construction of a 2 story, 20 x 66 ft. repair shop. Estimated cost $7,000. Private plans.

Pa., Phila.—R. Krook, Main St. and East Walnut Lane, awarded the contract for the construction of a 1 story, 72 x 80 ft. factory for the manufacture of textiles. Estimated cost $20,000. Private plans.

R. I., Pawtucket—Solway Dyeing & Textile Co., Ingrahamville, awarded the contract for the construction of a 1 story, 70 x 140 ft. textile plant addition. Estimated cost $40,000.

S. C., Clover—Hampshire Spinning Co., awarded the contract for the construction of a 3 story, 133 x 294 ft. mill. Product to be 50's to 70's combed yarns, packed on cones.

Tex., Houston—Houston Gas & Fuel Co., 607 San Jacinto St., plans to make extensive improvements to its gas manufacturing plant, including enlargement of holder, etc. Estimated cost $110,000.

Tex., Sabine—Magnolia Petroleum Co., plans to rebuild that portion of distributing plant destroyed by fire. Estimated cost $170,000. Architect not announced.

Tex., Stamford—Jay Cotton Oil Co., plans to build a 125 ton daily capacity cotton oil mill.

W. Va., Weirton—The Weirton Steel Co. awarded the contract for the construction of a complete coke and bi-products plant, consisting of about 40 ovens, at their mills, here.

Wis., Appleton—The Valley Dairy Products Co. awarded the contract for the construction of a 2 story, 60 x 80 ft. dairy. Estimated cost $50,000. Noted Aug. 3.

Wis., De Pere—The City, W. R. Mathews, Clk., plans to build a 2 story vocational school. Estimated cost $150,000. Architect not selected.

Wis., Green Bay—Standard Oil Co., 68 Wisconsin St., Milwaukee, awarded the contract for the construction of a 1 story, 52 x 110 ft. garage and warehouse, here. Estimated cost $40,000.

Wis., Lake Geneva—J. Nutini awarded the contract for the construction of a 1 story, 50 x 90 ft. ice cream factory. Estimated cost $40,000.

Wis., Milwaukee—S. E. Tate Printing Co., 133 2nd St., is having preliminary plans prepared for the construction of a 6 story, 60 x 120 ft. printing plant and office building. M. Tullgren & Sons, 425 East Water St., Archts.

Wis., Racine—H. & M. Body Corp., 608 Center St., awarded the contract for the construction of 1 story, 100 x 240 ft. dry kilns. Estimated cost $125,000.

Ont., Georgetown—Smith & Stone Electrical Co., College View, is having plans prepared for the construction of porcelain kilns. Estimated cost $10,000.

Ont., Hamilton — Libbey Owens Sheet Glass Co. is preparing plans for extending its plant. Estimated cost $250,000. H. Allen, Mgr. Private plans.

Ont., Scarboro Junction—Kingston Road Lumber Co., 828 Kingston Rd., plans to build a planing mill. Estimated cost $25,000. Private plans. Architect not announced.

Que., Asbestos—Johns Manville Co., Ltd., 450 St. James St., Montreal, reported planning erection of plant, here. Estimated cost $1,000,000.

Que., Montreal—Burton Brewery Co. of Canada, plans to build a 3 story, 100 x 300 ft. brewery on St. Dennis and De Valier Sts. Estimated cost $400,000. B. H. Anglin, Pres.

American Machinist

321

Volume 57 NEW YORK, AUGUST 31, 1922 Number 9

Malleable Cast Iron

Poor Qualities of Pure Cast Iron—The Factors That Make Malleable Cast Iron Superior—Soundness, Strength and Good Machineability Attained

By ENRIQUE TOUCEDA
Consulting Engineer, American Malleable Castings Association

A NON-TECHNICAL article descriptive of any foundry product, in order to prove of real practical value to the general reader, must cover quite completely the details concerning the physical and structural characteristics of the product, the ease with which it can be machined, the facility with which it can be hot or cold worked, heat-treated or welded, and its cost. The commercial worth of any industrial product is determined not only by a consideration of these various characteristics, but by a rigid comparison of these properties with those possessed by such products as could be commercially substituted for it.

There are reasons, however, why it will best serve our purpose to consider first what these properties may be in the case of pure iron if it is used as a casting material. With this data in hand, and with some essential preliminary explanations, the reader will be in a position to exercise his own judgment in sizing up the advantages or shortcomings of the malleable iron casting as compared with the products that might be used commercially in its stead. He will be in a position as well to gather an intelligent idea as to the field to which this casting is best adapted.

According to various authorities, pure iron has an average ultimate strength of about 50,000 lb. per sq.in., accompanied by an exceedingly high ductility. Owing to the absence of carbon or phosphorus, the two elements that impart fluidity, this metal is extremely sluggish when molten. Structurally, pure iron when cast is made up of an aggregate of coarsely crystalline grains, as the microphotograph in Fig. 1 shows. While these grains are typical in form, their size will depend upon the rate of cooling from solidification. Therefore, it follows that if two castings of equal length but of different sized sections are poured from a ladle of pure molten iron, the crystalline structure of the heavier casting will be larger than that of the lighter, in proportion to the disparity in section.

Thicker the Section, Larger the Grain

As it is in rare cases only that castings are designed with uniform sections throughout, it follows that the crystalline structure of the thicker sections will be larger than that of the thinner sections, owing to the fact that the thicker sections cool more slowly than do the thinner ones. Not only is a coarsely crystalline structure unreliable in service, but internal strains are unavoidably developed in the casting, occasioned by the difference in the rate of cooling of the heavy and light sections. These strains are frequently of such magnitude as to cause the casting to crack either when cooling or when subjected to any slight strain in service. The more uneven this structural state is, the greater is the probability that these troubles will occur.

Experience has shown that if such a casting as we have just described is placed in an annealing oven and heated to around 900 deg. C. for a short interval of time and then slowly cooled, the defects in the structure will be modified. Not only will the coarsely crystalline grains in both the thick and thin sections be changed into ones very minute and uniform in size throughout all sections, but the internal strains which were occasioned by the difference in the rate of cooling of the disproportionate parts, will be removed.

Pure Iron Castings Commercially Inferior

Without entering into complete details, it can be stated that in the case of all of the various ferrous products to which we will refer, there exists a certain temperature at which the metal ceases to be magnetic. The constitutents that exist and are stable below this temperature change into others wholly different and stable only while above it. A coarsely crystalline structure can be broken up and replaced by one that will be permanent, very minute, and most reliable for the particular product in question.

In spite of what has been stated, castings of pure iron cannot be produced successfully or commercially for either structural purposes or for the construction of machines. On the one hand, they would be prohibitory in cost, while on the other, even if they were cheap, the lack of fluidity of pure iron when molten would occasion high loss due to mis-runs. The contraction after solidification is so great that any casting of intricate design would crack and pull apart at the junction of the thick and thin sections. A further handicap would lie in its high melting point, to which must be added several hundred degrees of superheat in order to raise the metal to a proper casting temperature.

Poor machineability, a characteristic of all soft metals such as copper and aluminum, is another shortcoming of pure cast iron. The castings would be unsound due to the blowholes which are very pronounced for such sluggish metals. The welding properties of such material are the best of any ferrous product, while it can be hot or cold worked with the greatest facility. The foregoing has been entered into in order to explain certain facts that could be more clearly brought out by a consideration of the characteristics of this metal whose casting properties could hardly be worse.

The main difference between pure iron and steel is that the latter must contain at least some carbon in order that it can be thus classified. The effect of adding carbon to pure iron manifests itself in an increased

tensile strength, a lessened ductility and an increased hardness, each in proportion to the amount of carbon added. The reason for these results lies in the fact that carbon does not remain as such when added to molten iron. As soon as carbon is added, it combines chemically with about fifteen times its weight of iron to form an intensely hard compound of definite composition called "carbide of iron"; and this notwithstanding the fact that one constituent is very soft and the other comparatively so.

But it happens that, some time after the metal has solidified, this very hard carbide of iron refuses to remain by itself and gathers unto and attaches to itself about eight times its weight of iron. As a result a mechanical mixture of definite composition is built up through the union of the two. A distinct constituent is created, which, while not quite as hard as carbide of iron, is much stronger and more ductile, although it is less ductile than pure iron.

It should now be plain to the reader why an exceedingly small amount of carbon added to pure iron can have such a profound effect on the physical characteristics of the latter. This can be illustrated by the use of concrete figures. If to pure iron such a trivial amount of carbon as 0.1 per cent be added, two reactions will take place. First, there will be formed from this 0.1 per cent of carbon about 3 per cent of iron carbide. Second, after solidification and at about redness, this 3 per cent of iron carbide will unite with about 8 times its weight of iron to form about 12.5 per cent of the mechanical mixture known as "pearlite." In Fig. 2 is shown a microphotograph of steel containing about 0.12 per cent carbon. The white areas are the carbonless iron and the dark areas the pearlite. Fig. 3 shows a microphotograph of the structure of a steel which has a 0.34 per cent carbon content.

Not only does carbon when introduced into pure iron produce the far reaching effects noted, but it also has a marked influence on the melting point of the metal and on its fluidity and contraction. This is the case to such an extent that very superior castings could be made of this very pure steel, which would have a strength, ductility and hardness very easily adjusted by the carbon content. However, it happens that commercially, castings cannot be made of pure iron and carbon, because of the great expense that this would entail.

Commercial steel is always contaminated with a greater or less percentage of phosphorus, sulphur, manganese and silicon, the first two being very harmful when in excess of a certain quantity. Consequently, its freedom from the first two chemicals is a measure of the quality of commercial steel. Its carbon content, owing to its influence on the physical characteristics of the metal, actually determines its appropriateness for this or that particular purpose. For this reason carbon is not considered in the light of an impurity, but as a blessing.

The American Society for Testing Materials grades steel castings into Class *A* and Class *B*. With reference to those of Class *A* which, the writer can state, predominate by a considerable amount in tonnage, it is provided that they need not be annealed unless so specified. While no physical requirements have to be complied with, it is required that the carbon and the phosphorus should not exceed 0.30 per cent and 0.06 per cent, respectively.

In the case of Class *B* castings, it is provided that in all cases they shall be properly annealed, depending upon their design and composition. This class is graded into soft, medium and hard, having, respectively, minimum ultimate strengths of 60,000, 70,000 and 80,000 lb. per square inch. The yield point in each case should be at least 45 per cent of the ultimate strength. The elongations should not be less than 22 per cent, 18 per cent and 15 per cent, while the reductions of area should not be less than 30 per cent, 25 per cent and 20 per cent, respectively. In regard to composition, it is specified that both the phosphorus and the sulphur content must be less than 0.05 per cent.

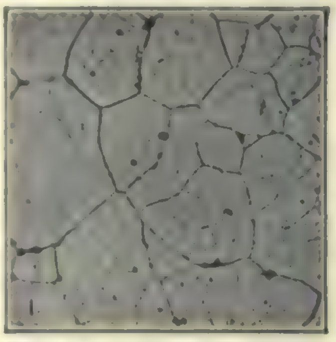
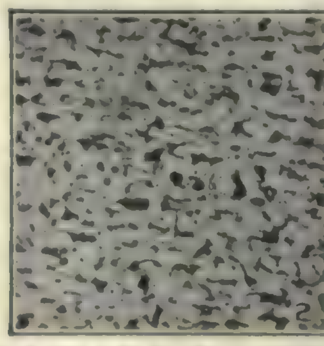



FIG. 1—MICROPHOTOGRAPH OF PURE CAST IRON, SHOWING THE COARSE CRYSTALLINE GRAINS. FIG. 2—MICROPHOTOGRAPH OF STEEL CONTAINING 0.12 PER CENT CARBON, SHOWING THE CARBONLESS IRON AND PEARLITE

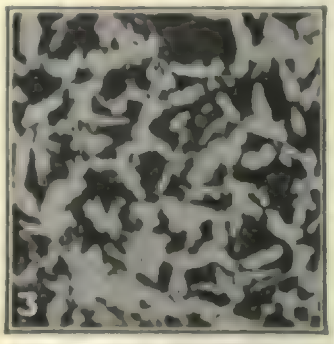
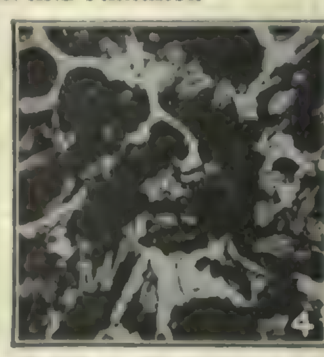



FIG. 3—MICROPHOTOGRAPH OF STEEL CONTAINING 0.34 PER CENT CARBON. FIG. 4—MICROPHOTOGRAPH OF HARD IRON, SHOWING CARBIDE AND PEARLITE

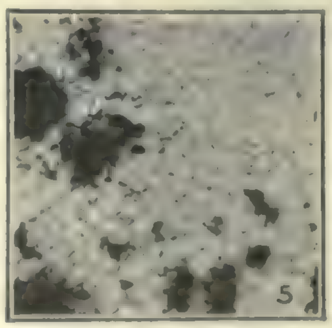


FIG. 5 — MICROPHOTOGRAPH OF MALLEABLE CAST IRON AFTER ANNEALING

No better casting exists than a sound, high-grade steel casting, and the remarks that follow are not intended to offset or negative this statement in any particular. All products have certain properties that make them superior to others, while on the other hand they have other characteristics that would make the reverse statement equally true.

It has been pointed out that Class *A* castings predominate in tonnage and that they do not need to be annealed unless so specified. It can be stated then that, with this privilege allowed, not all such castings receive annealing treatment. It has been pointed out also that under these conditions the crystallization must be coarse in proportion to the size of the sections, as well as different in size in disproportionate sections, while internal strains must be present for reasons already

explained. In spite of this there is a large sale of Class *A* castings, even when they are unannealed.

It has been explained that the hardness of steel is a function of the carbon content. Inasmuch as quantity production is one of the essentials insisted upon by our manufacturers, it will be found that they will purchase in preference a low rather than a high limit of carbon for Class *A* castings. Exception is made to this, however, for special parts where high strength is needed, and on this account the ease of machining is sacrificed. This will mean a product that will probably not be higher than 0.15 per cent in carbon. Even with a carbon content as low as this, these castings will have a machining cost far in excess of what would be necessary in the case of malleable cast iron.

Melting and Pouring Malleable Cast Iron

Malleable cast iron is made by melting together a certain proportion of pig iron, sprew and low-carbon scrap of the proper composition. The molten metal is allowed to remain in the furnace under the oxidizing influence of the furnace atmosphere, until a cast test-sprew, when broken, shows a uniformly white fracture free from any particles of graphitic carbon, or, in other words, until all of the carbon in the metal is in chemical combination with the iron. If this condition is reached, and if the molten metal is hot enough to pour the castings without the danger of mis-runs, the furnace is ready to be tapped.

Castings made from such iron are of extreme brittleness and hardness, and except in rare instances where such properties are actually desired, would serve no useful purpose. The structure of this hard iron is made up wholly of the two very hard constituents, carbide of iron or cementite and the mechanical mixture known as pearlite. This structure has been microphotographed, as shown in Fig. 4. The white areas that stand in relief are the carbide and the dark areas the pearlite.

Before proceeding let us note other characteristics possessed by this hard iron, the composition of which will average about 0.85 per cent silicon, about 2.40 per cent carbon, about 0.18 per cent phosphorus, 0.07 per cent sulphur and 0.25 per cent manganese. We have seen that both carbon and phosphorus, in the order named, impart great fluidity to iron, and that they act as well to lower its melting temperature. The melting point of pure iron is about 1,500 deg. C., and that of steel castings such as can be machined with fair ease for steel, is around 1,460 deg C. Hard iron of the composition referred to will have a melting range between 1,130 and 1,275 deg. Centigrade.

Comparative Freedom From Blowholes

From the foregoing we must conclude that this character of metal is one that is much easier and safer to cast than either pure iron or steel, both on account of its greater fluidity and its far lower melting point. It has been shown that the higher the melting range of a ferrous product, the greater will be the amount of gas absorbed. Consequently, the greater will be the danger from the presence of blowholes, not alone due to the larger quantity of gas absorbed, but more particularly to the sluggishness of the metal.

Of all the defects to which castings are prone, the most serious are due to blowholes. On the one hand, it is impossible to ascertain the presence of blowholes except by the destruction of the casting itself. On the other hand, if a considerable amount of machining be done on castings that must be rejected subsequently due to these defects, the monetary loss will be great. In the case of steel, ferro-silicon and aluminum are the alloys generally used to produce soundness.

It can be safely stated that without the addition of some alloy to take care of the occluded gases, the soft steel casting would not be a commercial product. White iron, or hard iron as it is called in the vernacular of the foundry, contains an average of about 0.85 per cent silicon and 2.45 per cent carbon as cast. No alloys are ever added for the prevention of blowholes, as hard iron is practically free from this evil. This does not mean that blowholes never exist in the malleable iron casting, for such is possible due to bad molding practice, the blowing of a core or damp sand—accidents that may happen in the case of any cast product. It does mean, however, that only in very rare cases are they ever caused by occluded gas.

It, therefore, can be accepted as a fact that hard iron is essentially a sound metal. The contraction of white iron is not only somewhat less than that of steel, but from the evidence furnished it is clearly a metal of much greater fluidity and of lower melting range. From this, it follows that unsoundness due to shrink is much more liable to occur in the latter than in the former metal. On the other hand, it is only fair to state that, while the presence of shrink is highly objectionable in either product for obvious reasons, if the product is to be machined a shrink will prove more objectionable in malleable cast iron than in steel, for in the former a hard area will always accompany a shrink while in the latter this is not the case.

Annealing Malleable Cast Iron

After the hard iron castings have been cleaned, they are packed in tightly sealed pots in which they are surrounded on all sides with a slightly oxidizing packing. The pots are then placed in an annealing oven, heated to about 850 deg. C., at which temperature they are held for a period of not less than 60 hours. From this temperature they are allowed to cool at a rate that will not exceed about 10 deg. per hour until the temperature of the castings has dropped to about 600 deg. C., after which the rate of cooling can be considerably increased.

It should be noted that the very temperature that is required for annealing the hard iron castings coincides with the temperature at which the grain is refined. A coarsely crystalline malleable iron casting therefore is quite a practical impossibility. What takes place during this annealing and conversion process can be gathered from a comparison of the microphotograph of hard or white iron shown in Fig. 4 and the microphotograph of the annealed product shown in Fig. 5.

It has been pointed out that hard iron is made up wholly of two very hard constituents, cementite and pearlite. Now, while this is true, it must not be forgotten that the cementite existing as such, and the cementite in pearlite, consist of the chemical union of very soft carbon and soft iron. During the heat treatment of the castings, the chemical union is disrupted. The carbon is forced to separate out in small rounded nodules, leaving the carbonless iron as a ground mass throughout which these segregated particles of soft carbon are uniformly distributed.

The malleable process therefore consists first in melting a cast-iron mixture in such a manner that the

carbon and iron unite to form a very hard and brittle product, and then in subjecting this product to the influence of temperature and time, whereby the hard constituents are forced to break up into the two original soft ones.

As can be seen by a comparison of the accompanying microphotographs, malleable cast iron has a structure unlike either that of pure iron or of steel. Were we to ignore certain facts, we might state that its structure could be likened to that of pure iron if rounded nodules of carbon were uniformly distributed throughout the structure of the latter. We might also state that the structure of a steel casting would be similar to that of pure iron if the particles of pearlite were located at

FIG. 6—A CONNECTING ROD OF MALLEABLE CAST IRON WHICH HAS BEEN GIVEN A 180-DEG. TWIST TO ILLUSTRATE THE ABUSE THIS PRODUCT WILL STAND

the junction of the grain boundaries. While such indeed might be the hasty conclusion, there are certain essential facts that must be considered before one can obtain the correct point of view.

If to a ladle of pure iron there is added the same amount of silicon, phosphorus, sulphur and manganese as normally exists in malleable cast iron, but no carbon, and if the structure of this metal is compared with that of pure iron, it might be quite impossible to tell which was which from a comparison of their microphotographs. This is because silicon has the property of alloying with iron with such intimacy that even under the highest magnification one cannot be differentiated from the other. It would be impossible to tell the amount of phosphorus used, while the sulphur and manganese, having reciprocal attraction, unite together to form a light slag, which, if given the opportunity, will float to the top of the molten metal. If the metal is too sluggish to admit of its escape in this manner, the slag will be entrained in the casting in the form of rounded particles of indefinite shape that can then be seen and identified.

There will be a marked difference, however, in the physical properties of pure iron and the pure iron to which these particular impurities have been added. The addition of silicon will facilitate machineability to such an extent that this can take place at high speed. The strength will be increased without an appreciable sacrifice of ductility. The phosphorus will increase the stiffness, facilitate machineability but decrease ductility to some extent. The sulphide of manganese will be inert, unless it is present in a prohibitory amount.

From the foregoing it can be stated that while the structure of pure iron consists wholly of ferrite (carbonless iron), and the ground mass of the malleable iron casting also of ferrite, in that it is also carbonless iron, the physical properties of these two types of ferrite are wholly different. This distinction is not always made by writers on this subject.

These matters have been entered into in tedious detail, because the writer has been asked so often by even metallurgists of long experience, how it is possible that malleable cast iron consisting of a ground mass of ferrite so closely resembling the structure of pure iron, but weakened by the presence of particles of free carbon distributed throughout it, can have an ultimate strength considerably superior to that of the latter. In addition, many who use these castings fail to understand why they can be machined at such high speed with an almost perfect surface, while the machinability of pure iron, or iron almost pure like high-grade wrought iron, is so poor, and the machined surface so rough.

Characteristics of Malleable Cast Iron

Malleable cast iron is a product that is very unique in many ways. As has been explained, it is made from a white cast iron that is very fluid when molten, that melts at a temperature slightly lower than grey iron, and that is very sound when cast, each and all of which are characteristics that make for general integrity of product. The castings are not only very tough and strong, but they can be machined at a much higher speed than is possible in the case of any other ferrous product, and they have a machined surface that is smooth and of close texture. These castings cannot be welded and in this particular the soft steel casting is superior. They cannot be improved by heat-treatment.

Lest the reader be confused, it will be explained that malleable cast iron is a product that has the special characteristics of great toughness and of comparatively high strength accompanied by machining properties that can be excelled only by brass or some other non-ferrous alloy. While steel can be heat-treated in such a manner as to make it capable of standing a much higher strength

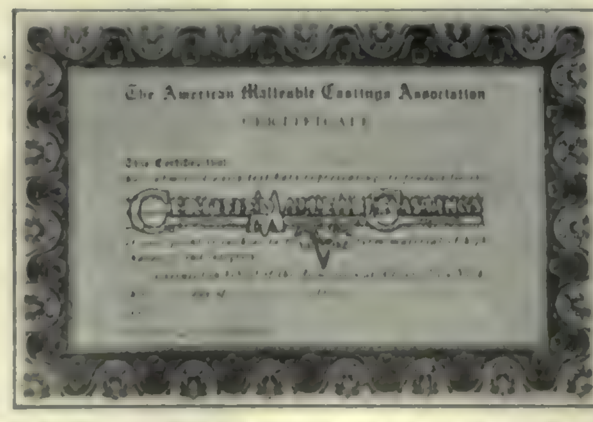


FIG. 7—CERTIFICATE ISSUED TO FIRMS WHOSE PRODUCTS HAVE PASSED THE A.S.T.M. REQUIREMENTS

than when in its raw state, this will be at the cost of ductility on the one hand and, to a much greater extent, of lessened machineability on the other. Malleable cast iron cannot be thus manipulated, and its use is applied to those cases in which the part is designed to stand great abuse in service and where maximum production is a prime essential. For such use it has no rival.

While there is no limit to the smallness of the casting that can be made, it is recommended that castings with sections in excess of 2½ in. or over 5 ft. long should not be made of this material. In Fig. 6 can be seen a fairly heavy casting, a connecting rod, that has been given a 180-deg. twist by way of illustrating the abuse this product will successfully withstand.

While some writers intimate that grey iron casting is a competitor, a perusal of the data which follow, in connection with the ultimate strength and elongation of

malleable cast iron, will correct this impression. Grey iron that is capable of being machined with anywhere near the facility of malleable cast iron will not exceed about 20,000 lb. per sq. in. ultimate strength, accompanied by no elongation whatsoever.

The writer is in a position to speak authoritatively in connection with the physical properties of malleable cast iron, its manufacture, the conditions of plant personnel, and the improvements that have taken place in the quality of this product during the past seven years. Not only has the product been improved in ultimate strength and ductility each year during this period, but the plants have been improved both in personnel and metallurgical apparatus, until in the case of the plants referred to little has been left undone in the way of scientific control that would make for uniformity of product.

A certificate, shown in Fig. 7 is issued each quarter to those whose product has passed the A.S.T.M. requirements. This certificate is granted after a daily test of test bars and an examination of the castings at each plant by an inspector attached to the engineer's office of these seventy plants who have co-operated to carry out this and other work of mutual interest. This certificate entitles the recipient to market "Certified Malleable Iron Castings," a product that is guaranteed to equal or exceed material that will stand up to the A.S.T.M. specifications that have just been discussed.

The uses to which these castings are put are many. The railroads, the agricultural implement manufacturers and the automotive industry are all high consumers of these castings, which are manufactured into machines of many types.

During the past three years, the average ultimate strength and elongation of the seventy different plants to which we have referred have been over 53,000 lb. per square inch and 15 per cent, respectively. The last complete monthly record in the writer's possession is that of August of last year. Some individual records during this month which may prove of interest by way of illustrating what some of the certificate holders can accomplish, are given in the following table.

Ultimate Strength Average, Pounds per Square Inch	Elongation per Cent
56,393	24.78
56,248	23.91
56,094	24.50
58,906	23.34
54,023	23.44

The average of eight others was 55,120 lb. ultimate strength and 20.27 per cent elongation. The yield point in these samples averaged about 33,000 lbs. per square inch. These results are very remarkable in a metal that can be machined at such high speed.

Matching the Wire With the Work

BY E. WANAMAKER

Electrical Engineer, Chicago, Rock Island & Pacific Railroad

Many tests tend to confirm what has been the general belief that the metal passing from the end of the electrode into the weld is in a highly molten state, with a generous proportion of it in a gaseous state and, therefore, extremely susceptible to atmospheric effects, even though the time of exposure to the atmosphere in this state be of short duration. By the use of such coated electrodes as are used on the Rock Island lines (and which it might be well to say, were only developed after years of experience and patient research, laboratory and service tests), we were able, to a large degree, to greatly minimize this damaging effect. By such protection of the metal in fusion, not only has it been possible to protect the iron and low carbon steel materials, but to go further and protect many of the various alloys, the use of which is extremely desirable to meet certain conditions, such alloys as nickel, vanadium, manganese and others.

Electrodes to have any real value must be very carefully produced to meet the necessarily exacting specifications, which in turn were only possible as a result of the combined prolonged efforts of those engaged in scientific research, development and application.

To produce such electrodes some expense is incurred over and above the production of mere wire, but in this and in no other way is it possible to produce an electrode of the proper composition and with the proper welding characteristics to meet the various requirements. A comparison of high-grade electrode costs with cost per pound of high grade steel castings, etc. (long ago deemed necessary) causes one to marvel at the low cost of good electrode material. It would seem reasonable to believe that we could no more secure good electric arc welds with poor or unsuitable welding material than we could expect to build machinery or structures out of poor or unsuitable material.

The necessity for welding materials of different composition to make possible productions of welds of various characteristics as desired to meet the service requirements, has been recognized for some time in oxy-acetylene welding. Yet there are many users of electric arc welding who endeavor to apply welding to different metals, each of a different analysis, using only one grade of electrode material. This should not be construed to mean that the composition of the welding electrode should in all cases be the same as the base metal. As stated above, the service requirements will determine the character of the weld metal desired.

For example, cast-iron electrodes have recently been used to build up worn cast-steel chafing plates between engine and tender of locomotive. The cast iron was simply deposited on the steel casting and allowed to cool normally, the rate of cooling being sufficiently quick to effect the formation of white cast iron, which is extremely hard, but especially suited for the service mentioned.

Examples of welding applications where the use of an electrode of an analysis or character approximately that of the base material has been found desirable or necessary to the success of the operation, are those of welding vanadium steel locomotive frames, where vanadium steel electrode material is used; or in the case of building up worn steel car wheel flanges where the wheel was slightly preheated and the flange built up with a high carbon steel material. In each case the weld metal is of similar character to the part welded.

The desirability of electrode materials to better facilitate electric arc welding of the different metals and to meet the diversified service requirement in repair and construction work, is recognized by many, but the fact remains that the use of such materials is not generally practiced, even in cases where their use would do much to give electric arc welding the standing it deserves.

From Journal of the American Welding Society, July, 1922.

A Modern Gear Cutting Shop

Survey of Various Departments—Floor Plans Show Arrangement of Stock Room and Machines—Details of Construction and Other Data

BY FRED H. COLVIN
Editor, American Machinist

THE shop of the Central Gear Works, which is a highly specialized plant belonging to the General Motors Co., was designed and equipped for producing differential gearing for a number of the cars built by the General Motors Co. It is located on what is known as the Holbrook property in the City of Detroit, but is far enough from the business center to give ample room in a single-story shop for all the space needed. It covers 360 by 570 ft., excluding the two-story office along the 360-ft. front.

Some idea of the construction and the excellent light distribution which is obtained by the use of the saw-tooth roof can be had in Fig. 1. This illustration shows a view down the center aisle, the long way of the shop, and the photograph was taken from the office end. The columns are placed on 30-ft. centers in one direction and on 40-ft. centers in the other direction, the longer spacing being in the direction parallel with the saw-teeth.

This shop is remarkably well lighted and is a particularly pleasant place in which to work. The radiators for heating are supported above the beams which run parallel with the saw-teeth, and are entirely out of the way. The artificial lighting is by the mercury vapor lamps shown. This view also shows the department numbers prominently displayed, the foremen's desks and stools and at the right the gravity track system.

A plan view of the shop is shown in Fig. 2, which gives an idea of the machine-tool layout, and from which the progress of the work from department to department can be fixed. The bar stock comes from an outside track and is stored in the space shown in the upper left-hand corner of the plan. A Napier bandsaw is located in this department so as to cut up stock as it may be needed by any of the machines. The stock rack is so extremely interesting that it will be shown in detail in another article.

In order to give a general idea of the equipment, the various kinds of machines have been lettered according to the list herewith. The size of motor on each, for this is entirely an independent-motor-driven shop, follows the name of the machine. The sequence of the machines listed is simply from top to bottom of the illustration and bears no relation to either the size of the installation or the importance of the particular machine. The list follows:

A. Gridley screw machines	10	hp.	each
B. Gridley automatics	3	hp.	"
C. Foote-Burt drilling machines	7½	hp.	"
D. Avey drilling machines	¾ and 1	hp.	"
E. Reed-Prentice lathes	5	hp.	"
F. Baker drilling machines	7½	hp.	"
G. LaPointe broaching machines	7½	hp.	"
H. Hartness automatics	13	hp.	"
I. Fay lathes	7½	hp.	"
J. Cincinnati-Bickford drilling machines	1½	hp.	"
K. Bullard Multaumatics	10	hp.	"
L. Natco drilling machines	15	hp.	"
M. Foster turret lathes	9	hp.	"
N. Gleason gear cutting machines	3	hp.	"
O. Brown & Sharpe grinding machines	7½	hp.	"
P. Barber-Colman gear hobbing machine	5	hp.	"
Q. Bullard vertical turret lathes	7½	hp.	"
R. Gould & Eberhardt gear roughing machines	10	hp.	"
S. Van Norman grinding machines	3	hp.	"
T. Heald grinding machines	2	hp.	"

FIG. 1—THE CENTER AISLE OF THE SHOP

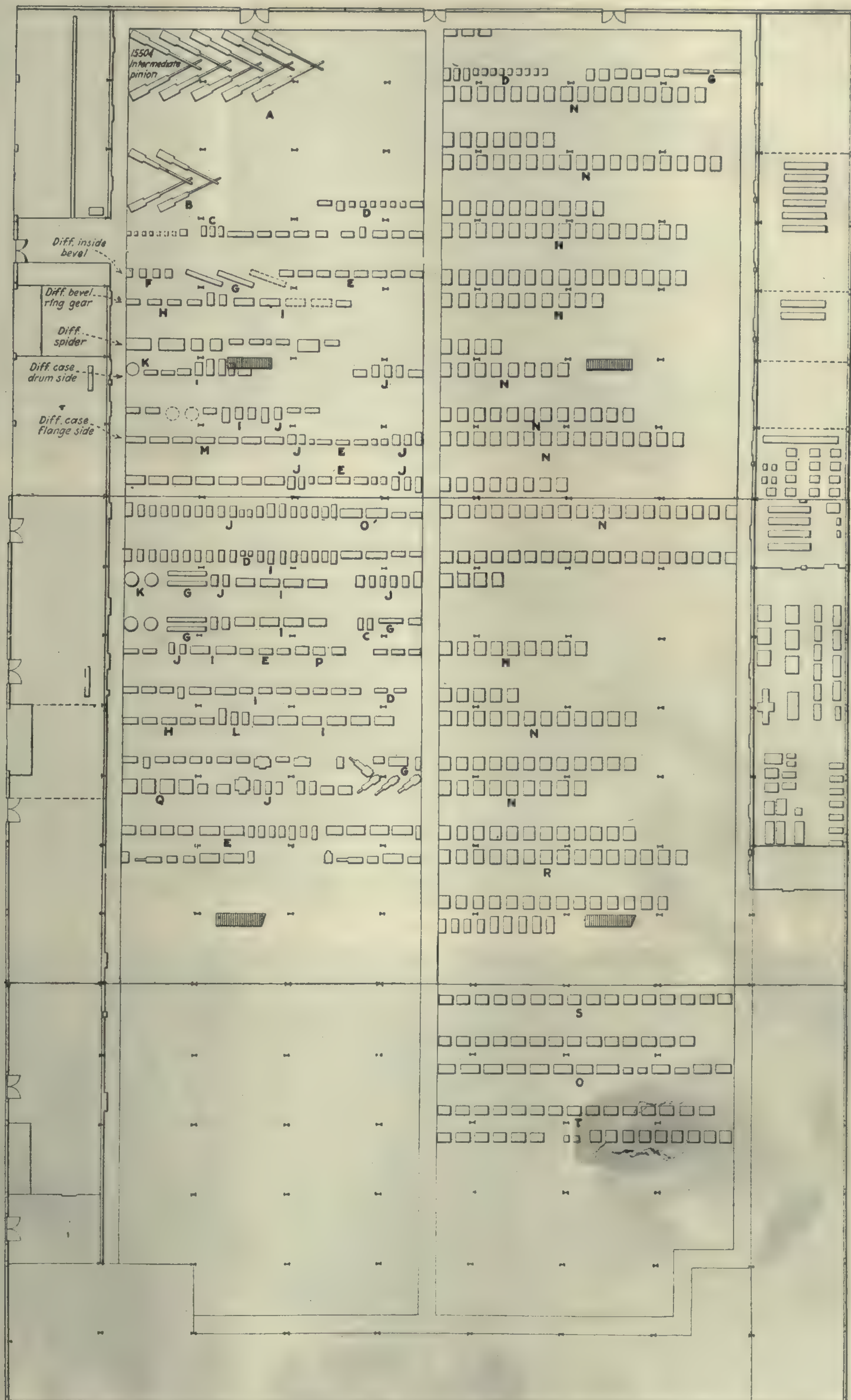


FIG. 2—FLOOR PLAN OF SHOP, SHOWING MACHINE TOOL LAYOUT

With this grouping of the machine-tool equipment in mind, a careful study of the whole shop layout is interesting to those responsible for production on a large scale.

A partial elevation of the front of the office building is shown in Fig. 3. It presents a very attractive appearance from the street and completely hides the shop behind it. A cross-section is shown in Fig. 4,

The photographic illustrations show some of the different departments, and give an excellent idea of many details of the shop layout, such as the arrangement of electric conduits for bringing power to the different machines, the grouping of the machines themselves, the space between them, the kind of drip pans and water guards used and other items of interest to the factory executive.

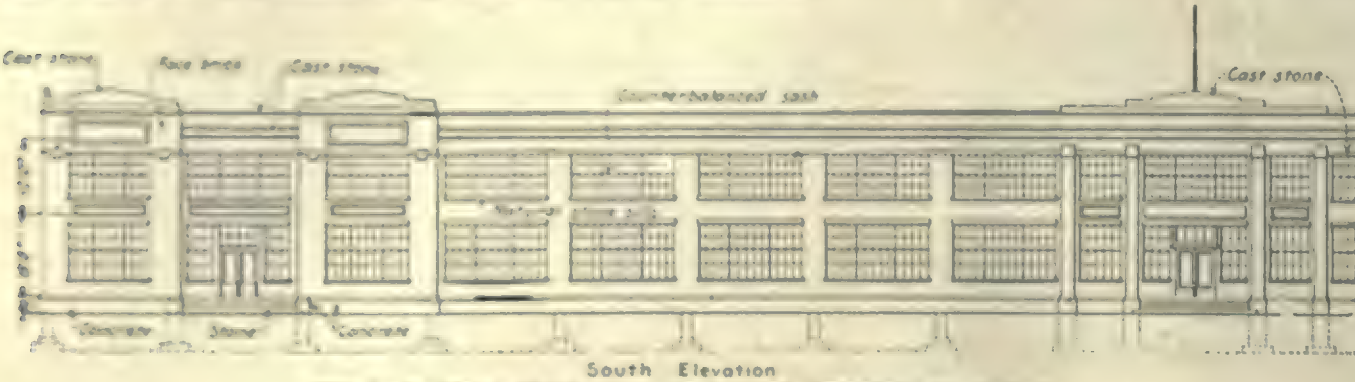


FIG. 3—PARTIAL ELEVATION OF OFFICE BUILDING IN FRONT

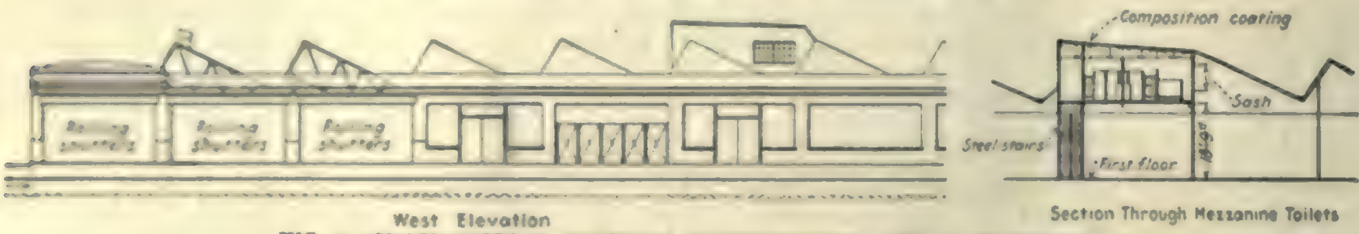


FIG. 4—CROSS-SECTION SHOWING CONSTRUCTION AND LAVATORIES

which gives an outline of the saw-tooth construction, shows how it is broken in places by the mezzanine lavatories, and how the lavatories are reached by stairs from the main shop. The lavatory floor does not project down into the shop, but it is level with the bottom of the valleys of the saw-tooth roof.

The construction gives a much more open appearance to the shop and aids in the uniform distribution of light. It also permits the complete and unhampered utilization of the space, so that departments can grow freely in almost any direction without being hampered in any way by the shop construction.

The Gould & Eberhardt machines for roughing out gears and pinions, including the complete guarding of the machines and the oil reservoirs with their pipes leading to the various bearings, are shown in Fig. 5. The battery of Gleason straight-tooth gear-cutting machines is shown in Fig. 6. The spiral gear generators shown in Fig. 7, handle both the ring gears and their pinions. Some of the ring gears are shown on the platform in the foreground. The platform consists of a substantial framework of steel panels, one on each side and held together by a cross panel at each end. The supporting feet are castings which hold the platform

FIG. 5—ROUGHING OUT BEVEL GEARS

FIG. 6—CUTTING STRAIGHT-TOOTH BEVEL GEARS

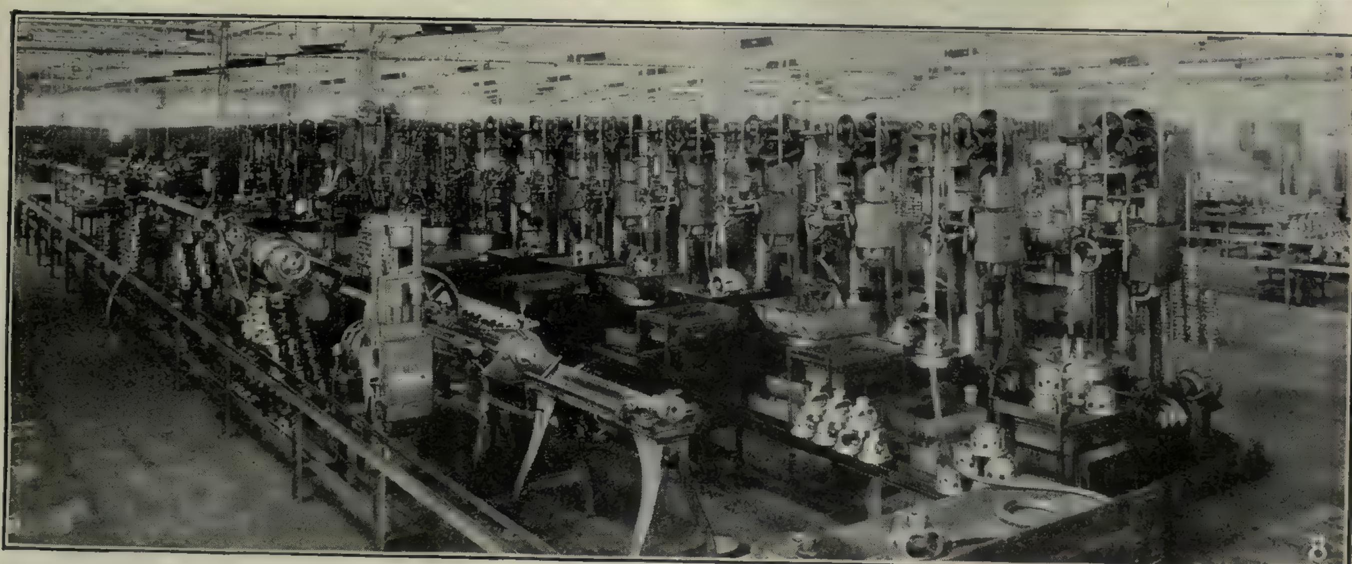


FIG. 7—WHERE SPIRAL BEVEL GEARS ARE MADE. FIG. 8—LINE-UP OF TOOLS IN MAKING DIFFERENTIAL PARTS. FIG. 9—WHERE THE INSPECTION GAGES ARE KEPT

at a proper height so as to be readily handled by the electric lift-truck.

The line-up of the department for making differential carriers or supports is shown in Fig. 8. The equipment consists largely of drilling machines, though some broaching machines and small vertical turret lathes are included.

Where the Inspection Gages Are Kept

Needless to say, the kind of work produced in this shop requires very close inspection and, in addition to an inspection room where work is checked as it progresses, inspection benches are provided in each department. The value of the necessary gages runs into thousands of dollars, for which reason the gages are kept in steel cabinets in the special inspection gage room shown in Fig. 9. The gages are all checked at frequent intervals, the routine requiring that they be turned into the inspection gage room on certain dates. They are carefully tested either by measurement or by master gages before being again issued to the shop inspectors.

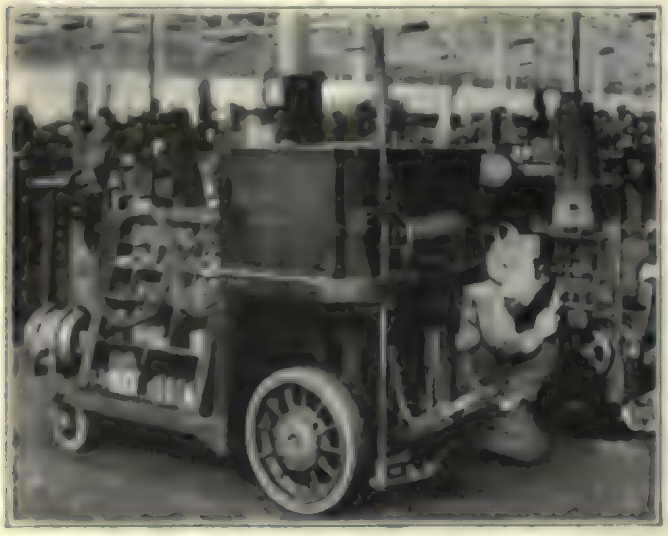


FIG. 10— THE ELECTRICAL REPAIR TRUCK

A valuable institution is the repair truck of the electrical department shown in Fig. 10. This truck carries all sorts of spare parts which are generally required in keeping motors in operation. The shelves and bins shown carry fuses of various kinds and capacities, insulated wire for emergency connection, conduit couplings and even a spare motor, in addition to the substantial vise and work bench over the bin.

Traveling Repair Shop

As soon as electrical trouble develops in any part of the shop, the electrician is notified by shop telephone and immediately runs his traveling repair shop to the disabled motor. In this way loss of time from electrical breakdowns is reduced to a minimum. This truck has been found to pay for itself many times and to aid greatly in keeping production at a maximum when trouble has developed.

There is also a very complete department for heat treating the gears, including oil and water pumps for circulating the cooling mediums, storage tank and oil for fuel. It is a thoroughly modern equipment in every particular, just as is that in the remainder of the shop which has just been described.

Cost Versus Value of Patterns

By James H. Yates

To the machine shop manager who handles much repair work the cost of patterns is always a serious consideration. Hardly one customer in ten can be made to understand why a pattern should be necessary or where the price comes in, and will always almost invariably "kick" at the item when it is time to settle the bill. In consequence, most managers look upon a pattern as a "necessary evil," to be avoided whenever possible; and because of this view of the matter I think a few comments from a practical standpoint will be of help and value to shops of this character doing pattern work.

It is common practice to obtain castings from the old part to be replaced, but this practice is, on the average, a very questionable one for several very practical reasons. In the first place, the casting is in most cases but a crude example of what is required, as it has shrunk in cooling 1/10 in. for every foot, while if it is a machined part it will have to be "doctored up" in the pattern shop to allow sufficient stock to finish it to the size desired.

Expensive Doctoring

To mold from an old or doctored casting usually consumes twice the time in the foundry that would be required if a suitable pattern were available, and the resultant casting will probably be difficult to handle in the machine shop as compared with the clean, correctly shaped casting to be obtained from a well-made wood pattern.

Then, too, the cost of doctoring the old casting, especially if it is broken, to put it in condition for molding may easily exceed the cost of a new pattern. In many cases that have come under the writer's observation the value of the time spent in "saving the cost of a pattern" has amounted to more than the saving. What is more, much additional trouble is sure to be met and time lost in the machining.

Patterns should be looked upon by shop managers as an investment instead of an expense. The investment may not be "gilt-edged," but on the average it is a very good one. The pattern is there, as good as ever, after the molder has finished with it, and if the part ever comes back for a repeat order, it may prove to be a profitable investment indeed. If a pattern is on hand, the cost of making the part a second time will be small, so that on jobs which are apt to come back again patterns should almost invariably be made of the parts to be replaced.

Erratum Notice

In the article "Making Chasers for Self-Opening Dies," on page 174, of *American Machinist*, in referring to the operation of grinding the throat of the chaser our correspondent stated that "the essential parts of the machine shown in Fig. 14 were designed and constructed at the factory where it is in use."

This statement implies that the machine itself was at least partially constructed by the users. The fact is that the machine was made, as may be seen from the nameplate on the base, by the National Machinery Co., Tiffin, Ohio. The statement should have referred to the attachment for holding the chasers.

Methods of Machine Tool Design

First Section of Chapter on Machine Tool Clutches — Jaw Clutches and Considerations Affecting Their Design—Saw Tooth Clutches

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

Clutches are used in machine tool design for a great variety of purposes: for starting and stopping either the entire machine or certain functions of it, for reversing, for slowing down or speeding up certain functions, and for making shifts between speed variators.

Clutches are of two principal types: friction clutches and positive clutches. Such clutches as pneumatic or magnetic clutches are generally friction clutches which are operated by compressed air or magnetic attraction and could be arranged as positive clutches if it were desirable.

Friction clutches are necessary where a heavy load must be picked up at a relatively high speed. Positive clutches are needed where we cannot permit of any uncertainty as to the taking up of the load. For instance, we would not admit a friction clutch in a feed mechanism used for the cutting of screw threads for the possible slippage might produce variable lead in the screw.

On the other hand, we could not use a positive clutch for connecting a large belt pulley driven by a heavy belt to the mechanism of a machine. If, for some reason or other, it is absolutely necessary to use a positive clutch for starting under heavy load, we should introduce some additional mechanism which reduces the speed to safe proportions. If, on the other hand, it is absolutely necessary to use a friction clutch in a mechanism which must maintain a certain fixed speed ratio to other parts of the drive, then we should arrange it so that the possible variations in speed cannot have any effect on the ultimate result.

We will not describe here the various kinds of positive clutches, as full description and data may be found in many standard works on the design of machine elements, but we will call attention here to such features as make them more or less adapted for use in machine tool design.

Shape of Clutch Teeth

All jaw clutches used on relatively fast running shafts should be made with some angle to the teeth. Square tooth clutches can only be used where the shaft runs at very low speed, such, for instance, as the feed screws for small milling machines. Of course they can be used even on heavier machines for such purposes as the throwing in of a hand wheel or crank for temporary use by hand. The angle recommended for the teeth of such clutches is 4 deg. on a side. A greater angle would be preferable, but experience has shown that 5 deg. or more is liable to lead to a working loose of the clutch under strain.

As a rule, there is no reason why the width of the tooth of such a clutch should be equal to the width of the gap. Exceptions are such cases where a shaft runs at very low speed, and where we do not wish to wait any length of time before it is possible to throw the clutch in. If, for instance, we had a clutch on a feed shaft revolving 1 r.p.m., and if there were three teeth in this clutch, we might have to wait almost 20 seconds before we could throw it in. To shorten this time it may be desirable to make the clutch with as many teeth as the strength of the individual teeth will allow.

In Fig. 119 two clutch members are shown with beveled teeth at the moment when the sliding member is about to enter the rotating member. If we wish the teeth of the sliding member to reach the bottom of the gap of the rotary member before it takes up the load, it will have to travel a distance B during the time that the rotary member has traveled a distance A; that is, if no other clearance is provided except that due to the angularity of the teeth. This distance B is about seven-and-a-half times as much as the distance A, if the teeth have an angle of 4 deg. on a side.

Speed of Engagement

The speed with which the sliding member travels in the direction of the arrow is limited because, as a rule, it derives its movement from a lever operated by hand. Consequently, it is not possible to get to the bottom of the teeth unless the rotating member travels at a low rate of speed. If the rotative speed of P is too great or the sliding speed of Q not great enough, the side walls of the clutch P will touch before Q has reached the bottom of the teeth of P. When that happens, Q will have to transmit the entire load, and it will only be possible to move Q further if the load is light and a sufficient leverage has been provided to move Q. On the other hand, we must not forget that if much leverage has been provided for the movement of Q its sliding speed must necessarily be low.

Altogether then, we see that it is difficult to pick up a load and have the clutches in the proper relative position at the moment of pick-up unless a sufficient amount of lateral clearance is provided. It might be thought that we will get some assistance if we make the distance B small, that is, if we make the clutch teeth shallow, but this is not the case, because if B becomes less, $2A$ also becomes less and we have not improved the conditions.

In Fig. 120 we see how it is possible to facilitate the throwing in of a clutch by making the gap wider than the teeth. The excess of width is supposed to be W. The teeth are shown square in the illustration. If we had made them angular, as in Fig. 119, we would have a total lateral clearance of $W + 2A$.

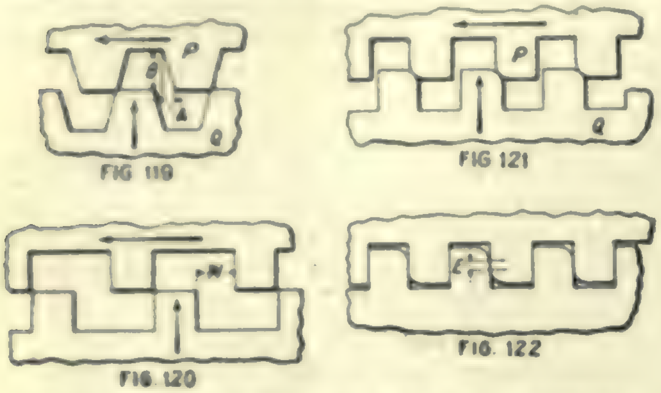
Rounding of Clutch Teeth Corners

In Fig. 121 is shown what happens to the teeth due to the fact that they are apt to strike on the corners. This effect of rounding the teeth becomes worse when once a round has been produced. In the condition as shown here, the sliding member will be pushed back by the rotating member unless the load is so light that it is possible to force it into position against the load. Doing this, we must not only pick up the load, but must

---

actually cause the sliding member to rotate at a higher angular speed than that of member P. As the illustration shows the conditions, there is no clearance at all and it would be practically impossible to make these clutches mesh if load or speed are appreciable. Giving the teeth a slight angle will assist conditions somewhat, but even then Q will be pushed back by the roundness of the teeth and this will be repeated over and over again, causing the round to become much more pronounced.

With good conditions, we will find that the round on clutch teeth gradually obtains a radius of about $\frac{1}{8}$ in. Fig. 122 shows what is the effect of this round when the teeth are in mesh. There is only a distance E left where the teeth properly bear one against the other.



FIGS. 119 to 122—FORMS OF JAW CLUTCH TEETH

If the round of the teeth becomes $\frac{1}{8}$ in., then $\frac{1}{8}$ in. of the length of the teeth is lost. In other words, if the clutch teeth were less than $\frac{1}{8}$ in. in depth there would always be a tendency to throw the sliding member out of mesh and the clutch would cease to act. In order to have sufficient bearing surface, the teeth should be more than $\frac{1}{8}$ in. in depth.

It has been found by experience that the circumferential speed of a jaw clutch should not be more than 150 ft. per minute. Should there be a case where it is almost unavoidable to use a higher speed, the depth of the clutch teeth should be somewhat increased. If, for instance, a depth of tooth of $\frac{3}{8}$ in. satisfactory with a speed of 150 ft. and it should be necessary to use a clutch for the same load but running at a speed of 200 ft., it would be advisable to make the depth of the teeth $\frac{1}{2}$ inch.

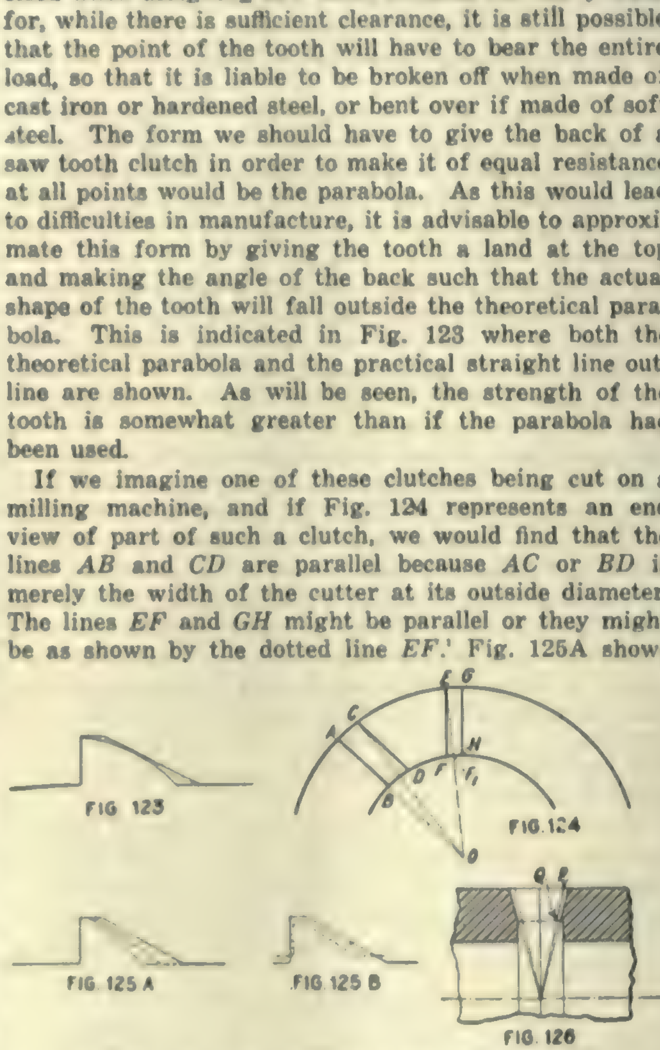
The shock on the clutch teeth is almost entirely due to the load; that is, to the number of foot-pounds of work per minute. So long as this load is the same, it makes relatively little difference so far as shock is concerned at what speed the clutch is running. If, for instance, 75,000 ft. lb. per minute must be transmitted and a clutch is used running at 150 ft. per minute, we will have a pressure on the teeth of 500 lb. If the clutch were running at 200 ft. the pressure would be 375 lb.; but the shock has not been diminished because the amount of work done is the same.

It was said that the shock is *almost* the same. It is not entirely so, because the energy of the revolving clutch has been increased on account of its greater speed. However, as a rule, this is but a small percentage of the total load to be picked up.

When the clutch, in the previous example, is made to run at 200 ft. per minute, but retaining the pressure of 500 lb. on the teeth, the amount of shock is materially increased because the work has been increased from 75,000 to 100,000 ft.-lb. We see, then, that the limit of the circumferential speed of the clutch is not set by the fact that the load increases with increased speed, but to something else and that is, that it becomes increasingly difficult to make the clutch mesh when we increase the speed.

Saw tooth clutches provide naturally the necessary clearance for throwing in, and are therefore less liable to be rounded off or to rebound. As a result, it is possible to make saw tooth clutches of less depth than square tooth clutches. Great caution should be exercised when designing saw tooth clutches for heavy loads for, while there is sufficient clearance, it is still possible that the point of the tooth will have to bear the entire load, so that it is liable to be broken off when made of cast iron or hardened steel, or bent over if made of soft steel. The form we should have to give the back of a saw tooth clutch in order to make it of equal resistance at all points would be the parabola. As this would lead to difficulties in manufacture, it is advisable to approximate this form by giving the tooth a land at the top and making the angle of the back such that the actual shape of the tooth will fall outside the theoretical parabola. This is indicated in Fig. 123 where both the theoretical parabola and the practical straight line outline are shown. As will be seen, the strength of the tooth is somewhat greater than if the parabola had been used.

If we imagine one of these clutches being cut on a milling machine, and if Fig. 124 represents an end view of part of such a clutch, we would find that the lines AB and CD are parallel because AC or BD is merely the width of the cutter at its outside diameter. The lines EF and GH might be parallel or they might be as shown by the dotted line EF_1. Fig. 125A shows



FIGS. 123 to 126—DETAILS OF SAW TEETH

the end view of a tooth both at the outside and the inside diameter; the full line showing the form at the outside and the dotted line the form which the tooth would have at the inside if all the lines AB, CD, EF and GH, Fig. 124, had been radial. As these lines are not radial, but are as shown in Fig. 124, the result is that the inside shape of the tooth will be as represented by the compound line in Fig. 125A.

We are never absolutely sure that the load will be picked up by the entire surface GH (see Fig. 124). Due to some looseness or imperfection here or there it is more likely that the first shock of the load will be borne either by the point G or the point H. The proportions of the tooth are correct at the point G, but at the point H these proportions are what the machining operation made them and not the result of design and calculation. Fig. 125A shows very clearly that even with the proper

way of manufacturing we would obtain a tooth at the inside much less strong than at the outside and the fact that we did not manufacture by the proper method has still further reduced that strength.

In order to obtain a tooth of equal strength at all points, we should have manufactured by a method similar to the cutting of a bevel gear. The result is shown in Fig. 126. All cuts are taken toward the center, so that the inside of the clutch will have a smaller height as well as a smaller length of tooth. Doing this, the end view of the tooth would become as shown in Fig. 125B, and not as in Fig. 125A. Not enough attention is paid to saw tooth clutches, their design and manufacture, and this is probably the reason why one finds them very seldom in heavy machine tools, though they are used in light machinery where the load is never heavy enough to cause breakage.

Wherever possible, saw tooth clutches should be used in preference to the square tooth variety. However, they are not adapted for reverse movements. Neither can they be used when it is essential that there shall be no lost motion between the teeth of engaging members.

In the foregoing the saw tooth clutch was shown with one vertical face. Though the angle of the active face is no longer necessary for the throwing in of the clutch, yet it is desirable to give the saw tooth clutch also an angle of about 4 deg. It will be found with square as well as with saw tooth clutches that at times it is difficult to disengage the clutch on account of the friction set up by the heavy pressure, and which may be considerable as the clutch teeth are not lubricated. Slight roughnesses in the teeth may make the disengagement exceedingly difficult. The angle of 4 deg. will materially assist in throwing out.

When saw tooth clutches are made without a land at the top and without flat at the bottom, they can readily be made on the milling machine by using an angular cutter of the proper shape and setting the clutch at an angle. The result will be as shown in section in Fig. 126 and it will be found that it is not necessary to bevel the top of the clutch along the line *PQ*. The blank may be turned up with a flat face and the result of the milling of the teeth will be that all the tops of the teeth lie in a cone.

Another Machinist Has Reminiscences

By Stephen McEvoy

After many years in the machine shop, during which time I have taken a turn at about every branch of the business, I often sit back and laugh as I recall some of my experiences, although many of them at the time they transpired seemed to be anything but humorous. These recollections help me to realize how little any one man actually knows. As a case in point I will relate one such experience that befell me years ago and taught me that it is not always safe to judge by appearances.

I was at the time foreman of a machine shop where, I am sorry to say, I had the reputation of being an "A No. 1 hard-boiled egg" who thought he knew all and then some about the machine business. I had gathered about me as strange and motley a crew of journeymen and apprentices as any old-time writer of fiction might desire, and among the apprentices was one mild youth of polished appearance and manner who was destined to teach me a lesson.

One of the jobs that occasionally came to us was the cutting of some large screws, quadruple thread, of 0.888-in. lead. Though this job was continually recurring, there was never at any one time a sufficient quantity to warrant the making of a master faceplate or any of the modern devices for securing accuracy and speed of production on such jobs. My method was to shift a change gear one-quarter turn for each separate start as I had been taught to do and which, I thought, was about the only method worth considering.

This method if carefully carried out will produce satisfactory results, as every mechanic knows; but, because of backlash, miscounting a tooth or so now and then, and general carelessness or cussedness on the part of the workmen, it was rare that I got a screw that could be induced to go in the nut without a great deal of filing and fitting. This state of affairs caused me great concern, besides eliciting much lurid language both from me and from my immediate superiors. It also helped to swell the scrap pile.

On the occasion to which I am referring an order had come through for one such screw and nut, and as usual, the screw when cut would not go into the nut. Here, thought I, is where I take it out of my polished apprentice; and to him I gave over the job of fitting, explaining to him in careful, though forceful English just what was to be done and how he was to do it. He listened attentively without giving me a chance to "go off the handle," and I finished by setting a time limit on the job which I knew to be impossible of accomplishment.

Just then I was called into the office where I was detained for a considerable time, listening to the choicest kind of a bawling out that ever fell to the lot of a harassed foreman; all on account of the cost and general inaccuracy of those same pesky screws. When I returned to the shop my temper was at the boiling point and I was in fit condition to annihilate that quiet little apprentice if things had not turned out satisfactorily.

Although the ridiculous time limit that I had set had not expired, I found my little man unconcernedly running the nut back and forth over the screw—a finished job and a perfect one, though a file had never been near it. I took it from him and held it in speechless amazement, mingled not a little with shame, as I listened to his explanation of how he did it.

That was a long time ago. You all know now, and I presume that many of you did then, how easy it is to set the compound rest parallel with the shears of the lathe and take one cut, draw the compound slide back one-quarter of the lead to take the next cut, and so on until you have finished.

That is what he had done. The lathe he had chosen was one of the few then in existence that were fitted with micrometer dials on cross and compound screws. When I had gotten the sand out of my eyes and put some prussian blue on the threads, I found that he had a perfect bearing on all of them.

I had learned my lesson. I never assume that a man knows less than I do because he *looks* that way. My apprentice got a raise that enabled him to look more polished than ever. He also got the job of making all such screws that came to the shop thereafter. Our superintendent got good screws at less than half the previous cost. The only sufferer was the scrap pile.

Heavy Machine Work in a Railroad Shop

Some Operations on Locomotive Side Frames—Method of Machining Cylinders and Valves—Work on Crankshaft for a Steam Boat

SPECIAL CORRESPONDENCE

THE first illustrations in this article relate to certain operations on locomotive side frames, Fig. 1 showing a very convenient laying-out floor with a big iron bench and rigid horses on which heavy frame sections, as well as lighter work such as rod straps, can be placed for laying out with square, surface gage, scales and calipers. Two large frame sections can be seen in the foreground with a number of straps and other parts on the big bench plate at the rear. The parts to be laid off for finishing are measured over important points, chalked on the surfaces and scribed and center-punched for center lines, hole centers and other working locations. Also, finished work is here readily inspected for squareness of surfaces, uniformity of corresponding dimensions, and general accuracy of all measurements, as called for on the blueprints.

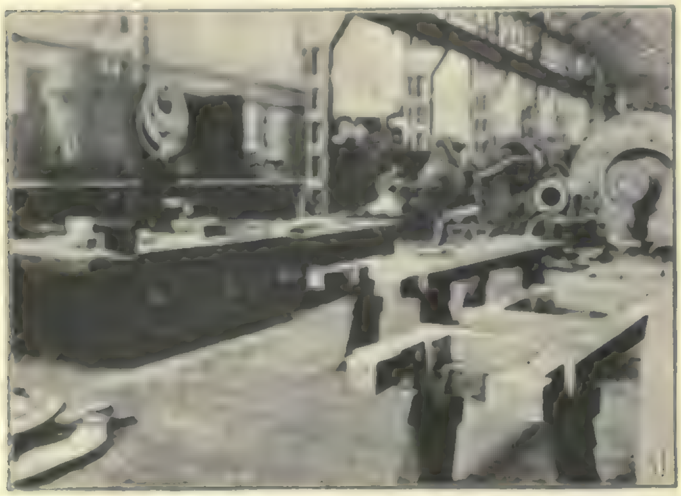
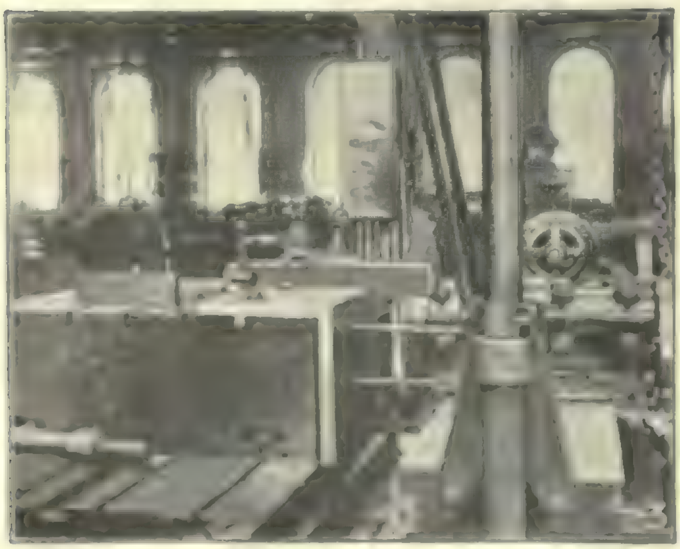


FIG. 1. EQUIPMENT FOR LAYING OUT WORK.

FIG. 2. A PAIR OF FRAMES ON THE SLOTTER

A great deal of the work necessary in machining locomotive frames is naturally handled on the vertical slotting machine, and Fig. 2 illustrates a slotter machining along the edges of heavy frames. The slotting-tool holder shown is made with back-stroke relief, so that upon the return stroke of the slotter ram the cutting tool is relieved in the cut, and upon the down stroke it again takes its original cutting position. This relief is obtained by means of a pivoted holder for the cutting tool, which holder is so operated by a compression spring as to normally stay in the working position, but upon the up stroke to swing back against the spring sufficiently to relieve the pressure of the tool point upon the work surface. Another interesting feature of this slotter tool is the swiveling and adjustment at the neck, by which the toolholder is connected to the shank proper, and by means of which the tool may be set around at any desired angle so that it can work along different surfaces and in corners to advantage. The rigidity of the construction permits the taking of deep



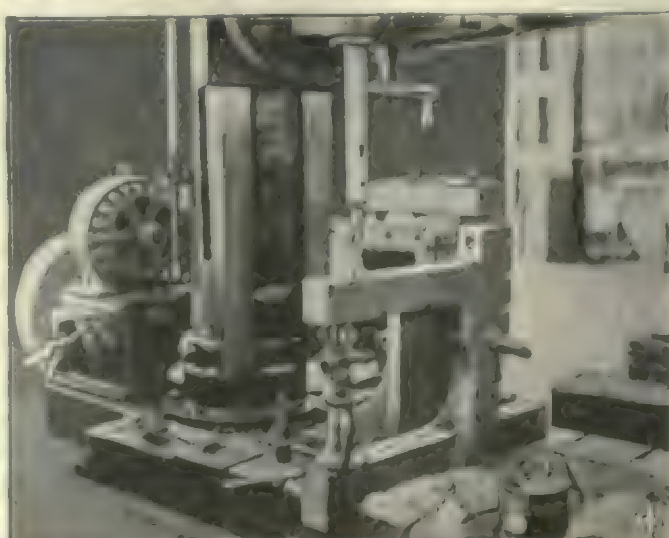
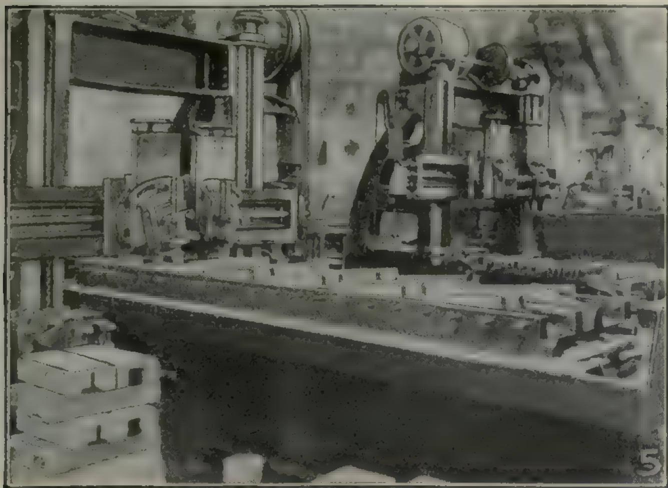


FIG. 3. SAWING OFF END OF FRAME SECTION. FIG. 4. DRILLING A FRAME MEMBER



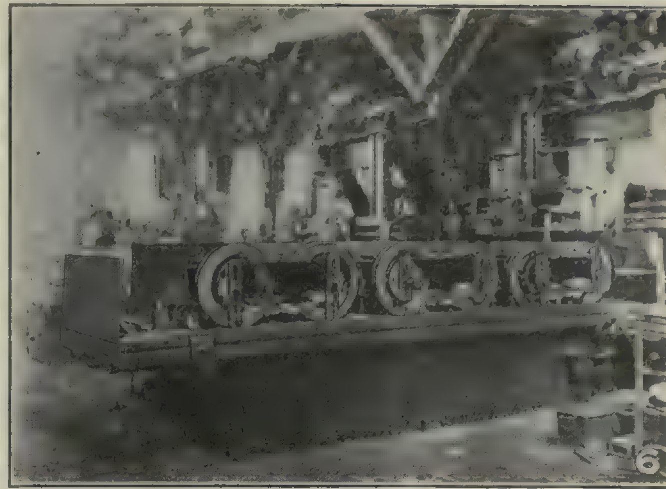


FIG. 5. PLANING WEDGES. FIG. 6. PLANER FIXTURE FOR DRIVING BOXES

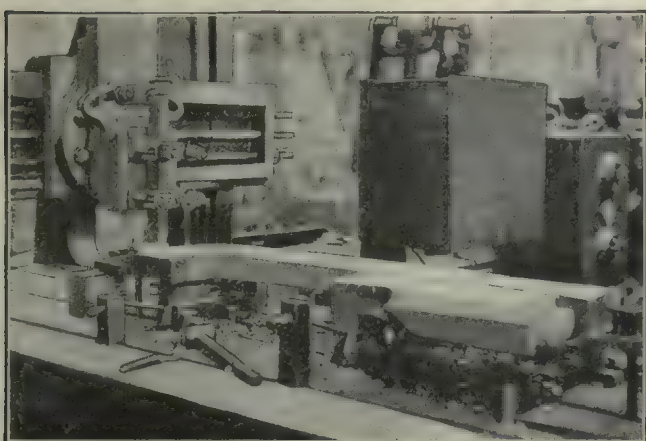


FIG. 7. PLANING A GUIDE YOKE

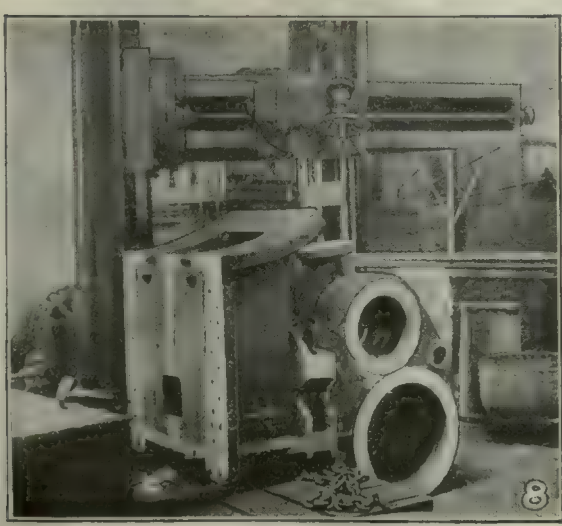
heavy cuts, and a pair of frames may be slotted at one setting all the way around. The frames rest upon parallel strips on the slotter table, and the outer ends are carried on rollers placed on parallel bars on a stiff floor support, which also can be rolled to give free movement for the adjustments.

In Fig. 3 a frame section is illustrated as forged up in the blacksmith shop and ready for the cutting off of the end with the cold sawing machine. The frame section is rigidly strapped to the upright face of the work table and the end projects sufficiently to allow the saw to clear the angle back-support on the table. This saw is used in various ways for work similar to that illustrated. One interesting application is to the cutting out of such work as rod ends to reduce the labor of drilling or otherwise getting the metal out of the open end of the rod. With the saw the bottom clearance holes are drilled at the inside of the rod end to allow the saw to run out at the end of the cut; and if a pair of saws are combined, the two sides of the rod end opening are cut out at once.

A drilling operation on the frame section is shown in Fig. 4, with the work under the radial drill. The work is clamped to the side of a big angle plate and a jack is applied to take the downward thrust of the drill.

Some planing jobs are shown in the illustrations which follow. The fixture on the planer in Fig. 5 is a double one, for holding two rows of wedges, there being twelve wedges in the fixture as set up. Along the center of this fixture there are parallel ledges, against which the work is forced by the series of setscrews tapped through the side walls of the fixture. Two eyebolts are tapped into the top of the fixture, so that it can be readily picked up by slings and hooks with the overhead crane.

A fixture for holding driving boxes while planing the shoe and wedge bearing surfaces is illustrated in Fig. 6. This fixture is also a double arrangement with central



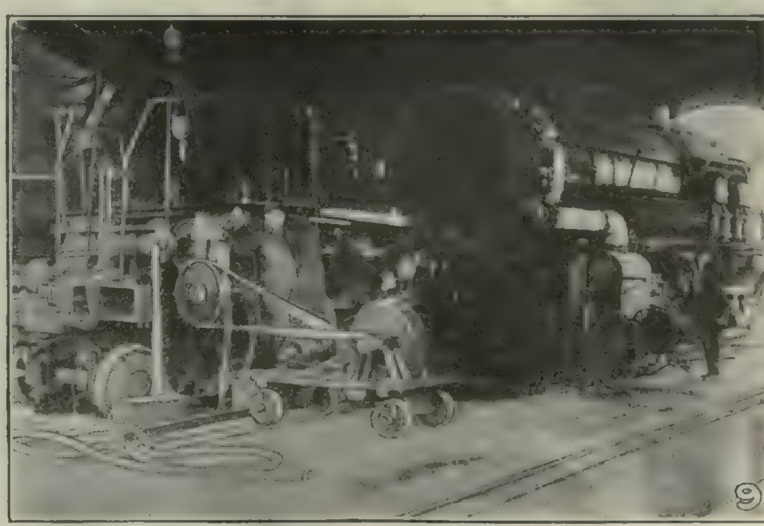


FIG. 8. CYLINDER DRILLING OPERATION. FIG. 9. REBORING A VALVE CHEST ON A LARGE ENGINE

FIG. 10. LARGE MANDREL AND TURNING OPERATION ON TUMBLER SHAFT. FIG. 11. MILLING KEYWAYS IN STEAMBOAT SHAFT

walls, against which the boxes on each side are securely clamped by bolts and straps as indicated. The fixture holds six boxes on each side. It will be noticed that, in addition to the straps by which the boxes are secured to the vertical ledge on the fixture, there are table straps between each pair of boxes to hold them down securely to the platen.

The operation illustrated in Fig. 7 is the planing of a special crosshead guide yoke. This yoke was cut out of metal 2½ in. thick by means of the oxy-acetylene torch and is shown as planed on the surface on a 42-in. x 10-ft. planer. An interesting feature of the job is the method of supporting and holding the work against side thrust by the stiff table posts with the downward pointed "toes" which bear against the sides of the yoke.

Cylinder work is always of interest in the railroad shop because of the size and shape of the casting and the special means often resorted to in handling the various operations. A very large cylinder casting is shown in Fig. 8, with the work in position under the radial drill for drilling and tapping various flange stud holes. This casting with its cylindrical valve chest has been bored, and the various faces have been planed on the draw-cut shaper. Under the radial machine it is possible to drill quite a number of holes before it becomes necessary to readjust the work.

A reboring operation on a similar cylinder is shown in Fig. 9 with the portable machine set up for operating in the steam chest. The illustration shows a big Mallet locomotive with half of the engine well stripped down in the round house. The portable boring bar is driven by means of a motor which is mounted upon a low truck so that it can be hauled to any point required. The motor is belted to a jack shaft on the truck and the power for the boring outfit is taken from a small

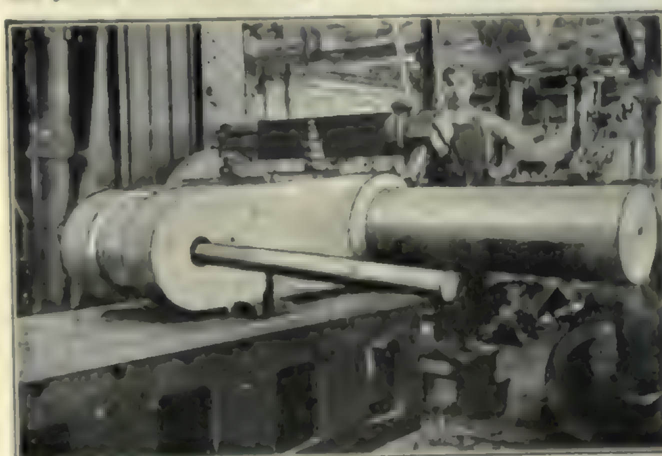
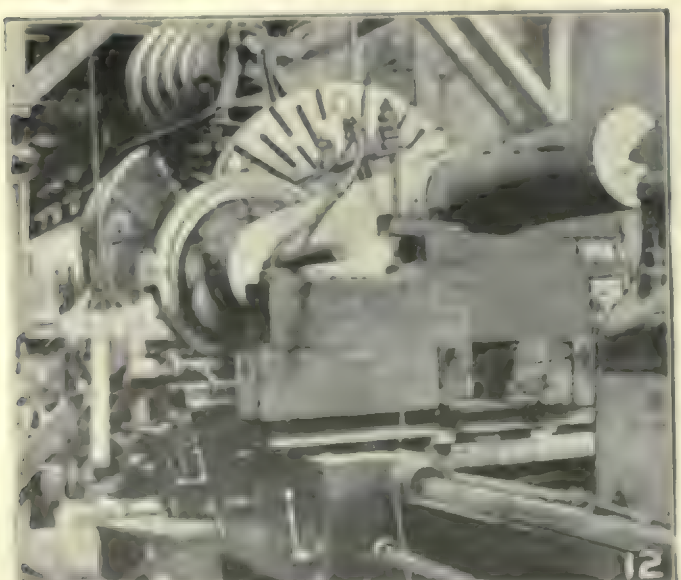


FIG. 14. SHAPING ENDS OF YOKE ON CRANKSHAFT



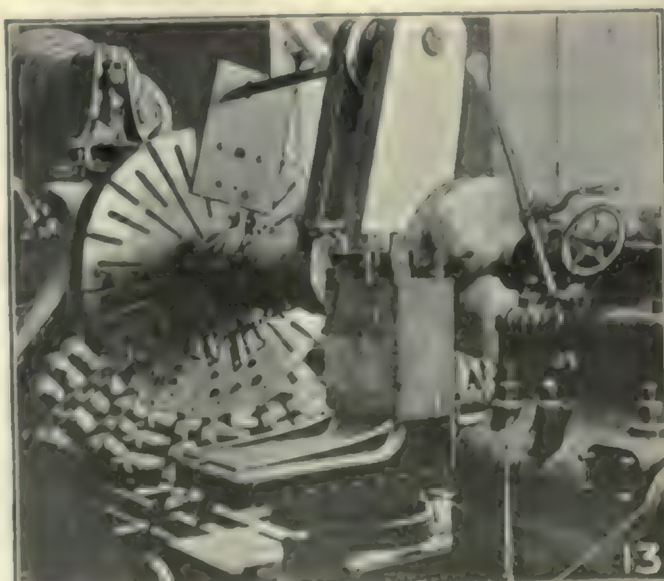


FIG. 12. TURNING PIN ON STEAMBOAT CRANK. FIG. 13. TURNING STEAMBOAT CRANKSHAFT

pulley on the end of the shaft. Behind the boring outfit can be seen a workman repairing a yoke by welding with the acetylene torch.

In Fig. 10 at the rear of the big lathe can be seen a mandrel for turning piston valve cages or bushings for various sizes of engines. This mandrel is made up of a heavy arbor with two cast-iron drums or cones. One of these is fixed at the end of the arbor while the other is adjustable along the arbor. Steps of corresponding diameter are turned on the cones, so as to receive work of the various sizes coming through the shops. With a sleeve or bushing put in place on the proper size of shoulder on the cones, the nut is tightened up and the work held securely for turning. The operation shown under way in the lathe is the turning of a tumbling shaft which is here mounted upon centers and driven by one of the arms contacting with a driver in the faceplate.

A STEAMER SHAFT

These shops, the Southern Pacific at Sacramento, have had a good deal of marine work along with regular railroad equipment to care for. Consequently, some of the operations attended to are of most unusual character. Thus, Fig. 11 illustrates a steamboat shaft 15 in. in diameter by 30 ft. long in which a number of keyways are being cut. The work is done in the draw-cut machine with a milling cutter. The feed for the cut is by means of the traveling column on the bed of the machine. Several floor blocks of cast iron with V-tops are used for holding the shaft during the operation. There are four sets of keyways cut along the shaft surface for the hubs of the spiders of a pair of paddle wheels.

Another steamer job is shown in Fig. 12. This is a crankshaft, which is here represented with a special rig in operation turning the crankpin. The work is blocked up in the lathe and lined up by the centers. The device for turning the crankpin is a worm-driven ring revolving in a bearing whose base is carried upon the lathe carriage. The carrying housing for the revolving ring is, of course, made in halves, enabling the case to be opened to remove the ring, which is also made in two parts. The ring is really a hollow mill with inserted tools, made to revolve around the crankpin and turn it to size. The feed is provided by a toolholder, which is moved along its guide in the turning ring.

The drive for the wormshaft is taken from a motor shown near the head of the lathe. In operation on this crank the tool was driven at the rate of about four turns per minute, and given a feed of $\frac{1}{32}$ in. per revolution. Three roughing cuts were necessary in turning down the rough crankpin and then a finishing cut taken with a goose-neck tool. About $1\frac{1}{4}$ in. of metal was removed in sizing the pin.

The turning of the shaft bearings, web sides and disk was accomplished with the crankshaft on centers and the faceplate heavily counterbalanced, in the manner shown in Fig. 13. The headstock and the footstock are shown blocked up, as in the previous illustration, and the tool for turning is carried on an elevating block on the toolrest of the carriage.

The final illustration, Fig. 14, shows the crankshaft set up on the draw-cut machine for the shaping of the curved ends of the webs and throws. The advantages of this type of machine for such work are evident. The ram reaches well out over the edge of the outer crank and by taking the cut on the draw stroke eliminates likelihood of chatter and irregularity of surface. The simplicity of the set-up for the work is also a decided advantage, as the setting of jobs of this character often consumes more time than the actual machine performance.

P. A.

BY CHARLES W. LEE

P. A. stands for Purchasing Agent; and pity the poor traveling man who has to "stand for" the average P. A., who, in the words of the manager of a large works where I recently called, "thinks this whole big establishment exists merely to give him a chance to buy something," and to whom Joe Renshaw's definition, "A P. A. is a man who knows that 99c. is less than $1 and that's every damn thing he does know," still applies after 50 years.

Here is something that happened recently. A price was requested and given on a repair part, and the P. A. wrote back that $75 was too much for the piece, that $60 was ample and all that he would pay; to which the reply was that if the P. A. would look more closely at the decimal point he would see that the price quoted was $7.50 and not $75.

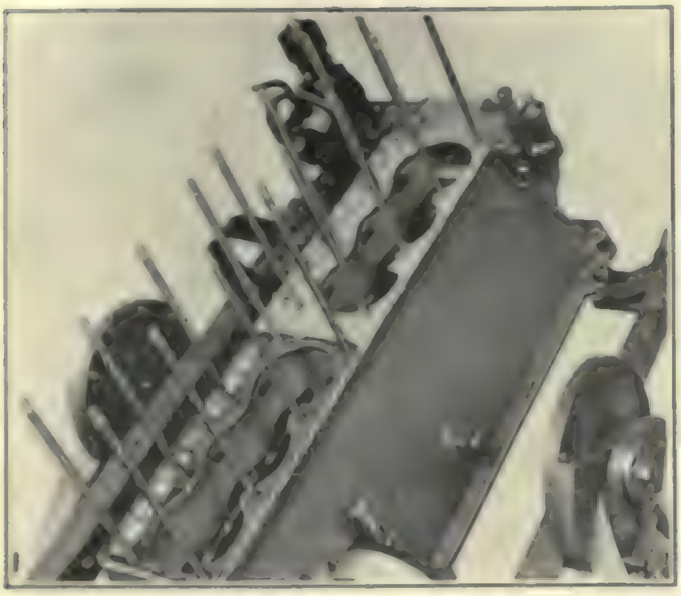
Every railroad man knows that the principal cause of hot boxes is "P. A. oil," and every shop man knows that the shop runs behind $300 while the P. A. wastes time and money telephoning all over the state trying to save 3c. on a keg of nails.

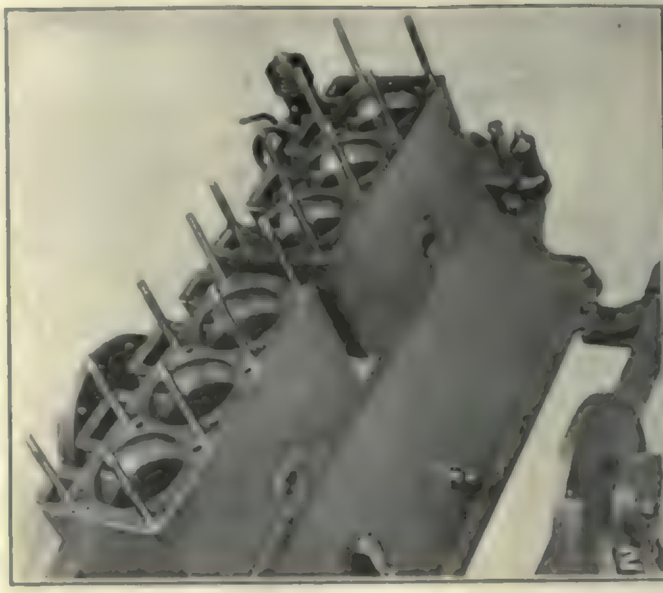
Now you know it has been mighty hot lately, and no traveling man likes to wait 40 minutes in a stuffy coop without word of any sort from the lordly P. A. You would probably do as I did, i.e., conclude that your time was fully as valuable as that of the P. A. and might better be put in elsewhere, which proved a good hunch for me, as at the next place I was received by the engineer of the works and taken in to see if I could furnish anything to do a certain thing better than it was being done.

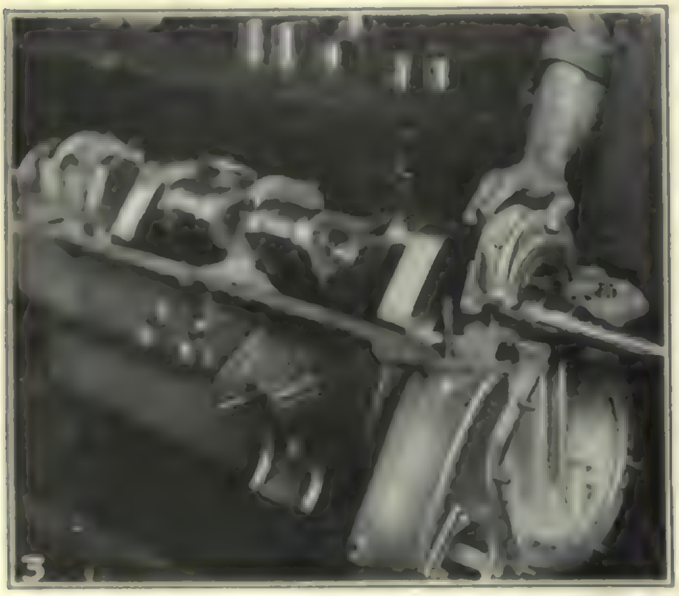
Here is what I am trying to get at: After 35 years of traveling it still amazes me that any concern that has anything to sell—which, of course, is every concern—should fail to realize that without buying there could be no selling. This is so simple a proposition that it is axiomatic and therefore cannot be proved; and it does seem to me that it would be well for every concern to treat the seller of today—who may be the buyer of tomorrow—with courtesy.

It would have been a simple and easy matter for the P. A. mentioned, who is of a type very frequently met—or failed to be met, to be more exact—if he was to be busy for 40 minutes, or as much longer as it would eventually have been if I hadn't gotten sore and flown the coop, to send out word that he would be busy for the specified time and if the traveling man had elsewhere to go, to go ahead and come back at 2 o'clock? Even the traditional message. "Nothing in your line today," would be better than *nothing*, as it would give a man the chance to put in his time elsewhere doing something more productive than waiting.

When I ran a shop "many years ago" I never failed to see every traveling man who called, and it was a mighty poor fish of a traveling man that I couldn't get valuable information from (there I go again, "never use a preposition to end a sentence with"). And the net result was all to the good. If then, why not now?







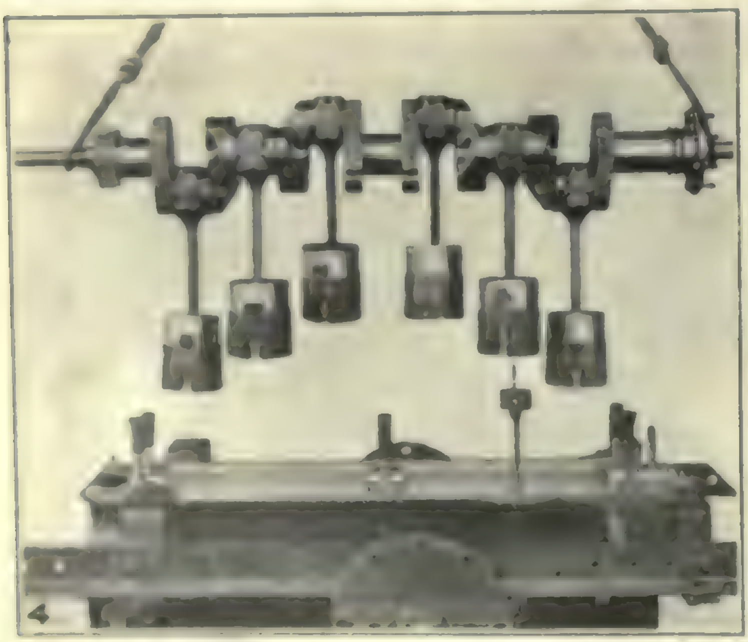
Ten Steps in Marmon Assembly

Special Correspondence

One of the most vital items in the building of good motor cars is care in assembling. These pages show the methods of handling the motor assembly in the Marmon plant, some being equally valuable in repair work.

In Figs. 1 and 2 the crankcase is shown on the assembly stand. The stand is then swung over, the crankshaft lowered into place and the bearing caps fitted, as in Fig. 3.

The crankshaft is then removed, the rods and pistons put in the shaft and the guards put over the rings as shown in Fig. 4. The guard is hinged at the back and held by the wedge-shaped clamp shown. These guards compress the rings in their grooves and allow the piston to easily enter the cylinder bore. As the pistons go down the guards slide up on them. The guards are easily removed by lifting the wedges. The top



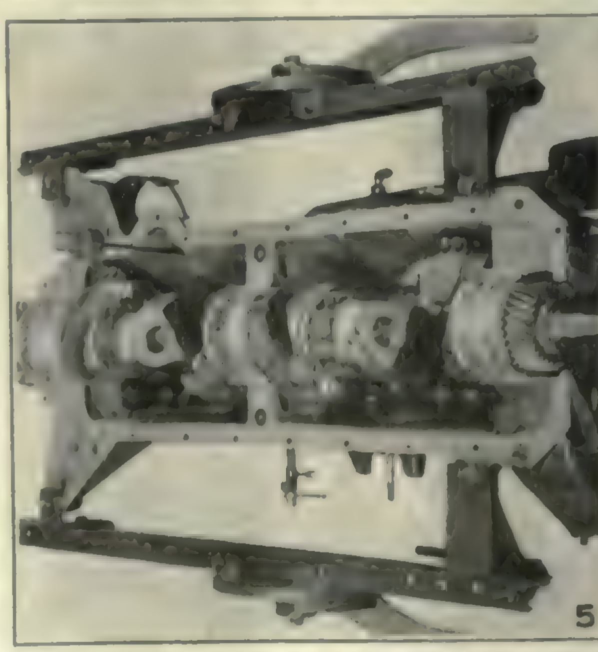
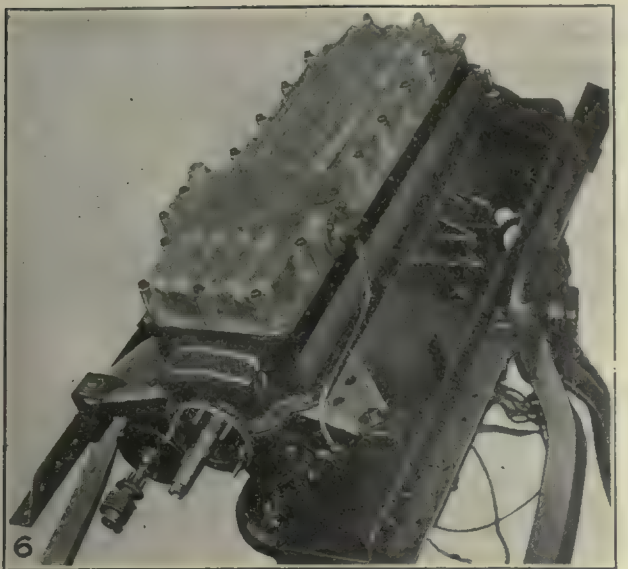
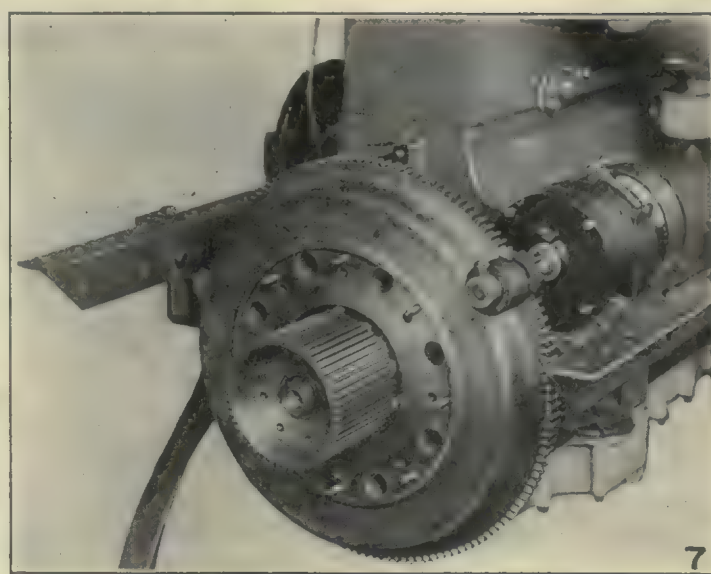


FIG. 1. ASSEMBLING STAND WITH UPPER HALF OF CRANKCASE IN POSITION. FIG. 2. CYLINDER BLOCKS IN PLACE ON CRANKCASE. FIG. 3. FITTING BEARING CAPS TO CRANKSHAFT. FIG. 4. CRANKSHAFT WITH PISTONS AND RODS ATTACHED READY TO BE LOWERED INTO PLACE. FIG. 5. TOP VIEW OF MOTOR READY FOR OIL PAN



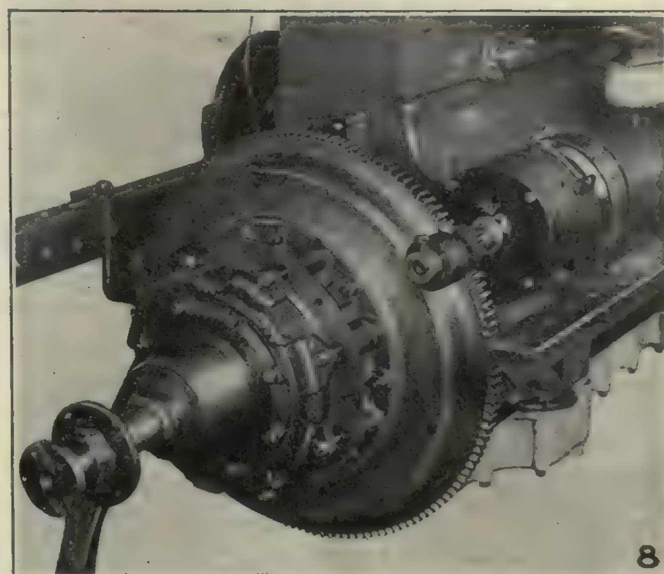


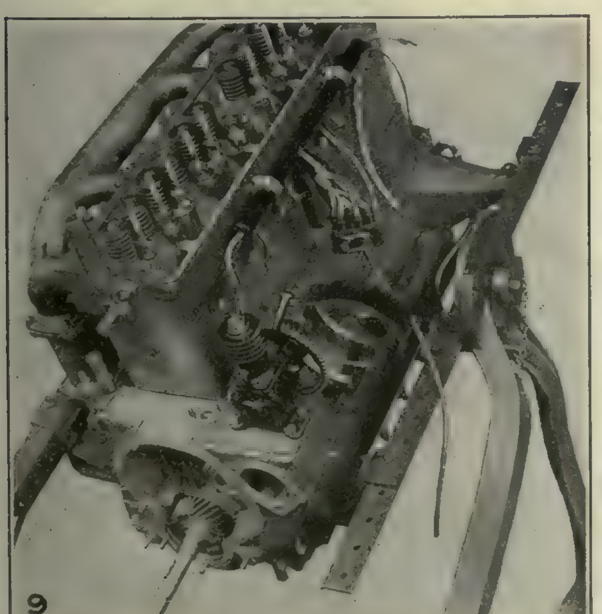
view, Fig. 5, shows the shaft in place ready for the lower half of the crankcase to be put on.

The lower crankcase in place is shown in Fig. 6. In Fig. 7, the flywheel and inner clutch members are in place. The starting motor, with its Bendix drive, is also shown as well as the simple manner of mounting the motor by means of the straps and adjusting bolt.

In Fig. 8 the outer clutch members are shown in place. It also shows the construction of the clutch. In Fig. 9 the assembly is rapidly nearing completion with the cylinder head and valves in place. The generator, held in a manner similar to the starting motor, is not yet in place. The timing gear, which incidently is of duralumin, to reduce noise, is also missing.

A very complete test stand is shown in Fig. 10, as well as the large intake and exhaust manifolds and the carburetor. The large generator furnishes the load while the tachometer, geared direct from the generator shaft, indicates the speed of the motor in revolutions per minute, which must be known throughout the tests.





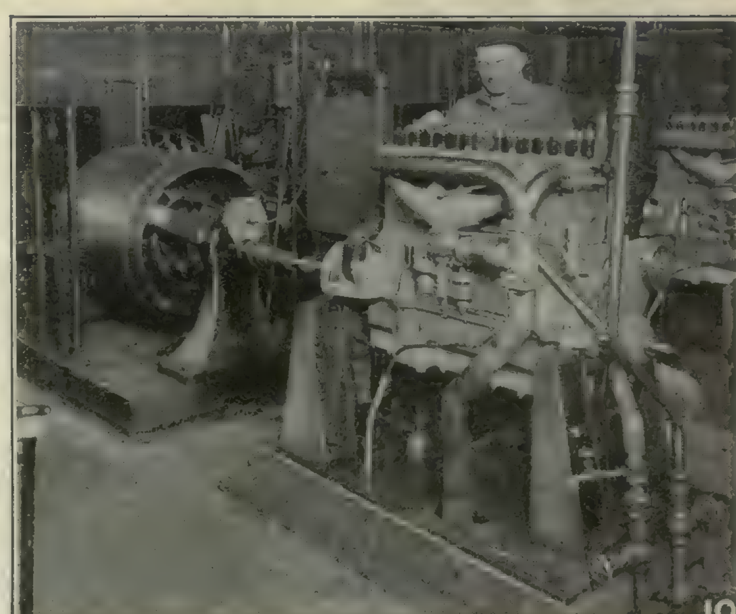
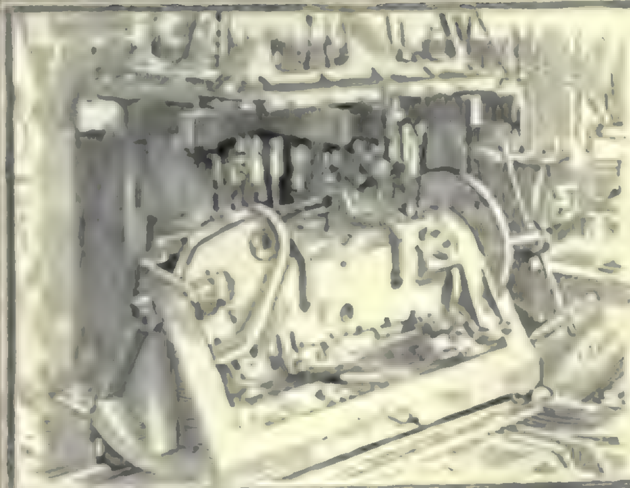


FIG. 6. CORRUGATED OIL PAN IN PLACE WITH OIL PIPE CONNECTIONS. FIG. 7. FLYWHEEL, CLUTCH SPIDER AND STARTER IN POSITION. FIG. 8. CLUTCH ASSEMBLY COMPLETE AND TRANSMISSION SHAFT.
FIG. 9. CYLINDER HEAD VALVES, TURNING GEAR AND TIRE PUMP IN PLACE.
FIG. 10. FINAL TEST STAND WITH DYNAMOMETER AND TACHOMETER



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Drop-Forging Dies Continued—Use of Edgers and Fullers—European and American Practice in Forging Non-Ferrous Metals

PIECES or work shapes are bent, "broken down" or "edged" in order to make less work for the dies in the actual striking up of the metals in forgings. Proper attention is not given to edges in many cases, because of the desire to keep the die-blocks as small as possible on account of economy. When die-blocks are too small there is very little room for the edger, and the consequence is that the upper and lower impressions are required to do more work than they should do. Therefore, they are not economical and wear out much more rapidly.

The principle of the "breakdown" or "edger" used for dies is shown in Fig. 431. In the example *A* the upper and lower dies are cut out at *B* along one edge in such a way that the stock can be placed here when in the rough and then roughly shaped into the required form. By doing this, much unnecessary work is avoided and the piece can be transferred from the edger to the impression and rapidly brought into shape. The importance of allowing sufficient stock in the die is clearly shown by this illustration, for there must be a sufficient distance between the edger and the impression, as shown at *C*. Otherwise the die will not stand up well and inaccurate work will result.

Several important points are shown, to illustrate the appearance of a die when looking down upon it and to give the names of the various parts of the die. The flash and gutter are shown, respectively, at *D* and *E* and the impression at *F*. The sprue *G* may be considered as the "neck" at the end of the impression. The gate *H* is the portion which approximates the size of the bar from which the forging is being made. The sprue should be comparatively thin so that it can be easily broken off.

An instance of a die having upper and lower impressions *K* and *L* and a very irregular lock is also shown in this illustration. The lock is made as indicated merely on account of the peculiar shape of the forging.

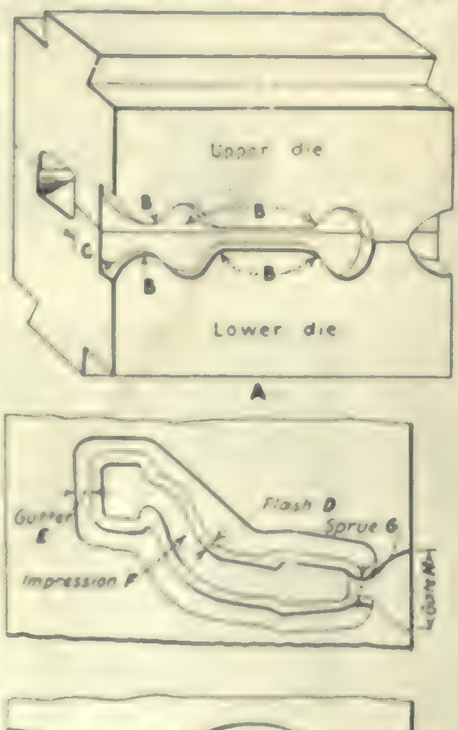


FIG. 431

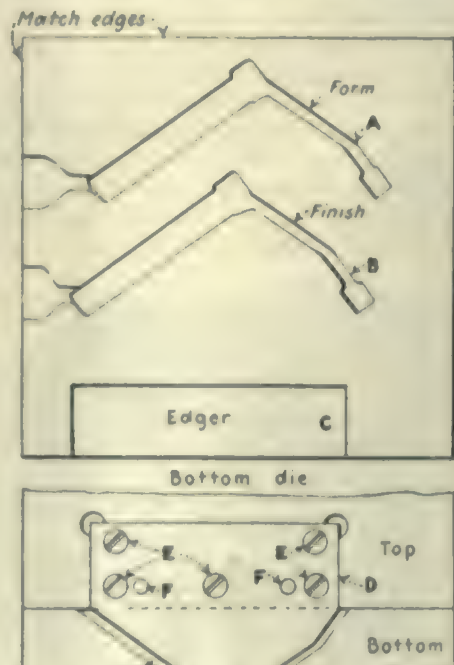


FIG. 432

FIG. 431—BREAKDOWN OR EDGER USED ON FORGING DIES. FIG. 432—EDGER MADE OF SEPARATE PIECE

In order to save stock in the dies and to economize on the labor necessary, there are certain cases when an edger may be made from a separate piece. It is

---

not considered the best practice, however, to do this, although it may be found an advantage in some cases. Fig. 432 shows an example of this kind in which the die has both form and finish impressions at *A* and *B*. The edger *C* is cut out in the lower die, and the upper one contains a separate piece *D* which is carefully located and fastened in place by means of screws and dowels at *E* and *F*. If the edger was to be made in one piece, all the rest of the die would have to be cut away, which would be an expensive machining operation.

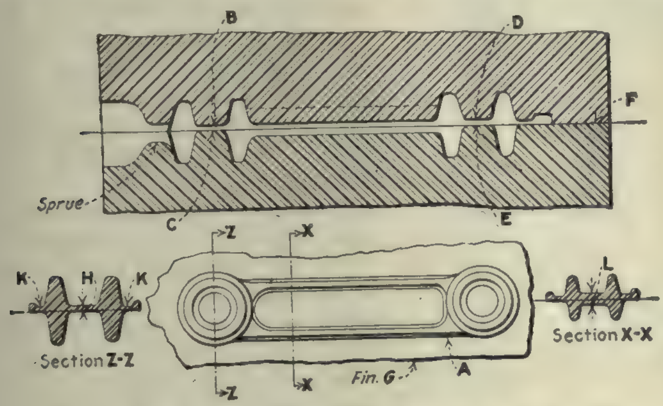


FIG. 433—METHOD OF MAKING HOLE IN FORGING

Hence, it appeared desirable to make up a separate piece as shown here.

There are many forgings of levers, connecting rods and similar work which require holes to be located in them. The holes cannot be made completely through a hub or boss, but the greater part of the metal can be removed so that only a thin web is left, which can be removed by punching in a subsequent operation. Fig. 433 shows an example of this sort in which the work is a lever having the shape shown at *A*. The bosses at each end are formed by means of suitable impressions in the dies, and the metal is compressed at *B*, *C*, *D* and *E* so that there is only a thin web remaining.

The lock *F* in this die is straight, and the lower plugs *C* and *E* come up flush with it. The upper plugs *B* and *D* do not come down quite to the lock. It is possible to make these plugs the same distance on each side of the lock, but there would be no particular gain in so doing. The diagram at *A* shows the work as it comes from the die with the fin *G* remaining on it. This fin is trimmed off and the work punched on a trimming press after the forging has been made.

In order to illustrate the appearance of the impression more clearly, a section *ZZ* is taken through the center of the boss to show the thin web at *H* and also the fin and gutter surrounding the piece at *K*. The section *XX* is taken through another portion of the die, and shows the web in the arm at *L*, which web is so made that it is equally distributed on both sides of the lock. The gutter and fin, however, are entirely in the upper impression.

There are several ways in which a forging can be made and one of them is usually somewhat better than the others. A decision should be reached as to which method is to be preferred, considering not only the amount of labor involved in making a die, but the durability of the die and the number of pieces which it can be expected to produce.

In Fig. 434 is shown at *A* and *B* the same piece of work made in two different ways. In the case *A* the work is forged on edge, while in the example *B* it is laid flat. The lock in both cases is straight, as shown in the sectional views. The impression for the boss *C* is in the upper die, while that at *D* is in both upper and lower halves. When metal is being forged and when there is a boss of considerable size on one side of the part, it is better practice to place this boss in the upper die, as the metal when struck has a tendency to rise up and fill the impression better than if carried downward and the boss made in the lower impression.

Another point of importance is the position of the large end of the forging. Two methods are shown at *E* and *F*. In the example *E* the small end connects with the sprue, while in the example *F* the large end is outward. The latter method is much to be preferred because the metal will flow more readily. These points are of importance and should be considered when laying out dies.

Use of The Fuller

When very irregular sections or large masses of metal are required in a forging at different points, it is a decided advantage to roughly shape the metal to an approximation of the form required. This is done by means of the "fuller," a diagram of which is shown in Fig. 435. The work is to be forged into the form *A*, and the lower impression *B* indicates the general appearance of the die. In order to provide sufficient metal to fill the portion *C*, a fuller is cut at *D* so as to shape the bar to approximately the form shown at *E*. After this has been done, there is sufficient metal in the portion *E* so that it will fill *C* during the process of forging.

Flat fullers, as shown at *F*, are often made when the forging is supposed to be round, but an oval or curved shape like that shown at *G* is very much better. The

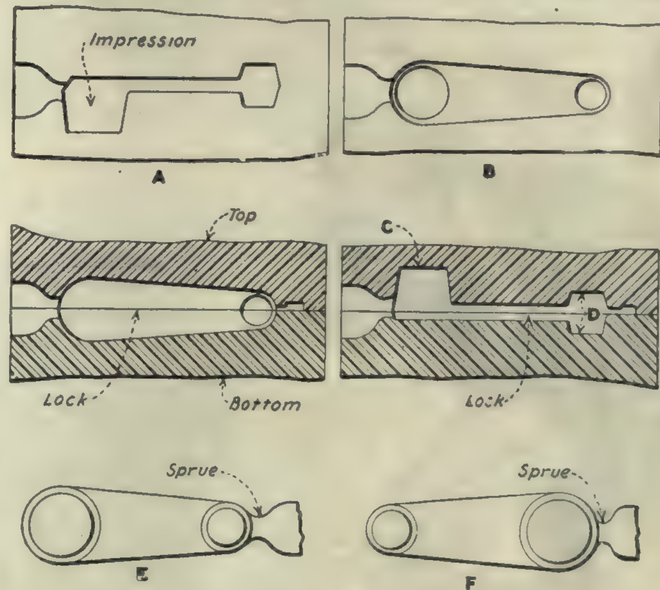
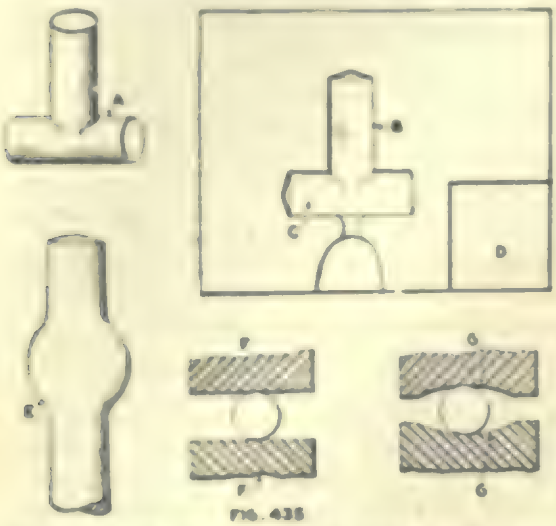


FIG. 434—POINTS IN DESIGN OF FORGING DIES

stock will be drawn more rapidly and there is less danger of "cold shuts." A cold shut is something similar to a seam in the metal, and is caused by the two portions not joining each other when turned over and compressed by the blow of the hammer. The stock when compressed should flow from the center first and not at the corners; and in order to make sure that this result will be obtained, there must be sufficient fullness of metal at the center so that it can be easily forced out by the hammer blow.

When the work is to be held closely to size or when the impressions are complicated in shape, it may be required to make two operations, using forming and finishing dies, both of which are in the same die-blocks. The nature of the work governs the shape of the die, and the necessity for forming and finishing would be determined by the points that have been mentioned.



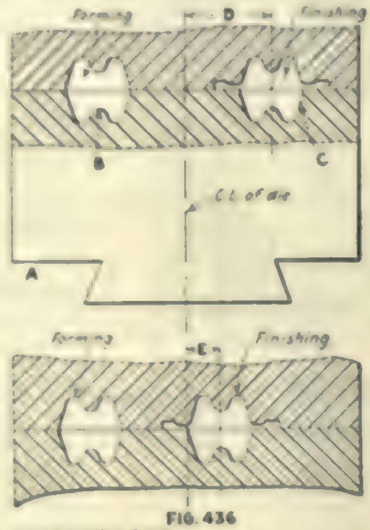


FIG. 435—USE OF FULLER IN DIE-BLOCK. FIG. 436—FORGING DIE WITH TWO IMPRESSIONS

In the example shown at *A* in Fig. 436, the impression *B* is for forming and that at *C* for finishing. The center line of the die is shown, and attention is called to the position of the finishing die with respect to the center. The distance *D* is too great, and more accurate work can be obtained by placing the finishing die as near to the center as possible, so that the dimension is more like that shown at *E*. This is a very important point when making dies which have both forming and finishing operations. It is evident that there is less chance for an error when the finishing impression is placed as nearly central as possible.

Another example of a forging die having two impressions is shown in Fig. 437. The top die is shown at *A*. The edger at *B* roughs out the shape or breaks it down. The work is then placed in the forming impression *C* and afterward in the finisher *D*. The dies are set up so that they will register properly, by means of the match edges, which are so arranged that they are in perfect alignment when the impressions register one with the other. The view shown at *E* gives the appearance of the dies from the front, and the diagram *F* is a side view which shows the shape of the edger and general dimensions of it. The forging with fin attached before trimming is shown at *G*.

In Fig. 438 is shown a piece of work *A* and the die which produces it. The portion *B* is the edger, which is slightly different in upper and lower dies on account of the shape of the piece. The impression *C* is the forming die, while that at *D* is used for finishing. The flash outline is shown in one die at *E* and in the other at *F*, while the gutter may be noted at *G*. This is a very good example of a well designed and accurately finished drop-forging die.

We have endeavored to take up the points of importance in connection with the design of dies for forging steel. Our aim has been to illustrate the principles and show the importance of the various features in die design. In order, however, to be a thoroughly practical designer of drop-forging dies a man should have considerable experience in the forging of metal, as it is difficult to bring out all the important points in such a way that they can be thoroughly absorbed by a man unfamiliar with this class of work. Complicated forgings require special treatment, and work of large size may require several "heats" in order to form it to the desired shape. These latter matters are obviously beyond the scope of the tool designer, and yet the information we have given should be of value in enabling him to understand the fundamental principles governing the design of drop-forging dies.

We have taken up a number of matters in connection with the forging of steel, and in order to make this article more comprehensive it seems desirable to make mention of the process of forging brass and bronze. In the United States the forging of brass parts has not been widely adopted, except the making of fuse parts during the war. In Great Britain and on the European continent many non-ferrous metals are formed in dies. The process deserves more consideration than is usually accorded to it, and we therefore believe that a few of the principles involved may be of use to the tool designer.

In the first place the machine used for the process

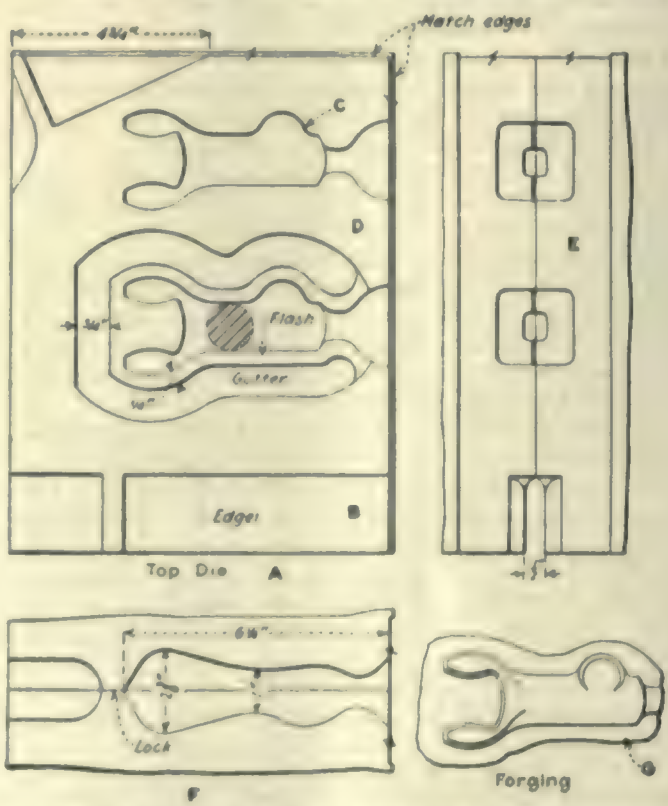


FIG. 437—FORGING DIE HAVING TWO IMPRESSIONS

is not a drop hammer, but a heavy single- or double-action press. Yellow brass mixtures of various kinds, as well as maganese or tobin bronze, can be forged

to advantage. Castings can be made to an approximation of the shape desired, and afterwards "struck up" in dies; but a better method is to use the process of extrusion to obtain special forms and then work the part up in dies to the desired shape. The temperatures required vary from about 1,250 to 1,300 deg. F., but very accurate control of the heating is not important. The temperature can be judged approximately by the color

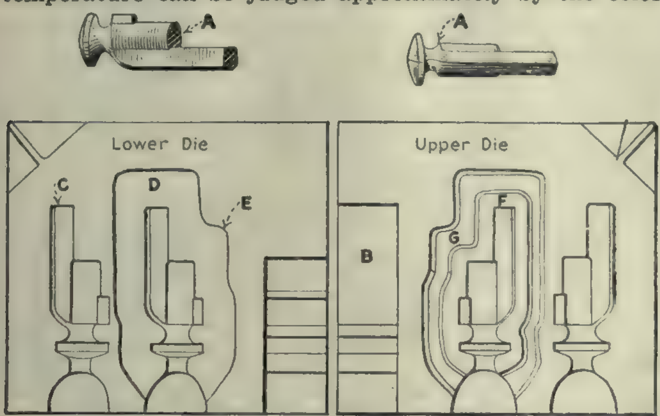


FIG. 438—UPPER AND LOWER FORMING AND FINISHING DIES

of the work, making it unnecessary to use pyrometers.

Dies for forging brass should be lubricated, and it is customary to swab them with cylinder oil, which the operator applies with a long-handled swab. The oil is necessary in order to prevent the dies from wearing too rapidly, on account of the excessive pressure. Occasionally it is found an advantage to add about one per cent of the powdered graphite to the cylinder oil, so that more body is obtained to resist the pressure. It is possible to hold brass forgings within an accuracy of ± 0.002 or 0.003 inches.

As there is a certain amount of variation in the thickness of the brass used, it is necessary to protect the dies from injury. Several methods are possible for accomplishing this result, a shear block or pin of some sort being the most logical method. Providing a shear pin in the crank of the press so that it will shear off before any damage is done, is probably as good a way as any to overcome the trouble.

In reality the process of making brass forgings consists of squeezing the heated metal between a pair of dies, thus causing it to flow sufficiently to fill the upper and lower impressions. Blanks are often made from bar stock when the work is simple, but the extrusion process is also used when work is of more complicated shapes. Dies can be expected to produce from 10,000 to 20,000 pieces, according to the nature of the work. Under good conditions from 6,000 to 8,000 pieces can be made in ten hours. If metal is required to flow a considerable distance, a double-action press should be used, the first movement to extrude the blank and the second to bring down the plunger through the upper die, thus causing the metal to flow.

Air vents should be provided so that the air can escape, in order not to hinder the flow of the metal and fill the die space. No. 70 drilled holes are often used for this purpose, and the small "needles" which are left in the holes are forced out by the compression at each operation so that they do not cause trouble. In the manufacture of dies for brass forgings the contact parts are made of high-speed steel, as they will withstand the temperature better than carbon steel.

In order to illustrate the principles in graphic form, Fig. 439 is given. In the example *A* the work is placed in the die *B*, and the upper die *C* comes down upon it to bring it into the approximate shape of the finished forging. It will be remembered that the work is done in a heavy punch press.

In order to illustrate the difference between the process of forming dies and machining, a diagram is shown at *D* in which the work *E* is manufactured from hexagon stock on a screw machine, using a forming tool *F* and a cutting-off tool *G*. When manufactured by means of the forging process, a billet can be used like that shown at *H*, and the work produced so that it appears as shown at *K*. The fin *L* is cut off by trimming dies after the piece has been formed.

The work shown at *M* is a cup-shaped forging which is made from the bar by means of the dies shown at *N*. The lower die is cut out as indicated at *O* to the form required, and the work is squeezed until it fills the dies and overflows at *P*. A "shedder" is provided in the upper die, as shown at *Q*, and an ejector *R* in the lower die. The portions *S* and *T* are made of high-speed steel to withstand the heat. Registry is accomplished by the sleeve *U*, which locates over the ring *V* in closing.

The principle of operation on a double-acting press is clearly shown at *W*. The dies come together in the same manner as those previously shown, and after the faces have touched each other the plunger *X* comes down and forces the metal into the die. In all probability the process of brass forging will come into prominence more and more in the manufacture of small brass parts where they are produced in quantities. An advantage of the process is the accuracy and rapidity that can be obtained in manufacture.

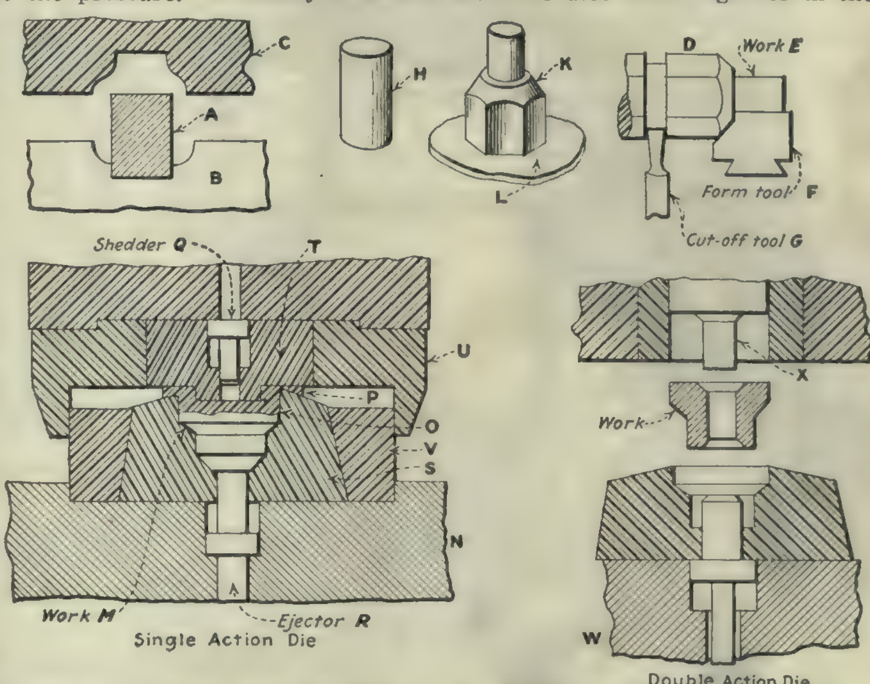
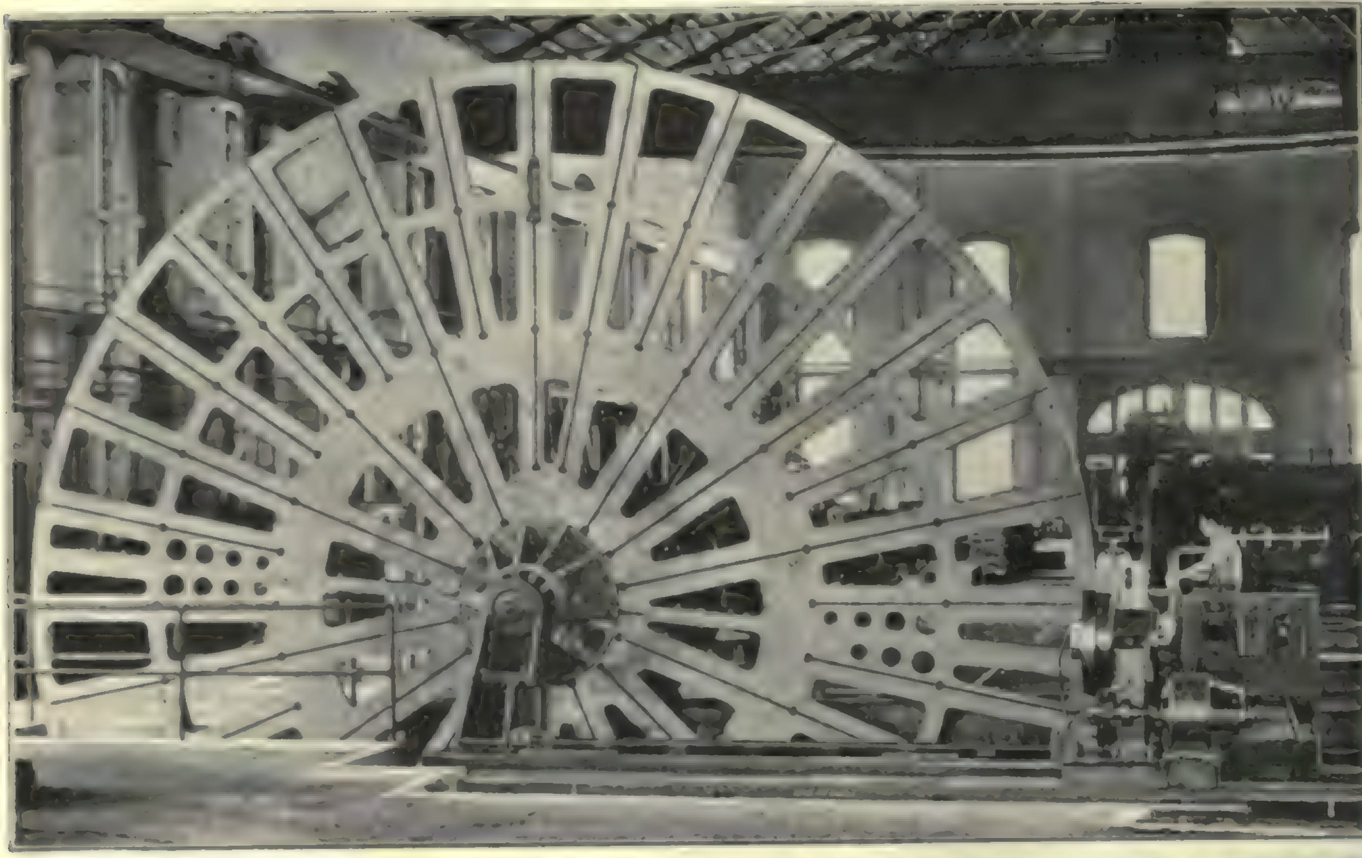


FIG. 439—METHOD OF FORGING BRASS, SHOWING TYPE OF DIE USED



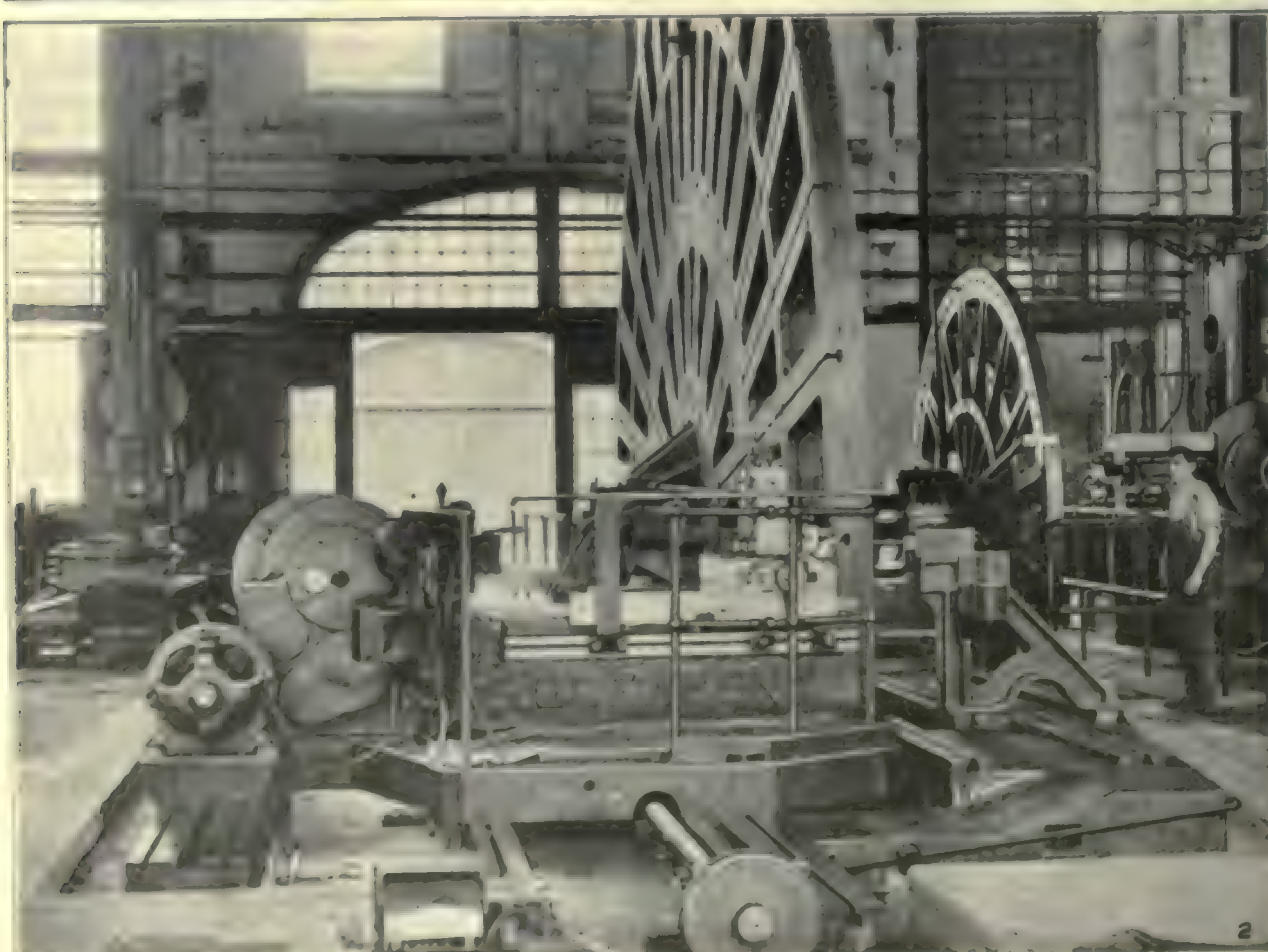


FIG. 1—GLEASON GEAR PLANER AT WATERTOWN ARSENAL. FIG. 2—SIDE VIEW OF SAME MACHINE

Large Gear Planer at Watertown Arsenal

At the Watertown Arsenal, Watertown, Mass., are built among other things the mounts for large guns for various kinds of service. Some of these mounts have large circular traversing racks for swinging the guns to different points, the largest one at present being 32 ft. pitch diameter and used on a 16-in. Barbette gun carriage. In order to cut these racks rapidly and accurately, the gear planer illustrated herewith in Figs. 1 and 2 was built by the Gleason Works, Rochester, N. Y. and has recently been installed. The faceplate was, however, designed and built at the Watertown Arsenal, to suit the work required.

This machine has a capacity for cutting both internal and external spur gears having a minimum pitch diameter of 5 ft. and a maximum diameter of 41 ft., with no limit as to the pitch to be cut. The stroke can be varied from 4 to 15 in. The cast-iron faceplate is 32 ft. in diameter, made in halves, the total finished weight being 18 tons. It is attached to the front end of the main spindle, which rests in two main bearings and one outboard bearing. Extensions allow gears up to 41 ft. pitch diameter to be cut. An index wormwheel 12 ft. in diameter is attached to the back of the spindle.

The indexing mechanism is driven by a constant-speed, non-reversible, 1-hp. motor running at 1,700 r.p.m. In order to reduce the friction on the worm gearing used for indexing, large roller bearings are provided, consisting of inner and outer sleeves and having 1-in. rollers, 12 in. in length. The planing mechanism is so arranged that either form tools or plain tools guided by special forms can be used, depending on the shape of the teeth to be cut.

The two main bearings form part of an upright frame bolted firmly to a bedplate resting on concrete foundations. The outboard bearing is also attached to a bedplate resting on a firm foundation. A third bedplate is provided for the base of the tool slide. This base can be traversed within a range of from 2½ to 20½ ft. from the center of the faceplate, by means of a screw driven by a 5-hp. constant-speed motor provided with reversible control.

To prevent deflection of the faceplate under the cut, a thrust brace is provided which can be moved to either of the three circumferential ribs on the back. This brace is supported in a bearing secured to the rear baseplate, and is so controlled electrically that the operator of the machine can by means of a remote control, withdraw it $\frac{1}{32}$ in. while the machine is indexing. On completion of the indexing, the brace can be again brought into contact with the faceplate by the remote control.

The main drive is from a 10-hp. variable-speed motor having a range of from 300 to 1,200 r.p.m. By means of change gears and the speed controller, the strokes of the tool ram can be varied from 6.6 to 66 per minute.

Cutting compound is delivered by a motor-driven pump. The toolslide is provided with automatic feed and has proper support for the various kinds of forms used in planing teeth, also housings for the rolls that engage the forms. The total weight of this machine is 200 tons. The extreme height with all extensions attached is 24 ft. 6 in. The length is 53 ft. and the width 20 feet.

The machine is operated from a platform attached to the base, and on one side of the platform is a panel containing the control switches, automatic control and means for complete manipulation electrically. As the traversing motor travels with the sliding base, the cables furnishing the current are coiled on a spring-actuated drum which automatically takes in the slack or allows the cables to be paid out, according to the direction of traverse.

Job Welding Shop Problems

By S. W. Miller

By a job shop is meant a shop which takes in any kind of work that is brought to it. The work may be large or small, easy or difficult, and there may be much of one kind or there may be no two jobs alike. The job welding shop comes under this specification but has an additional difference. The work is almost entirely repair work. In repair work of any nature, the objects are to have the repaired part strong enough to stand the service required of it, and to do it at a price as low as possible consistent with good workmanship and a fair profit. There are many difficulties in accomplishing this result in a job welding shop. In considering these difficulties, we will confine our attention to repair work, because in production work the difficulties can be overcome in the course of a short time, and after this has been done, the rest of the work is comparatively easy.

The difficulties in a job welding shop may be classified as follows: (1) The work itself; (2) the varied natures of metals that are of the same general type; (3) financial problems; (4) guarantees on the work.

Work

The first head may be sub-divided into the following: Preparation; welding; finishing. The preparation of the work involves the making of the V, the method of lining up the work, and the arranging for and taking care of the expansion and contraction.

The welding covers the decision as to whether gas or electric welding be employed, and upon this decision somewhat depends the preparation. The method of preheating really should be considered in connection with the welding, although it is important enough in some cases to be considered separately.

The method of finishing the work, if finishing be necessary, as do all the other operations, depends on the facilities on hand. It is difficult to lay down general rules for any of these matters and it is probably best to consider what has been done in individual cases.

Varied Nature of Metals of Same General Type

Under the second heading, it should be remembered that in a production job the material used can be specified so that uniformity can be obtained, which enables the welder to use the same methods and practices at all times. In repair work, however, not only are the materials, for instance, cast iron, not uniform, but in many cases it is impossible to determine before the welding is started how the material is going to act during the welding process, and sometimes changes in methods have to be made in order to overcome difficulties of this nature that could not be anticipated.

The only thing that will guide a welder under such adverse conditions is experience, and to use this experience the welder's memory must be good and his observation keen.

The job shop is called on to handle all metals and it is seldom that one finds a welder who is able to do all of them well and still rarer to find one who is capable of doing all-around welding with both gas torch and electric arc.

It is sometimes difficult to distinguish between cast iron, malleable iron and cast steel. It is frequently impossible to distinguish between the various brass and bronze alloys and many failures have occurred because of these troubles. Similar difficulties exist with other metals, so that the job shop, to be successful, must have a wider knowledge of metals and their characteristics than any other kind of a shop.

Financial Problems

Third, the majority of job shops do not have any real knowledge of their costs, and it is frequently the case where there are a number of competitors in the same city, prices will be cut and recut until the work is being done at an actual loss by everybody. Such a condition is bad for the welding industry, but it will not be overcome until such shops see the importance of knowing what the work costs them. To do this is not so difficult, but does require a proper system of bookkeeping and a simple accounting method.

The items that are most frequently overlooked are those that are usually called overhead expenses, such as insurance, taxes, repairs of apparatus, and advertising. I do not mean that these expenses are not paid, but that they are not included in the charges made for the work in an intelligent way. Of course if the real cost of the work being done is not known, it is impossible to say what the charges should be, and charges must include a profit over all expenses or else the business will fail.

In connection with the financial end of the business, the treatment of the customer is of vital importance. A satisfied customer is the biggest asset of the business. Of course a customer cannot be satisfied unless the work is done properly, and at a reasonable price. The most essential thing, however, is to do the work properly even if in some cases it has to be done at a loss, and as a matter of policy, I believe it is wrong to do cheap work, that is, work which is deliberately so done, even with the understanding that first-class work is not needed. On the other hand, if the welder is so unfortunate as to do a piece of work badly, the best policy is to honestly admit it and explain why. There are so many jobs that come to the welding shop that have never been done before that it is no wonder that failures sometimes occur and honesty in this, as well as in all other cases, is the best policy. I speak of these things in some detail because they are many times overlooked or not understood or appreciated.

Guarantees

A welding shop is frequently asked if it guarantees its work, and such shops frequently advertise that they guarantee all jobs. A general statement to the effect that all work is guaranteed in reality means nothing and there should be some specific form of guarantee covering all usual cases.

It is also well to know that, in all probability, a general statement as to any guarantee is not legally effective unless it is specifically called to the attention of the customer before the work is undertaken, and if it is not intended to guarantee the work, the customer should be advised of this at the time the work is taken in, and in important cases the further precaution of notifying him in writing should be taken.

Whatever is done in the way of guarantees should be done as a matter of principle, and the policy should be followed strictly and altered only as experience indicates that changes may be safely made.

As in all other work, welding has its tragical and humorous sides. The tragical may be well represented by the accidents that have occurred either through lack of knowledge or pure carelessness, as when tanks that have contained oil, gasoline or other explosives have been worked on with a cutting or welding torch. It is equally dangerous to work on them with an electric arc. Explosions have occurred even after a tank has been washed out with water, or steamed out, so that the only safe way is to keep the tank as full of water as possible while the work is being done. It should first be filled entirely, care being taken to see that all pockets are filled. The water can then be let out just enough so that the welding can be done.

The dangers of looking at the electric arc are well known to you, and in all cases precautions should be taken so that even side flashes from the arc may not get to anyone's eyes.

There are many humorous questions asked by customers; that is, they are humorous to us. One of these questions is quite frequent, that is, whether cast iron can be welded. Courtesy and tact demand that we should not smile under such conditions, but that a careful explanation of the principles of fusion welding be given, so that the customer may understand that all metals may be joined together by these processes. Then his idea of welding will be broadened and his confidence in it increased. It is even sometimes necessary to demonstrate to the customer that metals can actually be melted together. As a matter of fact, we can all be asked questions in connection with welding which we are unable to answer.

The Field of Association Publications

It has long been a question as to both the ethics and the desirability of associations or societies entering the publishing business as a financial enterprise. Bulletins, containing news of the society and more formal transactions, to put on record the proceedings of the society so that the valuable information presented can be preserved for future use, are essential to every technical organization. But when the society publication enters the field of the standard periodical, even when the sole desire is to help the society to become self-supporting and of even greater value, several real problems are presented.

Such a problem faced the Associated Advertising Clubs of the World, an association devoted to making advertising of the greatest value to all. After serious consideration on the part of the managers, this association has decided to "clean up its own backyard" as it expresses it, and withdraw from the field of regular publications. Hereafter their official organ will carry no advertising except that pertaining to the activities of the association. This will change the whole character of the publication and take it out of the general periodical field, but the managers feel that it is the best policy for this association as well as for others which are similarly situated.

Their decision is well worth careful consideration by all managers of association publications.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Angles of Cutting Tools

By J. Herron

I was very much interested in the article by M. Tolliver on page 231 of *American Machinist*. The discrepancies he pointed out were so striking that I looked up page 218, Vol. 55, of *American Machinist* and did some speculating on my own account.

The tabulation to which Mr. Tolliver referred is given here in a different form, so as to bring in a somewhat clearer view the things I wish to point out.

	Top rake, degrees	Clearance at point, degrees	Roughing speed	Roughing feed	Finishing speed	Finishing feed	Amount of metal removed in unit of time. Roughly	Contained angle, degrees
A	18	5	23	$\frac{5}{32}$	23	$\frac{5}{16}$	$3\frac{19}{32}$	67
B	15	6	28	$\frac{1}{16}$	28	$\frac{1}{16}$	$1\frac{3}{4}$	69
C	12	10	15	$\frac{1}{2}$	15	$\frac{1}{2}$	$7\frac{1}{2}$	68
D	12	15	18	$\frac{1}{4}$	18	$\frac{1}{4}$	$4\frac{1}{2}$	63
E	8–10	7	40	$\frac{1}{8}$	40	$\frac{1}{8}$	5	73-75
F	8	6	25	$\frac{1}{4}$	25	$\frac{1}{2}$	$6\frac{1}{4}$	76
G	8	6	16	$\frac{3}{32}$	$20\frac{1}{2}$	$\frac{3}{32}$	$1\frac{1}{2}$	76
H	8	5	26	$\frac{5}{16}$	26	$\frac{5}{16}$	$8\frac{1}{8}$	77
I	7	8	12–20	$\frac{1}{4}$	12–20	$\frac{1}{4}$	3–5	75
K	6	6	14	$\frac{1}{8}$	12	$\frac{1}{8}$	$1\frac{3}{4}$	78
L	6	7	16	$\frac{5}{16}$	16	$\frac{1}{2}$	5	77
M	6	4	30	$\frac{1}{16}$	30	$\frac{1}{16}$	$1\frac{7}{8}$	80
N	5	7	55	$\frac{1}{8}$	50	$\frac{3}{8}$	$6\frac{7}{8}$	78
O	4	6	18	$\frac{1}{8}$	18	$\frac{1}{8}$	$2\frac{1}{4}$	80
P	4	$4\frac{1}{2}$	24	$\frac{1}{8}$	24	$\frac{1}{4}$	3	$81\frac{1}{2}$
Q	2	7	$19\frac{3}{4}$	$\frac{5}{16}$	$19\frac{3}{4}$	$\frac{5}{16}$	$6\frac{1}{4}$	81
R	2	7	30	$\frac{3}{8}$	30	$\frac{3}{8}$	$11\frac{1}{4}$	81

The first column of this table gives the top rake of the tool in degrees. The second is the clearance at the point. The third gives the contained angle of the tool. The fourth and fifth give the roughing speeds and feeds. The sixth and seventh, the finishing feeds and speeds; and the eighth, the product of roughing speed and feed.

Looking over the first column it will be noticed that the top rake varies between 18 and 2 deg. The second column shows that the clearance varies between 15 and 4. The range of roughing speeds is from 55 to 14 ft. per minute. The roughing feeds vary between $\frac{1}{2}$ and $\frac{1}{16}$ in. It will be seen that the finishing speeds are as a rule the same as the roughing speeds, but now and then one will be found slightly more, and occasionally one slightly less, than the corresponding roughing speed. The same is true in regard to the finishing feeds. As a rule these feeds are the same as those used for roughing, but sometimes they are more and sometimes less.

I am going out from the supposition that the amount of metal to be removed is practically the same on all tires. I dare say this assumption is nearly, if not quite, correct; but if there should be a wide difference in the amount of metal to be removed from various tires, I would naturally ask why there should be such a difference. If one tire can be forged with a small amount of metal to be removed, why shouldn't it be possible to forge another tire the same way? There is, of course, a certain amount of difference between individual tires; but where a general practice is developed for the boring out of tires, we may, of course, expect that the maximum amount of metal to be removed is the basis of such practice.

Assuming then, that the depth of cut is the same in all cases, we can say that the product of roughing feed and roughing speed, will be a measure of the amount of metal removed in a unit of time. We find in our tabulation that this amount of metal is as little as $1\frac{1}{2}$ or as much as $11\frac{1}{4}$, and one may say that all possible combinations between these extremes are found.

Looking over these figures one wonders what may be the reason why there are such startling differences in practice in different shops. The difference in amount of metal may be explained by the fact that there is a powerful machine in one shop, where another shop must get along with an old and out-of-date machine not capable of taking heavy cuts. But, if this is so, then why is a much sturdier tool required to cut 3 cu.in. than one to cut $7\frac{1}{2}$? The $7\frac{1}{2}$ cu.in. are removed with a tool having a top rake of 12 deg., a clearance of 10 deg. and a contained angle of 68 deg., whereas 3 cu.in. are removed with a tool having a top rake of 4 deg., a clearance of $4\frac{1}{2}$ deg. and a contained angle of $81\frac{1}{2}$ deg. Again, we find on line *D* that $4\frac{1}{2}$ cu.in. are removed by means of a fragile tool with a contained angle of 63 deg., whereas in the case of line *L*, 5 in. are removed with a tool of 77 deg. angle.

One may ask why it is necessary to run at such a low speed as 14 ft. per minute and with $\frac{1}{8}$-in. feed, as is the case on line *K*, if in another case, (line *N*) a speed of 55 ft. or nearly 4 times as much is used and with the same amount of feed per revolution. Again, if a cut can be taken at 30 ft. with a feed of $\frac{3}{8}$ in. (see *R*), why must the speed be reduced to $19\frac{3}{4}$ ft. per minute when a feed of $\frac{5}{16}$ in. is taken, as is the case in *Q*? One could go on asking such questions, because it would be difficult to find a greater lack of uniformity than shown in this tabulation.

As Mr. Tolliver says, surely it cannot be that everybody is right. Some one practice must be better than another and probably one is the best or maybe the least bad.

It is surprising that there should be two shops which vary in their practice on important operations to any great extent, considering the facilities which are offered for interchange of ideas. When one can pick out seventeen shops all doing the same kind of work, with the same kind of machines and the same kind of tools and working on the same material, and then find that there

is not only no uniformity but extreme differences in all the elements of the operations, one begins to wonder how such a thing can happen. The writer does not believe that this lack of uniformity is confined to railroad shops but is inclined to doubt whether it exists, to the same extent, in other types of large machine shops. If, in the future, I read about railroads farming out some of their work, I'll feel as if there is at least *one* good reason for it, and if I ever read again about the special training required of the railroad shop men I'll turn to my tabulation and smile.

It seems to be a fact in machine shop practice that every little king and potentate has his own laws, his own customs, his own habits and his own practices, and is proud of them. There are not many industries apart from the machine shop where such difference in practice could persist. The concern holding onto the lesser practice would soon be out of business. What there is in the machine shop that makes people hang on tenaciously to their own individual practice and makes them defend, as if their lives depend on it, any old way or custom they may have is more than the writer can tell.

Practical men have often sneered at the work of the efficiency engineer and with some excuse and maybe some reason, but if ever the efficiency engineer should want to get back at the sneering practical man, all he has to do is point to the tabulation herewith.

A Speedy Home-Made Drill Fixture

By H. E. Crawford

As our shop is a small job shop, it is only natural that we should get the job of drilling the holes in the brass cap shown at *A* in Figs. 1 and 2. As the holes

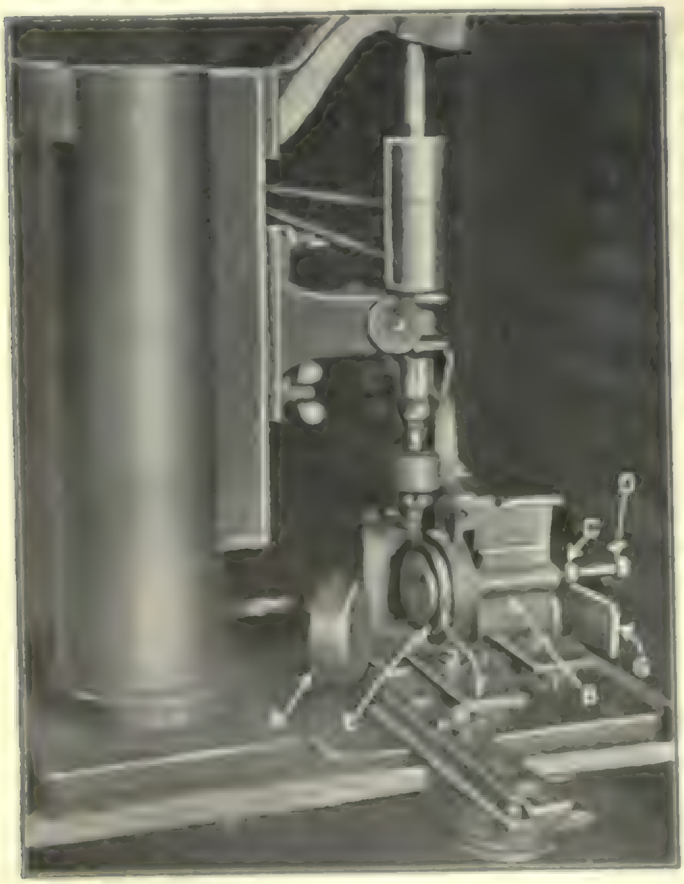


FIG. 1—REAR VIEW OF DRILLING FIXTURE

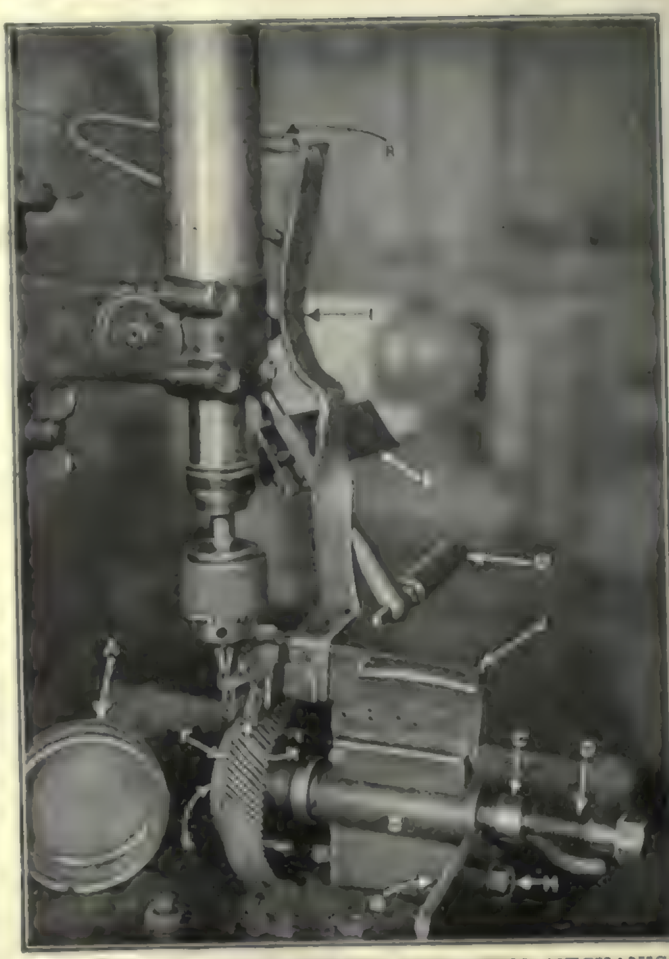


FIG. 2—FRONT VIEW SHOWING OPERATING MECHANISM

have to be evenly spaced and in practically perfect alignment, the foreman devised a semi-automatic fixture.

The casting *B*, Figs. 1 and 2, was bored to receive the shaft *C*, which in turn was drilled and tapped to receive the capscrew *D*. The plate *E* was then turned and drilled at three equi-distant points on the circumference, the holes extending through to the hole in the center of the plate. Then three pins similar to the one shown at *F* were slipped in the holes and the plate was attached to an old spiral gear which was used for an index plate. The end of shaft *C* was pressed into the gear and then assembled to the casting *B* by the simple process of slipping the shaft into the hole. It is held in place by the plate *G*, which is ground on the end so that it will slip into any one of the grooves shown. This plate is slotted so that the hole *H*, Fig. 2, will hold the shaft in place and yet allow it to be slipped back and forth for adjustment in another groove.

The screw *D* is long enough to project through the gear and into the plate *E*, and is tapered on the end so that when it is screwed in, it forces the pins *F* out. Plate *E* is turned to a fit for the brass cap, and when the screw *D* is screwed in, the pins are forced out, holding the cap in place. Withdrawing the screw allows the pins to release the cap.

Piece *I*, which is a strip of bar iron twisted to the shape shown, is riveted to the plate *J* and this is attached to the casting *B* by a screw which serves as a hinge. The small piece *M*, which has a pin on the under side that fits into the grooves between the gear teeth, is also held by a screw which acts as a hinge. This locates the piece for drilling, and is held down by the action of a small coil spring, as shown.

When the lever O is raised, the block P that is attached to it rides in the twist in the bar I, forcing it back and raising the piece M, thus dragging the pin over into the next groove. When the lever is lowered, the bar I is pulled forward by the spring R, and the spiral gear, together with the piece of work, is rotated the required distance. As the action of the lever is primarily to raise and lower the machine spindle, the whole operation is done in one movement. The action of rotating the work is accomplished before the drill enters the piece.

The brass cap is 3¼ in. in diameter, with a $\frac{1}{16}$-in. wall. The drill is a No. 53. Each cap contains 358 holes and we drill six caps per hour, a total of 2,148 holes per hour.

Some Modern Railroad Shop Equipment

By I. B. Rich

Just as an evidence that some railroad shops at least have modern shop equipment, I am showing a few illustrations from the New York, New Haven & Hartford Railroad shop at Readville, Mass. First is a large Landis grinding machine for piston rods and similar work and is used for truing worn piston rods instead of trying to turn or file them as is too often done. This method gets the rod round in the shortest time and without removing more metal than is necessary. The machine is shown in Fig. 1 set up with one of the worn piston rods in place for finishing and truing.

FIG. 1—GRINDING PISTON RODS

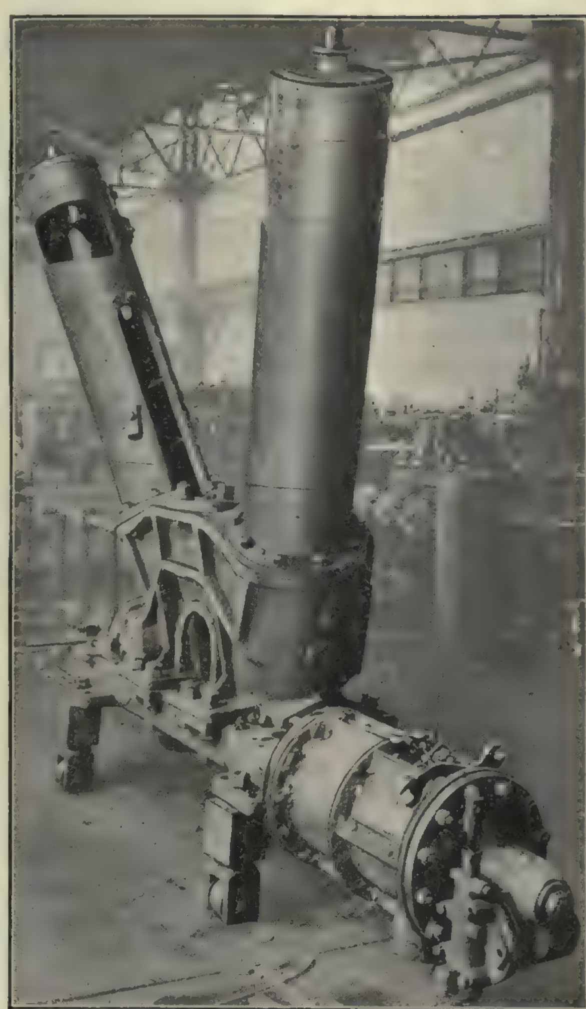


FIG. 3—A NEW REPAIR JOB—THE STOKER

Then comes the heat-treatment room, Fig. 2, for valve motion pins and other parts which require case-hardening or other treatment. It is well equipped with a gas furnace at the right, and with two American continuous gas furnaces for drawing the temper, at the left. Quenching tanks of different sizes and shapes can also be seen, all being provided with steam pipes for warming the water to the desired temperature. This is a very complete little department and has proved much more satisfactory than attempting such work in the blacksmith shop, as is very frequently the case.

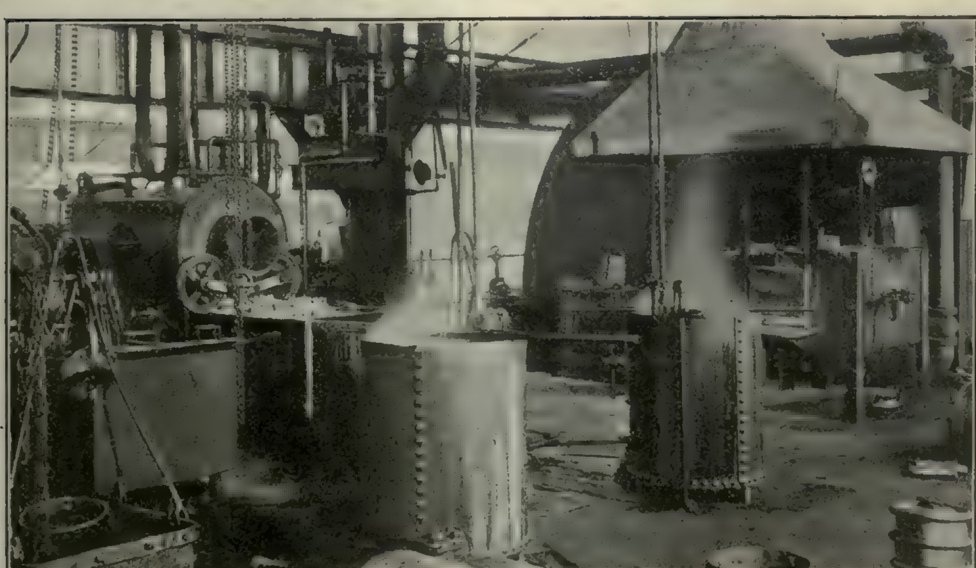


FIG. 2—HEAT-TREATING EQUIPMENT

A third evidence of modern equipment is shown in Fig. 3. This is a modern mechanical stoker for one of the big locomotives. The stoker is mounted on large casters for easy handling in the shop and is taken apart and assembled in the position shown. Mechanical stokers add a new piece of apparatus to the shop man's burden, but he is handling it, just as he handles everything else which comes along, as best he can.

How Much Do You Spend for Tools and Equipment?

By A. W. Field

At the end of a period or at the close of the year a question is often asked: "How much do you spend for tools and equipment?" The answer to this question is something that every superintendent and every manager wants to know at one time or another. But the question is somewhat like placing "the cart before the horse," for it would be more appropriate, from the standpoint of either expense or investment, if the question were put: "How much should I spend for tools and equipment?"

During the writer's experience his work has been in factories where equipment, especially small tools, were ordered at random or at the instigation of some department head without due investigation as to the merits of the expenditure. As an illustration, a foreman may have some difficulty with a piece of work which has been produced for some time past by more or less crude methods. He decides suddenly that a special tool, jig or fixture should be made to do a particular operation on this part, and at once places a requisition for the tool. The requisition is approved and the equipment made.

Upon investigating the conditions, it is found that the expenditure was not warranted for several reasons. Comparatively few pieces may be produced in a year's time, or to employ the special equipment may add time to the operation, (as often happens), and increase instead of decrease the cost. It may also be discovered that the accuracy desired can be obtained by the former "hand method" of producing and that the saving effected by adopting the new equipment may be nil, and therefore the chance to make the investment a paying proposition is eliminated.

In considering an expenditure, whether it be for $5 or $5,000, the natural question is "Will it pay for itself?" Let us suppose that an order is placed for a jig to do a certain operation. It is but natural for the men responsible for the expenditure to want to know first, what the cost is going to be; and second, in what length of time will the saving effected pay for the cost of the jig.

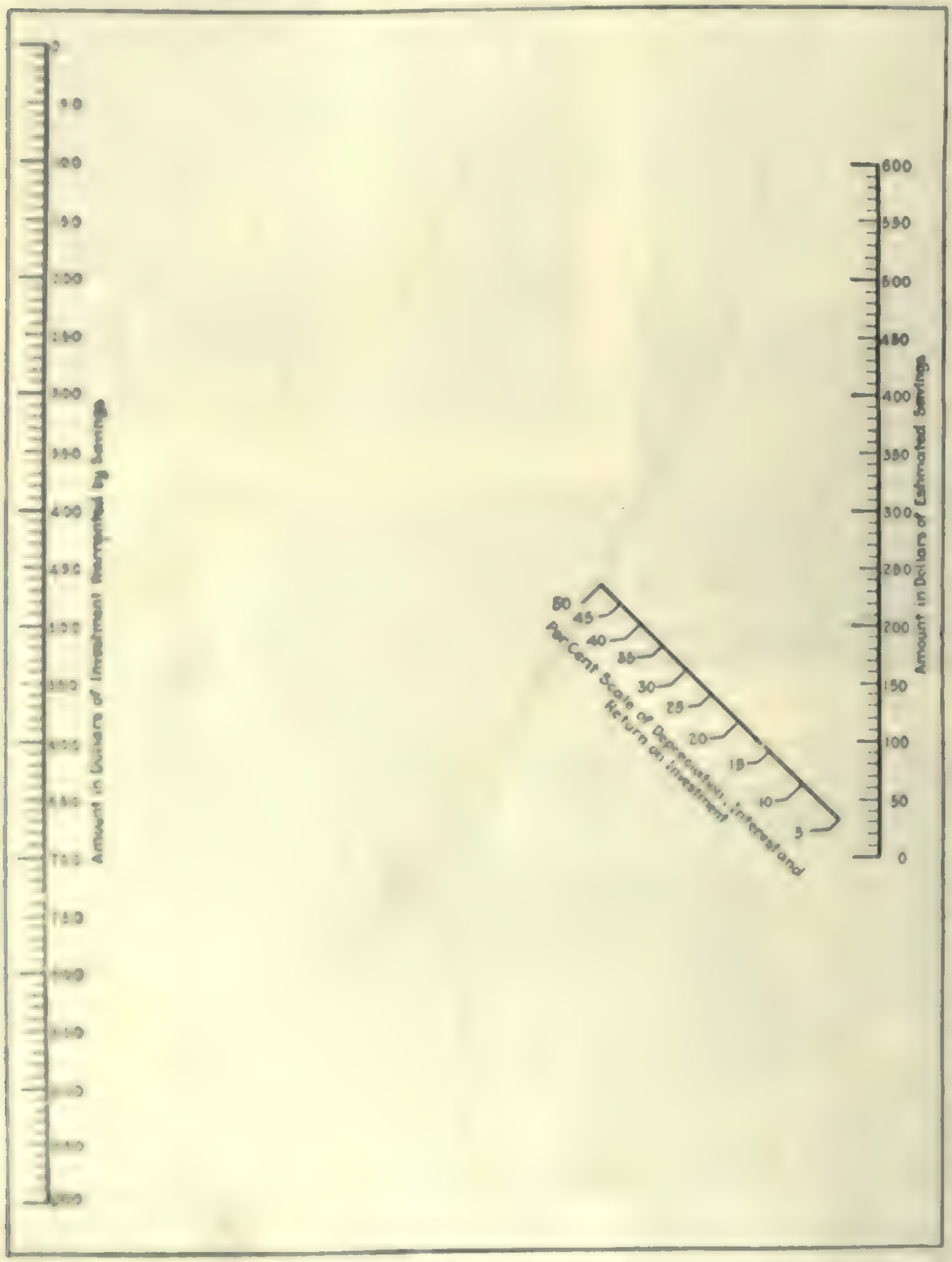


CHART FOR FINDING THE AMOUNT OF MONEY TO BE EXPENDED FOR TOOL EQUIPMENT WHEN THE ESTIMATED SAVING, DEPRECIATION, INTEREST AND RATE OF RETURN ON INVESTMENT ARE KNOWN

Let us assume that by the present method of doing the work it is costing an amount of money which can be reduced $200 per year, this being the saving estimated at the time the order is placed. Let us assume, also, that 10 per cent for depreciation and interest is to be considered and in addition a 15 per cent return on the investment is desired, as this particular tool is of such a character that its life will be comparatively short. The problem, then, is to determine what amount can be expended judiciously upon such a piece of equipment.

By referring to the accompanying chart, this amount is readily found. First, locate the estimated saving on the right-hand scale, which in this case is $200 per year. Next, locate the total per cent, in this case 25 per cent, on the diagonal scale and connect these points by a straightedge. On the left-hand scale at the intersection of the straightedge we find $810. This is the maximum amount that should be expended for the equipment upon the basis used. It represents the principal for which $200 is the interest per year at 25 per cent.

With a saving of $200 per year, it would, of course, require four years for the jig to pay for itself. If, in the meantime, the jig was for any reason disqualified for service, the loss would be proportionate to the useful life and service of the jig. In estimating the saving, therefore, it is important that the useful life of the equipment be considered as well as the possible replacement of the part for which it is to be used by another part, thereby making the equipment obsolete long before its allotted time.

The same reasoning applies to machinery and other equipment as it does to small tools and fixtures. Suppose, for example, that a part is now being produced in quantities at a cost of $1,000 per year. It is estimated that a saving of $500 can be affected by adopting a new machine. But in operating this machine the cost of operation will be $350 more per annum than the cost of operating the former equipment. The actual saving therefore is only $150. To this, then, must be added $100 for new tool equipment which is not available for use and must be made. The saving will then be decreased to $50.

Now, while the machine is special, it may be so constructed that it would have a possible life of 20 years, which is a long time. The depreciation and interest would not need to be as heavy as in the former case cited, but other conditions make it desirable that the machine pay for itself within five years' time.

The cost of the new machines, let us say will be $1,500. Therefore, on a saving of $50 per year, the machine would require 30 years to pay for itself! On the other hand, if we assume interest and depreciation at 8 per cent and a return on the investment of 32 per cent, we have a total of 40 per cent. Locating on the chart 40 per cent and $50 saving, we find that the expenditure warranted is only $125. It is obvious that, unless other conditions make a losing investment worth while, the outlay of $1,500 for the new machine would be unwarranted, if it is based upon a saving of only $50 per year.

In a great many shops and factories investments such as these are found and are usually known as "white elephants." A little consideration as to the probable saving, depreciation, interest and initial cost of the proposed new equipment would have indicated at once that such an investment or expenditure would not be a paying proposition and the "white elephant" would never have been born. In the present time of making the dollar go further and affecting economies wherever possible, the chart will serve as a ready aid in at least indicating in what manner new expenditures for equipment should be made.

Recessing Tool for Screw Machine—Discussion

By C. G. Spicer

Referring to the Editor's note, at the bottom of my article under the above title on page 76 of *American Machinist*, perhaps the fault was mine in that I may not have made the drawing clear.

When the tool is in position to cut the recess, it is in advance of the holder a distance equal to its own width, so that the chips easily clear themselves.

The comment shows me that *American Machinist* is alert, which I appreciate.

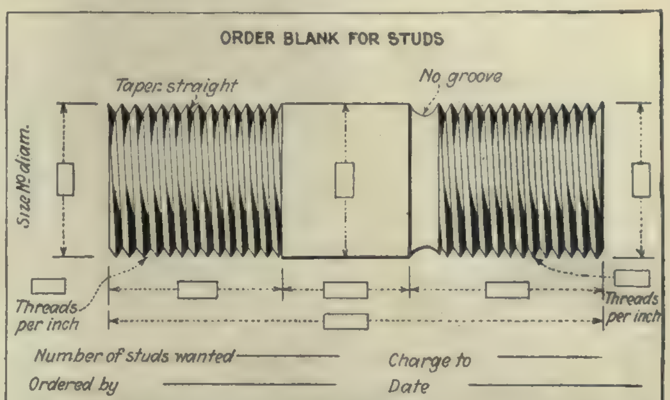
Railroad Shop Methods of Fitting Studs and Plugs

By F. M. A'Hearn

The article on page 553 Vol. 56, of *American Machinist*, more especially that part on page 555, illustrated by Fig. 12, showing the practice of the Southern Pacific Railroad shops in fitting boiler washout plugs, gives a simple and sure way of avoiding trouble in renewing washout plugs.

The writer has had experience with a similar method, differing, however, in the use of taps having a taper of 1 and 1½ in. in 12 in. instead of the taper of 1¼ in. as described in the article already mentioned. The 1½-in. taper brings the plugs to varying diameters in even steps of ⅛ in. each. This seems less complicated in sizing the plugs for threading.

A similar method may be used in the renewal of boiler studs. In this case the taps are made with a taper of ¾ in. in 12 in. and by varying the number sizes of



SAMPLE ORDER FORM FOR STUDS

Instructions: Fill in all blank dimension spaces with dimension wanted. Cross out word "no" if a cylinder head stud is wanted grooved. Cross out "straight" or "taper" as wanted. Where numbered boiler tap sizes are wanted, cross out "diameter" and fill in tap number. Give threads per inch.

Machine operator will not make studs if any space is not properly filled, so that he is shown exactly what is wanted.

the boiler fit ends of the studs in step sizes of $\frac{1}{16}$ in. each, the nominal diameters of the boiler threads are kept in even sixteenths. This practice tends to avoid confusion when a change from the regular one-eighth variations, common to locomotive studs, must be made on account of defective boiler threads requiring retapping.

As the renewal of studs in a locomotive receiving classified or general repairs may involve the use of studs having varying lengths of the same diameter, some with enlarged boiler threads, some with standard threads on either end, and others grooved for front cylinder head fastenings, an order blank or form similar to that shown in the accompanying illustration will be found useful. The blank spaces should all be filled in to furnish the machine operator with sufficient information to make what is wanted. It also sets aside the time-worn practice of placing the blame for all errors upon the machine hand by putting the responsibility for mistakes where it actually belongs.

The practice of "grooving" or "nicking" front cylinder head studs provides a means of protecting cylinder ends when front heads are forced loose from cylinders. Large locomotives equipped with steel cylinder heads require careful attention in this respect.

A Troublesome Milling Job

By J. C. Adams

The sketch herewith shows a job of milling which used to give me a great deal of trouble. The piece was cast iron and the thickness about $\frac{3}{16}$ in., never more than $\frac{1}{4}$ in. It was very springy and, no matter how many supports I put under it, it would chatter and

A TROUBLESOME MILLING JOB

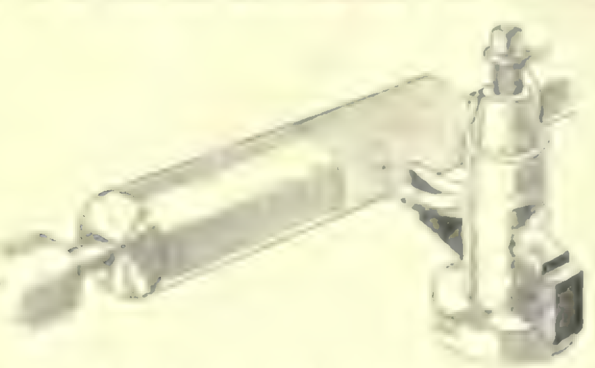
make a fearful noise. Of course, the finish was rough and even two cuts would not make it really smooth.

The other day I had an idea. I overhung the piece so that I could use a larger cutter. I had been using a $\frac{1}{2}$-in. end mill, and now I used a $2\frac{1}{2}$-in. shell end mill. I placed it so that the upper part of the mill did all the cutting. The result was surprising. The cut was taken without any chatter at all. The reason is simple and I don't understand now why I did not think of it sooner. With the small cutter, placed as it was, the pressure was downward and the piece was bent and would move up and down. With the large cutter, the pressure was horizontal, or nearly so, and there was no spring or bending. Of course with the larger cutter I had to slow down the spindle speed, but just the same the piece was milled quicker because I could use a much heavier feed, had to take one cut only, and did not need to fuss away a lot of time fitting pieces of wood and wedges under the work.

Another Way to Catch the Thread

By H. O. Turnbull

I read with interest the scheme for "catching" the thread by the "jump" method, published on page 970, Vol. 56, of *American Machinist*, and I am submitting



POINTER THAT INDICATES THE POSITION OF THE THREAD TOOL

herewith the method I use for the same purpose when there is no backing belt or thread dial on the lathe.

From a piece of sheet iron about $\frac{1}{8}$ in. thick I cut a pointer as shown in the sketch. This pointer I hold in the toolpost by catching the shank on top of the thread tool and under the toolpost screw, making sure that the point measures just 1 in. in advance of the point of the tool and enough higher so as not to interfere with the work.

This scheme has an advantage over the method mentioned in the previous article for the reason that it enables the operator to know positively whether or not the tool point is going to follow the previously cut thread; for when the carriage is run back for the new cut it is run far enough to bring the pointer over the end of the work before the nut is locked in. If, when the nut is closed, the pointer is not exactly over a previously cut thread the operator knows that the tool is not going to follow, and there is ample time to unlock the nut and make a resetting before the tool gets far enough along to spoil the work.

Single Key for Two Slot Widths

By Stephen McEvoy

In a recent issue of *American Machinist* Frank C. Hudson showed a design of key for fixtures to accommodate the varying width of T-slots in milling machine

FIG. 1—A DOUBLE PURPOSE T-SLOT KEY

and other tables. The method shown, however, requires a separate key for each slot.

The key illustrated herewith is simpler and requires but one key for two sizes of slots. We take a piece of cold-rolled steel $\frac{3}{4}$ in. square by $\frac{1}{2}$ in. thick. Two sides

FIG. 2—(LEFT) KEY IN $\frac{3}{4}$-IN. T-SLOT. (RIGHT) KEY IN $\frac{5}{8}$-IN. T-SLOT

are milled so as to leave $\frac{5}{8}$ in. width for half the depth, or $\frac{1}{4}$ in. This block can now be used with the narrow or $\frac{5}{8}$-in. side parallel with the slot, and it fits a $\frac{5}{8}$-in. T-slot. Or, it can be turned 90 deg. so that the full width fits into a $\frac{3}{4}$-in. slot. The general appearance is shown in Fig. 1, while Fig. 2 gives more details.

Bi-chromate of Potash as a Quenching Medium

By John Livie

In hardening some shell reamers we experienced trouble from checking in the quenching bath. On advice, we made up a bath consisting of 1 lb. of potassium bi-chromate to about 40 gal. of water, which stopped all the trouble at once. Can any of the readers tell me in what way the chemical affected the steel?

EDITORIALS

Holding Up the Machine Tool Builder

WE LIKE to think that business ethics has improved greatly during the past decade, but once in a while we get a jar that makes us wonder how far some managers of big corporations have advanced beyond the cave-man type. The chief engineer of a big corporation enlisted the aid of a well-known machine-tool builder to improve his product and reduce his cost.

The agreement was that a new machine should be designed and that if it worked satisfactorily a dozen machines should be ordered at a price which would cover the cost of designing and development. Further machines would also be required, about a hundred in number, and these were to be supplied at a lower price. A perfectly straightforward agreement, made in the presence of four or five people.

The machine-tool builder went to work and built a machine which more than met all requirements. The company's own engineers pronounced it O.K. in every way and the way seemed open for completing the order for the entire lot. In the meantime, however, the chief engineer who ordered the machines resigned and the manager of the company refused to carry out the agreement. He offered to buy the first machine and perhaps a few more, at the minimum price agreed upon for the hundred. This price, it will be remembered, did not include development costs which had been taken care of in the previous order for twelve.

Fortunately for the machine-tool industry, this particular builder had two very important qualifications, a backbone and a bank account—and he promptly told the alleged big business man where to head in. Fortunately again, the machine can be utilized for other classes of work and if the company which ordered it ever get any the full price will be paid.

There are too many cases of this kind where the machine-tool builder has been made to stand the cost of developing new machines for the builders of various machinery. Customers who demand unfair advantages like these are undesirable in every way and the machine-tool builder who can and will refuse to concede to unjust demands is doing a great work for the industry. When concerns with a reputation for unfair dealings find it difficult to secure machine tools they may realize that it pays to play the business game on the level.

What's the Matter With the Machine Tool Business?

THE employment manager of a good sized machine tool shop came into the office of the works manager the other day and said, "What's the matter with the machine tool business anyhow? Here is a list of about twenty good men who have quit us within a month, in the face of improved business too, to go into something else that pays better wages or offers more opportunities.

"Funny part is only a few are going to other mechanical lines. The automobile shops used to take even our poor men and pay 'em double what we could. But these men are going into laundries, grocery stores, insurance business and all sorts of work that ought not to pay nearly as well as working right here in our shop. A good mechanic has to have more real knowledge and training than any kind of worker I know, a lot more than those in any of the lines I have here on my list.

"Some, of course, are making a mistake and will come back to this or some other shop later. But the majority of them will make good and wish they had gone before. And it isn't saying much for the machine tool business either."

The employment manager was right. Machine tools are the foundation of every industry using machines of any kind. For the sake of the future of the country itself the machine tool industry should have the best workmen and the best designers in the land. To do this it must be the most attractive industry to the right kind of men, both as to working conditions and remuneration.

The automobile and other industries have pointed out the way, yet unfortunately, the very industries which have been made possible by machine tool development, are too often unwilling to pay a fair price for the machines they buy. The cost of developing these machines does not secure proper consideration. In one particular instance the builder of a machine lost several thousand dollars in this way while the purchaser saved enough in three months to cover its cost to him.

Neither exorbitant prices nor excessive profits have any place in any industry. But the users of machines should realize that the industry on which our future development depends should have more consideration than has been the case in too many instances. Not so much for the machine tool industry itself as for those industries which are dependent on it, and for the country as a whole.

Just Suppose

JUST suppose all union labor should adopt a new way of paying their leaders, giving them an increase of salary when their men had obtained higher wages, a reduction when the wages of the men had been reduced and no salary at all when there is a strike, how many strikes would there be in ten centuries? Think of the amount of real hard work the leaders would do to get their men a raise. Think of the desperate efforts they would make to prevent a cut. But not by striking. Heaven forbid. Think of all the tricks the leaders would learn to accomplish their object, whereas now they know only one. Maybe they know more, but anyhow they *use* only one. Think how everyone would work up, and perfect and polish up his own union, so as to get a higher price for his ware. Think of all the union leaders' weeklies, monthlies and quarterlies to spread and promote scientific union management.

But no, this will never happen, it is not practical. We should not expect the union leader to introduce such revolutionary methods, and if they don't, who will? The men? What have they to say about such matters?

No, this will never come to pass, but—

Just suppose.

Shop Equipment News

Landis Heavy-Duty Roll Grinding Machine

A large heavy-duty cylindrical grinding machine for finishing all types of hot and cold mill rolls is now being marketed by the Landis Tool Co., Waynesboro, Pa. The accompanying illustrations show one of these machines finishing a 16,000-lb. roll in the plant of the Aluminum Company of America, Marysville, Tenn.

The machine is entirely self-contained and is driven by three separate motors. One motor, shown in Fig. 1, drives the work and is mounted on the bed of the machine and directly connected to the headstock; one is mounted on a carriage traveling on a track at the back of the machine for driving the grinding wheel, as shown in Fig. 2, and a small motor is directly connected to the water pump. All the motors are controlled by means of push buttons on the operator's platform.

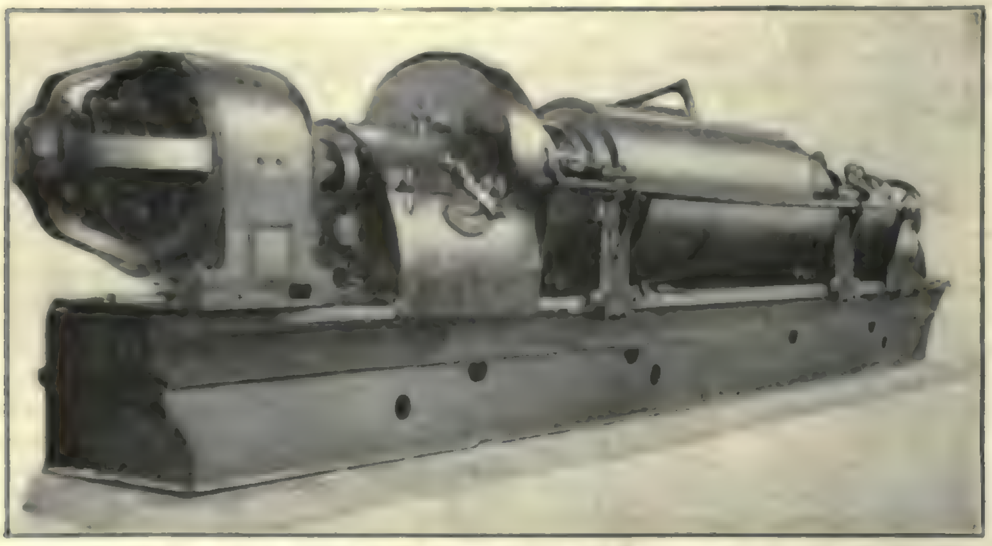


FIG. 1—LANDIS HEAVY-DUTY ROLL GRINDING MACHINE

The operator's platform is mounted on the grinding wheel carriage so that the operator has a clear view of the wheel and the work at the point of contact, which view cannot be obtained if the machine is operated from the front. The carriage traverse and reversing mechanism are all contained in one unit mounted on the grinding wheel carriage within easy reach from the operator's platform. All gears are made of chrome-nickel steel and run in a bath of oil. The main drive on the grinding wheel carriage is through a worm and rack which gives smooth operation, while provision has been made for a tarry at the point of reversal. Provision is also made for a power movement of the grinding wheel base for moving the wheel rapidly toward and away from the work.

A special feature embodied in the machine is an attachment for grinding the periphery of the roll either concave, convex or straight, as desired. The amount of crown or concavity is varied by a simple system of gearing at the back of the machine. The gearing can be engaged and disengaged by means of a lever on the operator's platform.

The roll supports furnished with the machine are of the two-bearing type, which permits grinding the journal without changing the position of the roll, so as to get the body of the roll and the journal concentric. The bearing blocks are adjustable in the roll supports so as to accommodate journals of different diameters without need of different bearings.

It is stated that under actual operating conditions the machine has removed as much as 7 cu.in. of chilled iron per minute, and the accuracy and sensitiveness have been maintained throughout the work. The machine is built in standard 20-, 30- and 40-in. sizes in any required length. Its construction adapts it to surfacing all sorts of large rolls of the type just described.

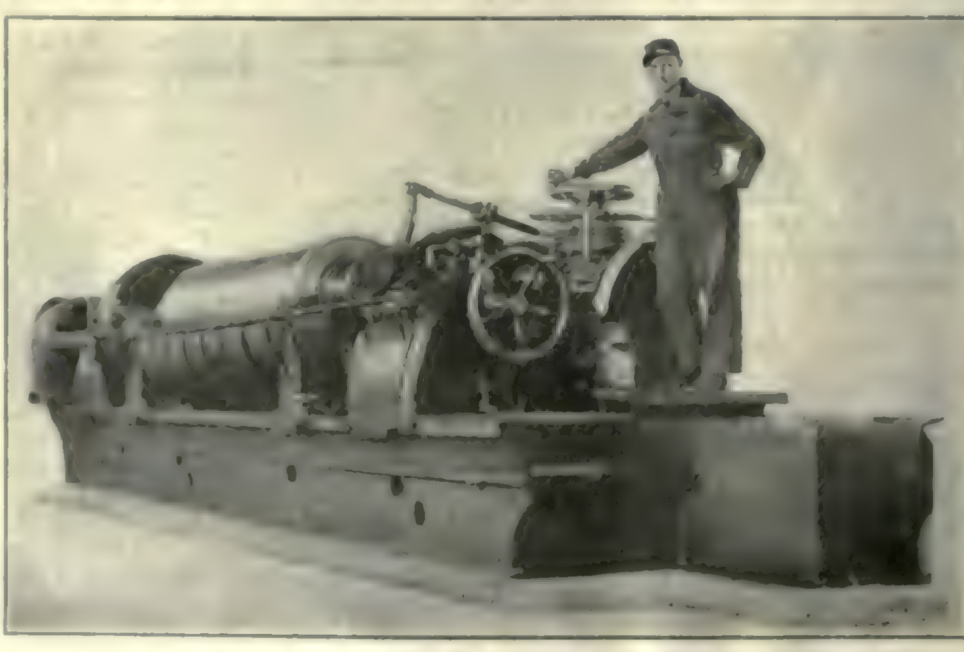


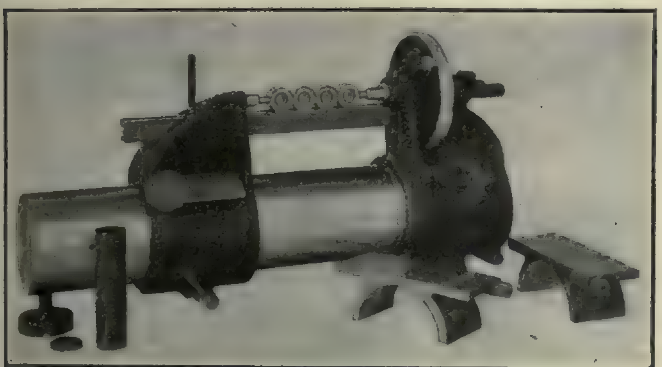
FIG. 2—OPERATING CARRIAGE ON LANDIS ROLL GRINDING MACHINE

Pratt & Whitney "Super-Micrometer"

The super-micrometer brought out by the Pratt & Whitney Co., Hartford, Conn., is really a bench measuring machine. It has capacity up to 8 in. in diameter, though its direct measuring capacity is only 0.500 inch.

It consists of two measuring heads, one with a stationary spindle and anvil, the other with a spindle which can be moved in and out by means of a large graduated wheel. The amount of spindle movement is 0.500 inch.

The wheel is not moved by hand but by a very small round belt which is engaged by the knurled knob shown. This knob has a smaller knob attached to it, which permits spinning it with the fingers so as to obtain rapid adjustment of the spindle. The final adjustment is made by turning the large knob very slowly. The belt is for the purpose of measuring always with the same amount



"SUPER-MICROMETER" MEASURING MACHINE

of pressure, by continuing the rotation of the knob until the belt slips. That the belt may be tighter at one time than at another has no effect on the accuracy because the machine is set up under the same conditions under which the measuring is done.

This setting up is accomplished by the standard inch blocks, which are machine-lapped by modification of the Hoke method and are accurate within five millionths of an inch. These blocks should be kept in a casing or pocket at the rear of the headstock provided for that purpose. As many inch blocks as required, but not more than eight, are set side by side on a bar which is slightly channeled out for convenience in holding them and which rests between a slot in the tailstock and a pin at the front of the headstock. This arrangement insures that the blocks will lie with their horizontal diameters in line with the centers of the spindles.

When the tailstock is brought up against the blocks it is clamped on the cylindrical bed of the machine, after which an arm, called the "zero arm," is swung around until a mark comes opposite the zero mark of the dividing wheel. If, as in the illustration, there are four inch blocks and the spindle is as far back as it will go, then it is possible to measure anything from 4 in. down to 3½ in. With the spindle entirely forward, it is possible to measure from 4 in. up to 4½ inches.

The marks on the spindle are 0.050 in. apart and the figures are given by 0.100 in. There are 500 divisions on the dividing wheel, of which every tenth is provided with a figure. These divisions are $\frac{1}{32}$ in. apart and each one denotes 0.0001 in., so that the figures read direct in thousandths.

The channeled bar may be reversed for supporting flat work and in addition two tables are furnished which can be laid on the bed to support larger work.

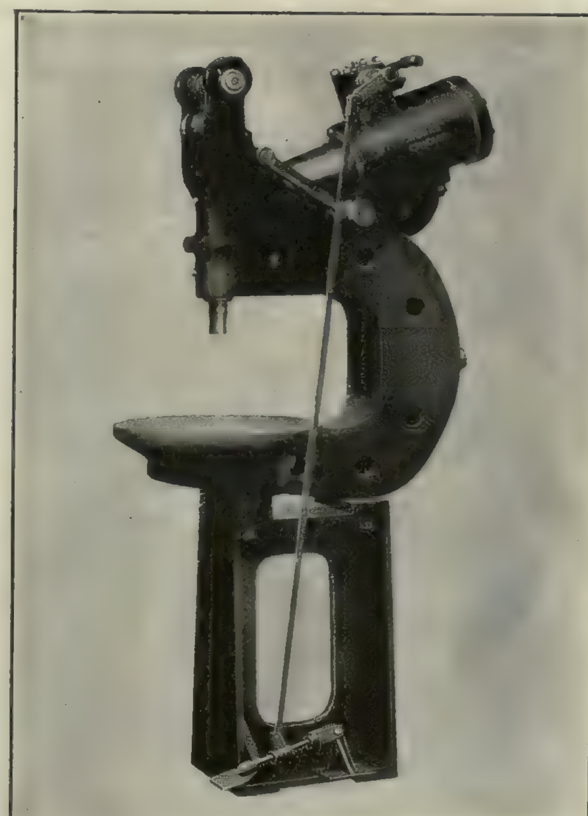
Hanna Pneumatic Toggle and Lever Press

A general utility press operated by means of compressed air or steam has just been placed on the market by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., the power mechanism of the machine being similar to that used on the riveters formerly made by the concern. The accompanying illustration shows the type of press employed for compressing or packing carbonizing material in pots around parts such as gears and forgings to be casehardened.

The press can be arranged with various forms of platens or work-supporting structures, so as to make it adaptable to straightening, bending, forcing, marking, embossing, coining, forging, briquetting, multiple riveting, and such operations. The machine is made in tonnages of 15, 20, 30, 50, 70, 80, 100, 125, 150 and 200. In all sizes it is portable in the sense that it can be moved without the need of moving any auxiliary equipment. The machine requires only a small floor space.

The die is mounted on an adjusting screw. The valve controlling its manipulation can be operated by either hand or foot. The length of stroke can be adjusted. The connecting mechanism between the die and its actuating piston consists of a combination of a toggle and lever. The piston imparts to the die a gradually decreasing speed and an increasing pressure for each unit of travel of the piston during the first part of its stroke. The last portion of the stroke of the ram is made at practically a uniform pressure. The first portion of the stroke, or the increasing pressure part, is from 1¾ to 4⅝ in. long, depending on the rating of the machine. The last portion, where uniform pressure is held, is from ⅜ to 1⅛ in. long.

The machine is well adapted to bending and straightening operations, since the pressure on the die builds up in the same ratio as the air pressure placed on the pis-



HANNA PNEUMATIC TOGGLE AND LEVER PRESS

ton. It is possible by throttling the air to bring on the work just sufficient pressure to deflect it the desired amount, and then to rapidly release the pressure. If the die travel is stopped by the work at any point within the uniform pressure stroke, the pressure on the die is a known predetermined amount in proportion to the pressure in the air line. This line pressure can be controlled by a pressure-regulating valve to within 5 per cent.

When used for marking, embossing, coining and forging uniformity of results can be obtained, since the pressure can be adjusted and maintained for each job. The regulating valve can be set, and the manipulation of the operating valve and variation in thickness of the stock within the limits of the length of the uniform-pressure stroke, do not affect the pressure obtained on the work.

Hendey "Junior" 12-Inch Lathe

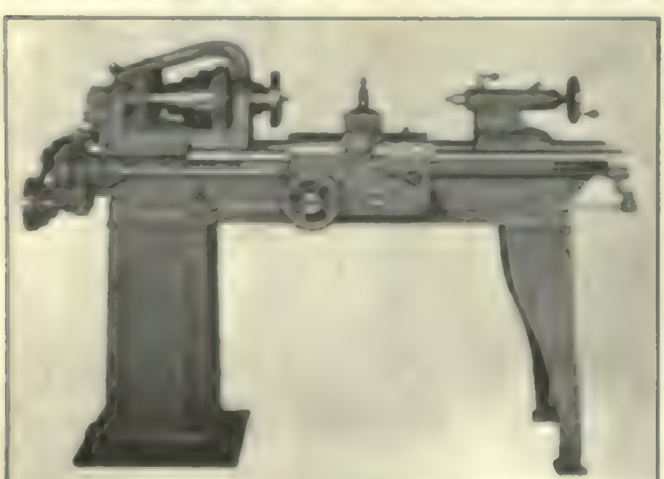
The Hendey Machine Co., Torrington, Conn., has brought out a lathe to be designated as the "Junior." The tool is intended for light manufacturing purposes, for small shops and for vocational school service, where a thoroughly practical and rugged tool is wanted, but without the full complement of attachments and features that have come to be recognized as part of a regular toolroom lathe.

This lathe is belt-driven to a four-step cone, as shown in the accompanying illustration, is provided with change gears instead of the gear-box for screw cutting, and the feed may be obtained either through the change gears or through a feed belt running over a three-step cone. The lead screw is 1 in. in diameter and has 6 threads per inch. Threads from 2 to 36 per in. may be cut. As in the regular Hendey lathe, the carriage traverse is stopped, started, or reversed by the movement of a lever on the apron.

The main spindle runs in tapered bearings, $1\frac{7}{8}$ to $2\frac{3}{8}$ in. and $1\frac{11}{16}$ to $2\frac{1}{16}$ in. in diameter, respectively, the bearings being provided with means to compensate for wear. The spindle nose is 2 in. in diameter, with an 8-pitch thread. There is a through hole $\frac{11}{16}$ in. in diameter. Quill back-gears provide a 10.4 to 1 ratio of reduction. With the two-speed countershaft furnished, 16 spindle speeds are available.

The carriage has a bearing of $16\frac{3}{8}$ in. on the shears. It is fitted with power crossfeed and compound rest. The toolpost takes 1 x $\frac{1}{2}$-in. tool shanks. The actual swing over the shears is $12\frac{1}{2}$ in., and over the carriage $7\frac{1}{4}$ in. The maximum distance between centers with the 5 ft. length of bed is $27\frac{1}{4}$ in. The lathe can be regularly furnished with 4, 5, or 6 ft. bed length, or longer upon order.

The equipment includes a two-speed countershaft, large and small faceplates, center rest and all necessary wrenches. All attachments to the standard 12-in. Hendey lathe are applicable to this one. A cabinet leg under the headstock end of the bed is fitted with shelves and partitions, providing a place to keep change gears, wrenches and accessory parts.



HENDEY "JUNIOR" 12-INCH LATHE

Changes in Reeves Centerless Grinding Machine

The centerless grinding machine made by the Reeves Pulley Co., Columbus, Ind., has recently undergone several changes in design, the latest model being shown in Fig. 1. A special feature of the machine is the "drop-in" work rest which makes it possible to grind either shouldered, tapered or straight work.

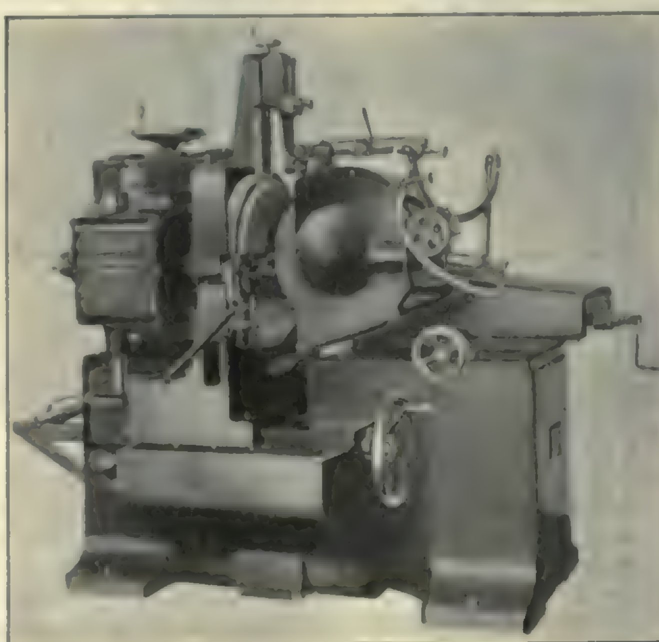
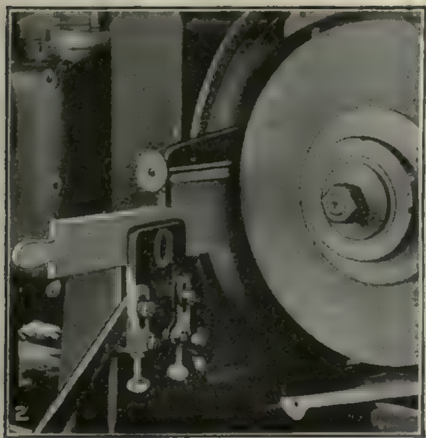


FIG. 1—REEVES CENTERLESS GRINDING MACHINE

The rest consists of a steel bar with a hardened and ground edge which supports the work in a true horizontal position between the two wheels. On top of the bar there is an extended slotted guide, leaving an opening just large enough to receive the work to be ground. On the sides of the bar are guide walls which hold the work in a straight line and exactly central between the two wheels. A stop is provided which may be adjusted for different lengths of rolls. The construction allows the rolls to extend between the wheels just far enough to grind the roll and not touch the shoulder.

The end of the guide, with a motor valve in position for having its stem ground, is shown in Fig. 2. The guide is mounted on rollers, so that it can be drawn forward, raised to permit the work to be entered lengthwise above the grinding point for a distance of 5 in. or less, and lowered to the grinding position. In this way the piece is centered and ground concentric throughout its entire length. The work rest, being mounted on rollers, can travel with the work; but the



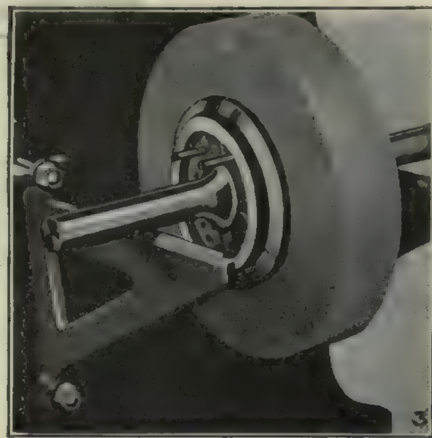


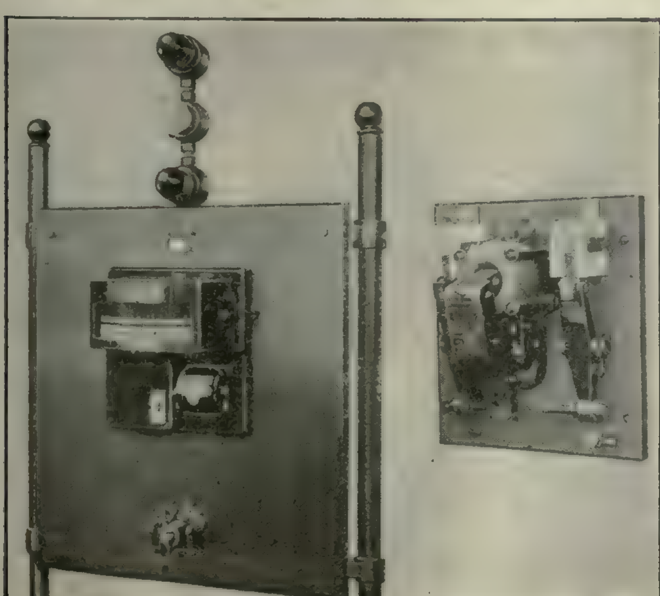
FIG. 2—GRINDING A MOTOR VALVE STEM. FIG. 3—BALANCING A WHEEL

drop-in method makes a convenient way to grind shoulder work such as valve stems and shackle bolts. Tapered work can also be ground on the drop-in work rest. The diamond dresser has an adjustment for obtaining any degree of angle desired to make the proper taper.

Another feature of the machine is the balancing ways and arbor for grinding wheels. It is essential that the wheel be in fairly accurate balance, so an easy method of balancing is provided. Holes are drilled in the chuck just within the bore of the wheel. Balancing pins are furnished which may be placed in the holes just opposite the heavy spot, so as to secure an accurate balance of the wheel. Permanent balancing ways are a part of the regular equipment, and are bolted to the base of the machine. Fig. 3 shows both the pins and the ways. A tapered arbor which fits the chuck is also furnished for use when balancing the wheel.

Hoskins Automatic Temperature Regulator

An apparatus for controlling the temperature of electric, oil or gas furnaces automatically has recently been placed on the market by the Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich. The temperature of the furnace can be held within limits of plus or minus 10 deg. F. The control mechanism automatically operates every 30 sec. to test the temperature.



HOSKINS AUTOMATIC TEMPERATURE REGULATOR

The regulator can be most easily adapted to use on electric furnaces, as the instrument operates a small relay that, in turn, actuates the main power switch, which is of the magnetic type. The complete equipment for use with an electric furnace is shown in the accompanying illustration. Signal lamps and fixtures, a relay, the magnetic control switch and the instrument itself can be provided mounted on a slate panel. The control switch is shown more clearly in the small view at the right of the illustration.

When the furnace is operating within 8 deg. F. of the desired temperature, a white signal light is lighted at the top of the board. If the temperature goes below this limit, a green light appears, while if it goes above, a red one is lighted. The mechanism operates the control switch, so that the error is corrected before it has deviated more than 10 deg. from the desired temperature. Thus the control is positive and automatic.

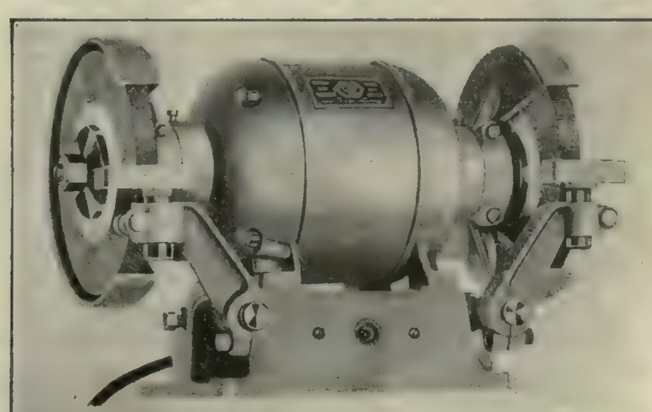
The control mechanism of the regulator is operated by a small motor, which can be supplied for use on either a.c. or d.c. lines of 110 to 220 volts. The case of the instrument is made of cast iron and has a black enamel finish. Its over-all size is 12x10½x8¾ in., and its net weight 27 pounds.

Black & Decker 8-Inch Electric Grinder

A small electric bench grinder carrying wheels 8 in. in diameter and ¾ in. wide, and driven by a ½-hp. motor, has recently been placed on the market by the Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md. The motor is not of the universal type, but is intended for operation on either direct current or alternating current of 40 or 60 cycles. It can be furnished for voltages of either 110 or 220.

Large bearings carry the combined motor shaft and spindle. The no-load speed is 3,600 r.p.m. The machine is furnished complete with two abrasive wheels, two wheel guards, two adjustable tool rests, a toggle switch in the base, and 5 ft. of electric cable fitted with an attachment plug.

The accompanying illustration shows the grinder arranged for mounting on a bench, although a pedestal can be furnished so that it may be stood on the floor. The net weight of the bench grinder is 75 pounds.

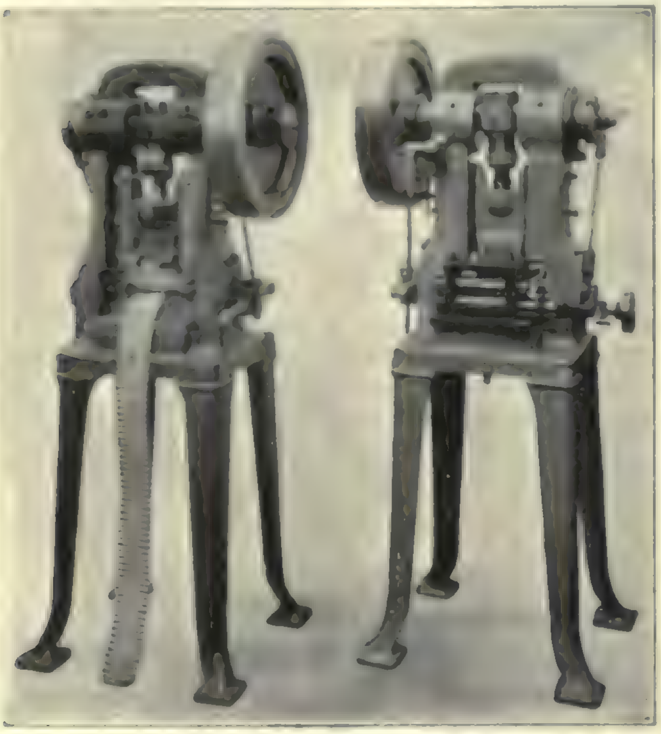


BLACK & DECKER 8-IN. ELECTRIC GRINDER

Dover Pillar Punch Press

The accompanying illustration shows front and rear views of a small pillar punch press made by Geo. W. Dover, Inc., Providence, R. I. The press was developed primarily for work on radiator cells, a strip of which can be seen in the view at the left of the illustration, although it is adapted to any sort of sheet-metal work within its capacity. If desired, it may be equipped with a roll feed.

The stroke of the ram is 1¼ in., and the vertical adjustment is 2 in. The maximum distance from the ram to the bed of the press is 5 in., the dimensions of



DOVER PILLAR PUNCH PRESS

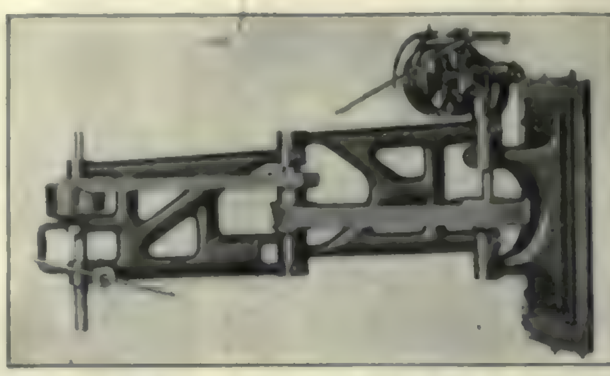
the bed being 9½x11 in. The machine is driven by means of a 3-in. belt on a flywheel 18 in. in diameter and having a solid web. With the legs it weighs 700 lb. The floor space required is about 36x40 inches.

Hammond Wall Bracket Drill

A light swinging drill for attachment to a wall or post, and that reaches any point within a radius of 3½ ft. of its fastening, has recently been placed on the market by the Hammond Manufacturing Co., 6545 Carnegie Ave., Cleveland, Ohio. The machine has a capacity in steel of ¾ in., and is especially adapted to work on parts for electrical instruments, switchboards and stoves.

The drill is belt-driven through tight and loose pulleys 8 in. in diameter and carrying a 2-in. belt. The countershaft is geared to the upright shaft, from which two belts carry the drive to the spindle. The countershaft yoke can be set to any position to conform to the overhead drive. It is provided with a belt-shifting lever.

The two arms swing on stationary sleeves, so that the pressure does not come directly on the driving shafts. The spindle is equipped with ball thrust bearings, and has a No. 2 Morse taper hole and a traverse of 2½ in. The spindle quill is of steel with bushed bear-



HAMMOND WALL BRACKET DRILL

ings and the rack cut from the solid. A spring counterbalance is provided.

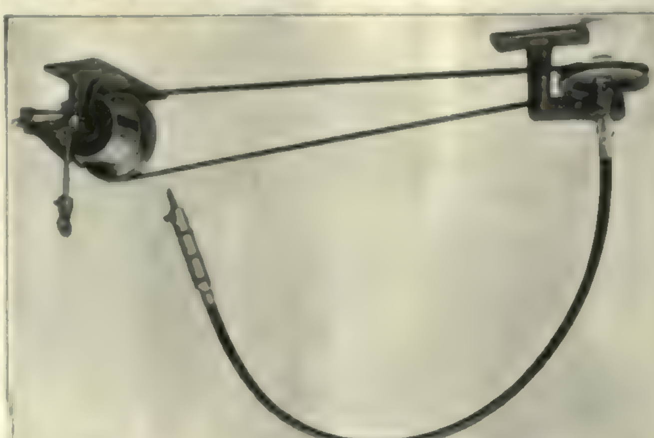
The tight pulley ordinarily runs at 400 r.p.m., and two speeds of the spindle of 500 and 1,300 r.p.m. are provided. The spindle pulley is covered with a belt guard. The shipping weight is 250 pounds.

Hergi Type NK4S Flexible-Shaft Outfit

The flexible-shaft outfit shown in the accompanying illustration is a recent product of the Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn. The outfit is intended primarily for driving screws, as in the manufacture of radio equipment. It is arranged primarily for over-head mounting, but can be secured to either the bench, wall or ceiling. When the screwdriver is employed in the vertical position, the bracket is ordinarily mounted on the ceiling; but for horizontal work, it can best be mounted on the wall. In this way, the flexible shaft can be kept quite straight while the work is in process.

The counter-shaft is equipped with tight and loose pulleys and with a lever-operated belt shifter for moving the belt from one pulley to the other. A round leather belt transmits the power to the bracket carrying the flexible shaft. For speeds from 150 to 750 r.p.m. the swivel connection where the shaft joins the bracket is equipped with plain hardened and ground steel bearings. For high speeds, however, in conjunction with the ball-bearing hand piece such as used for grinding purposes, a ball-bearing swivel connection can be furnished.

The style of flexible shaft and hand piece needed to suit the work can be provided. The finder sleeve can be furnished to fit the screw that is being driven.



HERGI OVER-HEAD FLEXIBLE-SHAFT OUTFIT

News Section

Steel Treating Society Elects Officers

At the recent election of the American Society for Steel Treating, the following officers were elected for the ensuing year: President, T. D. Lynch, research engineer, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.; second vice-president, W. S. Bidle, president, W. S. Bidle Co., Cleveland, Ohio; secretary, W. H. Eisenman, 4600 Prospect Avenue, Cleveland, Ohio; director, S. M. Havens, assistant treasurer and manager, Ingalls-Shepard Division, Wyman Gordon Co., Harvey, Ill.

The board of directors of the society will be composed of the newly elected officers and the following: First vice-president, R. J. Allen, metallurgist, Rolls Royce Co. of America, Springfield, Mass.; treasurer, J. V. Emmons, metallurgist, Cleveland Twist Drill Co., Cleveland, Ohio; director, J. J. Crowe, metallurgist, Philadelphia Navy Yard, Philadelphia, Pa.; director, A. E. White, past-president, director engineering research, University of Michigan, Ann Arbor, Mich.; director, F. P. Gilligan, past-president, secretary-treasurer, Henry Souther Engineering Co., Hartford, Conn.

The new officers will begin their duties at the close of the annual convention of the society, which will be held at Detroit Oct. 2 to 7 at the same time as the International Steel Exposition.

Calvin W. Rice Goes to Rio Exposition

Appointment of Calvin W. Rice, secretary of the American Society of Mechanical Engineers, as official delegate to the Engineering Congress to be held in connection with the International Exposition at Rio de Janeiro, has been announced at the national headquarters of the society in New York City.

Mr. Rice, who goes as the emissary of organized engineering in the United States, and who for purposes of representation at the Congress has been elected an honorary vice-president of the Society, will sail from New York Aug. 23 on the steamship Pan-America, which will convey Secretary of State Charles E. Hughes and his party to the Brazilian capitol.

Mr. Rice's journey was called by officials of the Society the opening of a new chapter in international relations among engineers. For many years, it was stated, this Society has been active in laying the groundwork of a close union of thought and effort among the engineers of the world as a part of an elaborate plan of public service which is being gradually linked to the technical activity of the Society, and which, through a national network of local sections, professional divisions and administrative committees, is enlisting the co-operation of nearly 200,000 members in every State. From the Rio Congress engineers look for results which will give to Pan-American ideals new meaning and vitality. The work of this Congress, it was said, is another phase of the world-wide engineering movement sponsored in London by Sir Robert Hadfield, in Paris by Eugene Schneider, head of the famous Creusot works, and in Italy, Czechoslovakia and other European nations by leading engineers and government officials.

Machine Tool Exhibit in New Haven

Under the combined auspices of Yale University and the Connecticut section of the American Society of Mechanical Engineers, a machine tool exhibition will be held in the Mason Laboratory of the university, New Haven, Conn., Sept. 21, 22 and 23.

Several exhibitions of machine tools have been held in various parts of the country in the past few years but there has been no concentrated effort to bring them to the attention of the general public as is being done in this case. Yale University appreciates the courtesies extended its students interested in mechanical engineering by the manufacturing plants of Connecticut and New England and has generously offered the use of the Mason Laboratory for the exhibit. This offer by Yale made it possible for the Engineering Society to carry out a long felt wish and the exhibit should prove of interest not only to the shop superintendent, purchasing agent, master mechanic, but to the general public.

Students of Sheffield Scientific School get considerable practical experience on machines and tools on their tours of nearby manufacturing plants, and many makers of machines and machine tools in order to facilitate the work being done by Yale send demonstrators from time to time to explain the workings of their instruments, etc., and out of those demonstrations came the idea of the exhibit.

Mason Laboratory has unusual facilities for the handling of such an exhibition as this, in fact it seems to have been erected for just this purpose. It has a ten-ton crane and a number of smaller ones to move machines to their proper places, lecture rooms equipped with motion picture apparatus, wide hallways and plenty of floor space. There will be no cost to the manufacturer to show his goods and there will be no admission charged to those who wish to view the display. An opportunity to display small machinery and tools will also be afforded.

Kenneth F. Lees, 9 Hillhouse Ave., New Haven, Conn., is chairman of the executive committee which is responsible for the exhibit which is being held in connection with the Fall meeting of the Connecticut section of the American Society of Mechanical Engineers. No meetings are held in the Summer and through the exhibition it is expected that this meeting will be more on the order of a convention.

Greenville to Get New Steel Plant

A steel plant complete in all departments, costing $2,500,000 to erect and equip, to be known as the Greenville Steel and Iron Co., is to be built at Greenville, Pa., and put in operation next spring for the manufacture of alloy steels.

The backers of the new company propose building one 500-ton blast furnace, four 60-ton open hearths and one 10-ton open hearth for experimental and analytical work, a steel foundry, four rolling mills and a cold drawing mill. The proposed output is to be 165,000 tons of steel, 182,000 tons of pig iron, of which the plant expects to use 110,000 tons, the balance to be disposed of to other mills, and 12,000 tons of electrical steel castings. The rolls will be electrically operated and the backers expect to build their own power plant with a capacity of 15,000 hp.

The officers of the new company will be Colonel H. P. Bope, for many years connected with the Carnegie Steel Co., president; H. B. McConnell, formerly consulting engineer with the Carnegie Steel Co., managing director, and A. H. Davies, one of the best known open hearth men in the country, general superintendent.

The plant will be located south of Greenville, where 35 acres of land have been secured with direct rail connections with the Bessemer, Pennsylvania and Erie Railroads. General sales and executive offices are to be located in Greenville.

International Chamber of Commerce to Meet in Rome

Announcements have just been sent out for the second general meeting of the International Chamber of Commerce which will be held in Rome, Italy, March 18-24, inclusive, 1923.

The present indications are that there will be from two to three hundred American business men in attendance at this meeting. Already a number of prominent business men have made reservations on the S.S. Caronia, which has been chartered for the trip, among them being the following:

A. C. Bedford, chairman of the board, Standard Oil Co. of New Jersey; Julius H. Barnes, president, Barnes-Ames Co., New York; John H. Fahey, Boston, Mass., director, International Chamber of Commerce; Joseph H. Defrees, Defrees, Buckingham, and Eaton, Chicago; William Butterworth, president, Deere and Co., Moline, Ill.; Harry A. Wheeler, vice-president, Union Trust Co., Chicago; Lewis E. Pierson, chairman of the board, Irving National Bank, New York; Edward N. Hurley, Hurley Machine Co., Chicago; R. P. Lamont, president, American Steel Foundries, Chicago; Clarence H. Howard, president, Commonwealth Steel Co., St. Louis.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

SAN FRANCISCO, CAL., Aug. 27.

DURING the last ten days I have visited Spokane, Seattle, Tacoma, Portland and San Francisco. They are the five principal cities of the Pacific Northwest. They serve and are dependent upon a region that is in an economic sense almost self-contained, for it produces nearly everything that civilization requires except cotton and silk, and it can get cotton from Arizona and silk from Japan very quickly when either of them is needed. The coal strike has no terrors for the people in this section, for the fuel is chiefly oil and wood, though coal can be had from the Washington mines when needed. And the roads are so good that even if the railways stopped running it is probable that the many automobiles with which the country is supplied could furnish all the local transportation needed.

Therefore the community is not much concerned about the labor troubles that are vexing the East and Central West. The crops are generally good. They are bringing fair prices. The low rates at which the intercoastal and foreign traffic is carried by water through the Panama Canal gives the farmers and lumbermen of the Pacific slope a tremendous advantage over their Eastern competitors and in the event of a general tie up of the railroads it might be that many cities on the Atlantic seaboard would be fed with food brought from California, Oregon and Washington.

The feeling is therefore one of complacent optimism and confidence in the future. Credit is abundant, money is easily obtainable. There is little or no unemployment and the working men with whom I have talked seem satisfied with the wages paid them.

Among business men there is as elsewhere great complaint over the high taxes that they have to pay and it is therefore easy for the politicians who promise relief to get a hearing. The political pot is in fact boiling quite furiously. It seems quite probable that at the primary election shortly to be held some entirely new and rather radical candidates will be nominated but this corner of the United States has been for a long time the political laboratory of the nation and no one seems very much afraid of the experiments in government that are from time to time tried out here. Among the more far sighted business men there is perhaps some apprehension lest the pending tariff bill may adversely affect the foreign trade of the Pacific Coast, which is increasing rapidly, but only those who take a long distance view are as yet much concerned over this aspect of the situation and it is undeniably true that the high duty on wool which has evoked so much protest elsewhere is generally approved of in this section and especially in Idaho, Montana and Washington.

The announcement by the United States Steel Corporation of a 20 per cent increase in the wages of its day labor, supplemented in the press by reports of labor scarcity and higher wages elsewhere, was easily the most important event of the week. It served rather sensational notice on the rest of the country that the era of declining wages was definitely at a halt and that probably they would follow other barometric indicators upward. Bond prices reached their bottom about the middle of 1920, stock prices in August, 1921, commodity prices, production and trade about the same time or a little later, and commercial loans and money rates about last June.

Bonds have since recovered so far that there is some justification for thinking that their next peak is not many months ahead. Stocks have climbed about 30 per cent. Commodity prices are perhaps 10 per cent higher and the volume of trade has increased even more. As for industrial production, July figures compared with a year ago showed a gain of 177 per cent in pig iron output, 59 per cent in automobiles and 89 per cent in accessories and parts, 78 per cent in sugar meltings, 20 per cent in electric power production, 61 per cent in building contracts, 9 per cent in gasoline consumption, and 12 per cent in cotton consumption. Bank clearings for July were 15 per cent above last year, and the number of workers employed increased about the same.

The greater volume of business, however, has not brought satisfactory profits to many manufacturers, and their insistence that wages must still come down has partially obscured the fact that wages are subject to the same economic influences as bonds and stocks and that there is a market for labor as well as for commodities, a market which is bound to go up when demand begins to exceed supply. These are facts, whether we think higher wages are economically desirable at present or not. Most of us think not, but sellers who want higher prices must also expect to pay them for labor. The Steel Corporation's recognition of this fact is courageous, and it is the most convincing expression of confidence in the permanence of better business that could be given. I say "better business" because that is what it will seem like for some time to come. The far sighted will realize that rising wages are an important indication of the secondary inflation for which many economists have been looking, and that eventually bond prices will stop rising, commercial loans will increase, interest rates will go up and stocks will decline, and that later there will be a contraction of business and decline in prices again. But these developments are unquestionably far in the future and while the Federal Reserve ratio remains around 80 per cent we can be assured that many months of better business are still ahead.

Most of the other developments of the week were of transient importance. On the financial side the abundance of the country's credit resources for moving the crops without recurrence of the strain of former years, and for facing the transportation congestion which appears certain, is testified to by the huge amounts which banks all over the country have invested in securities. The Federal Reserve ratio, as a result of a small decrease in gold holdings and increase in deposit liabilities, showed an unimportant decline to 79.8 per cent. The best opinion still inclines to the belief that interest rates are at bottom, and it is reported that Secretary Mellon, a shrewd judge of the money market, will soon offer a large long term bond issue to retire the Victory 4¾ per cent notes which are callable on Dec. 15.

The terms adopted at Cleveland for settling the coal strike have been accepted by many other operators and it seems probable that production during the fall will be much heavier than anyone dared predict two weeks ago. When they are recognized, emergencies often disappear thus quickly. With the railroad strike little progress is reported. Most of the executives and shopmen are as far from a compromise on the seniority question as they were a month ago. A minority, however, are reported to be negotiating an agreement and if they do come to terms the settlement will probably spread as it has in the case of coal. Meanwhile each day's deterioration of equipment will accentuate the impossibility of moving the huge amounts of freight which will be offered as coal mines resume operation.

The German mark declined again last week until a thousand in New York cost only 52 cents. The catastrophe thus accentuated is unchanged in any important respect from last week, and until constructive action is taken by the Allies there is little more to be said of it. It is a relief to look at two of our largest customers nearer home. The Canadian dollar is at par and the outlook in Cuba is reported much more promising. Even China is winding up her civil conflict and seems likely to come out of it a stronger and more unified nation. She is the greatest potential market on the globe. Conditions in Japan show continued improvement with a favorable trade balance for July indicated.

Business in the United States has given astonishing evidence of its recuperative power in the past year, and all the indications are still tending upward. When one of them reverses itself it will be time to point out the necessity for caution. Until then we can view the future with assurance of an autumn of continuously expanding trade and a winter of prosperity.

Foreign and Domestic Trade Conditions

THE **outstanding event** in the news of the week, and overshadowing in its importance to American trade the discouraging failure to effect peace in the railway strike in the United States, is the failure of the Bradbury mission to Berlin with the subsequent collapse of the German mark. Normally worth 23.8 cents, it has dropped to a point where 100 marks are now worth 5¼ cents, to a point where 10,000 marks are needed to buy one pound sterling. Reports indicate that France has refused absolutely to consider the proposed plan for a five months moratorium and that she will insist on some sort of physical control over German industrial enterprises. In taking this step she is further jeopardizing her already precarious position. The complete collapse of Germany means the collapse of France also and with her Italy. And the effect such a situation would produce upon American trade is well worth sober thought. Already signs are not wanting of a falling off in demand from the European nations for our foodstuffs and raw materials—materials which they must have before they can revive their former productive industries and produce a surplus for export.

French foreign trade, according to reports just made public, continues to show an upward mounting of her adverse balance. Statistics compiled for the first seven months of the current year show total imports valued at 12,667,000,000 francs and exports valued at 10,802,000,000 francs. In other words, an unfavorable balance of 1,865,000,000 francs is indicated for the seven months period. This compares with an unfavorable balance in the corresponding period of 1921 of 588,000,000 francs. The figures for July show increasing excess of imports over exports, importations totaling 1,996,000,000 francs as against exports totaling 1,433,000,000 francs, or an unfavorable balance of over 500 million francs in July alone. These figures seem to indicate quite clearly that the frequent reports to the effect that France is rapidly recovering her favorable economic position are completely unfounded. France now has a national debt greater than any other European country, excepting Germany. It is rapidly approaching a point where it will be twice as great as that of Great Britain. France did not come anywhere near making both ends meet in 1921 and her plight for 1922 is even less promising.

Japan's foreign trade, after showing an unfavorable balance for twenty consecutive months, since October 1920, shows an excess of exports over imports for the month of July, according to preliminary figures furnished by the Department of Commerce. Exports totaled 144,800,000 yen as against imports of 142,200,000 yen, resulting in a small but favorable balance of 2,600,000 yen. This is an encouraging sign. Japan has just passed through a financial crisis. She is still suffering from the post war inflation period but she is moving rapidly forward and creating an excess production for export. In the past ten years she has made heavy investments to capital account and her industrial growth has been nothing short of marvelous. Between 1916 and 1918 alone the amount of capital invested in new enterprises in the empire totaled over $1,700,000,000, while capital used to expand existing enterprises in the same period totaled over $1,200,000,000. She was our sixth best customer in 1919. She contends with Canada for first place as a buyer of our steel and iron. She is one of our best customers for automobiles. The empire offers one of our best markets for machinery of all kinds.

Holland's foreign trade position shows improvement. According to reports imports for July were valued at 164,000,000 gulden in comparison with 171,000,000 gulden for July, 1921, and 152,000,000 gulden for June of this year. Exports for July amounted to 105,000,000 gulden, compared with the same total for July of last year and 101,000,000 gulden for June of this year. The import balance of 51,000,000 gulden for June is the most favorable monthly balance this current year. The July, 1922, import balance of 59,000,000 gulden brings the Dutch trade balance for the first seven months of the year up to 452,000,000 gulden, compared with an import balance of about 549,000,000 gulden for the same period of last year.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0273	$0.0261	$0.0270
Cold finished shafting......	per lb........	0.0365	0.0340	0.0415
Brass rods.....	per lb........	0.165	0.1750	0.1433
Solder (½ and ½)	per lb........	0.22	0.217	0.18
Cotton waste..	per lb........	0.115	0.11	0.102
Washers, cast iron (½ in.)...	per 100 lb.	4.00	3.83	4.06
Emergy, disks, cloth, No. 1, 6 in. dia.......	per 100.....	3.11	3.11	....
Lard cutting oil	per gal......	0.575	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

Finland's foreign trade continues to increase markedly and the balance of trade is much more favorable than last year, imports for the first half of 1922 exceeding exports by only 7 per cent, whereas in 1921 imports were more than double the exports.

Automobile production in the United States declined during the month of July as compared with June although the decline was not unexpected. The high peak for the current year was reached in June with 263,017 cars and 25,985 trucks produced. Figures for July thus far available and subject to revision when all reports are received, indicate a total of 223,201 cars and 21,243 trucks produced during the month.

Fabricated structural steel sales in the United States during the month of July, according to reports made to the Department of Commerce, by almost the entire fabricating industry, amounted to 62 per cent of shop capacity as compared with 7.1 per cent in June. Actual sales in July totaled 127,765 tons as against the June figure of 204,540 tons.

Commercial failures in the United States according to reports furnished by Bradstreet totaled 368 for the past week as compared with 363 for the previous week and 395, 133, 110, 179 for the corresponding weeks 1921 to 1918. The New England States had 29, Middle 101, Western 72, Northwestern 37, Southern 87, Far Western 42. Canada had 42 failures for the week, against 48 for the preceding week. In the United States about 76.6 per cent of the concerns failing had $5,000 capital or less and 14.6 per cent had from $5,000 to $20,000 capital.

Cost of living among wage earners' families in the United States on July 15, 1922 was 55.6 per cent higher than in July, 1914, according to the results of a comprehensive investigation of conditions the country over just completed by the National Industrial Conference Board. Between June 15 and July 15, 1922, there was an increase of two-tenths of one point or one-tenth of one per cent. The changes in the budget within the month were a slight rise in clothing and food prices, and a slight decline in averages sundries prices. These changes nearly balanced each other so that there was very little change in the budget as a whole between June and July. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and July, 1922, the cost of living dropped 48.9 points or 23.9 per cent. Since March, 1922 the cost of living among wage earners the country over has remained practically stationary.

Machinery Duties Under the Tariff Bill

WASHINGTON CORRESPONDENCE

The tariff bill as it passed the Senate shows material reductions in many items of machinery and tools from the form in which the measure was reported to the Senate last April, even though the original recommendations of the committee in most cases were for rates below those provided by the House.

Many items were cut down by the finance committee during debate and in several instances the committee was overturned by the Senate and lower rates were written into the measure on the floor. In others, the committee reopened paragraphs after they had been adopted and asked for reductions.

In the last week of Senate consideration of the bill, the finance committee, acting through Senator Smoot, reduced the duty on high-speed steel 7 per cent. Two days before, the committee reduced the rate on structural iron and steel if not advanced beyond hammering, from the House rate of seven-twentieths of a cent per pound to one-fifth of a cent per pound and reduced to 20 per cent ad valorem the duty on structural stuff if machined, fabricated for use or otherwise advanced beyond hammering. This latter rate is 5 per cent below the House figure, which also was on the higher basis of American valuation, and is 10 per cent below the figure originally recommended by the finance committee and previously reduced to 25 per cent by it.

REDUCTIONS ON MACHINE TOOLS

Heavy reductions were made by the Senate in the duty on machine tools. The House had provided a duty of 35 per cent on the American valuation. The Senate finance committee used this same figure in its original recommendation, which really meant a reduction, because it was based upon the foreign value, but was overturned by a vote of the Senate and a rate of 15 per cent was written into the bill. This rate is the same as the existing duty under the Underwood law. The rate in the Payne-Aldrich bill was 30 per cent.

The duty on steam engines, and locomotives was left at 15 per cent, a reduction under the House duty; a duty of 25 per cent on sewing machines valued at less than $75 and 40 per cent if valued at more than amount was voted into the bill; and a 25 per cent duty on cash registers and a 30 per cent duty on combined adding and typewriting machines were written into the bill by the Senate. Rates on textile machinery were fixed at 30, 35 and 50 per cent, according to classification, which figures are below the House rates but considerably above existing customs rates.

The Senate made a material reduction in the duties to be paid on chains, the rate varying according to size.

The rates of six-tenths of a cent per pound on nuts and washers and one cent per pound on bolts, as fixed by the House, were not changed by the Senate. The rates on nails and spikes were reduced slightly. The duty on rivets and studs was cut to 20 per cent, the House rate having been 25 and the original recommendation of the finance committee having been 40 per cent.

Blacksmiths' hammers, tongs, sledges, etc., were listed at 1½ cents per pound, as the House had decided also. Babbitt metal and other lead was unchanged from the House rate of 2¼ cents per pound upon the lead content and 2½ cents per pound if in sheets, wire, etc. Leather belting, upon which a duty of 4 cents per pound was recommended, was placed on the free list by vote of the Senate.

Gaskets of asbestos paper were given a duty of 25 per cent, a reduction below the House rate. Emery carries a duty of 1 cent per pound, and a duty of 20 per cent was put on emery wheels, files and paper.

HARDWARE AND SMALL TOOLS

As the bill passed the Senate, the duty on antifriction balls and rollers is fixed at 10 cents per pound and 55 per cent ad valorem, which is an increase over the House rate of 10 cents per pound and 35 per cent ad valorem.

The House rate on axles, six-tenths of a cent per pound, was not changed by the Senate.

The finance committee fixed a rate of 20 per cent on anvils weighing less than five pounds and 45 per cent upon heavier anvils.

The classification of wood screws of iron or steel according to length was stricken out and a rate of 25 per cent was imposed regardless of size.

Pliers, pincers and nippers will bear a lower duty, if the Senate rates are accepted in conference. The House recommended specific duties according to size plus 25 per cent, on American valuation, and the finance committee raised the ad valorem to 50, on the basis of foreign valuation, which would be about the same in dollars and cents, but subsequently this figure was raised to 60 per cent by the committee and the specific duties were eliminated, thus affecting a general reduction.

The House figures on files, rasps and floats were unchanged, being 25 cents per dozen for those two-and-a-half inches in length or less; 47½ cents per dozen for those from 2½ to 4½ inches; 62½ cents per dozen for those from 4½ to 7 inches, and 77½ cents per dozen for those over 7 inches in length.

Timken Readjusts Capitalization

Readjustment of the capitalization of the Timken Roller Bearing Co. by the sale of a large amount of stock, including some held by the Timken family, has been announced by officials of the company.

The plan contemplates the sale of 400,000 of the 1,200,000 shares of stock for approximately $12,000,000 or $30 a share. The 400,000 shares are owned by the Timken family. The family will retain the balance of 800,000 shares. There will be no changes in directorate or management.

Figuring in the big transaction is a group of New York bankers headed by Hornblower & Weeks. Included in the group to make the offering will be Dominick & Dominick, C. D. Barney and Co., F. B. Koch and Co., and others. The company manufactures tapered roller bearings and supplies, according to reports, about 90 per cent of the trade.

Thread Grinder Company Acquired by A. T. Doud

The Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa., well known in the machine tool and automotive industry field for its multi-graduated precision grinder, has just been acquired by A. T. Doud, of that city.

The company's new owner, A. T. Doud, president and treasurer, is a mechanical engineer of wide experience in the metal working industry and a graduate of Purdue University. He was formerly mechanical engineer for the Hale & Kilburn Co., Philadelphia, and during the war was associated with the Hero Manufacturing Co., in the capacity of general manager, in the manufacture of gas masks for the War Department.

F. V. Doud has been elected Secretary of the company and C. A. White, secretary of Leeds & Northup Co., Philadelphia, has been elected to the board of directors. F. Roger Imhoff, formerly sales manager has been appointed consulting engineer for the new organization.

The company will continue the production of its multi-graduated precision grinder on an enlarged scale, as well as its thread lead variator for obtaining lead from the ordinary lathe lead screw. It will also manufacture a gage block for testing lead screws and a permanent alignment wheel truing head for use on all precision grinders.

Bad Export Packing on Bolts, Nuts and Rivets

Chilean importers prefer sheet iron containers for nuts, bolts, and rivets, according to the Department of Commerce. They do not want shipments to come in wooden casks that break in handling. Europeans use the sheet iron containers and get the orders. One European firm recently got an order for fifteen tons of rivets by cable because American concerns are disregarding instructions to ship in double bags of heavy material which, while not as good as sheet iron kegs, are vastly better than wooden containers. On one shipment 80 per cent of the wooden kegs burst when they were let over the ship's side into lighters, the contents were scattered over the floor and had to be shoveled into bags and later sorted out by hand.

Southern Metal Trades to Meet in Memphis

The Southern Metal Trades Association, Atlanta, Ga., through William E. Dunn, Jr., president, announces that the annual meetings of the association will, hereafter, be held during the winter months, instead of in the summer as in the past. The next annual meeting will be held at Memphis, Tenn., the latter part of January or in early February, a definite date to be announced later. The association is said to have a membership representing a total invested capital of more than $50,000,000, the industries employing more than 25,000 workers.

Machinery Prospects Abroad

Washington Correspondence

Information reaching the Department of Commerce through its special agents abroad, through the consuls, and through its correspondence with individuals leads to the conclusion that the United States will furnish more metal-working machinery to the foreign market than it ever has before once that the transitory period incident to reconstruction is past. During the twelve months ended with June, the total exports of metal-working machinery were valued at $11,239,330. This is less than one-fifth of the value of the exports during the calendar year of 1919. During the war and until the close of 1920, American metal-working machinery was shipped abroad in such large quantities that it has become very widely known and its merit thoroughly established.

Metal-working machinery would be among the last commodities to feel the effect of a quickened buying power, it is pointed out at the Department of Commerce. Returning prosperity is first reflected in the demand for foodstuffs and clothing. Then come other staples and the luxuries, but before machinery buying increases perceptibly the wave of prosperity must be well advanced.

The specialists at the Department of Commerce expect to see the improvement in the demand for metal-working machinery mount steadily but the increase is certain to be gradual. The conditions abroad which forced the monthly average of metal-working machinery exports below $1,000,000 during the last fiscal year are passing, they declared, but there is nothing in the situation to encourage them to think that there will be any rapid expansion in the demand during the present fiscal year. During the last fiscal year Germany offered a competition which American manufacturers could not meet. Much of the advantage which the Germans held, however, was temporary and as costs of production catch up with the depreciation of the mark, the margin of advantage grows narrower and narrower. Moreover Germany lost so much of her skill during the war that it is being reflected in the quality of her machinery. Even now with prices geatly in favor of the German article, American machinery is being sold with quality arguments.

Barter Methods in Selling

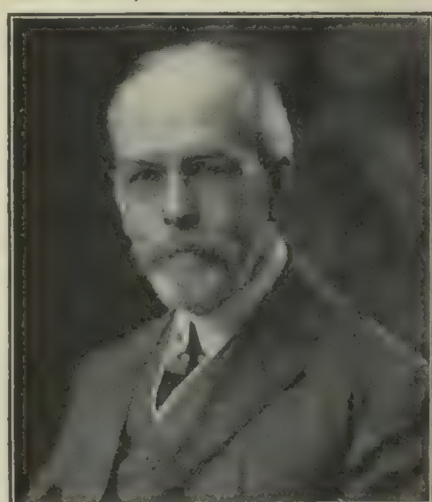
Both German and English competitors have had an advantage over the American manufacturer in their need for a great variety of commodities. Wool is a good example. In Argentina instances are known where machine tools were sold on a formal agreement to accept wool in payment. What is tantamount to the same situation has existed in many countries. The Germans, the English and the French have been more ready to set up this type of barter than have the American manufacturers.

The fact that Europe has been economizing as never before has affected the purchasing power of metal-working machinery consumers throughout the world. Europe is not buying and as a result large stocks of raw materials and semi-finished materials piled up in many countries, this threw an unusual load on their banks and business houses from being called upon to conduct financing on a larger scale than ever before. This made money hard to get for manufacturing and other enterprises. Since many years are certain to be required before the new normal is reached, the rehabilitation of the export business in metal-working machinery is certain to take some time, according to those who are studying that situation closely at the Department of Commerce. They are convinced, however, that once reconstruction has been accomplished, it will be found that American manufacturers are supplying a much larger proportion of the world's metal-working machinery requirements than ever before was the case.

Coleman Sellers, Jr.

Coleman Sellers, Jr., president of William Sellers and Co., Inc., died on Tuesday, Aug. 15, in his seventieth year after an illness of several months.

His connection with the Sellers house, then a firm, began in 1873 immediately after his graduation from the University of Pennsylvania when, after serving a practical course in the shops for several years, he took a position in the drafting room of which he soon became the head. He was appointed assistant manager in 1887, becoming at the same time a director of the company. He was elected engineer in 1902, and president in May 1905, holding this office continuously until his death.



He came from progenitors who, in the four preceding generations, gave many evidences of unusual mechanical and engineering ability, and the first of whom came to this country from Derbyshire, England, in 1682. His father, Coleman Sellers, a member of the Sellers firm in 1873, was one of the most brilliant mechanical engineers of his time, and of most versalite talents. Like his father, Coleman Sellers, Jr., was also a man of many parts and of liberal ideas, and while his principal inclinations and activities were in mechanical and engineering lines, he took keen interest in many other directions, scientific, literary, educational and the arts, and he was active in the civic life of Philadelphia as well as in city, state and national betterments.

He was long active in the affairs of the Franklin Institute, of which he was vice-president at the time of his death. He was a member of the Board of Commissioners of Navigation of Pennsylvania, to which he was appointed in 1907. He took special interest in the work of the American Philosophical Society, the American Society of Mechanical Engineers, the American Society of Naval Architects and Marine Engineers and the Engineers Club of Philadelphia of which he was one of the founders. He was president of the Philadelphia Chamber of Commerce from 1909 to 1913.

He served as chairman of Local Draft Board No. 20 during the early stages of our country's entrance into the war and with such fidelity and assiduity to both the Government and the draftees, that his intimates have since been convinced it seriously impaired his health and contributed not a little to his subsequent illness and death. It can therefore well be said that he too, made physical sacrifice to the Great War.

Mr. Sellers was a most lovable man, kind and considerate to all with whom he came in contact whatever their station in life. He had an especial sympathy for the young men of his profession, those just stepping upon the lower rounds of the ladder which he had climbed so brilliantly and successfully.

He had a keen sense of humor coupled with a most unusual fund of anecdotes. He was quick in repartee but never caustic or resentful. He could be sedate or gay, so that his presence in any gathering imparted an atmosphere suited to the occasion. His passing is a severe loss to his city, state and country; to his company and his associates therein, as well as to a very wide circle of friends.

Business Items

The Sanford Riley Stoker Co. and The Murphy Iron Works announce a change of address from 233 Broadway to Room 607, Terminal Building, 103 Park Ave., New York City.

The New England Brass Manufacturing Co., 5 Maple Avenue, Danbury, Conn., incorporated recently under the laws of Connecticut, organized the company during the past week by the election of the following officers: president and treasurer, M. Quamruddin, and secretary, D. S. Bradley, both of Danbury.

The Greenfield Tap and Die Corporation has steadily increased its operations in the last few months, except for a short midsummer period, and now has more than 700 employed in the various departments. Its "Little Giant" wrench, its latest new product, is now being brought to quantity production.

The Wico Electric Co., Springfield, Mass., opened bids Aug. 24 for a new building in West Springfield, planned to be the first of five units, each 400 x 90 ft., one story, brick construction. Beginning Jan. 1, 1923, the company will have in production a new magneto for engines under 5 hp. or smaller than those for which it has hitherto provided equipment. Operations in the new building which is to be ready at the beginning of the year, are to be started with a force of 200, with a view to

[illegible] that number in the near future. In addition to its old quarters on both sides of Taylor Street the company has rented the top floor of the American Electric Service & Maintenance Co.'s new building in the same street, to meet requirements until the new building is ready.

The Remington Typewriter Co. has resumed operations at its plant in Syracuse after two weeks' shutdown for inventory and vacations.

The Laughlin-Barney Machinery Co., Union Arcade Building, Pittsburgh, Pa., has opened a branch office in Erie, Pa., [illegible] Sassafras Street, with Samuel Mat[illegible] in charge.

The L. A. Young Industries has purchased the plant of the Denby Motor Truck Co., Detroit, according to reports. The factory, which is located at Holbrook avenue and the Grand Trunk Railroad, contains approximately 100,000 square feet of floor space, together with [illegible] acres of ground. The L. A. Young Industries will manufacture the [illegible] spring, a comparatively new product, in the newly acquired plant.

S. F. Bowser and Co., Fort Wayne, Ind., recently announced the appointment of L. E. PORTER, as assistant general manager. Mr. Porter, for the past three years, has been director of publicity. ROSCOE L. HEATON, formerly assistant to the president, now becomes advertising manager.

The Landis Tool Co. announces that, owing to increased cost of production, it has been found necessary to advance prices ten (10) per cent on all machines and machine parts, effective Aug. 15, 1922.

The Hunter Saw and Machine Co., Pittsburgh, Pa., announces that it has opened an office on 56 Pine Street, New York City, where they will carry a complete stock of metal cutting circular saw blades, as well as pneumatic hammer rivet sets and chisel blanks. Frank H. Harrison will be in charge.

The Ford Instrument Co., Inc., announces the removal of its offices and factory to its new building, Rawson St. and Nelson Ave., Long Island City, N. Y.

The Stewart-Warner Speedometer Corporation reports profits of $2,122,049 for the six months ended June 30, 1922, after expenses, depreciation, etc. This compares with $652,872 in the same period a year ago. The company's surplus for the period is $1,277,151 after Federal taxes and dividends, against a surplus of $52,872 in 1921. The total unappropriated surplus as of June 30 last is placed at $8,929,351.

Joyce Bros., Ltd., structural, civil and mechanical engineers, are opening an office at [illegible], Ont.

The Durham Manufacturing Co., of Durham, Conn., has been incorporated under the laws of Connecticut, to manufacturer metal and brass specialties, etc. The capital stock is [illegible], and the incorporators are [illegible] J. Bode, Edgar S. Francis, Arthur F. Hall, Harry C. Rich, Paul [illegible], Leonard B. Markham and William C. Hubbard.

The Hartford Valve Manufacturing Co., of Hartford, Conn., has been incorporated under the laws of Connecticut, to make and deal in valves, etc. The capital stock of the concern will be $50,000, and the incorporators are Mitchell S. Little, of the M. S. Little Manufacturing Co., Hartford; Michael H. Flynn and H. Bissell Carey, both of Hartford also.

The Edward Hollander Tool Co., Newark, N. J., has been organized by Edward Hollander, to operate a plant at 142 Miller Street, for the manufacture of machine tools and parts.

The Westinghouse Electric and Manufacturing Co. is now employing 3,300 persons in its Springfield (Mass.) plant, of whom 2,500 are in the automotive equipment division, where the production of lighting, starting, and ignition apparatus is being made to equip 1923 car models. This company now makes equipment for 67 makes of motor vehicles and maintains more than 300 official automotive service stations throughout the country. The radio division is increasing its output each month, the present rate of production being 22,000 receiving sets per month.

The Cowan Truck Co., manufacturers of electric-lift and hand trucks for industrial use, Holyoke, Mass., has appointed FREDERIC RUECKERT as sales manager and KEITH A. WOOD as engineer of material handling, the latter being a new division to teach scientific management in handling supplies and products in factories. This service will be available to the company's customers.

Personals

W. R. BASSICK of Bridgeport and H. L. SUTTON and WILLARD L. CASE of Stamford, Conn., have purchased the control of the Turner & Seymour Manufacturing Co., of Torrington, Conn.

In the reorganization of the company Mr. Bassick was elected president and general manager, and Mr. Sutton, who for several years was the general manager for the American Tube and Stamping Co. was chosen vice-president. Mr. Case will be secretary and treasurer. The board of directors consists of the above named officers, John N. Brooks, C. Barnum Seeley, president of the Bridgeport Trust Co., and A. M. Cooper of Bridgeport.

GEORGE SCHERR, 126 Liberty Street, New York City, will leave on Saturday, August 26, for an extended business trip to Europe, through Italy, Austria and Germany.

JOHN C. STANLEY, of the American and British Manufacturing Co., Bridgeport, Conn., has been chosen president of the newly incorporated Yalelms Corporation, manufacturers of compressed paper boxes, etc., Bridgeport.

THOMAS H. WICKENDEN and CHARLES MCKNIGHT, JR., have recently joined the development and research department of the International Nickel Co., New York City, to undertake development work in connection with alloy steels. Mr. Wickenden was for many years associated with the Studebaker Corporation as engineer in charge at their South Bend plant, and more recently associated with the Zeder-Skelton-Breer Engineering Co., in a consulting capacity. Mr. McKnight was formerly works manager of the Carbon Steel Co., and engaged for many years in the production of alloy steels.

H. S. MCDOWELL, formerly engineer in the aeronautical engine laboratory of the Washington navy yard, has become research engineer for the Maxwell Motors Corporation, Detroit, Mich.

A. L. REA of Zanesville, Ohio, has assumed the management of the new plant of the Federal Radiator Co., at Zanesville. This plant will operate to full capacity from now on. Associated with Manager Rea is W. H. WATT, as superintendent of the foundry department, who, for several years past, was identified with the plant of the American Radiator Co. as assistant superintendent of the foundry.

T. S. SCOTT, Kingston, Ont., has been appointed city engineer at Niagara Falls, Ont., to succeed J. C. GARDNER.

JOHN C. BROOKS, formerly assistant to the president of the Goodell-Pratt Co., Greenfield, Mass., has been appointed general manager of the Fiberloid Corporation, Springfield, Mass.

WILLIAM E. CASEY, formerly production manager of the Penn Metal Co., Boston, Mass., and superintendent of naval construction work at Squantum and Fore River shipyards during the war, has been appointed instructor of sheet metal work in the Holyoke (Mass.) public schools.

Obituary

MESHECH FROST, president of the National Machinery Co., Tiffin, Ohio, died Aug. 6 at the age of 75. He was often referred to as the man who built Tiffin, as twenty industries were brought to Tiffin through his efforts alone. The presidency of the National Machinery Co. was the only executive position he held in the long list of industries in which he had extensive holdings. Mr. Frost spent the last ten years of his life in New York City, where he had wide financial interests. Besides his widow, he leaves a son, Earl R. Frost, general manager of the National Machinery Co., and a daughter.

RICHARD D. REED, one of the best-known men in the radiator and boiler industry, died in Westfield, Mass., Aug. 16, after a long illness. For many years he was identified with the H. B. Smith Co., of Westfield, his father, the late John R. Reed, having been head of that concern. He was a member of the American Society of Mechanical Engineers.

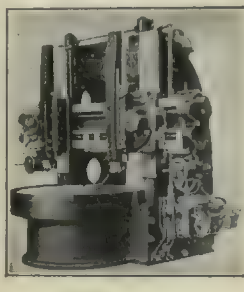
PARK BENJAMIN, noted patent lawyer, author of a number of works on scientific subjects and father-in-law of the late Enrico Caruso, died Aug. 21 at his home in Stamford, Conn., in his seventy-fourth year. From 1872 to 1878, Mr. Benjamin was associate editor of *The Scientific American* and took charge of the production of Appleton's "Cyclopaedia of Applied Mechanics" as editor-in-chief.

CHARLES G. DAVIS, formerly manager of the Canadian branch of the Maple Leaf Harvest Tool Co., Ltd., Silver

Condensed-Clipping Index of Equipment

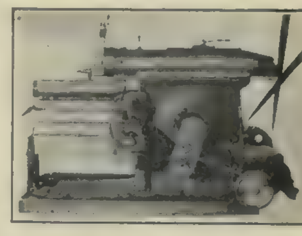
Patented Aug. 20, 1918

Boring and Turning Mills, Vertical, Heavy-Duty
Colburn Machine Tool Co., Cleveland, Ohio
"American Machinist," June 1, 1922.



The machine is furnished in 42-, 48-, 54-, 62-, 72- and 84-in. sizes. It possesses a single-lever control for feed and rapid traverse of the heads and rams, automatic gravity lubricating system, forced lubrication of angular and vertical spindle bearings, spring counter-weighting of rams and turret slide, friction disk clutches to raise and lower the crossrail, and single-pulley drive. Four of the twelve speed changes are provided by the speed-change gear box and three by a secondary unit in the base. Sixteen changes of feed from 0.006 to 1 in. per revolution of the table are available for both horizontal and vertical movements. Each head is independently controlled.

Shaper, Crank, 32-Inch
R. A. Kelly Co., Xenia, Ohio
"American Machinist," June 1, 1922.



The shaper is intended particularly for heavy duty in railroad and forge shops. The table is of the revolving type, and work may be clamped on either side or on the top. The feed does not operate during the cutting stroke of the ram, and its direction is controlled by a lever o the top of the box, while th amount of the feed is controlled by the lever on the side. Th gear box has four changes o speed engaged by a ball lever on top of the box. The clutch and brake are controlled by a long lever at the front of the shaper. All machines may be easily fitted with motor equipment, and a gear box may be quickly installed. Extreme stroke, 33 in. Vertical table movement, 12½ in. Cross traverse, 30 in. Weight, 6,500 pounds.

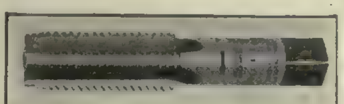
Drilling Machine, Sensitive, "Superspeed," 13-in.
Fosdick Machine Tool Co., Cincinnati, Ohio
"American Machinist," June 1, 1922.

The machine is built in both bench and pedestal types, and in combinations of from one to eight spindles. Three spindle speeds of 5,700, 8,000 and 12,000 r.p.m. are available, although other speeds may be substituted. By a special speed-changing arrangement, a single turn of a handle automatically releases the belt tension, and shifts the belt. In the pedestal machine, the elevating table is of the quick-acting counterbalanced type, with the clamping handle in front. The traverse is 10 in. The counterbalanced head has a vertical traverse of 6 in. Capacity, drills up to ½ in. in diameter in steel, iron or brass. Weight, bench type, 225 lb.; pedestal type, 464 pounds.

Thermometer, Resistance, Direct-Reading
Brown Instrument Co., Philadelphia, Pa.
"American Machinist," June 1, 1922.

The thermometer is intended for accurately gaging a high temperature when only a small range is required. A more accurate reading than when the range on the scale starts at zero, can be obtained by the large sized degree divisions. The change in electrical resistance occurring in metals with a change in temperature can be accurately measured, and a scale can be calibrated to read directly in degrees of temperature. Bulbs can be furnished for all uses, for high or low temperatures or for use in chemical processes. In dry kilns, the instrument can be employed to measure both temperature and humidity.

Tap, Ground, "Sharpening Face" Flutes
John Bath & Co., Worcester, Mass.
"American Machinist," June 1, 1922.

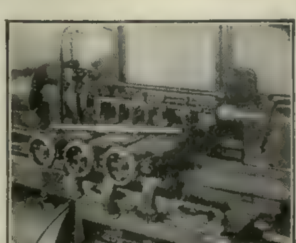


The shape of the flute of the tap leaves a projecting face upon which is the cutting edge. The cutting face is undercut to give the effect of top rake. The taps are ground to size and to their final shape after hardening. The first four teeth are eccentrically ground, but the remainder of the cutting part is concentric and the outside diameter is uniform. Beginning with the fifth tooth and continuing for four or five turns, the pitch diameter is constant and to exact nominal size. From this point, however, the pitch diameter falls away in a uniform taper toward the shank, where at the last turn it is 0.00125 in. under size. Regrinding does not impair the accuracy of the tap.

Chuck, Differential, Scroll-type
E. Horton & Son Co., Windsor Locks, Conn.
"American Machinist," June 1, 1922.

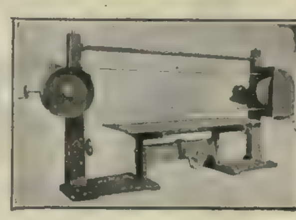
The chuck is for use on turret and engine lathes. The power of the machine is utilized to close the jaws and grip the work. When the chuck is running forward with the lathe, if the handwheel is pressed and its movement stopped, the scroll-plate will close the jaws. One revolution of the handwheel moves the chuck jaws $\frac{3}{32}$ in. radially. A quick forward movement of the handwheel will deliver a hammer blow upon the gear train, and will release the grip. The handwheel turns easily and may be spun rapidly backward or forward to open or close the jaws. The chuck is available in 9-, 13- and 16½-in. sizes.

Necking Attachment for P. & W. Full Automatic Lathe
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," June 1, 1922.



The attachment is used for squaring shoulders or necking below the turned surfaces of work being prepared for grinding, and is adaptable to other operations where the crossfeed can be utilized. It consists of multiple carriages that replace the regular carriage of the lathe; and one, two or three of these carriages may be adjustably clamped to the front way of the bed. Each carriage has a regular toolslide or a multiple toolpost. Adjustment for depth of cut is made by handwheels mounted on screws carrying graduated dials. The cross-slides are actuated by cams, which can be adjusted to provide any sequence of the cross movements, or all slides may be moved in unison.

Sanding Machine, Belt, Self-Contained, No. 183
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," June 1, 1922.



The machine is adapted particularly to rapidly sanding and polishing flat or irregular wooden surfaces, as well as to polishing metal surfaces. The sand belt pulleys run in either direction on ball bearings that are provided with vertical individual adjustment. The bearing housings are moved by handwheels. With the slow-speed motor drive, the motor is directly connected to the driving pulley, or a high-speed motor may be geared to the pulley. The machine will take work of any length, and sand to the center of a 72-in. circle. It will hold work 42 in. high on the table. Without the table, work 66 in. high from the floor can be accommodated. Table: 96 in. long, 32 in. wide; travel, 36 in. horizontally; adjustment, 14 in. vertically. Belt: 31 ft. long; width, up to 10 inches.

Clip, paste on 3 x 5-in. cards and file as desired

[illegible], N. Y., died very suddenly while in England according to a cablegram received from his wife. He went to England some months ago to recuperate from a recent illness.

ALBERT G. LAIRD, formerly secretary and treasurer of the McRae and Roberts Brass Works, Detroit, Mich., died recently at his home in Wallaceburg, after an illness of two months.

LOUIS C. STEHER, member of the board of directors and director of purchases of the S. F. Bowser & Co., Fort Wayne, Ind., died, August 20, 1922.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Commercial agent in Sweden desires to secure the exclusive representation of firms for the sale of [illegible] machinery, etc. Reference No. [illegible].

The purchase is desired by a merchant in Wales of type-setting machinery, types and [illegible] used in the printing trade. Quotations, c.i.f. Newport or Bristol channel port. Reference No. [illegible].

Commercial representatives in New Zealand desire to secure an agency for the sale of galvanized fencing wire, staples, nails and allied products. Quotations c.i.f. Wellington or Napier. Reference No. 3219.

Company in India desires to purchase or secure an agency for hardware, steel products and structural steel. Quotations, c.i.f. Karachi. Reference No. [illegible].

A merchant in Canada wishes to purchase [illegible]. Quotations f.o.b. port of shipment. Payment, cash. Reference No. [illegible].

A hardware company in Mexico wishes to purchase all kinds of hardware, plumbing supplies, sheet iron, iron piping, paints and [illegible], and arms and ammunition. Quotations c.i.f. El Paso, Tex. Cash to be paid. Reference No. 3247.

A manufacturers' representative in Italy desires to purchase steel for the manufacture of ball bearings. Quotations, c.i.f. Genoa or Savona. Terms, cash against documents. Reference No. [illegible].

A commission merchant in Cuba desires to be placed in touch with exporters of flour milling machinery. Reference No. 3272.

The representative of an American firm in Italy desires to secure an agency for the sale of automatic [illegible], leather, rope, electric wire, tin plate, and aluminum products. Quotations c.i.f. Italian port. Reference No. 3298.

A manufacturer in Mexico wishes to purchase [illegible] of different colors and designs, and locks, hardware, trimmings and other materials for the manufacture of trunks. Reference No. 3300.

Firm of commission merchants in the Punjab, India, desires to secure an agency for the sale of metal sheets and hardware. Quotations, c.i.f. Indian port. Reference No. [illegible].

Firm in [illegible] wishes to secure an agency for the sale of cigarette-making machinery, [illegible]. Quotations f.o.b. American port. Reference No. [illegible].

A business man in Switzerland desires to secure an agency for the sale of [illegible] and automobile accessories. Quotations c.i.f. [illegible] port. Correspondence, German. Reference No. [illegible].

A firm of commission agents in Canada desires to secure an agency for the sale of [illegible], hardware specialties, silver-plated ware and cutlery. Quotations, f.o.b. Canadian port. Reference No. [illegible].

A buying association in Greece desires to purchase cold rolled steel bars for concrete reinforcement, in the sizes of 1? to 100 [illegible] 12 to 15 meters long and 5 to 30 [illegible] in diameter. Quotations c.i.f. [illegible]. Payment arranged by confirmed letter of credit in the United States. Reference No. 3349.

Book Reviews

Forms, Records and Reports in Personnel Administration. By C. N. Hitchcock. Paper covers, one hundred and twenty-eight 6 x 9-in. pages. Published by the University of Chicago Press, Chicago, Ill. Price, $1.75.

The handbook is a collection of representative records and reports designed to give the industrial personnel managers that kind of information which will best enable them to determine policies wisely and to administer the policies effectively. The book is divided into seven parts. Part I takes up the functional organization for personnel administration. Forms and records are given in Part II for the employment section, in Part III for the training section, in Part IV for the health and safety section, and in Part V for the research and planning section. Part VI deals with profit sharing, insurance and benefit forms, while in Part VII are given statistical reports for managerial use. The records are complete in detail and cover all the data necessary in personnel management.

Pamphlets Received

Variable Speed Transmission. The Reeves Pulley Co., Columbus, Ind. An useful pocket manual on variable speed transmission. The booklet is designed to place before engineers, millwrights, factory superintendents and operators complete information which will enable them not only to plan installations, but to care for and operate them most efficiently.

The Importance of Correct Lubrication. Phinney Brothers Co., Oil City, Pa. A pamphlet of 20 pages outlining some of the troubles occurring in motor vehicles and marine motors due to incorrect lubrication and helpful hints as to means of correcting the difficulties.

Handbook of the Electric Power Club. The Electric Power Club, Kirby Building, Cleveland, Ohio. This publication marks the 14th edition of the handbook of the Electric Power Club, covering substantially all the standardization it has effected in electric motors, motor pulleys, generators, transformers, electric tools, mining and industrial locomotives, control equipment, power switchboards and switching equipment manufactured in this country.

The Treatment of Carbon Monoxide Poisoning. Reprint No. 728, from the Public Health Reports, Treasury Department, United States Public Health Service, by R. R. Sayers, past assistant surgeon, and H. R. O'Brien, assistant surgeon.

Trade Catalogs

Wood Split Pulleys. The Reeves Pulley Co., Columbus, Ind. Catalog No. P-33, just issued, containing thirty-one pages. The catalog illustrates and describes in detail the various styles and sizes of Reeves wood split pulleys, wood sheaves and fly wheels. The publication will be sent to parties interested in conjunction with the Engineers Manual of variable speed transmission when desired.

Milling Cutters. The Lovejoy Tool Co., Inc., Springfield, Vt. A new catalog of 1? pages containing numerous illustrations showing the company's line of positive locked inserted teeth milling cutters. The catalog also describes the company's stellite blades, taper shank arbors and multiple cutter boring heads.

Printing Press Control. The Monitor Controller Co., Baltimore, Md. Bulletin No. 103, just issued, containing 32 pages. This publication should be of exceptional interest to all printing press manufacturers and users. It contains complete description matter with numerous illustrations on the company's Monitor automatic equipment for the control of printing presses, binding and other printing shop auxiliary machinery. The illustrations showing the application of the equipment in various plants, are interesting and instructive, and the publication deserves praise for the care shown in its arrangement.

Lock Nuts. The Drake-Lock Nut Co., 2440 E. 75th St., Cleveland, Ohio. A folder describing the company's line of lock-nuts, of especial interest to motor car, tractor, truck, engine and machinery builders.

Flexible Shafts. The Hergi Manufacturing Co., 250 Fifth Street, Bridgeport, Conn. Supplement catalog No. 16, just issued, describing the Hergi Flexible shaft equipment especially adapted for grinding and screw driving.

Galvanometers. The Roller Smith Co., 233 Broadway, New York City. Bulletin No. 250, just issued, containing illustrations and descriptive matter on the portable direct current galvanometers made by this company.

Centrifugal Pumps. The Pennsylvania Pump and Compressor Co., Easton, Pa. A new bulletin, known as Bulletin No. 202, containing illustrations and descriptive matter on the company's line of double suction single stage centrifugal pumps with useful engineering data.

Gears. The W. A. Jones Foundry and Machine Co., Chicago, Ill. Catalog No. 24, just issued, giving full details of the numerous styles of Gears manufactured by this company. The publication is both a catalog and a handbook on gears, containing complete dimension data on all sizes manufactured as well as standard gear tables of use to the engineer, draftsman and purchasing agent.

Cranes. The Northern Engineering Works, Detroit, Mich. Bulletin No. 524, just issued with numerous illustrations of the jib, truck, and stacking cranes manufactured by this company and their practical application.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society of Mechanical Engineers, regional meeting, Sept. 25, 26 and 27, 1922, Hotel Kimball, Springfield, Mass. Secretary Calvin W. Rice, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. Building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Buck Falls, Pa., (Delaware Water Gap).

National Machine Tool Builders' Association, annual convention, New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

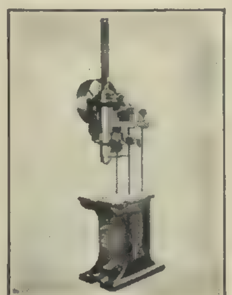
Stud Setter, Self-Opening, "Jarvis"
Geomet Tool Co., New Haven, Conn.
"American Machinist," June 1, 1922

The tool is simple in design and provides a quick grip and release for the work. The setter is made in three sizes. The No. 1½ size has a capacity up to ½-in. studs, and is provided with a No. 2 or 3 Morse taper shank. The No. 2 size has a capacity up to ⅞ in., and Nos. 3 or 4 taper shanks. The capacity of the No. 3 size is up to 1¼ in., and Nos. 4 or 5 shanks are used. Special sizes of taper shanks can be furnished to suit particular needs, and special sizes of jaws can be supplied.

Measuring Wires, Thread, Precision
Van Keuren Co., 362 Cambridge St., Boston, Mass.
"American Machinist," June 1, 1922

The wires are used in the measurement of screw threads, angles and profile gages and are made by methods similar to those used in the manufacture of gage blocks. They are 1⅞ in. in length, and are lapped the full length. The wires provided for each thread measurement are of the theoretical diameter to touch on the pitch line, or at the pitch diameter of a perfect thread. They are packed in glass bottles, the labels on which show the calibrated diameter of the wires to hundred-thousandths of an inch. The set shown includes wires for measuring U. S. F. threads of from 6 to 36 threads per inch. Additional sizes are made ranging from a ¼-in. diameter measuring plug to wires 0.00641 in. in diameter for measuring screws with 90 threads per inch.

Press, Power, Flexible
General Manufacturing Co., 255 Meldrum Ave., Detroit, Mich.
"American Machinist," June 8, 1922

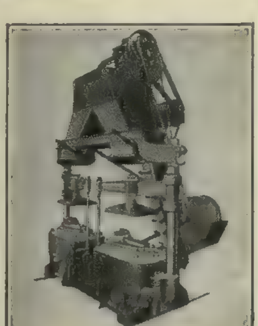


The press is adapted to straightening, pressing in bushings, and assembling parts having press fits. As it has a stroke of 9 in., it may also be used for push broaching. The pressure applied may vary from a few pounds to 8 tons. The press is a three-post machine, mounted on a base with the table top 30 in. from the floor. Two of the posts are in tension, the third post is under compression. Power applied to the pulley by the belt drives the ram at constant speed in one direction. The nut turns with the ram until pressure is applied on the pedal, which action applies a brake that stops the nut and causes the ram to descend. The height between the ram and table is ordinarily 12 inches.

Molding Machine, Duplex, Portable, Model 14-42
William H. Nicholls Co., Inc., 2 College Place, Brooklyn, N. Y.
"American Machinist," June 8, 1922

The Model 14-42 machine is intended principally for making copes and drags simultaneously. There are two adjustable screw heads. The cope can be made on the split pattern plate attached to the jolt head, and the drag can be made on the right-hand side and rolled over before squeezing. The pattern can be drawn with the electro-magnetic drawing device and both halves can be squeezed at the same time. The valve is placed low and has a horizontal handle that is easily accessible. The machine has a 6-in. length of jolt and a 14-in. squeeze.

Molding Machine, Portable, Duplex, Self-Contained, Model 12-36, Type D.
William H. Nicholls Co., Inc., 2 College Place, Brooklyn, N. Y.
"American Machinist," June 8, 1922

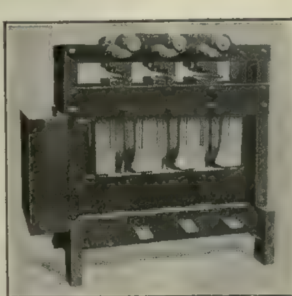


The machine consists of two stripping-plate molding machines mounted on the same base with a riddle, sand conveyor and a double boot hopper having sand gates. It is mounted on four wheels running on steel rails. The combination squeeze and drawing action semi-automatically squeezes on the up-stroke of the piston and draws by gravity on the down-stroke. Each half of the machine is operated separately by means of one valve for jolting, squeezing and drawing the patterns. The sand is conveyed to the hopper, dropped into the flask and made into molds, which are set on the floor directly in front of the machine as it travels along. Height, 10 feet.

Welding Set, Arc, Electric, Semi-Automatic, Portable
General Electric Co., Schenectady, N. Y.
"American Machinist," June 8, 1922

The welding equipment consists of a semi-automatic lead, an automatic welding head with control mechanism, and a standard for holding a reel of electrode wire. Power is supplied to the arc through a flexible cable having a plug for attachment to the nearest welding circuit. The reel carrier is equipped with a brake and is intended to hold any size of reel up to 2½ ft. in diameter. Since the welding operation is continuous, interruptions which tend to affect the strength of the weld, are reduced. Weight, 400 pounds.

Heater, Forging, Electric, Two-Path, Berwick
American Car and Foundry Co., New York, N. Y.
"American Machinist," June 8, 1922



The machine is intended for heating the ends of bar stock or points along the length of the material, and can be operated on either 220 or 440-volt current. The heaters are ordinarily built with one, two or three electrodes, but may be supplied with four or five. The right-hand electrode of each unit has a vertical movement operated by a treadle, and a horizontal adjustment operated by sliding the clamping device along its shaft. The left-hand electrode may be adjusted horizontally. Length of heat, 1 to 8 in. or 3 to 11 in. Range of stock diameter with No. 3 heater, ⅝ to ⅞ inches.

Drill, Pneumatic, Portable, Thor, "Pigmy"
Independent Pneumatic Tool Co., Chicago, Ill.
"American Machinist," June 8, 1922

The drill has a pistol-grip handle, with the control valve in easy reach, and is non-reversible. It is made in three sizes, the No. 25 size having a drilling capacity of ¼ in. and weighing only 5 lb., the No. 375 size having a capacity of ⅜ in. and weighing 5½ lb. and the No. 50 size having a capacity of ½ in. and weighing 6 lb. The speeds of the tools are 2,200, 1,400 and 1,000 r.p.m., respectively. The drills are fitted with Jacobs chucks, the No. 25 having a No. 1B chuck, the No. 375 a 2B, and the No. 50 a 6B. A screwdriver attachment and wire brush can be furnished. The tool can also be employed for reaming and wood boring.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Shapes plates and bars quoted at \$2@\$2.10, f.o.b. Pittsburgh, on new business. Quotation of \$1.80 per 100 lb. disappearing from the market. Scarcity of basic iron; heavy inquiries from consumers for foreign iron. Steel structurals also scarce; fabricators quoting on no deliveries before end of last quarter. Shape mills mostly out of market on current business. Steel pipes up \$6 per ton at mill; discounts reduced 3 points on new Pittsburgh basing card of Aug. 25. Mill rise reflected in New York and Cleveland warehouses; discounts reduced 3 points on black pipe in both cities since Aug. 8. Steel sheets advanced 25c. per 100 lb. in New York and Cleveland, during last two weeks.

Lead quoted in New York warehouses at 6.2c. as against 6.1c. per lb. Copper prices unchanged; zinc slightly higher in St. Louis. Dealers' purchasing prices of old metals (non-ferrous) higher in Cleveland. Cotton waste (white) quoted at 9c.@11½c. as against 7½c.@10c. per lb. in New York; rise due to mill scarcity caused by textile strike.

Declines—Tin quoted at 32½c. as compared with 33½c. per lb. one week ago, in New York warehouses. Linseed oil down 3c per gal. (5 bbl. lots) in Cleveland; no change in New York and Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	\$25.55
Northern Basic	28.27
Southern Ohio No. 2	27.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.44
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	30.17
Basic	27.25
Grey Forge	31.50
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.00
Basic	26.00
Bessemer	27.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	8.75	6.5	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.03	3.50	3.90
No. 12	2.[illegible]@2.[illegible]	4.08	3.55	3.95
No. 14	2.50@2.70	4.13	3.60	4.00
No. 16	[illegible]	4.23	3.70	4.10
Black				
Nos. 17 and 21	3.00@3.25	4.30	4.05	4.60
Nos. 22 and 24	3.05@3.30	4.35	4.10	4.60
Nos. 25 and 26	3.10@3.35	4.40	4.15	4.65
No. 28	3.15@3.40	4.50	4.25	4.75

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.15@3.40	4.60	4.10	5.60
Nos. 12 and 14	3.25@3.50	4.70	4.20	5.70
Nos. 17 and 21	3.55@3.80	5.00	4.50	6.00
Nos. 22 and 24	3.70@3.95	5.15	4.80	6.15
No. 26	3.85@4.10	5.30	4.95	6.30
No. 28	4.15@4.40	5.60	5.25	6.60

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	44½	29½
LAP WELD					
2	61	49½	2	39½	25½
2½ to 6	65	53½	2½ to 4	42½	29½
7 to 8	62	49½	4½ to 6	42½	29½
9 to 12	61	48½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	44½	30½
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	40½	27½
2½ to 4	63	52½	2½ to 4	43½	31½
4½ to 6	62	51½	4½ to 6	42½	30½
7 to 8	58	45½	7 to 8	35½	23½
9 to 12	52	39½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	4.03	3.50	3.70
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	5.20	4.91	5.28
Cold finished shafting or screw	3.65	3.45	3.70
Cold finished flats, squares	4.15	3.95	4.20
Structural shapes (base)	2.93	2.76	2.80
Soft steel bars (base)	2.83	2.66	2.70
Soft steel bar shapes (base)	2.83	2.66	2.70
Soft steel bands (base)	3.63	3.06	3.45
Tank plates (base)	2.93	2.76	2.80
Bar iron (2.35 at mill)	2.83	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/32	8.00		12@13
⅛	6.50		11@12
3/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.50
Lead (up to carlots), St. Louis 5.55@5.60; New York	6.20
Zinc (up to carlots), St. Louis 6.25; New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	19.00
Antimony (Chinese), ton spot	5.50	7.50	6.50
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	19.50	18.75
Brass tubing (100-lb. lots)	21.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.25	17.50	15.75
Brass wire (carlots)	18.25	19.50	.....
Zinc sheets (casks)	8.50	9.00	.....
Solder (½ and ½), (caselots)	23.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.75	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J	39.00	.....	..

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.25	11.50
Copper, heavy, and wire	11.75	11.75	11.25
Copper, light, and bottoms	9.75	10.00	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.25	6.25
No. 1 yellow brass turnings	6.50	6.25	6.75
Zinc	3.00	3.50	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.14	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville... per net ton	13.50@14.00		
Coke, prompt foundry, Connellsville... per net ton	15.00@16.00		

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50-10%
1⅛ and 1¼x3 in. up to 12 in.	25%	65%	60-10%
With cold punched sq. nuts	30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	....	$4.00 off
Button head bolts, with hex. nuts	20%	$3.90 net	.....
Hex. head and hex. nut bolts	25%	....	65-5%
Lag screws, coach screws	45%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	....	55%
Tap bolts, hex. head, list plus	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70-10%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.00	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	55%	65%	60-10%
Rivets, tinned	55%	65%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$4.50	$3.50	$3.35
Cone heads, ditto (net)	4.60	3.60	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	....	$3.70 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	30-5%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Hartford—E. C. Kiley, 766 Asylum Ave.—one small bench lathe (used).

Ill., Chicago—Continental Scale Wks., 2126 West 21st Pl.—one 6-spindle drill press, No. 1 or 2 taper.

Ill., Chicago—Robey Tank Wks., 2513 Robey St.—power pipe cutting machine to cut up to 4 in. (used preferred).

Kan., Wichita—Allen & Lee Mfg. Co., 821 Union National Bank Bldg., manufacturer of oil burners—drill press, lathe, belting, hangers, pulleys, shafting, bearings and emery grinder.

Kan., Wichita—The Guarantee Repair & [illegible] Co., 1st and Waco Sts., J. H. [illegible], Purch. Agt.—power planer, wood [illegible], drill press, iron lathe, and emery stand.

Kan., Wichita—W. Pearsons, 811½ North Main St.—one power lathe and drill press.

Kan., Wichita—A. Swanson, 820 North Main St.—one power lathe, emery wheel and stand for garage.

Kan., Wichita—D. E. Varner, 1617 South St. Francis Ave.—power wood lathe for making handles.

Kan., Wichita—Watkins Mfg. Co., 200 North Waco St., C. A. Watkins, Purch. Agt.—drill press, lathe, grinders, shafting, hangers, belting, pulleys, and pulley bearings, for the manufacture of automobile parts, for proposed factory at Syracuse, N. Y.

Kan., Wichita—Wichita Boiler & Machine Shop, Wichita and 1st Sts., A. McFarland, Purch. Agt.—one 24 in. iron power lathe.

Kan., Wichita—E. C. Wright (jeweler), c/o [illegible] Drug Co., [illegible] East Douglas Ave.—power lathe for jewelry.

Mich., Detroit—J. R. Wood, 616 East High St.—miscellaneous equipment for garage on West Warren St.

Mo., Kansas City—L. O. Mitchell, 713-15 Central St.—one power lathe, drill press, and complete set of hand tools for machine shop.

N. J., Newark—G. W. Heath & Co., 208 1st St.—automatic screw machine, ⅞ in. capacity, for the manufacture of fountain pens.

N. Y., Brooklyn—Montauk Mfg. Co., 843 Union St.—drill press, saw table, small [illegible] and lathe for the manufacture of phonographs.

N. Y., Buffalo—L. Cantor, 64 Manchester Pl.—tools and equipment for proposed brick and steel garage, at 132 Carroll St.

N. Y., Salamanca—T. E. Bargett, Wildwood Ave.—small tools, machinery and equipment for large addition to garage, machine and repair shops.

Pa., Bethlehem—The Bethlehem Steel Co.—alligator shears.

Pa., Holland—The New Holland Machine Co.—[illegible] plain surface grinder with emery wheel not less than 18 x 2 in. or 24 in. [illegible] cup wheel suitable to surface hard [illegible] plates up to 15 in. square (new or used).

Pa., Phila.—J. West, 1118 North 54th St. (repair shop)—one key cutting machine, electric power.

Pa., Warren—Struthers Wells Co.—one 6 ft. boring mill.

Pa., Wilkes Barre—F. Gettinger—machinery and equipment for garage and repair shop on Main St.

Va., Richmond—The 14th St. Garage, 5 North 14th St., L. A. Huff, Purch. Agt.—one lathe and drill.

Va., Richmond—M. Hunter, (electrical contractor), 111 North 8th St.—lathes, drill press, and buffing machines, for proposed manufacturing and repairing department.

Va., Richmond—Richmond Motor Co., 10th and Broad Sts.—reboring machine and lathe.

Va., Richmond—Richmond Pressed Metal Wks., 6th and Stockton St., S. M. House, Purch. Agt.—lathes, punch and die machinery.

Va., Richmond — Rickerstaffs Repair Shop, 1811 East Main St.—lathes.

Va., Richmond—Standard Electric Co., 1821 East Main St.—emory wheels and frame, drill press and lathe.

Wis., Evansville — Schultz-Bray Auto Sales Co., W. F. Schultz, Purch. Agt.—repair machinery and air tank.

Ont., Listowel—McIntyre & Melrose—prices on tools and equipment for garage and auto repair shop.

Machinery Wanted

Calif., Escalon—C. V. Biggs—one newspaper press, job press, linotype and complete equipment.

Calif., Oceanside—The News—proof press and large perforating machine.

Conn., Bridgeport—Evening Star, Inc., 592 Water St., publishers—linotype machine.

Conn., New Haven—Mott Constr. Co., 440 Elm St., builders and mill work—woodworking machinery.

Ga., Atlanta—B. Mifflin Hood Brick Co. —additional machinery for the manufacture of clay and brick products, for plant at Rome.

Ill., Chicago—M. O'Connor, 144 West Kinzie St.—good size air compressor, either belted or direct connected type.

Ill., Polo—Tri-County Press—one linotype and intertype machine.

Ia., Cedar Rapids—The Bd. of Educ., J. A. Moteje, Secy.—equipment for vocational and manual training departments of proposed Junior High School.

Ia., Cedar Rapids—The Mercy Hospital, c/o Sister Sephias, 6th Ave. between 8th and Division Sts.—laundry, refrigeration, and vacuum cleaning equipment for proposed addition to hospital.

Kan., Pittsburg—The New York Confectionery Co., Bway., one power beater, 5 ft. diam.

Kan., Wichita—Foose & Pence, 123 North Market St., manufacturer of shoes—leather working machinery, hangers, polishing machinery, pulleys and belting.

Kan., Wichita—Goodwin-Reser Printing Co., 412-413 Butts Bldg., F. Goodwin, Purch. Agt.—power job print stapler, and power perforating machine.

Kan., Wichita—Public Market Co., 124 West Douglas Ave.—one 8 ton ice machine.

Mass., Clinton—The Roubais Mills, Inc., 792 Main St., manufacturer of woolen cloth —steaming and brushing machine. (Curtis and Marble, used)

Mich., Grand Rapids—The Grand Rapids Tire & Rubber Co., Fuller St., H. F. Swan, Purch. Agt.—milling machine and rubber working machinery, etc.

Mich., Muskegon Heights—Solar Polar Storm Sash & Screen Co., J. J. Gillman, Mgr., c/o Brunswick-Balke-Collender Co., Muskegon—punch press, drill presses (radial and others).

Mo., Kansas City—W. Byers, 1st and Charlotte Sts.—welding outfit and cutting torches.

N. Y., Brooklyn—Thompson Dyeing Co., 215 26th St.—one 40 in. belt driven basket extractor.

N. Y., Buffalo—Air Reduction Sales Co., 120 [illegible] St.—machinery and equipment for proposed $125,000 air reduction plant.

N. Y., Buffalo—The Art Work Shop, 828 East Ferry St., manufacturer of art metal work and leather goods—machinery and equipment for proposed factory addition.

N. Y., Buffalo—Keystone Tool & Metal Co., 58 Oak St.—tool making machinery and equipment for proposed factory addition.

N. Y., Buffalo—Sikes Chair Co., 500 Clinton St., G. C. Dow, Mgr.—woodworking machinery.

N. Y., Buffalo — Wire Wheel Corp. of Amer., 1700 Elmwood Ave.—machinery and equipment for proposed $15,000 addition to wire wheel factory.

N. Y., Dunkirk—Skelton Shovel Co., c/o Chamber of Commerce—$135,000 worth of machinery and equipment for proposed factory, for the manufacture of shovels and tools of like character.

N. Y., Elmira—The Gravy-Brown Co., (manufacturer of extracts, etc.,) S. F. De Ved, Pres—machinery and equipment for plant at Canisteo.

N. Y., Jamestown — Jamestown Panel Co., 32-34 Steel St.—equipment and machinery for the manufacture of panels, etc.

N. Y., Jamestown—Watson Mfg. Co., 81 Taylor St.—machinery for the manufacture of steel window and door screens.

N. Y., New York—Kovat & Knauber, 800 Edgewater Rd., (iron works)—one air compressor, about 100 cu.ft. capacity, A.C.

N. Y., Philadelphia—Indian Chair Co., O. Liders, Pres. & Mgr.—additional equipment for chair factory.

N. Y., Rochester—The Northeast Electric Co., Whitney St.—machinery and equipment for large addition to factory, for the manufacture of auto electric systems.

N. Y., Rochester—C. Schlicker, 12 Bloomingdale St.—small machinery and equipment for the manufacture of surgical instruments.

N. Y., Tonawanda—The Spalding & Sons Co., Wheeler St., manufacturer of sporting goods—complete machinery and equipment for $200,000 factory now under construction.

N. C., High Point — Marietta Paint & Color Co., manufacturer of paint and products—machinery and equipment for 4 story factory now under construction.

N. D., Fargo—Pokodot Co., R. D. Savage, Mgr.—electric drier or sterilizer for a breakfast food.

O., Amherst—Hoyneslte Powder Co.—machinery and equipment for the manufacture of blasting powder.

O., Columbus—The Columbus Sucker Rod Co., 525 West 1st Ave.—machine for making sucker rod joints, to take full length rods up to 25 ft.

O., Lancaster—Lancaster Lens Co.—one air compressor.

O., Lisbon—Pittsburgh, Lisbon & Western R.R., N. B. Billingsley, Genl. Mgr.—machinery for locomotive repair shop at New Galilee, Pa.

O., Minerva—The Owen China Co.—equipment for addition (11 kilns) to factory.

Okla., Commerce—J. F. Reitz (timber yard and planing mill)—woodworking machinery and saw mill.

Pa., Butler—Record Printing Co. (newspaper) — wire stitching machine, motor power.

Pa., Coraopolis—Standard Steel Spring Co.—special crane equipped with long hoisting drums and 2 hooks on 12 ft. centers, for lifting heavy plates.

Pa., Middletown—Middletown Ice Co.—complete machinery and equipment for proposed ice manufacturing plant, on Race St.

Pa., Norristown—Norristown Cigar Box Co.—one crosscut saw, 1 rip saw with frames.

Pa., Phila.—Fischers Hi Grade Dairy Co., North and Orthodox St.—sterilizers, steam vats, bottling machines, etc., for dairy.

Pa., Phila.—H. A. Haussmann, 1527 Germantown Ave.—full line tools and machinery for the manufacture of candy.

Pa., Phila.—F. W. Hosbach, 2415 South St., (woodworking)—additional woodworking machinery for new factory.

Pa., Phila.—Logan Ice Co., 10th and Windrim Sts., C. W. Roberts, Purch. Agt.—ice manufacturing machinery for new plant.

Pa., Phila.—T. J. Luttrell, 3726 Walnut St. (sheet metal and heating contractor)—additional metal working machinery for new shop.

Pa., Phila.—J. Schintzler, 2305 East Susquehanna Ave.—one printing press, Colts Armory, 14 x 22 in.

Pa., Phila.—Standard Provision Co., 212 North Front St., (meat packers) A. Rabinowitz, Purch. Agt.—conveyors, refrigerating machines, steam kettles, etc., for packing house.

Pa., Reading—Reading Hardware Co., 6th & Willow Sts., manufacturer of hardware and specialties—machinery and equipment for proposed 7 story addition to factory.

Pa., Stroudsburg—Pocono Food Products Co., 1st St.—refrigeration machinery and equipment for large refrigerator and fruit storage plant, now under construction.

Pa., Warren—J. T. Newell, 244 Penna. Ave., W.—complete machinery and equipment for proposed job printing plant.

Pa., Williamsport—Hermance Machine Co., 1st & Campbell Sts.—machine shop and machine manufacturer—equipment for pattern shop under construction.

Pa., Williamsport—The Stewart Artificial Ice Co.—machinery and equipment for ice freezing plant addition.

R. I., Providence—The Colwell Worsted Mills, 204 Hartford Ave.—one Kenyon two-bowl 72 in. crab, (used) in good condition.

Tenn., Chattanooga — The Browning Hosiery Mills, East Main St.—twenty-five 3½-in. cylinder 176, 200, or 240-needle machines for hosiery work.

Tenn., Memphis—United States Fireworks Co.—machinery and equipment for proposed large addition to factory.

Va., Kenbridge—T. H. Allen—coal loading and conveying machinery.

Va., Richmond—H. A. Carter, 400 East Marshal St.—small corrugating machine to corrugate metal sheets 3 to 5 ft. long, for soda water fountain, etc.

Va., Richmond—Cussons, May & Co., 415 and 419 Bowe St.—tin binding machine for binding calendars.

Va., Richmond—Southern Steel Products Co., 4th and Bainbridge Sts.—bar benders.

Va., Richmond—Virginia Carolina Rubber Co., 10 North 19th St., R. A. Simpson, Purch. Agt.—mill for milling rubber, also colander machine.

Wis., Burlington—J. Abby & Sons—air compressor, gas storage tank, and pump, for proposed garage.

Wis., Cazenovia—Cazenovia Creamery Co.—machinery for the manufacture of dairy products.

Wis., Cudahy—The Federal Rubber Co. —special rubber working machinery.

Wis., Hartford—W. B. Place & Co.—one fleshing machine, 2 paddle vats, and 2 drums for tannery addition.

Wis., Kewaunee—Kewaunee Mfg. Co.—woodworking machinery and motors for proposed addition to factory, for the manufacture of laboratory furniture.

Wis., Milwaukee—J. Holly, 781 34th St. —one 20 to 30 in. band saw for woodworking.

Wis., Milwaukee—Seaman Body Corp., 1732 Richard St.—iron working and woodworking machinery for proposed auto body factory.

Wis., Milwaukee—Traffic Control, Inc., c/o A. J. Sweet, 531 Grand Ave.—electric drills for the manufacture of traffic control devices.

Wis., Nekoosa—M. J. Power—foundry equipment including cupola and furnace.

Wis., Peshtigo—Peshtigo Paper Co.—traveling crane.

Wis., Plymouth—The Phoenix Cheese Co., R. A. Harbach, Mgr.—refrigeration machinery of several tons capacity, steam power equipment of 300 hp., also special cheese-making equipment.

Wis., Racine—P. Meyer Mfg. Co., 407 Blaine Blvd., P. Meyer, Purch. Agt.—wood turning machinery for the manufacture of household utensils.

Wis., Stevens Point—Pfiffner Lumber Co., 229 Franklin St.—band saw.

Wis., Waukesha—Waukesha Lime & Stone Co., Route 7—limestone crushing machinery.

Wis., Wausau—Marathon Motor Car Co., 210 McClellan St.—machinery for auto repair shop.

Wis., Wisconsin Rapids—South Rudolph Co-operative Cheese Co., c/o I. Thompson, Route 2—cheese making machinery, vats and belting.

Ont., Byng Inlet—Graves Bigwood Lumber Co.—machinery and equipment for power house and planing mills damaged by fire and lightning to extent of $100,000.

Ont., Kincardine—Circle Bar Knitting Co. —prices on complete equipment for new dye house, including vats, tanks, and all general equipment.

Ont., Listowel—Ideal Manufacturing Co., G. A. McDonald, Mgr.—equipment for the manufacture of patent bread moulders, special tools and small electric motors in quantity.

Ont., London—The Coco Cola Co. of Canada, Edmonton, Alta., D. W. Hawkes, Mgr.—$50,000 worth of bottling and soft drink equipment for factory, here.

Ont., Neustadt—The Grey Furniture Co., J. C. Heuther, Mgr.—prices on woodworking equipment for proposed addition to factory.

Ont., Port Dover—Port Dover Spinning Co., H. S. Martin, Pres.—special equipment for the manufacture of sport cloths.

Metal Working Shops

Calif., Newman—The Newman High School Dist., R and Kern Sts., had plans prepared for the construction of a 1 story, 32 x 60 ft. shop. S. Wade, secy. F. W. Reid, East St., Concord, Archt.

Conn., East Hartford—Colonial Auto Co., 1279 Main St., Hartford, awarded the contract for the construction of a 1 and 2 story garage, showroom, and service station, on Connecticut Blvd. Estimated cost $40,000. Private plans.

Conn., Hartford—The Automatic Refrigerating Co., 618 Capitol Ave., awarded the contract for the construction of a 3 story 53 x 71 x 95 ft. addition to its plant, for the manufacture of refrigerating machinery. Estimated cost $50,000.

Conn., Norwalk—E. M. Jennings Co., 27 Harrison St., will soon award the contract for the construction of a 1 story, 55 x 155 ft. garage, automobile sales and service station, on West Ave. Estimated cost $40,000. J. W. Northrop, 211 State St., Bridgeport, archt.

Conn., Plainville—The Standard Steel Bearings, Inc., Railroad St., plans to build a large factory addition to its plant, 1 story. Private plans.

Ill., Chicago—Sloan Valve Co., 4300 West Lake St., is receiving bids for the construction of a 1 story, 39 x 132 ft. factory at 4336-40 West Lake St. Estimated cost $16,000. A. S. Alschuler, 28 East Jackson St., Archt.

Mass., Attleboro — The Hartley Clock Co., c/o Monks & Johnson, Archts., 99 Chauncey St., Boston, is having plans prepared for the construction of a 3 story, 60 x 240 ft. buildng. Estimated cost $125,000.

Mass., Boston—Druker & Rudnick, 18 Tremont St., awarded the contract for the construction of a 1 story garage, automobile sales and service station, on Harvard Ave. Estimated cost $75,000.

Mass., Everett — The Boston Elevated Ry., 108 Mass. Ave., will receive bids until Sept. 2, on sub-structure and foundations for two 160 x 300 ft., and two 53 x 56 ft. car repair shops, etc. D. P. Robinson, 61 Bway., New York City, Engrs.

Mass., West Springfield (Springfield P. O.) Wico Electric Co., c/o P. Brown, Pres., 44 Avon Pl., Springfield, is having plans prepared for the construction of four 1 story, 90 x 400 ft. buildings, here, for the manufacture of electric goods. Architect not announced.

Mich., Detroit—J. R. Wood, 616 East High St., awarded the contract for the construction of a 1 story, 90 x 120 ft. garage, on West Warren St. Estimated cost $40,000.

N. J., Trenton—Mercer County, E. E. Margerum, Dir. of Buildings, County House, plans to build a 2 story, 55 x 75 ft. garage addition, on Brunswick Ave. Estimated cost $35,000.

N. Y., Albany—The Electric Supply & Equipment Co., 103 Allyn St., Hartford, Conn., will soon award the contract for the construction of a 4 story, 40 x 63 ft. factory, for the manufacture of electrical supplies, appliances, etc., on Bway, here. Estimated cost $50,000. Private plans.

N. Y., Dunkirk—Skelton Shovel Co., c/o Chamber of Commerce, plans to build a factory for the manufacture of shovels and tools of like character. Estimated cost $125,000. Architect not announced.

N. Y., Jamestown—Watson Mfg. Co., 63 Taylor St., plans to build a 4 story addition to its factory for the manufacture of steel window and door screens. Estimated cost $24,000.

N. Y., Lockport—Dittmer Gear & Mfg. Co., Grand St., plans to build an addition to its factory for the manufacture of gears and gear products.

N. Y., New York—J. Arfman, 439 East 90th St., will build a 75 x 100 ft. garage on Ave. A. Estimated cost $100,000. Private plans.

N. Y., New York—H. Harjes, 408 West 76th St., awarded the contract for the construction of a 4 story garage at 403 West 76th St. Estimated cost $200,000. Private plans.

O., Cleveland—The Crucible Steel Castings Co., Canal Rd., awarded the contract for the construction of a 1 story, 100 x 280 ft. foundry, on West 82nd St. and Almira Ave. Estimated cost $100,000. W. H. Shepard, Pres. Noted Aug. 24.

O., Cleveland—Templar Realty Co., c/o M. Marmorstein, 605 Ulmer Bldg., awarded the contract for the construction of a 1 story, 52 x 86 ft. garage on East 69th St. and Euclid Ave. Estimated cost $40,000. Building to be leased to the Central Chevrolet Co., c/o A. B. Bashaw, Akron, O.

Pa., Charleroi—S. S. Jones, Belle Vernon, awarded the contract for the construction of a 2 story, 60 x 100 ft. garage on Donner and 9th Aves. Estimated cost $40,000.

Pa., Phila.—Henderson Bros., 25th and Spruce Sts., awarded the contract for the construction of a 2 story, 40 x 118 ft. and a 1 story, 30 x 115 ft. garage, on 27th and Bainbridge Sts. Estimated cost $100,000.

Pa., Pittsburgh — The Westinghouse Electric & Mfg. Co., East Pittsburgh, awarded the contract for the construction of a 4 story, 100 x 200 ft. manufacturing and storage plant, on Susquehanna and Lang Aves. Noted Jan. 26.

Wis., Beloit—J. Terwillizer, Clinton, is receiving bids for the construction of a 2 story, 75 x 135 ft. garage on Broad St., here. Estimated cost $50,000. Private plans.

Wis., Burlington—J. Abby & Sons, are receiving bids for the construction of a 1 story, 30 x 82 ft. garage. Estimated cost $40,000. M. F. White, c/o Wilbur Lumber Co., 908 Trust Bldg., Milwaukee, Archt.

Wis., Milwaukee—Seaman Body Corp., 1732 Richard St., awarded the contract for the construction of a 5 story, 100 x 225 ft. and 100 x 420 ft. auto body manufacturing plant. Estimated cost $350,000.

Wis., Neenah—Jaeger-Dowling Co., 214 South Commercial St., awarded the contract for the construction of a 1 story, 75 x 120 ft. garage. Estimated cost $40,000. Private plans. Noted August 10.

Wis., Waukesha—The Waukesha Fdry. Co., Lincoln Ave., has selected a site and plans to build a 2 and 3 story, 50 x 195 ft. steel factory and foundry. Estimated cost $50,000. Architect not selected.

Wis., Wausau—Marathon Motor Car Co., 210 McClellan St., awarded the contract for the construction of a 4 story, 60 x 120 ft. garage and service station. Estimated cost $75,000.

Ont., Listowel—McIntyre & Melrose have purchased garage and auto repair shop and will build an addition, also add another story to present building and install hoist for handling cars to second story.

Ont., Niagara Falls—The Dominion [illegible] Co. will build a 1 story, [illegible] ft. [illegible] factory on Portage Rd. Estimated cost [illegible].

General Manufacturing

Calif., Mountain View—Interstate Tractor Mfg. Co., c/o W. Moser, Archt., Wells Fargo Nevada Bank Bldg., San Francisco, is having preliminary plans prepared for the construction of a group of factory buildings, here.

Calif., Richmond—The Luning Mineral Products Co. plans to build a plant for the manufacture of dry colors, on 21st St. Estimated cost [illegible]. L. E. Brown, Pres.

Calif., Sacramento—The State Dept. of Public Wks. will receive bids until Sept. 11, for the construction of a 2 story, 160 x 160 ft. printing plant, on 11th and O Sts., here. Estimated cost $140,000. G. B. McDougall, Forum Bldg., Sacramento, State Archt.

Calif., San Francisco—U. S. Metal Products Co., 330 10th St., is having plans prepared for the construction of a 2 to 4 story manufacturing plant.

Calif., Santa Clara—Santa Clara News, awarded the contract for the construction of a 1 story newspaper publishing plant. Estimated cost [illegible].

Calif., Stockton—Xclusive Laundry, 427 East Lafayette St., awarded the contract for the construction of a 1 story, 92 x 150 ft. laundry on Lafayette and California Sts. Estimated cost $50,000. Noted July 27.

Conn., Bridgeport—Siemon Hard Rubber Corp., State St. extension, awarded the contract for the construction of a 1 story, 80 x 170 ft. factory addition. Estimated cost $30,000.

Conn., Hartford—The Acme Bedding Co., 34 Brown St., awarded the contract for the construction of a 2 story, 45 x 70 ft. bedding factory. Estimated cost $25,000. Noted July 27.

Ga., Rome—R. Miffin Hood Brick Co., Atlanta, has purchased plant of the Rome Fire-proofing Co., here, and plans improvements and additions. Estimated cost $75,000. Architect not announced.

Ill., Chicago—The Chicago Evening American, 325 West Madison St., is having plans prepared for the construction of a 3 story, 100 x 125 ft. printing plant at 210-14 South Peoria St. Estimated cost $175,000. P. Gerhardt, 64 West Madison St., archt.

Ill., Chicago—J. T. Igoe Co., 117 West Harrison St., awarded the contract for the construction of a 10 story, 100 x 150 ft. printing plant on Van Buren and Jefferson Sts. Estimated cost $750,000.

Ill., Granite City—The National Enameling and Stamping Co., Federal Reserve Bank, St. Louis, Mo., is receiving bids for the construction of a 1 story, [illegible] ft. warehouse and manufacturing plant, here. [illegible] Farmers Bank Bldg., Pittsburgh, Pa., Engr.

Ia., Cedar Rapids—The Bd. of Educ., J. A. [illegible], Secy., receiving bids and will [illegible] about Sept. [illegible], for the construction of a [illegible] story, [illegible] ft. Junior High School, including vocational and manual training departments. Estimated cost [illegible]. [illegible], 212 Andrus [illegible] Bldg., Minneapolis, Minn., Engr. B. Rugh, [illegible] Bldg., Archt.

Me., Portland—The Confederated Home Abbatoir Corp. is having plans prepared for the construction of a 4 story meat packing, ice manufacturing and refrigeration plant. Estimated cost $300,000. [illegible], 257 Westminster St., Providence, R. I., Engrs. Noted June 15.

Mass., Dorchester (Boston P. O.)—The [illegible] Co., [illegible], Boston, is having plans prepared for the construction of a 1 and 2 story distributing and storage plant, on Dorchester Ave. Estimated cost $75,000. Private plans.

Mass., East Lee—The Mountain Mill Paper Co., [illegible], awarded the contract for the construction of a 1 story 50 x 150 ft. and 40 x 60 ft. addition to its plant. Estimated cost $40,000.

Mass., Holyoke—The Farr Alpaca Co., Jackson St., awarded the contract for the construction of a 6 story, 100 x 300 ft. cotton warp plant. Estimated cost $600,000. Noted July 27.

Mass., New Bedford—New Bedford Boiler and Machine Co., 42 Front St., will build a 4 story, 60 x 167 ft. warehouse. Estimated cost $150,000.

Mass., Watertown—The Hood Rubber Co., awarded the contract for the construction of a 2 story, 96 x 208 ft. addition to its factory. Estimated cost $75,000.

Mich., Grand Rapids—The Grand Rapids Tire & Rubber Co., Fuller St., will build a 3 story, 44 x 226 ft. factory. Estimated cost $250,000. H. F. Swan, Purch. Agt.

Mich., Muskegon Heights—Solar Polar Storm Sash & Screen Co., J. J. Gillman, Mgr., c/o Brunswick-Balke-Collender Co., Muskegon, is receiving bids for the construction of a 1 story, 30 x 80 ft. factory, here. Estimated cost $25,000. Private plans.

Minn., Minneapolis—The Northwestern Tire Co., 632 3rd Ave., S., is having plans prepared for the construction of a 2 story, 48 x 120 ft. sales and service station, on Harmon Pl., between 10th and 11th Sts. Estimated cost $50,00. Lund & Lunt, 224 Essex Bldg., Archts.

Minn., St. Paul—North St. Paul Casket Co., North St. Paul, awarded the contract for the construction of a 4 story, 95 x 150 ft. factory and office building on University Ave. and Briggs St. Estimated cost $92,750.

N. J., Trenton—The State, Court House, plans to build 2 shops on 3rd St., one for woodworking and the other for manufacturing concrete articles. Estimated cost $35,000. A. B. Mills, 142 West State St., Archt.

N. Y., Jamestown—Jamestown Lounge Co., 40 Winsor St., plans to build 3 small additions, including a dry kiln. Estimated cost $6,000.

N. Y., Jamestown—Jamestown Panel Co., 32-34 Steel St., plans to build an addition to its woodworking factory for the manufacture of panels, etc. Estimated cost $8,000.

N. Y., Long Island City—The National Liquid Bleach Co., 18 Purvis St., plans to build a factory on Foster Ave. between Honeywell and Buckley Sts. Estimated cost $500,000.

N. Y., New York—Kokem-Chisholm Co., 74 Center St., awarded the contract for the construction of a factory for the manufacture of barber supplies, on 134th St. and Willow Ave. Estimated cost $90,000.

N. Y., Rochester—The Northeast Electric Co., Whitney St., plans to build a 51 x 90 ft. addition, 25 ft. high, to its plant, for the manufacture of auto electric systems. Estimated cost $30,000.

N. Y., Rochester—Rectograph Co., 282 Hollenbeck St., plans to build an addition to its factory, for the manufacture of photographic appliances. Estimated cost $5,000.

O., Amherst — Hoyneslte Powder Co. plans to rebuild portion of its powder plant destroyed by explosion.

O., Cleveland—D. D. Wessels & Son, 1385 East 17th St., manufacturer of sanitary tubs, awarded the contracts for the construction of a 2 story, 100 x 102 ft. factory and warehouse, at 2009 Oregon Ave. Estimated cost $50,000. Noted Aug. 24.

O., Columbus—Columbus Show Case Co., Grant Ave. and Buckingham St., awarded the contract for the construction of a 2 story, 82 x 382 ft. factory. Estimated cost $100,000.

O., Dayton—The Andrews Baking Co., 10 North Main St., plans to build a 2 story, 60 x 140 ft. bakery on 3rd and Charter Sts. Estimated cost $100,000. Architect not selected.

O., Dayton—Delco Light Co., North Taylor St., awarded the contract for the construction of a 6 story, 150 x 350 ft. factory, on East 1st St., for the manufacture of electrical apparatus. Estimated cost $600,000. G. B. McCann, Secy.-Treas.

O., Dayton—Miami Ice & Fuel Co., Ludlow Bldg., plans to build a 4 story, 60 x 160 ft. cold storage plant. Estimated cost $150,000. Architect not selected.

O., Minerva—The Owen China Co., manufacturer of china ware, plans to build an addition of 11 kilns to its present plant. Private plans.

Pa., Cambridge Springs—Blystone Mfg. Co., awarded the contract for the construction of a 90 x 260 ft. factory, for the manufacture of Blystone concrete blocks. Noted July 13.

Pa., Corry—The Kurtz Brass & Wood Bed Co., is having plans prepared for the construction of a 2 story, 100 x 150 ft. addition to its manufacturing plant. Private plans.

Pa., Phila.—Fischers Dairy, Orthodox and Worth Sts., awarded the contract for the construction of a 2 story, 40 x 61 ft. dairy, a 2 story 52 x 54 ft. stable, and a 16 x 31 ft. power house.

Pa., Phila.—J. T. Hockstra, Archt., 1713 Sansom St., is receiving bids for the construction of an ice cream plant, including four 1 story, 96 x 182 ft. buildings, for the Logan Ice Co., 10th and Windrim Sts. Estimated cost $150,000.

Pa., Phila.—Lutheran Publishing Co., 9th and Sansom Sts., awarded the contract for the construction of an 8 story, 74 x 117 ft. printing plant on 13th and Spruce Sts. Estimated cost $500,000. Harris & Richards, Drexel Bldg., Archts.

Pa., Phila.—Standard Provision Co., 212 North Front St., will open bids Sept. 1, for the construction of a 3 story, 60 x 90 ft. and 70 x 160 ft. packing house, on Callowhill and Willow Sts. Estimated cost $150,000. Private plans.

Pa., Warren—J. T. Newell, 244 Penna. Ave. W., plans to build a 4 story, 50 x 160 ft. job printing plant, on Liberty St. Architect not announced.

Pa., Williamsport—Stewart Artificial Ice Co., awarded the contract for the construction of a 1 story, 35 x 75 ft. ice plant addition on 1st St. Estimated cost $15,000.

R. I., Woonsocket—The Evening Call Publishing Co., 75 Main St., plans to build a 3 story mechanical building. Estimated cost $45,000. Private plans.

R. I., Woonsocket—French Worsted Co., Mill St., awarded the contract for a 1 story addition to its 5 story spinning mill. Estimated cost $40,000.

Wis., Cazenovia—Cazenovia Creamery Co. is receiving bids for the construction of a 1 story, 60 x 156 ft. dairy. Estimated cost $50,000. Private plans.

Wis., Cudahy—The Federal Rubber Co., awarded the contract for the construction of a 4 story, 120 x 250 ft. manufacturing plant. Estimated cost $250,000.

Wis., Green Bay—Fort Howard Paper Co., South State St., plans to build a 3 story, 100 x 140 ft. paper finishing plant. Estimated cost $200,000. Private plans.

Wis., Hartford—W. B. Place & Co., will build a 3 story, 60 x 60 ft. addition to its tannery. Estimated cost $30,000. Private plans.

Wis., Kewaunee — Kewaunee Mfg. Co., awarded the contract for the construction of a 2 story, 30 x 140 ft. factory addition for the manufacture of laboratory furniture. Estimated cost $45,000.

Wis., Madison—J. R. and E. J. Low, Archts., Strand Bldg., are receiving bids for the construction of a 1 story, 60 x 182 ft. factory on Charter St., for J. Feldman Paper Box Co., 515 Regent St. Estimated cost $60,000.

Wis., Plymouth—The Phoenix Cheese Co., is having preliminary plans prepared for the construction of a 5 story, 30 x 60 ft. factory addition, and also a 2 story, 30 x 60 ft. addition to present building. Estimated cost $60,000. R. A. Harbach, Mgr. Private plans.

B. C., Marpole—The Pacific Meat Co., 688 Columbia St., Vancouver, will build a 2 story, 65 x 100 ft. abattoir and cold storage packing plant, cattle sheds, etc., along the Frazer River, here. Estimated cost $80,000. H. Idsardi, c/o owner, Engr.

B. C., Vancouver—Canadian Pipe Co., Ltd., 550 Pacific St., plans to rebuild its wood pipe factory, recently destroyed by fire. Estimated cost $40,000 to $50,000. Engineer and Architect not selected.

B. C., Vancouver—The Dominion Government, Ottawa, Ont., awarded the contract for the construction of a 30 x 60 ft. grain drying plant, 90 ft. high, and a 1 story, 30 x 75 ft. boiler house, here. Estimated cost $85,000.

Ont., Neustadt—The Grey Furniture Co. plans to enlarge its factory and install additional machinery and equipment. Estimated cost $35,000. J. C. Heuther, Mgr.

American Machinist

361

Volume 57 NEW YORK, SEPTEMBER 7, 1922 Number 10

Parkerizing—A Rustproofing Process

What the Parker Rustproofing Process Is—The Three Operations in Its Application—Kinds of Parts Treated—Apparatus and Equipment Required

By L. C. MORROW
Managing Editor, *American Machinist*

RUST, formed by the chemical action of water, atmosphere and iron is visible evidence of the destruction of iron and steel and constant vigilance is required to prevent its formation. Without the actual getting together of the iron, water and oxygen from the air there can be no rust. If polished iron or steel is kept *perfectly* dry, it will stay polished, or if it is kept covered by a substance that will keep away water (moisture) the polish will remain.

Oil, if thick enough and viscous enough, will keep the iron free from water when it is applied as a coating on the metal, and is fairly efficient as a rust-preventing agent. But its use generally interferes with the utility of the article protected. A better protection would be a substance that would adhere to or be a part of the metal and still permit it to be handled. Three general methods have been used to provide such a protection, namely, the application of an organic substance (painting, lacquering, enameling), the application of an inorganic substance (galvanizing, electroplating, metal spraying), and the chemical conversion of the surface of the object being protected (browning, bluing, blacking and other processes).

"Parkerizing" belongs to the conversion method. It consists in changing by chemical action the surface of the metal to form other substances that will not change into rust. The substances so formed are basic iron phosphates (ferrous phosphate and ferric phosphate), insoluble in water and permanent in the air.

The Parker process is the property of the Parker Rust Proof Co., Detroit, Mich., which licenses manufacturers for its use. It is a development from two English patents, one purchased from Thomas Watts Coslett, the other from Frank Rupert Granville Richards. The first contemplates the use of a dilute solution of phosphoric acid with iron filings, the second the use of dilute phosphoric acid with an oxidizing agent. Improvements made by the present owners include the addition of manganese and other metals to the phosphoric acid and the development of a chemical test whereby the strength of the solution can be easily and readily controlled.

Three operations are necessary in Parkerizing—cleaning, processing and finishing. With the processing solution at proper strength, success in the coating depends entirely upon the thoroughness of the cleaning. Any method of cleaning that produces a chemically clean surface is satisfactory. Some bright parts or parts that

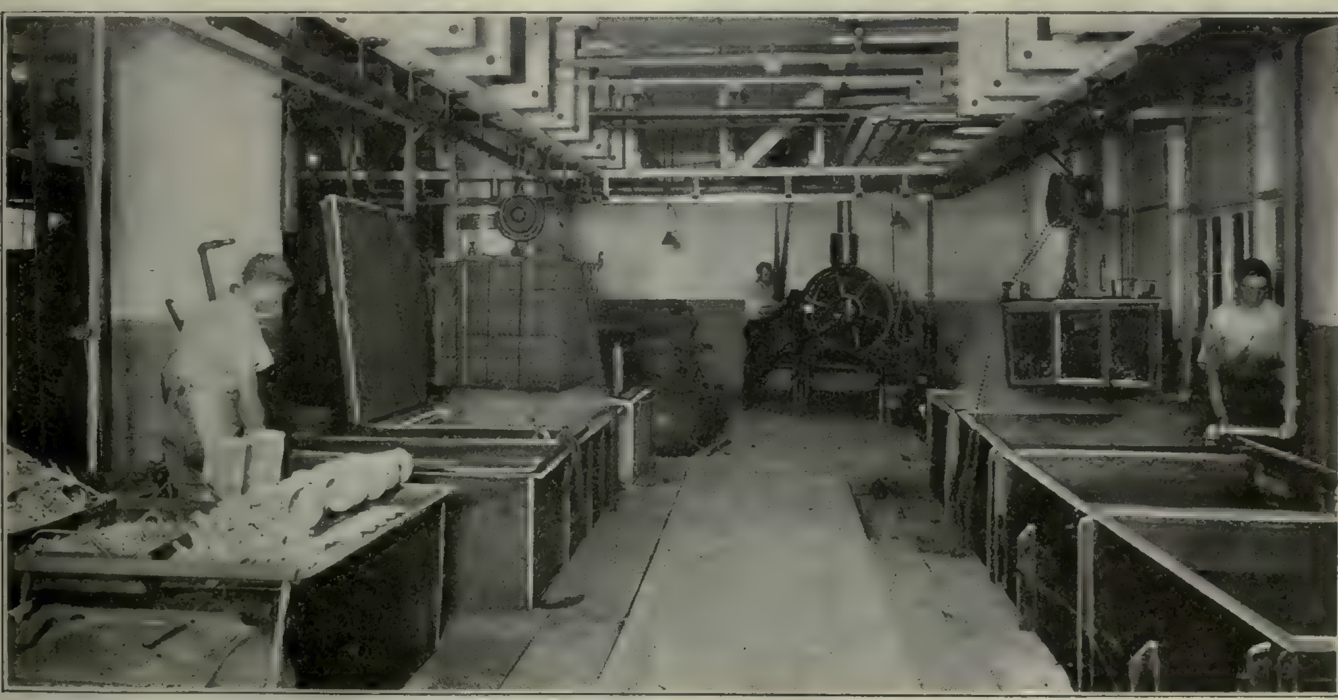


FIG. 1—THE PARKERIZING DEPARTMENT

The sand blasting machine is seen at the rear. On the right are alkali, rinse, pickle and rinse tanks in the order named, the alkali tank being nearest the sand blast. On the left are the processing tanks. The finishing tank, in the foreground, has the cover down and is used, for this illustration, to display components and containers. A chain block serves the tanks and blast.

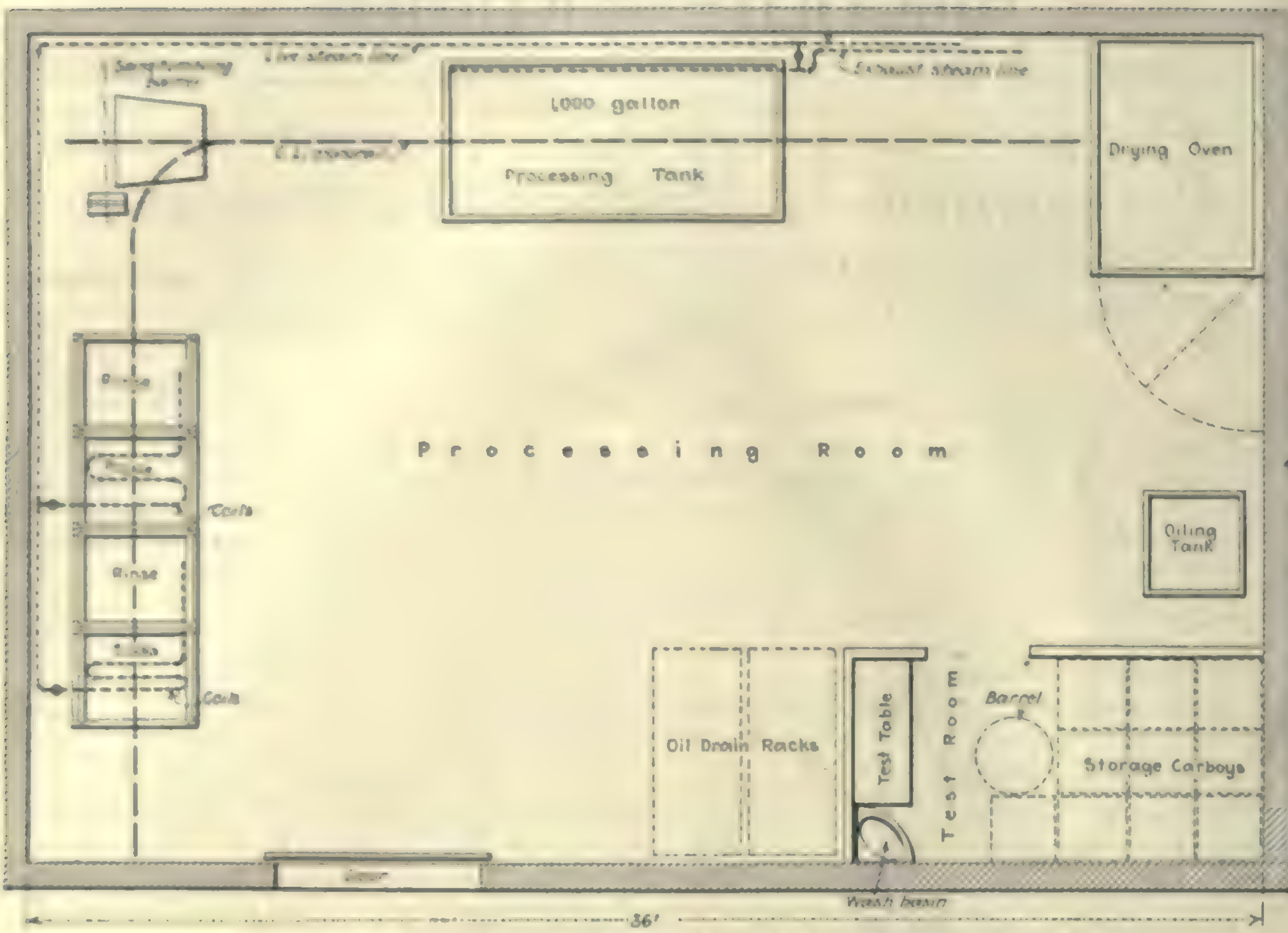


FIG. 2—MODEL LAYOUT FOR AN INSTALLATION OF 1,000 GALLONS CAPACITY

have been machined all over can be processed without further cleaning. Sand blasting is the best method of cleaning, but pickling can be used successfully if all pickling residue is removed before processing. Pickled surfaces process less quickly than sand blasted surfaces.

When pickle is used as a cleaning medium the operations normally are as follows:

(1) Alkali wash
(2) Rinse
(3) Pickle
(4) Rinse
(5) Sand rub or sand roll.

The article is then ready for processing. For best results alkali water must be used at a boiling temperature and all rinse waters must be boiling. The temperature of the pickle itself, which frequently consists of one part of sulphuric acid to seven parts of water should not be higher than 180 deg. F. and not lower than 160 deg. F. A pickling solution recommended for the process consists of one gallon of water to four fluid ounces of sulphuric acid and a limited amount of sodium bisulphite. The bisulphite is added in small quantities in the ratio of one pound to one hundred gallons of pickle from time to time during the day's operation. The object of the bisulphite is to supply sulphur dioxide gas which renders iron scale more soluble in the pickling solution. It is necessary that the sodium bisulphite be added under the surface of the water, because if it were put in on the surface all the gas would be liberated there and would pass immediately into the air.

The object of the sand rubbing or rolling is to remove such pickle residue as the rinse may fail to take off and it must be carried on with great care. Rubbing is ordinarily a manual operation and is used only on such parts as cannot be rolled with sand in a barrel. Where it is required a shallow box containing sand from 3 to 6 in. deep placed on a table or bench is often provided for this purpose. The articles may be rubbed with a brush or a cloth or rubbed directly in the sand.

Rolling is merely tumbling with sand after final rinsing and drying. The tilted tumbling barrel is considered best for this operation because with it the amount of fall can be regulated. The duration of

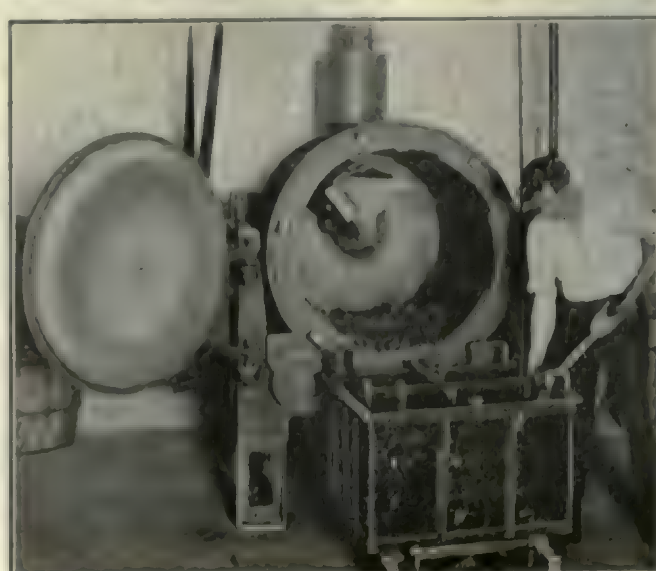


FIG. 3—LOADING THE SAND-BLASTING MACHINE

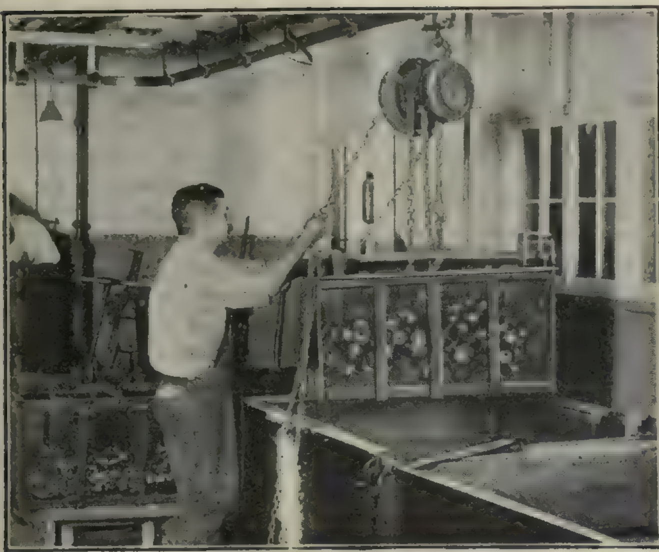


FIG. 4—CLI ING BY PICKLING

The basket of parts has t been taken from the alkali wash and is about to be rinsed. It will then move to the right to the pickling tank and after that to the rinse tank. Inside dimensions of the tanks: length 4½ ft., width 4 ft., depth 3½ ft.

tumbling varies from 5 to 20 min. and the speed of the barrel from 15 to 45 r.p.m. A clean sharp sand is used. For parts that are small or fragile the sand should be of such size that it will pass through 40- or 50-mesh screen. Coarser sand may be used for larger pieces. The barrel is often fitted with a screen cover so that the sand can be removed by turning the barrel downward and the parts left clean. In other cases a shallow box is provided with a coarse screen cover on which the full load of the barrel is dumped, the sand passing through the screen. A variation of the rubbing process involves the use of a wire brush to help in removing the residue from receptacles or pockets.

The method of cleaning by sand-blasting makes unnecessary the washing, rinsing and rubbing operations. Ordinarily no other cleaning is done although in special cases a combination of chemical cleaning and sand-blast may be desirable. A very fine velvet surface may be produced by first pickling and then sandblasting with fine sand at very low pressure.

Any method of cleaning that will produce a chemically clean surface is satisfactory for Parker process and in many shops individual ideas have been worked out with success. Tumbling, with an abrasive in the presence of the cleaner, may remove the burrs from stampings and at the same time produce very fine surfaces for Parkerizing. Electric cleaners are also used in some cases. The cleaning operation may serve two purposes—that of removing the scale and other foreign matter from the surfaces, also of scouring and polishing the surfaces so as to secure the most desirable finish for the processing operation.

The amount of time necessary for the various suboperations depends upon the nature of the work. On a 0.30 caliber rifle barrel the alkali wash required 10 min. immersion, first rinse 3 to 5 min., pickling 30 sec., second rinse 3 to 5 minutes.

Processing

After cleaning, the articles are immersed in the processing solution for from 40 min. to 2 hr., the length of time required depending upon the nature of the work. The bath is maintained at a temperature of 210 deg. F. Proper immersion will leave all surfaces in free contact with the solution. To secure that condition the articles are placed in steel baskets, racks or trays such as shown in Figs. 5 and 6. The tank itself is of steel, arranged with steam coils to heat the solution. A bath can be used over and over, but loses strength for every surface processed. To renew it, chemicals must be added from time to time, the amounts depending upon the loss in strength indicated by a well-defined and positive test. For small articles the tank contains a cylinder or barrel made of perforated metal, that is revolved slowly by a mechanical device. The purpose is to expose all surfaces that are to be coated to the action of the processing solution. Reference has been made to heating the solution by steam, but tanks can be arranged for gas heating as well.

The physical evidence of change is a vigorous bubbling in the solution that begins as soon as the work is immersed. This bubbling is the evolution of hydrogen gas. It decreases after about 15 min. and when it ceases altogether it indicates that the chemical action is complete. It is desirable to leave the work in the solution a short time after the bubbling action ceases

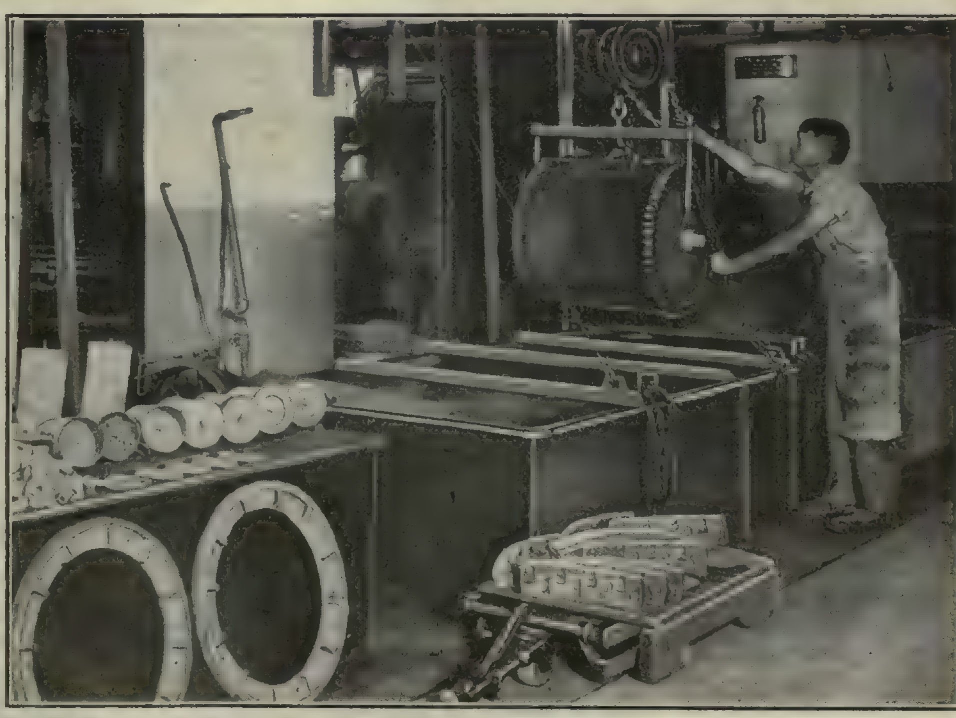


FIG. 5—PROCESSING

Showing a rotating cylinder made of perforated metal, used for processing small parts. The processing tanks are of 1,000 gallons capacity and the dimensions are 9½ ft. long, 4 ft. 2 in. wide and 4 ft. deep. Processed parts are shown at the left and on the truck. The large rings and segments are parts of tire molds. The small cylindrical containers lying on top of the tank cover are made of screen. They are loaded with parts and are placed in the rotating cylinder for processing, preventing, in that way, the mixing of parts.

FIG. 6—FINISH DIPPING AFTER PROCESSING
An oil drain board is shown in the foreground. Baskets of various shapes are used as containers for the parts.

and no harm results if the work is left in longer as the chemical action entirely ceases as soon as the surface of the metal is completely converted to iron phosphates.

What actually takes place on the iron or steel is that minute particles of iron are dissolved from the surface and are replaced by the phosphates of iron contained in the solution, this change continuing until the entire surface consists of iron phosphates instead of iron. The analysis of the solution that brings about this change is: H_3PO_4 (orthophosphoric acid) in quantities less than ½ of 1 per cent; phosphates of iron and mangenese; water about 99 per cent.

Manganese dioxide is added to serve as an oxidizing agent, its function being to accelerate the reaction by removing the hydrogen in the form of water.

Finishing

After processing is complete the work is removed and allowed to dry, without rinsing. Pieces of appreciable volume will retain enough heat from the baths to dry themselves. Where large quantities of small thin parts are processed a drying oven or a hot plate will greatly accelerate the drying. The finishing operation consists of the application of a neutral mineral oil that brings out a characteristic grayish black mat finish. An additional chemical dip has been developed by the Parker company that, if applied before dipping in oil, will give a permanent black color, much deeper than the mat produced by the oil dip alone, and will add appreciably to its rust-resisting qualities. The most recent development has been the partial change of the phosphate coatings with certain organic chemicals, the modified coatings having a far greater resistance to rust. The solution used contains also phosphates of manganese. There are other preparations for finishing, some requiring oven drying. Paint may be applied, as may enamel, lacquer and similar coatings. The process does not make an undercoating for plating.

The amount of building up on a surface is not over 0.0003 in. and frequently there is no increase in size. Other physical properties of the metal treated remain practically the same. Temper, magnetism and tensile strength are not affected to any extent. Processing does interfere somewhat with spot welding. Solder will not stick to a Parkerized surface, but articles that have been soldered can be coated without trouble, except that the solder itself will not be covered.

It is considered that a floor space of 1,500 sq.ft., equivalent to a room about 35x45 ft. is necessary for a standard installation of 1,000 gal. capacity. A model layout for an installation of that capacity is shown by Fig. 2. A tank is expected to turn out four loads of processed parts per 10-hr. day at an approximate cost of \$0.006 per square foot of processed surface. The equipment required for a complete installation (much of which may be omitted in many cases) is as follows:

Cleaning equipment, when sand-blast is not used: 1 alkali tank, 1 rinse tank, 1 pickle tank, 1 or more cleaning baskets, 1 tilting tumbling barrel.

Processing equipment: 1 processing tank with steam coils or gas for heating; processing baskets, or trays, or racks, or a perforated revolving steel drum, whichever may serve the purpose best, depending upon the nature of the material to be processed.

Finishing equipment: 1 or more steel tanks for dipping, depending upon the finish required; 1 or more baskets for dipping; 1 or more drain boards; for special finishes—a drying oven.

Testing: A simple testing equipment that can be used successfully by a workman of average intelligence.

Parker process is adaptable to parts produced in many industries, not only to add to their life while in service but for preservation while in stock and to enhance their appearance.

Electrical equipment is frequently placed in basements or cellars where it is exposed to dampness and on that account is equipment that should be protected by a rust-proof coating. Among the parts adaptable for the coating are telephone instruments and bell boxes, timer parts, magneto, motor and starter parts, meter boxes and switchboard parts.

Machine and instrument parts that fall under the same classification include parts of automobiles, cameras, typewriters and similar machines, phonographs, moving-picture machines and sewing machines. Automobile accessories such as chains, springs and jacks are continually subjected to weather and on that account merit protection. Lock parts are in the same category. Molds for tires and parts made from celluloid and similar materials have been found to be benefited by Parkerizing in that the amount of cleaning is very much reduced and there is less likelihood that the part being formed will stick to the mold. A peculiar use has been found in the canning-machinery industry. The coating, while it may react with the organic acids of fruits and foods, will not produce a substance that is harmful if eaten.

A Parkerizing plant in operation on commercial work is shown in the several illustrations. The photographs were obtained at the plant of the Pyrene Manufacturing Co., Newark, N. J., where Parkerizing is one of about eighteen methods of finishing metal parts, conducted in a department devoted to commercial finishing. With the exception of a tumbling machine everything essential to Parkerizing is shown in Fig. 1, sandblast, alkali, pickle and rinse tanks, processing and finish-dipping tanks. Closer views of the operations are shown in Figs. 3, 4, 5 and 6. Drying baskets and draining apparatus are conspicuous in the last illustration.

Employee Suggestion Plans

Reward for Suggestions in Money and Promotion—How the Priority of Suggestions Is Determined—Some Successful Plans in Practice

By SANFORD DeHART
Director of Hospital and Employment, R. K. LeBlond Machine Tool Co.

"WHY was Jim Smith selected for the job of plant engineer? He has had no college education, and so far as I know he has received no training which would particularly fit him for the position of plant engineer."

"Jim was appointed to the position of plant engineer largely because he has been a consistent prize winner in suggestion contests. The big boss was of the opinion that a man who could think of so many different valuable suggestions would make an ideal plant engineer."

The foregoing colloquy took place between a workman and his foreman in a factory in the Middle-West. The manager of this factory made it a practice to select men for positions of authority on the basis of the valuable suggestions they submitted. Several of his men "woke up one morning and found themselves famous" because of some hidden talent brought to light by their suggestions. This manager is very enthusiastic about the results he has obtained from the suggestion system which he inaugurated in his plant twenty-three years ago.

> THE INSTALLATION and operation of a suggestion system are absurdly simple. The success or failure of the system, however, depends largely on the personality of the one in charge, and on the proper recognition by the management of the employee making the suggestion.
>
> One manager selects men for positions of authority on the basis of the valuable suggestions they have submitted.
>
> Even though a suggestion is not accepted, the employee should be told the reason and encouraged to make other suggestions. A record file should establish the priority of the suggestions received.

A department with a personnel of ten persons devotes its entire time to investigating and answering suggestions which are either sent to them through the mail or deposited in locked boxes provided at the entrance of each department. After the suggestion department has reviewed a suggestion, a final disposition is made of it by a committee consisting of the factory manager, controller, chief engineer, office manager, supervisor of the order department, assistant sales manager, chief inspector, efficiency engineer, supervisor of the assembling department, one man of the rank and file, and the head of the suggestion department.

Each suggestion is copied without the name of the suggestor and is referred to the head of the division affected, who submits a report to the suggestion department. If this department thinks the report satisfactory, it passes the report on to the suggestor. If the report is not satisfactory, a further investigation is made by either a member of the suggestion department, or some other head of a division.

If the idea is not accepted, a letter is written giving in detail the reasons for not adopting it. In its reply, the department tries to make the suggestor feel that it was glad to have the opportunity to investigate the suggestor's idea even though the idea could not be adopted.

In the past twenty years, the company has paid its employees more than $75,000 for suggestions. Last year 8,200 suggestions were submitted by employees, and of this number 2,200 were adopted. Of the 80,000 received in the past nine years 30,600 were adopted. The largest rewards were given during the first six months of last year in which 1,009 suggestions were adopted and $10,000 awarded in prizes.

The winner of the capital prize in this contest invented a counter-wheel knurl engraving machine. The knurls had always been engraved by hand, a process which was necessarily slow and imperfect. Nine or ten hours of work were required to complete a knurl by hand, while the machine which this man invented, engraved a complete knurl in thirty-five minutes, and turned out a far better product.

From the foregoing it may be gathered that this company would be very reluctant to abandon its suggestion system. The system is a success in the plant mainly because of the personal interest taken in it by the manager, for the success or failure of any suggestion system depends largely on the personality of the one in charge. While some industrial managers are thoroughly cognizant of the benefits accruing from such a system, conversely, many manifest very little interest in suggestions emanating from the employee.

Suggestion systems are an unqualified success if the employee making the suggestion is given the proper recognition by the management. This recognition may be in the form of money, honorable mention in the factory magazine or merely a pat on the back. It is a short-sighted policy to receive a good suggestion without giving the person who made it the proper credit. Even though the suggestion cannot be used, the employee should be told the reason.

Not long ago, I visited a factory in the Middle-West, and while there saw a condition which obviously needed improvement, and which could have been made by any employee having the slightest mechanical training. I spoke to one of the employees about it, thinking that perhaps it had not occurred to him that such a condition might be improved. He informed me, however, that he was fully aware that the defect could easily be remedied, but had long since stopped making suggestions, as he had never received any credit for those he had previously made. Yet, a large box labeled "Suggestions" had been placed conspicuously in the shop; but had long passed into innocuous desuetude because of the lack

of interest on the part of both employer and employee.

The installation and operation of a suggestion system are so absurdly simple, that it is a remarkable thing that such a system is not universally adopted. The monthly suggestion contest of another shop in the Middle-West is fairly representative of these systems in general. The contest is open to all employees. Every submitted suggestion is given due consideration, and if adopted, worth-while awards are made. The following rules are used:

(1) All employees are eligible to submit suggestions and receive rewards.
(2) When two or more employees submit similar suggestions, the one whose suggestion slip was first received will be given credit.
(3) The idea is to be described as thoroughly as possible. Any suggestion not clear to the committee will be returned to the sender for further details.
(4) Date and sign all suggestions and give badge number.
(5) Sketches should accompany suggestions regarding mechanical apparatus, whenever possible.
(6) The stub attached to the suggestion blank is to be retained in all cases.
(7) Reason for not accepting suggestions will be given to sender.
(8) Employees may have submitted suggestions reconsidered by forwarding written request to the suggestion committee.
(9) Drop all suggestions in the suggestion box. Do not send by mail to the committee. Use the standard form of suggestion slip in all cases, but if more space is necessary to describe your idea in full, attach one or more sheets of paper to the suggestion slip. Use one side of paper only.
(10) All suggestions which bear the name of employee submitting the same will be acknowledged.

The suggestion committee meets once a week to consider suggestions made, and you will hear from your suggestion as soon as possible.

What to Suggest

(1) Improve methods of manufacture.
(2) Improve machinery or other equipment.
(3) Increase efficiency and production.
(4) Increase co-operation and united effort between individuals or departments.
(5) Improve working conditions.
(6) Eliminate waste of any kind, time, effort, material, power.
(7) Prevent accidents and increase safety.
(8) Make every job at our plant the best job of its kind anywhere.

In this company, suggestion boxes, numbering about thirty-eight in all, are located throughout the plant. Each box is numbered and the suggestions collected from the various boxes are numbered to determine the origin of the unsigned suggestions.

Upon the receipt of a suggestion, it is given a record number, and entered on a card file. These cards contain the employee's name, number, date suggestion is submitted, suggestion number, record number, to whom referred, date referred, date of receipt of reply, date closed, award and final disposition.

It occasionally happens that a number of suggestions in this plant can be closed at once. There are others, however, that may be held in abeyance for months. The record file is intended to establish the priority of the suggestions submitted in case the installation of the apparatus is made after a long period. The suggestion plan has been in operation in this plant for three years. During this period 1,045 suggestions have been submitted, of which number approximately 150 were deemed worthy of award.

One company reports that one of its best suggestions came from a young girl in the girl's department. This girl, still in her teens, submitted a suggestion which decreased by 25 per cent the cost of the product manufactured by the concern, and for this suggestion she received a $50 prize. Rewards as high as $500 have been given for suggestions in this concern and, in addition, machine safe-guards have been named after the employee who suggested them.

Another concern rewards its employees for finding defective links in crane and sling chains, presenting a pocketbook to the employee who discovers one defective link and a gold watch to the employee finding the largest number of defective links.

Foremen Sometimes Excluded from Contests

In one firm all employees except supervisors, department heads, foremen, job foremen, section heads and sales agents may compete in suggestion contests. In another firm, heads of departments, draftsmen, experimental men and others in similar positions are excluded from participation in the suggestion plan, for the management is of the opinion that any plan that causes competition between the executives and the men is undesirable. This rule is not inexorably adhered to in all establishments.

One company employing ten thousand persons has never excluded the foremen from the privileges of the suggestion system, and considers this a wise plan. Some very good ideas have been obtained from the foremen, ideas which probably would not have been brought forward had there not been a prospect of compensation.

For a time the concern tried classifying the foremen by themselves, removing them from competition with the workmen, and basing the foremen's prizes upon the awards received by the men working under them. This did not prove to be a successful plan, however, and recently the old arrangement was resumed. During the year 1921, $10,500 was paid to employees for suggestions.

A description of the operation of this system is as follows:

Suggestion blanks are placed at convenient points about the works. Any employee having a suggestion to make writes out a full description of his idea, places it in an envelope marked "manager's office," and drops it in a locked mail box nearby. If a sketch is necessary to illustrate the employee's idea, and he has not the necessary skill to make one, he is privileged to have one of the draftsmen make a simple sketch for him.

The suggestions are collected daily and sent to the manager's office. Every suggestion is there stamped with the date on which it is collected. It was found necessary to do this because on several occasions different employees made suggestions on the same thing almost simultaneously, and until the suggestion blanks were dated, the question of priority could not be determined.

As soon as the suggestion is received, a copy of it is sent to the superintendent of the department to which the suggestion applies. He investigates the merits of the idea and returns the suggestion to the office with his recommendations and reasons. In the meantime a printed acknowledgement has been sent to the person who made the suggestion. If the recommendation of the superintendent is endorsed by the manager, the superintendent is instructed to carry out the suggestion and a report is sent to the maker stating that it has

been adopted. If the suggestion has not been adopted, the maker is advised to that effect.

At the end of each month all the suggestions accepted and put in operation during the month are listed, together with a brief description of the ideas and their advantages, and a copy is sent to each member of the suggestion committee, which is composed of the superintendents of the various departments. A few days later a meeting is held for the purpose of making the awards of the prizes for the suggestions of the preceding month.

Each suggestion on the list is taken up by the superintendent who had charge of putting it into practice. The superintendent at the same time gives his idea of the prize the suggestion merits, if any. A discussion of the advantage of the suggestion follows; and a vote is taken as to the suggestions for which prizes are to be awarded, and the amount of each prize.

The suggestion boxes of another concern are in charge of the "factory conditions section" of the personnel department. The contents of these boxes are collected by the safety inspector while on his daily rounds through the factory. As suggestions are received by the superintendent of the personnel department, they are given a file number, and are acknowledged by post card. An endorsing sheet is prepared for recording investigations and decisions. The ideas are then referred to the general committee at their next weekly meeting. This committee is made up of the committee chairman who is the superintendent of the personnel department, the chairman of the factory committee on methods and improvements, the chairman of the engineering committee on inventions and improvements, and a representative of the patent department.

> THE SUGGESTION system reacts favorably upon the employee and at the same time benefits the management.
>
> Besides receiving a monetary prize, in working out his idea the suggestor gains an increased knowledge of the business which frequently leads to promotion and increased pay.
>
> An improved product, better factory and office system, new selling and advertising methods, better health and safety features and savings of thousands of dollars in production costs, are some of the advantages derived by the management.

The remuneration for suggestions may take one of three forms, monetary consideration, advancement in position, or honorable mention. This suggestion plan has been in operation for the past eight months. Sixteen hundred persons are employed.

The number of suggestions disposed of by the committee has been analyzed as follows:

Received	127	
Acted upon	122	
Adopted—Special Reward	35	($367.50)
Adopted—Honorable Mention	11	
Good but already taken care of prior to receipt of the suggestion	2	
Good but not feasible for present adoption	19	
Not feasible	55	
Held over for further consideration	5	

The concern believes that the percentage of good ideas submitted (59 per cent of the total) speaks very well for the plan. Of the good ideas, 53 per cent had to do with improvements in manufacturing methods, 42 per cent were inprovements in design of apparatus, the remaining 5 per cent pertained to factory routine.

Some of the suggestions submitted brought about large savings in the costs of production, and others solved some design difficulties. As an example of the latter, the case of a new means for lubricating the rotor bearings of large machines might be cited. The rotor bearings of this machine weighed approximately 45 lb., were equipped with ball bearings and revolved at a speed of 8,600 r.p.m. Perfect lubrication was a prime requisite to the successful functioning of the machine. One of the department foremen became interested in the problem, though his work at that time did not include the responsibility for the manufacture of that part. Nevertheless, he worked on a scheme which solved the problem and was awarded a substantial money prize by the suggestion committee.

There is no question of the good psychology in having an employee understand that his efforts along these lines are appreciated, for the system reacts favorably on the employee and also benefits the management.

One manufacturing organization employing 6,000 persons has had a suggestion plan in effect in some form since 1894. The president of this concern says: "We believe the value of the suggestion system to be almost limitless. Our plan has proved to be very profitable. It has resulted in giving us an improved product, better factory and office systems, new selling and advertising methods, better health and safety features, saved thousands of dollars in the cost of production, and in fact every phase of the company's business has been benefited by the suggestion plan.

"Another feature that should not be lost sight of is the benefit the suggestor receives besides the monetary prize, and that is the increased knowledge of the business which he gains by working out his idea. It also leads to promotion and increased pay. A large number of our executives who have been promoted from the ranks were consistent prize winners in our suggestion contests."

Spiral or Helical?—Discussion

By F. F. Dorsey

May I suggest that your discussion of the distinction between a spiral and a helix might well be extended to include a third form of curve often used in machinery, and also commonly called a "spiral"? I refer to the curve which may be considered as a compromise between the spiral and the helix, and described as the path of a point moving at a constantly increasing distance, around another point which moves along a straight line.

I understand that this curve is properly termed a "volute," and it is often used in springs. It was also formerly much used in the "fusee" of watch movements, in combination with a chain and a "barrel," to equalize the force of the main spring.

SPECIAL AUTOMOTIVE

Fig. 1—Milling edges of four connecting rods on Cincinnati milling machine. Work raised to cutters by cam at side. Production, 4 rods in 5 min.

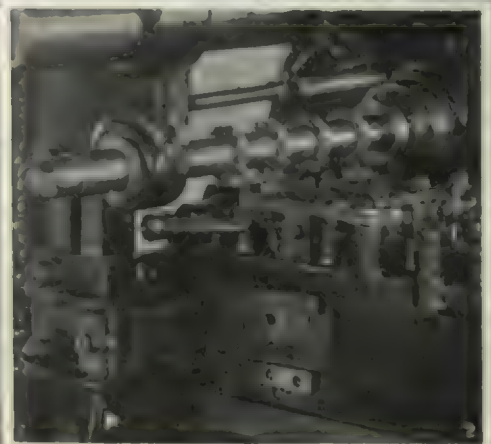


Fig. 2—Channeling four rods on Cincinnati milling machine. Same cam device lifts work to cutters and drops at end of cut. Production, 4 rods in 5 min.

Fig. 3—Facing connecting-rod bosses on double-ended swiveling fixture on Cincinnati milling machine. Mills two rods at each pass. One end loaded while other is in the work. Upper cutters run 38 r.p.m., lower 23 r.p.m. Production time under 2 min. per pair.

MACHINING METHODS

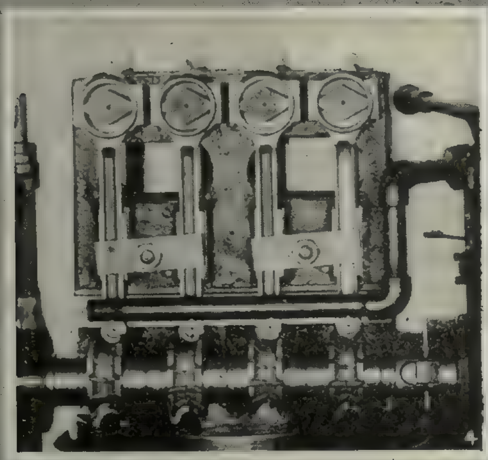


Fig. 4—Rounding small end of rods on Cincinnati milling machine. Work located on studs through finished holes. Production time, 2 min. for 4 rods.

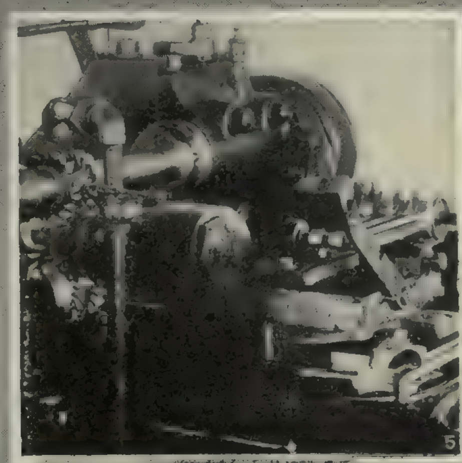


Fig. 5—Splitting cap from rod and milling both lugs. Two sets of cutters. Swiveling fixture carries 3 rods on each end. Production, 80 rods per hour.

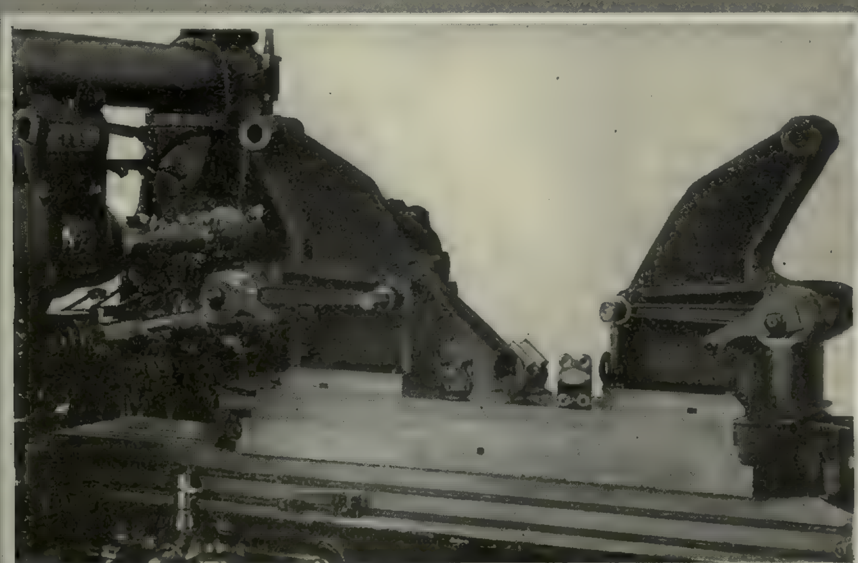


Fig. 6—Milling between lugs on four-bolt rod. Note simple clamps. Swiveling fixture carries two rods at each end. The job is on a Cincinnati milling machine. Production time, 75 rods per hour.

Methods of Machine Tool Design

Second Section of Chapter Dealing With Machine Tool Clutches—Milling of Clutch Teeth—Clutches for Power Presses and Screw Machines

By A. L. DeLEEUW
Consulting Editor, *American Machinist*

CLUTCHES which can be machined on the milling machine should preferably be made with an odd number of teeth. When the clutch is to be made in some different way—for instance, on the Gleason bevel-gear generator—it is immaterial, so far as the manufacturer goes, whether the number of teeth is odd or even. Considering the action of such a clutch it is preferable to make it with an even number of teeth.

The reason why an odd number of teeth should be used for the milling method is that the odd number

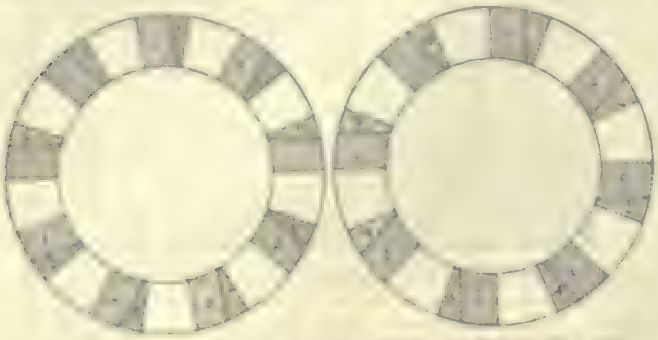


FIG. 127—DIAGRAMS TO ILLUSTRATE METHODS OF CUTTING CLUTCH TEETH BY MILLING

permits the milling cutter to go through from one end of the clutch to the other, so that a clutch with fifteen teeth will require only fifteen cuts, whereas a clutch with fourteen teeth will require twenty-eight cuts. In Fig. 127 two jaw clutches are shown with nine and eight teeth respectively, and the cuts taken through them are indicated by figures 1, 2, 3, etc., while the cut-away parts are shaded one way for the first cut and the other way for the second cut. It will be seen that for the nine-tooth clutch one merely needs to index once clear around the circle, while with eight teeth it is necessary first to index once clear around the circle and then shift the clutch a sufficient amount to produce the desired width of gap, then index around once more.

It is never advisable to slide a clutch over a shaft with only one key, with the exception, of course, of such clutches as may be used for connecting up a crank or handwheel for manual operation of a machine part. The double key is not so much required for the throwing in as for the throwing out of the clutch, because the single key is very apt to cause binding between the clutch and the shaft and make it almost impossible to throw out the clutch under a moderately light load. Even better than the double key is the splined shaft.

In Fig. 128 is shown a clutch construction for a sliding shaft. In this case it is not safe to mount the clutch directly on the shaft, because whether the shaft slides through the gears or the machine element holding the gears slides along the shaft, there will be a tendency to take the clutch along by the friction of shaft or key. To overcome this danger the clutch is keyed to a sleeve which extends from one bevel gear to the other and prevents any endwise motion of these gears. The sleeve itself is keyed to the shaft.

If the gears themselves serve to give a motion to the member which holds them or to the member which holds the sliding shaft, then it is possible to avoid the above-mentioned difficulty without the use of the sleeve. Let us suppose that the gears are placed at the bottom of a column which slides over a bed and that the shaft is located in the bed; and let us further suppose that by throwing the clutch into gear A (on the left), we cause the column to move to the right. Then it is clear that the movement of the column will have a tendency to hold the clutch in mesh. As gear A causes a movement to the right, gear B must necessarily cause a movement to the left; so that, whether the clutch is thrown in to the right or left, it will always be safe. On the other hand, if the bevel gears are used for some other purpose, so that there may be right-or left-hand movement between gears and shaft, whether the clutch is in one way or the other, then there might be a tendency to throw the clutch out by its movement. Such a case might happen with this same column and bed if the gears were not for moving the column but, for instance, for giving movement to the elevating screw of the saddle on the column.

Though the sleeve construction is not absolutely necessary in some cases, it is advisable to employ it wherever possible. It brings the key for the clutch to a larger diameter. This facilitates the throwing out because the pressure on the key is less. On the other hand, it is always necessary to examine carefully the conditions of each individual case. We might find a case where the maximum possible length of the clutch is sufficient as compared to the size of the shaft, but would be too short as compared to the size of the sleeve. In that case, what we would gain by reduced pressure on the key would be lost by the insufficient length of the clutch, and the shifting might actually become more difficult.

A well-known construction of clutch is that which is permitted to make one or more revolutions after which it is supposed to throw itself out. Such clutches are

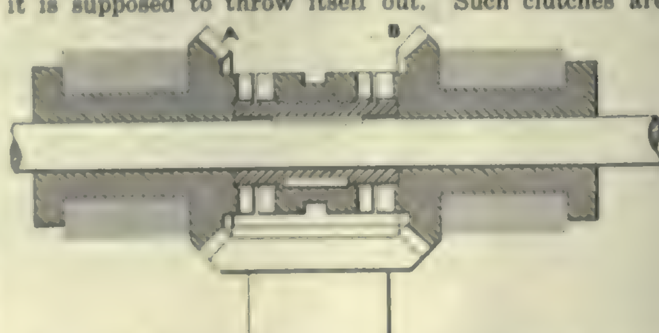


FIG. 128—CLUTCH CONSTRUCTION FOR SLIDING SHAFT

used in power presses, in screw machines, etc. Fig. 129 shows the essential parts of such a clutch. The gear A derives its movement from some source and must transmit this movement to gear B; or, in general, to shaft C. Gear A runs loose on the shaft and is constructed with clutch teeth D. The clutch E is made to mesh with D during one revolution. E is keyed to the

*For the author's forthcoming book. All rights reserved.

shaft, so that during that one revolution the shaft also will turn. A spring *F* tends to push clutch *E* into mesh, but is prevented from doing so by an obstruction *G*. This obstruction can be removed either by hand or by some part of the mechanism. This permits the clutch *E* to jump forward and to engage *D*. There is a cam-shaped portion *H* milled in the outer circumference of the clutch which, when bearing up against the obstruction *G*, pulls the clutch out of engagement. All that is necessary then to cause the clutch to make one turn is to withdraw the obstruction for a single moment and let it go back into place. If it should be desired to have the clutch make two or three or more revolutions, some arrangement should be made so that the obstruction cannot go back into place until after the entire number of revolutions but one has been completed.

It should be noticed that, when the clutch is in engagement, there is spring pressure between *B* and *A* and, unless the proper precautions were taken, there would be end pressure against the bearings. To take care of this end pressure, gear *B* bears up against a shoulder of the shaft and gear *A* is limited by a collar *I* pinned or setscrewed to the shaft.

A modified construction of this arrangement is shown in Fig. 130. In this case the clutch is mounted on the hub of one of the gears. This has the advantage of

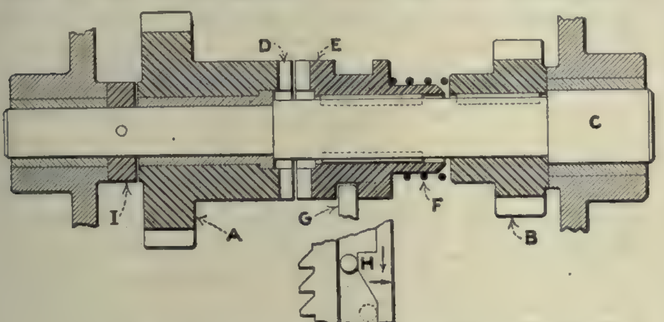


FIG. 129—LAYOUT OF POWER PRESS CLUTCH

being a neater construction, but gives less bearing for the clutch with the same length over all.

It sometimes happens that such a clutch is used in a cycle of operations which requires a very accurate timing. It will be necessary to have the clutch make exactly one revolution—no more, no less. Such a condition might exist in a gear cutter, for instance, if it is used for the indexing. In that case, a construction such as shown in Fig. 131 is used. The cam-shaped groove or projection of the clutch again serves to throw it out of engagement, but there is also a disk on the shaft with a notch in which the projection of a lever fits. For the starting of the clutch both obstructions are lifted out of the way; that is, the one against the cam-shaped portion of the clutch and the one in the notch of the disk. Fig. 131 shows this arrangement. A single movement of the lever *A* operates both levers *B* and *C* and allows the clutch to engage. Lever *B* can return to its starting position, ready to intercept the projection of the clutch, independent of lever *C*. The projection of this latter lever rides on the circumference of disk *D*. When the clutch has made almost one revolution, it is thrown out in the manner described above, but the momentum of the parts permits the shaft to go a small distance further until it is stopped by the projection of lever *B* entering the notch. It happens sometimes that the momentum of a small clutch is not sufficient to overcome the friction which may retard the shaft, so that there would be a certain degree of uncertainty as to whether the projection of lever B will actually enter the notch or not. In that case it is well to make the disk heavy enough to act as a flywheel. Even where the accurate cycle is not required, but where the clutch runs at relatively low speeds, it may be necessary to provide for such a flywheel effect.

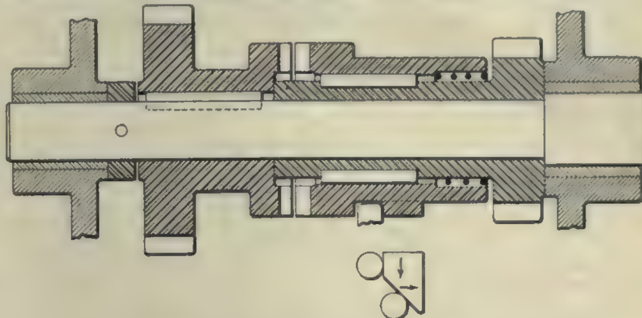


FIG. 130—MODIFIED TYPE OF PRESS CLUTCH

In many cases, more than one revolution of the clutch is required, and this may be combined with the necessity of accurate timing. To accomplish this, two disks are provided, as shown in Fig. 132. These disks are side by side, but are run at different speeds. If, for instance, we should wish five revolutions of the clutch before stopping, we would run disk *B* at one-fifth of the speed of disk *A* and do this by a system of back gearing between *A* and *B*. Disk *A*, which is the slow-running one, would be provided with a notch considerably wider than is required for the projection of the lever but less than one-fifth of the circumference; while disk *A* would have a notch just wide enough to admit the projection of another lever so as to stop it in the correct position. In addition to these two levers, there is a third one which carries the obstruction which holds the clutch out of engagement.

In starting this mechanism, a single movement disengages all three levers. The clutch engages, and both disks begin to turn disk *B* slowly, and *A* as fast as the clutch. Levers *P* and *Q* are in some way connected so that the movement of either of the two must be followed by the other. The two levers, for instance, might both be keyed to shaft *S*. Lever *R* is not connected to the two, though it may be pivoted on the same shaft.

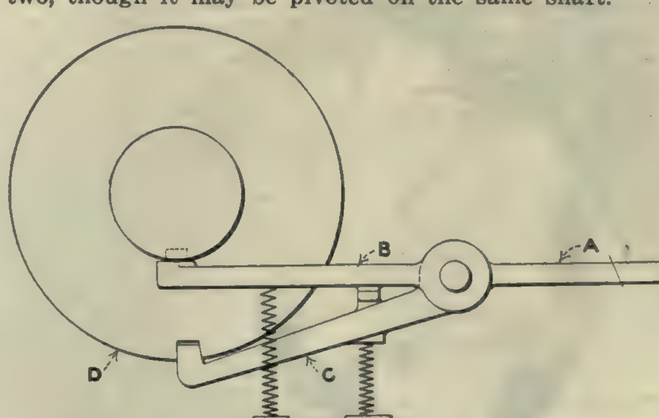


FIG. 131—USE OF TWO LEVERS FOR ACCURATE TIMING

As soon as the handle of the levers is released, they try to resume their original position, but are prevented from doing so by the fact that *Q* rides against the slow-running disk *B*. The lever *R* has a tendency to jump back in the notch of the fast-running disk *A*, but is prevented from doing so by a projection of this lever

which bears up against a similar projection of lever P, in the manner shown in Fig. 131. When finally the large notch in the slow-running disk has come far enough, levers P and Q are permitted to resume their original position. We are now on the last turn of the clutch. The lever R, however, cannot yet jump in because it is riding on the circumference of the fast disk. When the last revolution of the clutch is com-

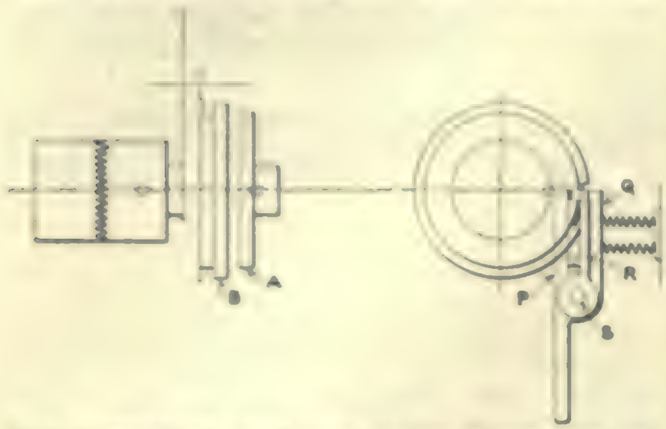


FIG. 132—SKETCH OF CLUTCH PARTS WHERE TWO OR MORE REVOLUTIONS ARE TO BE MADE

pleted, it throws itself out and, immediately after, R jumps into the notch of the fast disk.

When a positive or jaw clutch is used in a mechanism where a certain relation must be maintained, we may find that it is not sufficient merely to use such a clutch but that certain additional provisions must be made. To make it somewhat clearer, we will take a concrete example:

A boring mill is provided with screw-cutting attachment which derives its motion from a vertical feed shaft. The gearing is so arranged that one revolution of the feed shaft will cause the toolbar to move 1 in. There is also a quick traverse arrangement used for returning the toolbar and for its approach to the work. This quick traverse arrangement is driven from a shaft running at constant speed.

In Fig. 133 this arrangement is shown in diagrammatic form. A is the shaft which gives the movement to the toolbar through gears B and C and shaft D. It is this shaft A which makes one revolution for 1 in. of movement of the toolbar. Shaft A derives its motion either from feed box P or from quick traverse arrangement Q. In order to make sure that the tool point will always have the same relation to the thread to be cut, we must have feed shaft A in a certain definite position when the toolbar is raised to a certain point. To speak more definitely, let us say that a chalk mark on shaft A must point due north when a mark on the toolbar has been raised to the point O. This relation is maintained as long as we use the feed box only, but when we disconnect shaft A from the feed box and clutch it to the quick-traverse arrangement, we may get an entirely different relation; nor does this matter so long as we have some means of connecting the feed box to the shaft again in exactly the same manner in which it was connected before.

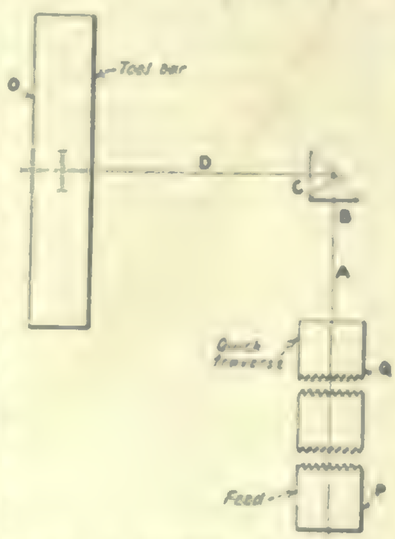


FIG. 133—SKETCH OF BORING MILL SCREW CUTTING ATTACHMENT

If the clutch with which we connected the shaft to the feed box has five teeth, then there would be five possibilities, namely, that shaft and box were connected in exactly the same manner as before, or that they would be 72 deg., 144 deg., 216 deg., and 288 deg. away from their proper relation. In order, then, to be absolutely sure that we will regain the original position, we must make the connecting clutch with one tooth only. Such one-tooth clutches are not necessarily clutches on which only one tooth has been cut. They may have more teeth, but one tooth and the mating gap should be larger than all the others so that the two clutches can mate only in one certain position. If we were cutting 5 or 6 or 7 threads to the inch, we might find that the toolbar is 5 or 6 or 7 threads away from the work, but never a fraction of one thread. For $3\frac{1}{2}$ or $4\frac{1}{2}$ or any other number of fractional threads we would need a shaft which moves the toolbar 2 in. per revolution.

Mystery Stuff in Industry

FROM *Power*

The small boy loves a secret; the hidden cave and the mystic password give him endless thrills. When he grows to be a man, he can still indulge himself in similar delights by membership in various fraternal orders. Such membership may be of real benefit to him and do no harm to others.

But the same instinct, combined with a short-sighted view of business relations, has led many a business man to throw the cloak of mystery over his "trade secrets." He does this to keep them from his competitors. Yet in nine cases out of ten they already have the information.

"Experience in dealing with producers of different commodities has shown that secrecy is largely a method by which producers have been fooling themselves," says George Otis Smith, the director of the United States Geological Survey, who has had long contact with production statistics. "Those who really wish to know the scope of competitors' activities have plenty of ways to find out. Secretive operators, who eventually decided to change their methods, have been surprised very much on disclosing their secrets to find that these secrets already were well known to their competitors."

The industries that make the greatest progress are those where co-operation replaces suspicion and where energy is directed into productive channels rather than wasted in the attempt to preserve trade secrets. Manufacturers that co-operate in obtaining and disseminating knowledge of common value find their reward in many ways. Unfair competition grows less as competitors come to know and trust one another. Production costs are reduced to the mutual benefit of producers and consumers. Finally, the good will of the consumer—a matter of first-rate importance—is best fostered by an attitude of frankness in regard to methods of manufacture and distribution. On the other hand, secrecy invariably breeds suspicion.

Effect of German Standardization on Exports

By Oscar R. Wikander

The following communication to the American Engineering Standards Committee is by an American engineer who has just returned from Germany, where he represented the Committee in conferences concerning the international standardization of ball bearings. Describing the great strides in standardization that have been made by German industries during the last few years, and the important foreign trade advantages accruing to German industries because of their intense standardization activities, he said:

There is no doubt in my mind that one of the main reasons why forward-looking Germans force their standardization work is because they want to introduce German standards in the great importing countries, and possibly in the whole world. Holland, Switzerland, Austria, Sweden, and many other European countries follow the German lead very closely. The great German deliveries in kind to France will no doubt be made as far as feasible according to German standards, thereby introducing them in that country.

It was only a few years ago that the "Normenausschuss der Deutschen Industrie," an organization corresponding to our American Engineering Standards Committee, was formed, but the amount of work which it has already accomplished is stupendous. The Normenausschuss has already issued several hundred sheets of approved standards, and about twice as many are already published as proposed standards. This enormous output of the German organization has led many to believe that it was merely a factory, producing 'paper standards', and that its work was not to be taken very seriously. A personal investigation convinced me that this is not the case, and I found that the great output of standards was merely due to the enormous efforts put forth and to the enthusiasm of the great majority of the interested parties.

This enthusiasm is due to a more or less general recognition, created under the pressure of war conditions, of the great economic value of standardization, and to the very generally accepted opinion that a standardized industry would be one of the strongest weapons in Germany's struggle for economic rehabilitation and financial reconstruction.

To give a concrete illustration of this point, I may mention that at the time of my visit, a syndicate of nineteen German manufacturers and one Swedish manufacturer were executing an order for seven hundred locomotives for Russia, all of the same design, and every part in every one of them was being made interchangeable with the corresponding part in all the others, all parts having been manufactured to the same fits and tolerances. This feature will have the great advantage of permitting the Russian railroads to use any disabled locomotive as a store of spare parts for all the others. In one case a locomotive was assembled from parts machined in twenty different shops, with no more difficulty than a locomotive which was built complete in one shop. In case of future orders, the Russians will no doubt specify that all new locomotives of this class be built not only of the same design as above, but so that every part is interchangeable with the above.

It is easy to realize what great advantages German manufacturers of locomotives will have over those of other nations when competing on the basis of such specifications, and this example illustrates the economic advantage which can be gained by German industry in introducing its standards in all countries importing mechanical equipment.

Another error in our conception of German standardization is the belief that the Normenausschuss is autocratic in its methods and is not in as close contact with the industries as our own standardizing bodies. I found, on the contrary, that absolutely the same methods are used there as here to arrive at national standards. The staff of the Normenausschuss is merely co-ordinating and directing the work of the various committees, and the actual work in establishing standards is left to such experts as are recognized leaders in the various industries.

The Normenausschuss is a big organization built up along the same lines as the American Engineering Standards Committee. Its personnel consists of the same high grade type of men as selected in this country for that kind of work, only there are more of them and their work is greatly facilitated on account of the eager response from the German industry, whose leaders look to standardization as one of their greatest hopes for salvation.

Many of the big German manufacturers have standards departments of their own, with a number of engineers and draftsmen working permanently on national standards. I found the staff of the Normenausschuss greatly interested in American standardization and very anxious to collaborate with us in establishing international standards.

It was proposed that they should send the American Engineering Standards Committee all the drafts of any importance submitted to their own committees for consideration, so as to make it possible for them to obtain American comments on important propositions, which might be of value in making final decisions. It was also suggested that the American Engineering Standards Committee keep the Normenausschuss posted on its more important work. It would, of course, be highly desirable to establish international standards and great efforts are being made to obtain them in certain lines, such as ball bearings.

The days may not be far distant when our manufacturers will receive inquiries from oversea countries to furnish goods according to the German national standards or specifications, as referred to above in connection with the Russian locomotives, and it behooves us to plan in time to meet such conditions. England seems to have realized fully the importance of recognition of her standards, and is trying to force the adoption of them in her colonies and dominions.

On account of its very efficient organizations, the German Standards Committee has come to play a more important role in the industrial life of the nation than originally expected and manufacturers write to the Normenausschuss for advice on questions of the most intricate nature.

In conclusion I wish to express the hope that the example of the German engineers and manufacturers may spur us to make equally large contributions in work and money to the cause of standardization, and that our leading engineers may try to realize the enormous economic importance of both national and international standards.

Can You Drive a Rivet?

By Charles W. Lee

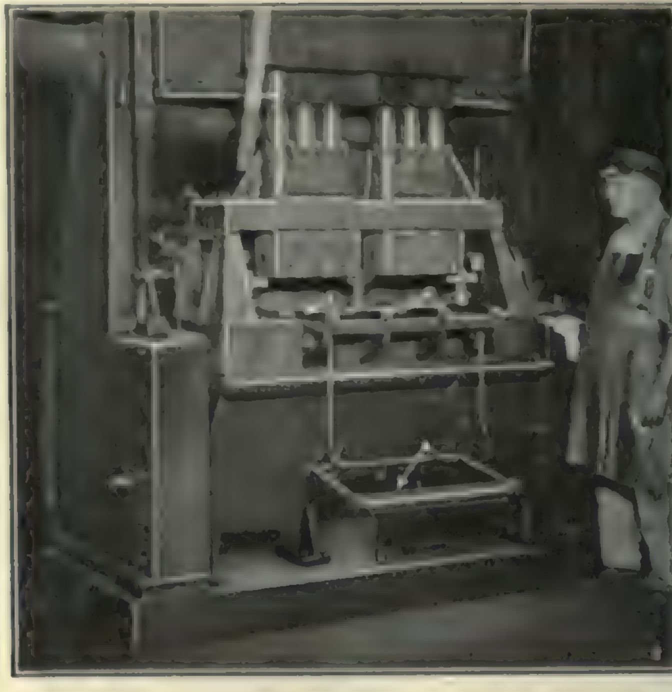
A great many persons who think sloppily when they think at all have an idea that a thing should not be called wrong by one who cannot make it right; or in other words that there should be no criticism by one who cannot find a remedy. This is the reason why the "practical man" so greatly despises the "theoretical man," who in his turn equally despises the practical man, neither realizing that each is necessary to the other.

The oftenheard expression, "Oh, that is all right in theory but it will not work out in practice," gets my goat, because a little reflection will show that whatever will not work out in practice is not right in theory, and that a theory is not wrong simply because it cannot be made to work by the one who propounds it.

I heard an old "practical man" with whiskers say to a young man without whiskers who ran a boiler factory and ran it well:

"Say, young fella, can you drive a rivet?"

"No," the young man said, "but I know when a rivet is well driven;" and whiskers shut up. But he had enough good practical common sense to keep right on buying his boilers of the same young man.



Marmon Methods on Cylinders and Crankcases

Special Machines and Fixtures for Profiling, Milling and Grinding Cylinders—Scraping and Lapping Crankcase Joints—Inspecting After Machining

SPECIAL CORRESPONDENCE

THE cylinders of the Marmon car are cast in blocks of three each, as in the case of the Rolls-Royce and a few other makes. The cylinder blocks are first faced on a Cincinnati milling machine after which they are rough-bored on a combination Beaman & Smith machine. All operations are located from three points on the cylinder block. The bolt holes are then drilled in the flanges and after another drilling and milling operation the cylinder castings are milled on the lower side of the water jacket in an Ingersoll profiling machine which handles two cylinder blocks at once, as can be seen in Fig. 1. The movement of the table is controlled by the form and roller shown at *A*, which guides the profiling cutter around the barrels of the three cylinders, a counterweight taking care of the cross-movement, holding the roll in contact with the form.

The surface thus profiled is used in locating the cylinders for the final boring, as can be seen in the Foote-Burt machine, Fig. 2, where two cylinder blocks, or a complete motor, are bored at one setting. This view shows the way in which the cylinder blocks are held in position by the clamps beneath, the clamps being easily adjusted by the wrench shown. In removing the cylinders, the operator steps on the treadle *A*,

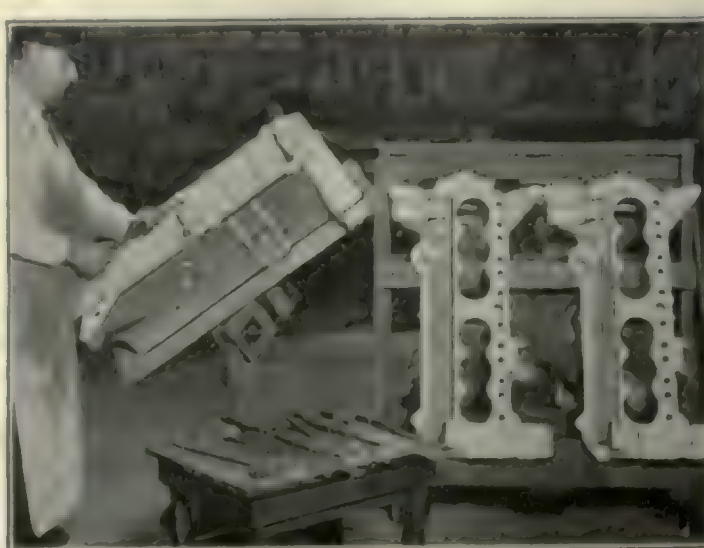


FIG. 1—PROFILING BOTTOM OF CYLINDER. FIG. 2—THE FINISH-BORING. FIG. 3—CYLINDER GRINDING FIXTURE. FIG. 4—CLEANING CRANKCASES


FIG. 5—MILLING UPPER SURFACE. FIG. 6—LAPPING THE JOINT

which raises a supporting pad *B* and *C*, under each cylinder block. The clamps are then released, swung at right-angles so as to allow the cylinder blocks to pass and the work is easily lowered and removed.

There remains only chamfering, counterboring, milling the sides, drilling for spark plug holes, and the water test of 40 lb. The cylinders are then painted, after which they go to the Heald grinding machines for finishing in the bore. Fig. 3 shows the type of grinding fixture used. Provision is made for exhausting the grinding dust and also for running water through the cylinder jacket during the grinding operation. The substantial construction of the grinding fixture helps to insure accuracy and squareness of the bore. Interesting experiments with diamond boring tools have also been made to secure the best cylinder possible.

The first operation on the crankcase is to brush the aluminum casting all over so as to remove any loose material, to smooth off any small snags or projections and in this way prevent the possibility of foreign particles getting into the bearings after the motor is assembled. Fig. 4 shows the special truck which carries four of the crankcases, and also the scraping stand at the left on which they are readily clamped. As can be seen, these stands are readily adjustable so as to make it easy to reach all parts of the crankcase without getting into strained or uncomfortable positions.

Both the crankcases and the oil pans which go under them, are machined on a large Ingersoll milling machine as shown in Fig. 5. In this case the fixtures are also the product of the Ingersoll company whose varied experience makes it possible for it to design fixtures of various kinds for handling work rapidly. As will be seen these fixtures support the outer edges of the lower crankcases against the thrust of the milling cutter so as to prevent breakage or distortion. It will also be noted that supporting strips are cast across the crankcases and stiffen them during the various operations.

Particular attention is paid to securing a perfectly flat surface and an oil-tight joint between the upper and lower crankcases. After being very carefully milled, these surfaces are lapped on the large lapping table shown in Fig. 6. This is a cast-iron table, grooved in both directions so as to present small squares, which prevent the accumulation of the lapping material on the surface of the table itself. A fine abrasive is used and the lapped surface carefully inspected on another plate as shown in Fig. 7.

The inspection of the crankcase is shown in Fig. 8 where gages of two different types are used in checking up the two surfaces to make sure they are parallel in both directions. After lapping, the surface is carefully cleaned to prevent any of the abrasive finding its way from the crankcase surface to the bearings.

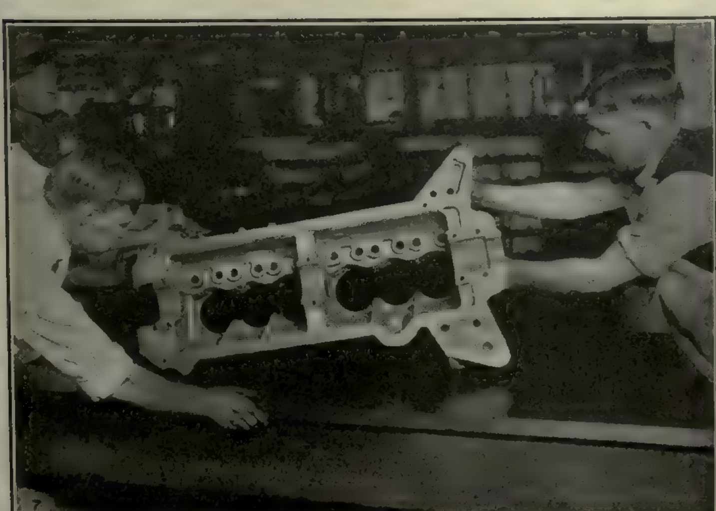
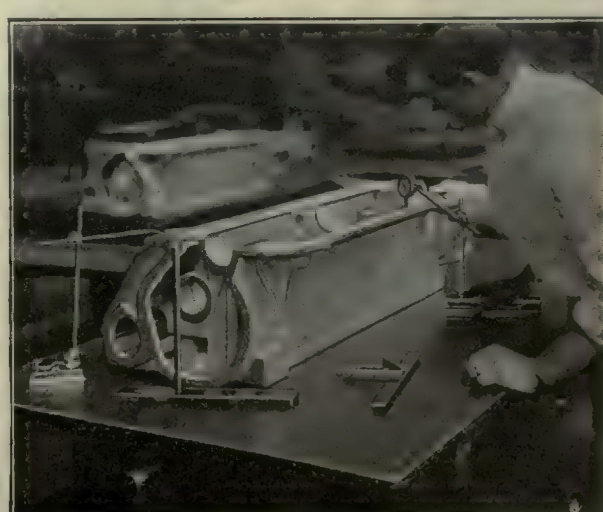



FIG. 7—INSPECTION OF JOINT. FIG. 8—GAGING THE CRANKCASE

A Combination Gage and Adjusting Fixture

By C. J. Dorer

The maintaining of accuracy when riveting and soldering parts together on a production basis is a difficult matter, and the fixture here presented is for work that requires extreme accuracy for alignment and center distance in work of such character.

A number of devices such as the average straightening fixture were used, but with little success. After considerable experiment the fixture shown in Fig. 1 was designed. This fixture makes it possible to not only check the part, but to correct it. The part in this case is shown in Fig. 2 and consists of a $\frac{3}{8}$-in. shaft, 10 in. long, to which a sheet metal plate 0.097 in. thick is securely riveted. This plate has two balls formed thereon, which extend outwardly and parallel to the shaft. To this plate is riveted a disk which is also soldered to the outer sides of the two balls.

Prior to being inspected by this gage, the balls and

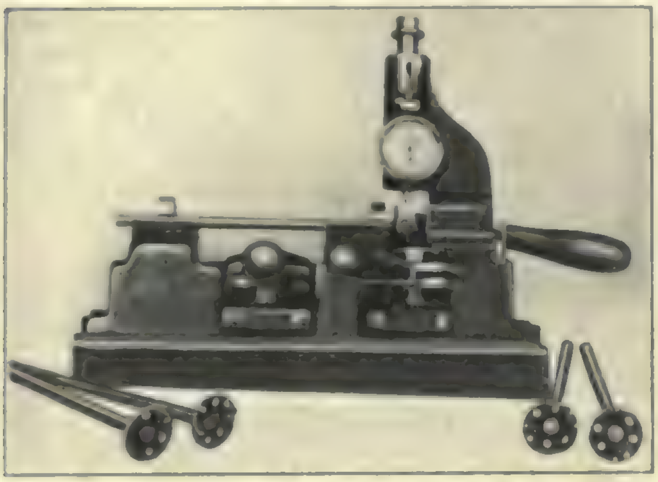


FIG. 1—COMBINATION GAGE AND ADJUSTING FIXTURE

shaft are inspected for center distance. They must be equidistant from a line normal to the shaft. This phase of the checking is taken care of by a different gage.

The gage herein described is used for determining whether the balls are diametrically opposite each other, the shaft being at the center; and if they are not, it is used for adjusting them until they are diametrically opposite each other, within ± 0.001 inch.

There are numerous reasons for the accuracy that must be maintained relative to these balls, as the shuttle of a sewing machine is driven, and consequently, timed by them. The alignment of driver holes in the shuttle with these balls, and in which the balls operate, must be practically perfect. To describe this phase of the driver would be to enter upon an unnecessary description of the very heart of the sewing machine.

Principle of Operation

The block 35, Fig. 3, is so made that when placed in the gage its top surface A' against which the ball rests, is such as to cause the center of the ball to be at A or above the horizontal line B. This means that the ball at the opposite side is a corresponding distance below the line B. The same holds true as to alignment diametrically when the block has been reground several times. The ball might then rest on the surface C' its center being at C, which is below line B, and therefore the opposite ball would be a corresponding distance above line B. Therefore, if the indicator is set at zero by means of the master gage the parts which are placed in the gage will register in a like manner when they are correct, that is, when they are diametrically opposite each other. The indicator will also register the amount of error if there is any. The amount of varia-

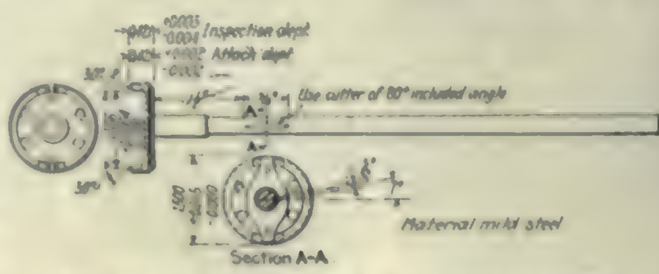


FIG. 2—THE WORK TO BE GAGED AND ALIGNED

tion tolerated in block 35 is between $\frac{1}{32}$ to $\frac{1}{64}$ in. plus or minus.

It should be noted that this amount of variation in block 35 will produce practically no variation of center distance in the position of the ball relative to the indicator plunger.

It should also be kept in mind that the gage is set to a master before using and that the checking of the parts is a comparative check with the master as a basis.

When the ball which is against or near block 35 is clamped, the rest of the shaft is lying freely in the half bushing as shown. The shaft is then clamped, and in this way no strain is set up between the ball and the shaft at this time. The other ball is then tested, and if the indicator does not register within the limits the ball is forced in the desired direction, up or down. This forcing sets up strains which are released as soon as the clamps are opened and the shaft lies free.

The position of the balls is then reversed and the reading is again taken. The balls will now show more nearly in alignment than before owing to the bending or forcing. If they are not within the limits, the operation can again be repeated, and so on, until the balls are diametrically in line with the center of the shaft.

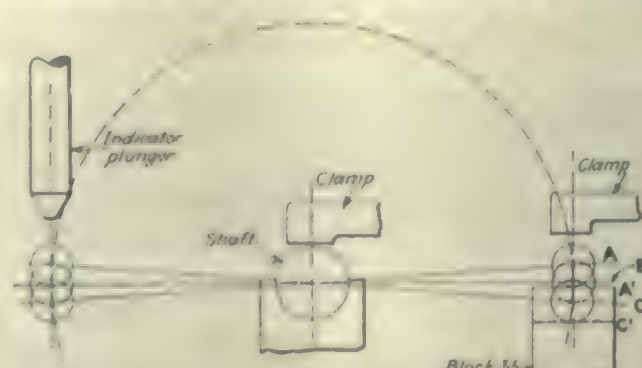


FIG. 3—DIAGRAMS SHOWING PRINCIPLE OF THE GAGE

Occasionally shafts are found which are so far from being correct that they cannot be corrected in the gage. These have to be either re-operated or scrapped.

The reason for reversing the balls after each bending is so that the bending will be equalized to some extent on each side of the center of the shaft. The clamp

must be released after each bending so as to release the strains which are set up between the clamped balls and the clamped shaft.

Method of Operation

The part is laid in the hardened tool steel semi-circular blocks *B* and *C*, Fig. 4, and one of the balls caused to rest upon block *A*. The ball is then held by clamp *D*, after which the shaft proper is clamped by clamps *E*.

It was essential, as this job is on a 100 per cent production basis, to have quick-acting clamps, and therefore cam actuated clamps were used. The clamps, which are operated by a split cam *G*, quickly tighten and release the piece, about 90 deg. of motion being required. The clamps are adjustable and can be rectified by unlocking and turning stud *H*. They are actuated by pin *J*, which rides in a slot in the cam, shown in the left-hand illustration.

Block *A*, against which one of the balls is clamped, wears quite rapidly. A master gage which is practically a duplicate of the part is used to set up the job. By using the master gage it is possible after regrinding block *A*, to reset the indicator.

After the part has been securely clamped, plunger *K* is brought down on the free ball. This is the most delicate part of the gage, as the plunger must come down with enough pressure to insure its being tight against the ball, and still not cause it to be displaced. This was accomplished by the construction shown in the section shown in Fig. 4. A bracket *L* was built and bushed with bushings *M* and *N*. Gaging plunger *K* is placed in a long sleeve *O* in which it has a sliding fit, and is backed up by a spring *P* of proper pressure. Sleeve *O* has a shoulder against which spring *R* presses, holding it up. Pin *S*, which rides in a slot in bracket *L*, prevents sleeve *O* from coming out. Plunger *K* is also provided with a stop pin *T* which rides in a slot in sleeve *O*, a clearance slot being provided in bracket *L*. Pin *T* also engages the indicator bar and registers the accuracy of the part.

The action of these parts is as follows: As sleeve *O* is pushed down, it in turn, through spring *P*, gently pushes plunger *K* down until the plunger strikes against the part and registers the error on the indicator. The operator continues to press down on sleeve *O* until the head of the sleeve strikes the top of the bracket. About $\frac{1}{16}$ in. of motion is required to bring sleeve *O* to a stop after plunger *K* strikes the ball. Therefore, it makes little difference how hard the operator presses on sleeve *O* as the pressure of plunger *K* on the work will always be the same if the sleeve is pushed all the way down. Also, spring *P* is always compressed the same amount, the same holding true for spring *R*.

Correcting the Reading

After taking the reading, if the location of the ball is not within the limits, which are ± 0.001 in., the operator can correct it by means of lever *V*. This lever is fulcrumed on a screw and is provided with a slot so that it can be slid in and out. The ball engaging end is provided with a hole which encircles the ball. By means of this lever the operator can gently bend the part in the desired direction. After bending, the piece must be reversed so that the other ball is brought under the indicator. The second ball is then tested in the same manner. The average part can be tested and brought within the limits with two or three attempts.

It is not necessary to release the part after each bending operation, as the strains which are set up in the metal are not released until the clamps are opened. An experienced operator can quickly bring both balls and shaft into alignment very quickly.

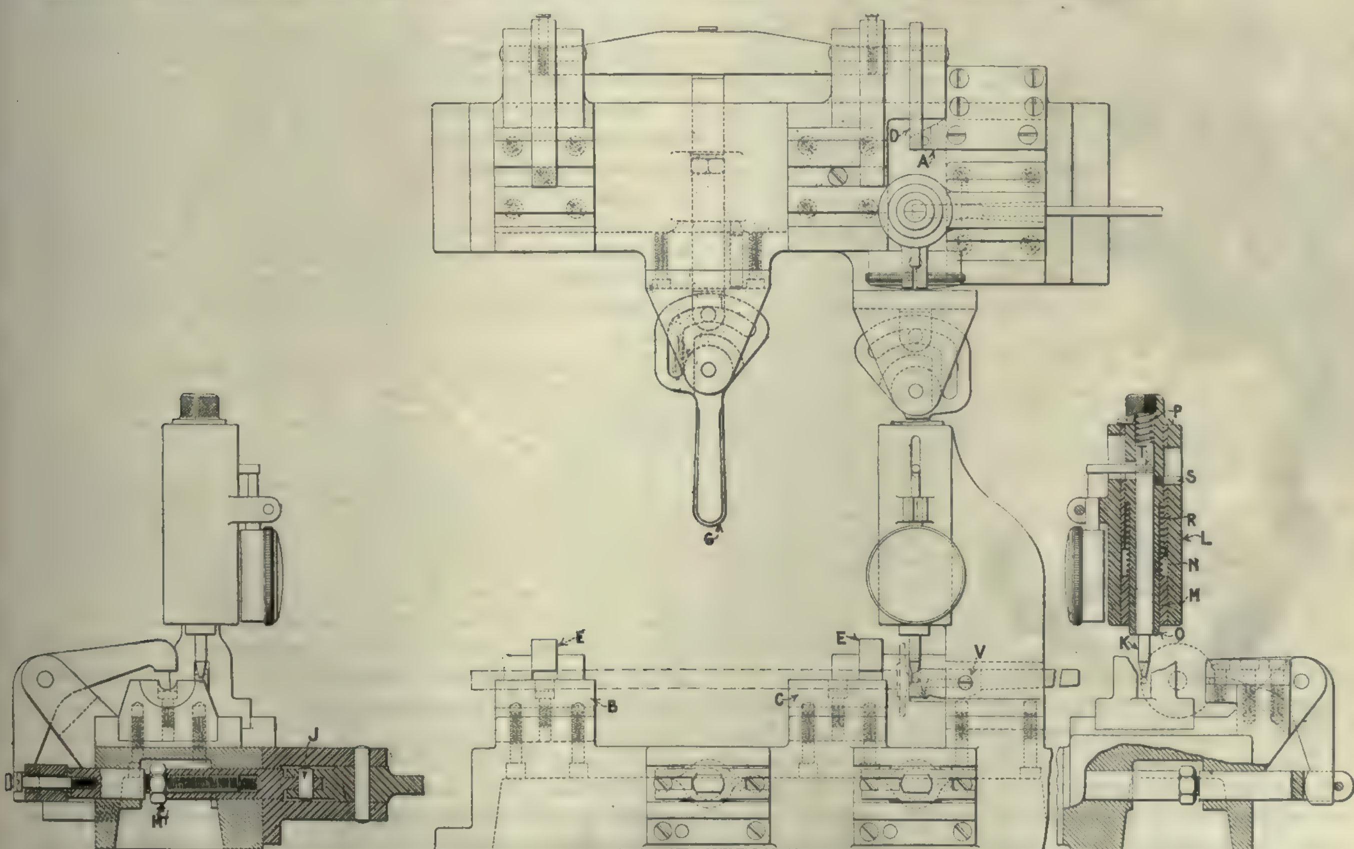


FIG. 4—DETAILS OF COMBINATION GAGE AND ADJUSTING FIXTURE

Treatment of Carbon Steels

What Various Chemical Compositions and Treatments in Steel Making Produce—Properties and Uses of Some Steels—Methods of Working

BY DEAN HARVEY

THE enormous variety of applications of steel products in practically all of the industries has made it necessary to develop many grades of steel covering a wide range of physical properties, in order to obtain materials best suited to each use. The steel maker has produced steels differing greatly in strength, ductility and hardness, by varying the chemical composition of the steel, and also by changing the character and extent of its mechanical working and of its heat-treatment during manufacture. The user has greatly improved the essential characteristics by further heat-treatment.

The selection of the proper grade of steel for any application is important in order to obtain the greatest efficiency by a combination of quality and cost which gives the material the properties best suited to that application.

The chemical compositions of some of the commonly used grades of steel bars are shown in Table I. The wide variety of physical properties which the steel maker may obtain with these grades of carbon steels is illustrated in Table II. The chemical composition and the physical properties vary somewhat with the size of the bar, and so average values are given, to enable comparisons to be made between the different materials.

Higher strength, increased toughness, greater resistance to shock, and other desirable characteristics, may be obtained by proper heat-treatment of carbon steels or by the use of heat-treated alloy steels.

> DIFFERENT characteristics are given to carbon steel by changing the chemical composition, the mechanical working and the heat-treatment in manufacture.
>
> Strength, hardness, toughness, ductility, resistance to shock and brittleness may be increased or decreased by varying the chemical content.
>
> Hot working breaks up the crystals and improves the soundness of steel by closing the blowholes.
>
> Cold working increases the hardness and strength and gives accuracy in size.

EFFECT OF CHEMICAL COMPOSITION

The addition of a small percentage of carbon, manganese, phosphorus, sulphur or silicon gives steel various physical properties.

Carbon increases the strength and hardness but decreases the ductility.

Manganese increases the strength and hardness. In ordinary carbon steel it is used principally to remove the oxygen and sulphur from the steel.

Phosphorus reduces the ductility and renders the steel "cold short," that is, brittle when subjected to shock at ordinary temperatures.

Sulphur causes the steel to be "red short," or brittle at a red heat, and thus interferes with hot working.

Silicon is usually present in small quantities. It tends to promote soundness and provides greater toughness by removing gases and oxide from steel and eliminating blowholes.

The different physical properties the steel maker produces in the grades of steel given in Tables I and II make them adaptable to different uses. It is of interest to note the principal factors which accomplish these results.

Rivet steel is soft, tough and very ductile. The low carbon and manganese content causes low tensile strength and high ductility, while the toughness and ductility are increased by keeping the phosphorus and sulphur content low. Cold-drawn bessemer screw stock is used for high-speed screw machine work. For free cutting at high speed, the steel must be brittle, and this brittleness is obtained by adding both phosphorus and sulphur. The required close accuracy of dimensions is secured by cold drawing which also considerably increases the strength. This steel costs considerably more than hot-rolled steel, due to the cost of the cold drawing operation.

Open-hearth low carbon steel is soft, tough and ductile. The strength is greater and ductility lower than those of rivet steel. It is used especially where a tough, ductile steel is required, and where rivet steel would be too ductile or not strong enough.

Cold-drawn open-hearth screw stock is similar to bessemer screw stock, except that it is made by the open-hearth process. It is tougher and not as free cutting as the bessemer steel, but machines fairly well even at high speed. It is used for screws and other applications where greater toughness is required than is obtainable with bessemer screw stock, and where accuracy of dimensions and free cutting quality are needed.

Cold-rolled axle steel is a strong, tough steel with good machining qualities. The tensile strength and especially the elastic limit are much increased by the cold-rolling.

Hot-rolled axle steel is strong and tough, with fairly good machining qualities. The carbon and manganese are high enough to give the steel good strength, yet low enough to keep the steel from being too brittle, or too hard to be readily machined. Phosphorus and sulphur are low and so do not cause brittleness.

Music wire is a very strong, tough wire used especially in pianos and springs. The strength is very much increased by cold-drawing.

EFFECT OF MECHANICAL WORK

There are four methods of working steel: By rolling, hammer forging, press forging and drawing. Bars may be rolled to about ¼ in. in diameter, but the smaller sizes are usually rolled approximately to size and then finished by cold drawing through a die. For bars

larger than 7 in. in diameter, forgings are often used instead of rolled bars, in order to obtain more thorough working of the steel.

Hammer forging requires in proportion a greater pressure than rolling or press forging, due to the shorter time of application, and the effect is not likely to extend as far below the surface of the piece.

TABLE I—CHEMICAL COMPOSITION

Grade of Steel	Carbon % (Approx.)	Manganese %	Phosphorus %	Sulphur %
Rivet steel........	0.08 to 0.15	0.30 to 0.50	0.04 max.	0.045 max.
Cold-drawn Bessemer screw stock..	0.08 to 0.16	0.60 to 0.80	0.09 to 0.13	0.075 to 0.15
Open hearth low carbon steel......	0.10 to 0.20	0.40 to 0.70	0.04 max.	0.05 max.
Cold-drawn open hearth screw stock	0.15 to 0.25	0.60 to 0.90	0.06 max.	0.075 to 0.15
Cold-rolled axle steel	0.30 to 0.40	0.40 to 0.80	0.05 max.	0.05 max.
Hot-rolled axle steel	0.35 to 0.50	0.40 to 0.70	0.05 max.	0.06 max.
Music wire........	0.90 to 1.10	0.30 to 0.50	0.025 max.	0.025 max.

Press forging, in which the piece is struck a blow and the pressure is continued, is best adapted for the working of large pieces. The slow action allows the metal to flow, causing the entire mass to be worked. The pressure may be either continuous or intermittent.

Drawing, or passing the steel through a die, is more often used for obtaining accuracy of dimensions than for working the steel, except in the case of steel wire.

The physical properties may be largely affected by mechanical working of the steel. Hot working, by either forging or rolling, tends to improve the soundness of the steel by closing up blowholes. It also breaks up the crystals and removes the cleavage planes along which failure would take place.

The important consideration is to obtain thorough working of the steel throughout its entire mass, so that it will have uniformly high strength because the steel is sound and has small crystal structure. The method of obtaining this result is of secondary importance.

The work should be continued until the steel has cooled well below the critical temperature, in order to prevent large crystals from forming again. The critical temperatures are those at which physical changes take place in the steel. These changes are indicated by liberation of heat during cooling and absorption of heat during heating of the steel, thus retarding the cooling or heating. The temperature at which the working of the steel is stopped has much to do with the physical properties. Steel which has been worked considerably below the critical temperature has a much higher elastic limit than steel the working of which was discontinued at a high temperature.

TABLE II—TENSION TEST

Grade of Steel	Tensile Strength Lb. Per Sq.In.	Yield Point Lb. Per Sq.In. (Minimum)	Elongation In 2 In.; Per Cent (Minimum)
Rivet steel......................	45,000 to 55,000	23,000	34
Cold-drawn Bessemer screw stock...	80,000 to 95,000	70,000*	10
Open hearth low carbon-steel.......	55,000 to 70,000	28,000	20
Cold-drawn open hearth screw stock	75,000 to 90,000	65,000*	12
Cold-rolled axle steel.............	80,000 to 95,000	70,000*	8
Hot-rolled axle steel..............	75,000 to 90,000	40,000	18
Music wire......................	300,000 to 330,000	250,000	..

* Elastic limit.

By elastic limit is meant the greatest load per unit of original cross-section which does not produce a permanent set. It is lower than the yield point which is the load per unit of original cross-section at which a marked stretching of the specimen occurs without increase of load, and which is usually determined by the drop of the beam of the testing machine.

Cold working, or straining the cold metal beyond the elastic limit causes permanent deformation of the crystals, with increase in the hardness and strength of the steel. The tensile strength may be increased 20 to 40 per cent and the elastic limit 60 to 100 per cent by cold working.

Cold working may be beneficial or harmful depending upon the manner in which it is done, and upon the use to which the steel is to be put. Unequal working, causing internal strains may result in season cracks in service. Large reduction in section of the piece during one pass through the rolls or through the die should be avoided, as this is likely to produce cracks. It is preferable to obtain the desired dimensions by several successive reductions in section rather than to obtain this result in one operation. This applies to both hot and cold working. Excessive cold working may cause the splitting of the steel.

Cold working is generally used for its effect upon the physical properties of the steel, to obtain accuracy of size or to produce complicated sections which could not be obtained in any other way commercially.

Putting Limits on All Dimensions—Discussion

By M. E. Duggan

Mr. Gregory says on page 848, Vol. 56 of *American Machinist*, "In all shops there is a standard of workmanship which is what might be called an unwritten code, and it *should not take a new man long to become acquainted with that standard.*" Suppose we lend the new man a little assistance, that he may become acquainted with the "standard," the "unwritten code," in the shortest time possible, because during the time he is getting acquainted with the shop methods and standards, mistakes—or what would be considered in this particular shop to be mistakes—might show up when the final checking of the job is done.

Showing to the patternmaker, after he has finished making a pattern for a piece complicated in design, a card having on the back the record and time limit for making this pattern, is just so much "bunk." A short talk between the foreman and the patternmaker before the job is started, is the best kind of time-limit record.

I have worked in the pattern shop of a large concern where everything was done on the time-limit system. The new man just starting to work would be given a pattern to make upon which the time limit was set by a journeyman who had been a patternmaker in the employ of this company fourteen years, and as he said himself, "he knew the number of nails in the patternshop floor." During my employment with this company in their pattern shop, I don't remember ever having a drawing or job explained to me by the foreman patternmaker.

I do remember getting "hell" from him several times, *after the pattern was made*, because of some trifling mistake that would not have happened had the job or drawing been explained to me at the start. I have seen a pattern with a ten-day time limit in this shop, made in seven and one-half days in another shop.

A new man just starting to work would be told by his friend that six days was the time limit on the job he was about to make. When he had finished he would learn to his sorrow that five, not six days was the time limit and that his "friend" had given him a "bum steer." A time limit is a hindrance rather than an aid to the man who does not understand his job right from the start.

An Up-to-Date Bar Storage Rack

Bars Can Be Loaded Into Rack Directly from the Cars—Ease of Access for Withdrawing Stock for Manufacture

BY FRED H. COLVIN
Editor, American Machinist

THE quantity of bar stock used in a large automobile gear cutting plant runs into very heavy tonnage. The design and construction of the storage rack of The Central Gear Works, Detroit, Mich., is unusually convenient and has much to commend it. The stock is received from the spur track which runs beside the shipping platform, the outside of the rack being shown in Fig. 1. The bar stock is handled direct from the freight cars into the racks, the bars being segregated according to size.

The rack is open on the other side from the platform into the shop itself, as shown in Figs. 2 and 3. Each side is provided with a rolling steel curtain so that the men in the shop need not be exposed to the cold when the rack is being either filled or emptied. On the other hand, both curtains can be raised at once, allowing ventilation through the rack, should it be desirable in extremely hot weather.

Details of construction of the rack can be seen in Fig. 2. The rack is 90 ft. long and 14 ft. 2 in. high. The openings are about 21 in. wide and 31½ in. high in the clear, with the openings in the lower part slightly less in height. There are 195 openings in the racks which are accessible from the outside and 24 blanked at the outer end by the supporting columns with an opening on the inside. These short compartments can be used for storing pieces that have been cut off.

The racks hold 20-ft. bars with sufficient clearance at each end. They have a very convenient means of determining how far the bars are to be pushed through when unloading from the car, so as allow the inside steel

FIG. 1—OUTSIDE OF THE RACK FROM RECEIVING PLATFORM

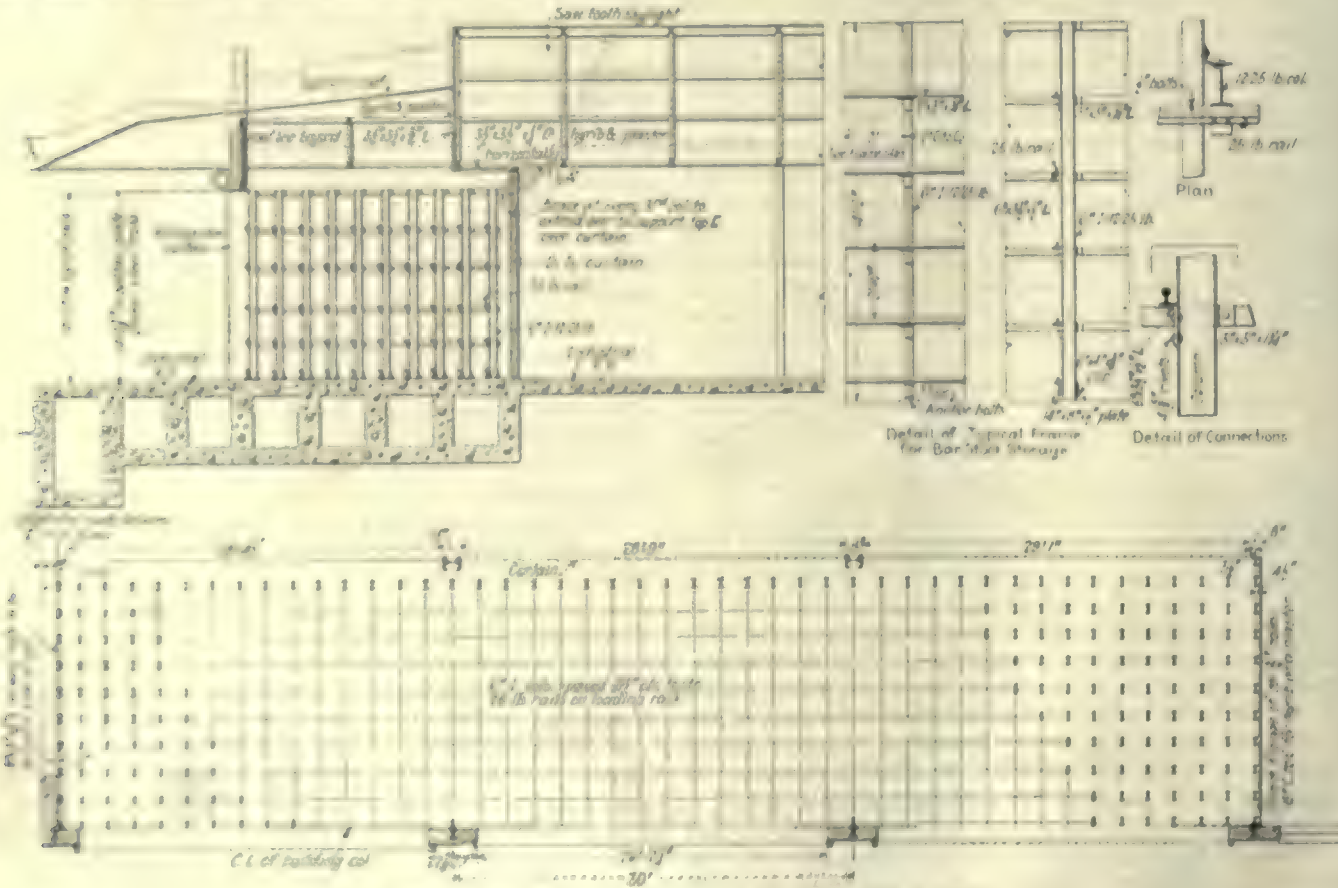


FIG. 2—PLAN VIEW OF DETAILS OF STORAGE RACK

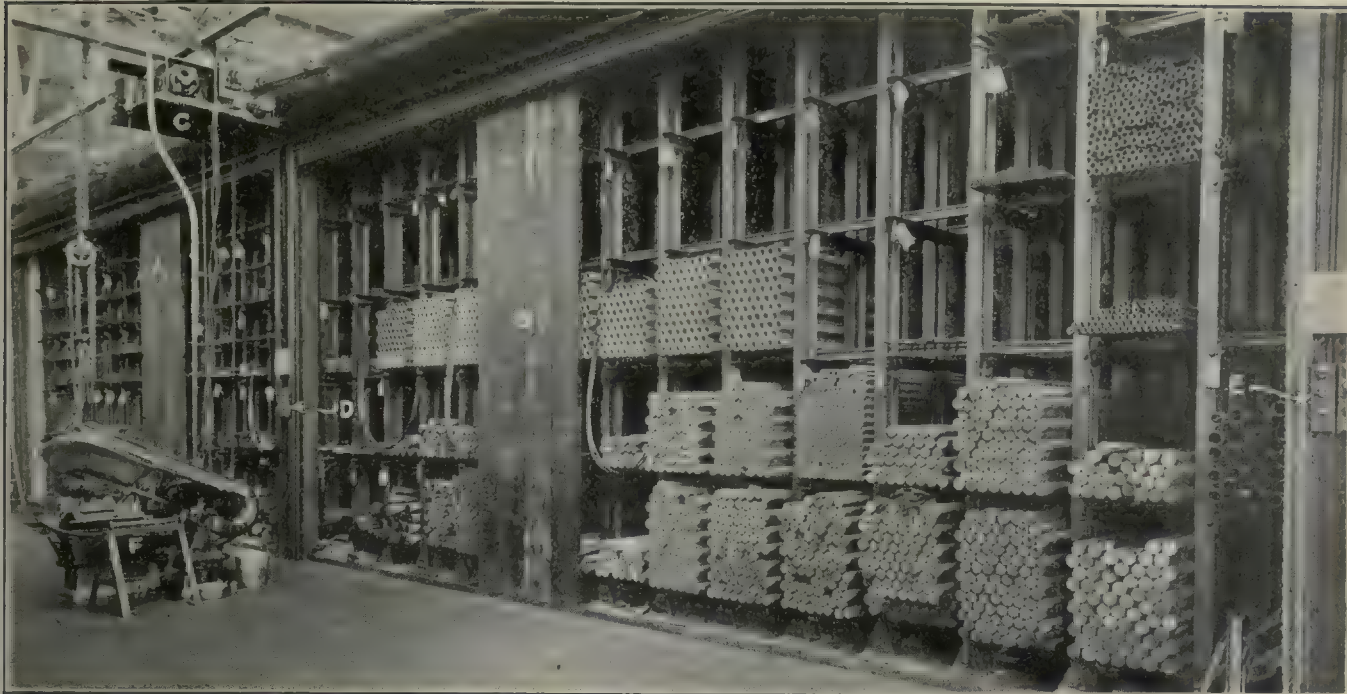


FIG. 3—SHOP SIDE OF THE RACK, SHOWING STOCK IN PLACE

curtains to be rolled down, to permit the closing of the curtains on the shipping platform side, and to enable the workmen to reach the stock conveniently. This device can be seen in Fig. 3.

Each of the three sections has two loading gages in the shape of heavy plank stops, one inside the shop and the other outside at the shipping platform. The outside gages are shown at *A* and *B*, Fig. 3. Each gage hangs on suitable rollers and is supported at both top and bottom in substantial runways. When any particular bin is to be loaded, the plank stop is placed in front of that bin on the inside end. Men working on the platform simply push the long bar through until it touches the stop and then pull the bar back a half inch or so to give the necessary clearance.

The steel curtains are operated by a motor located at *C* and controlled by push buttons at *D* and *E*. These buttons enable the operator to raise or lower any one of the steel curtains without manual labor, adding materially to the convenience and up-to-dateness of this type of storage rack.

A chain hoist is provided for aiding in handling long bars when necessary. Bars can be removed from the racks and cut up on the Napier band saw shown at *F* whenever the work in hand makes it desirable. It will be noted that each bin carries a tag designating the contents of the bin. A running inventory is kept which makes stock-taking an easy matter.

All necessary details used in the construction of the rack are shown in Fig. 2, and it certainly has much to commend it. Those who are contemplating installing storage racks, or whose present equipment is inadequate, cannot do better than to study this rack from its various angles.

Negative Nepotism

By Charles W. Lee

A certain "Old Man" of beloved memory, who was boss of the whole works, had a son Jim learning the trade in the machine shop department.

The foundation walls of the machine shop were washed by a river, which normally flowed by, but rose every spring and flowed in and washed the lower floor—which, however, has nothing to do with the story, but may help to identify the place if the reader is curious.

One day Jim was leaning out of a window and fishing in the river; and another apprentice boy on the floor above happened to see Jim, and let him have, so to speak, the entire contents of a water bucket. So Jim counted the windows from the end of the room, went upstairs, counted the same number of windows, and easily found a boy who looked rather guilty.

Then he went down to the Old Man's office.

"Say, Dad, Bill Jenkins up on number three floor poured a bucket of water all over me!"

"How could that happen?"

"Oh, I was leaning out of the window."

"Why were you leaning out of the window?"

"Oh—well—I was just fishing a little while my lathe was running."

The Old Man was very busy, being much occupied, as usual, with matters of finance and general management, as it was a large works; but he left several pressing things waiting while he hurried up to number three floor to establish the identity of one Bill Jenkins.

The identity of Bill Jenkins having been established, the Old Man went to him, and said,

"Are you Bill Jenkins?"

"Y-y-yessir," said Bill.

"Did you douse Jim with a bucket of water?"

"Y-y-y-e-es sir."

The Old Man put his hand in his pocket:

"You did a good job, and here is half a dollar to douse him again next time you catch him fishing out of the window."

Then the Old Man returned to his regular job of financiering and general managing. The reader may supply his own moral.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Casting Rod Packing in a Railroad Shop

By I. B. Rich

The use of soft metal packing on air brake pump rods and similar apparatus has developed some interesting methods of casting the rings in various railroad shops. The molds and methods used by the New York, New Haven & Hartford Railroad are shown in Figs. 1 and 2.

One of the molds is shown in Fig. 1 with some of the rings removed. It does not, however, show the coned ends on the rings already in the mold. The mold proper is the heavy cast-iron plate *A* which is bored for twelve rings of different kinds. The cores *B* are placed in the molds, the cover *C* lowered and the metal poured through the small gates represented by the small round white dots in the upper plate. The sprues have a sharp taper so as to be easily pushed out from the under side of *C* after they are cut off.

After the molds are all poured the bar *D*, which is removed from the cover as soon as it is lowered for pouring, is placed in the stud *E*, which is mounted eccentrically. A partial revolution of this stud slides the cover plate endwise and shears off all the sprues at one movement. The bar is then placed in the mold cover and used to raise it as shown. It will be noted that some of the cores have a projection on one side which makes a split in the cast ring, while others leave the rings solid. Also that the cores have a crossbar on the inside so that they can be easily handled in and out of the molds.

A similar but larger mold is shown in Fig. 2. In fact this is one of a battery of four molds permanently arranged on a heavy truck so that it can be run in front of the melting furnace when it is to be used. These molds are for larger rings but the method used is the same as in the first case. The four molds are mounted at an angle and all have their covers connected to a central stand equipped with pulleys and counterweights. This arrangement makes it much more easy to handle the covers, and in fact something of this sort is necessary with molds as large as this. This view shows the allowance for end movement in the hinges which takes care of the shearing of the gates. The method of stringing the cast rings on wooden sticks, is shown in front of the mold.

The Necessity of Clean Oil

By Frank C. Hudson

My letter regarding the scoring of motor bearings where a forced feed is used (*American Machinist*, Vol. 56, page 919), seems to have stirred up a healthy discussion. Regardless of the merits of the two systems, splash or forced feed, there can be no question as to the cause of the scoring being grit and other impurities in the oil. The one answer seems to be to keep the oil free from these impurities, either by suitable filters in the oiling system, if that be possible, or by removing the oil, cleaning it and using it over, with perhaps the addition of some new oil.

Installations of apparatus for purifying oil are becoming more numerous in large machine establishments, but are usually out of the reach of small shops, not to mention motorists. Oil reclaiming plants would seem to be a possibility in many localities, but they would require a high type of honest and careful operation to be of real value. It is difficult to imagine a business where carelessness or the slightest lapse from the straight and narrow path of strict honesty, would do more harm or be more difficult to detect.

Clean oil and enough of it is a necessity, which, to the small users, means frequent emptying of the old oil and refilling with new oil.

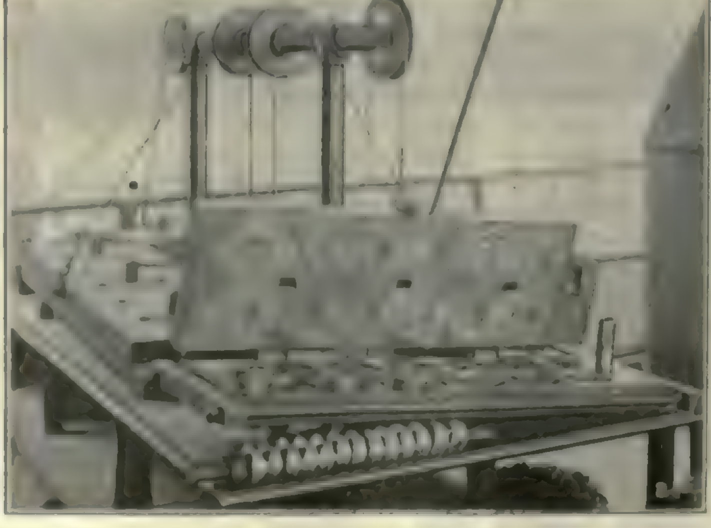
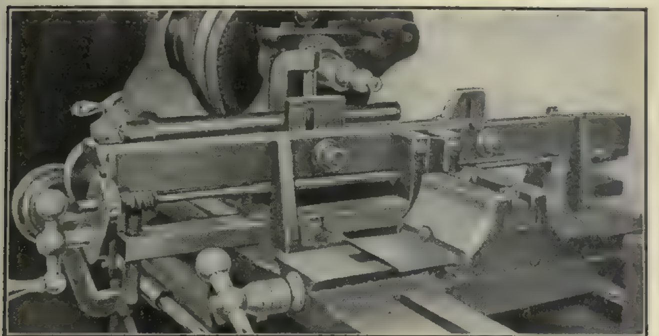


FIG. 1—MOLD FOR CASTING PACKING RINGS. FIG. 2—FOUR LARGER MOLDS ON TRUCK

Milling Seats for Woodruff Keys in a Lathe

By Robert Brainard

The keyseating attachment shown herewith is in operation in a small machine shop in Wisconsin. It consists of a long V-block with three bearings for a worm shaft. The three worms carried by the shaft drive three worm gears that turn three large screws threaded into a heavy block that is bolted to the carriage. Perpendicular guiding is provided by castings



ATTACHMENT FOR MILLING SEATS FOR WOODRUFF KEYS IN A LATHE

bolted to the carriage. The worms are operated through spur gear and pinion by means of the ball crank handle.

The V-block is used to support large shafts but small shafts are held in a smaller V-block bolted to the side of the larger block. In the illustration a shaft is in position in the smaller block. In either case clamping is done by the C-clamp.

Three Planing Jobs in a Railroad Shop

By Herbert Crawford

The guides on the back heads of steam chests on locomotives fitted with Walschaert valve gears are difficult things to plane without the use of special holding fixtures.

At the Readville, Mass., shops of the New York, New Haven & Hartford Railroad the fixture shown in Fig. 1 is used. The hole for the valve stem is first drilled in the head, a special holding fixture being used. The head is then mounted on a mandrel and faced in a lathe, after which the stud holes are drilled.

The work then goes to a Woodward & Powell planer

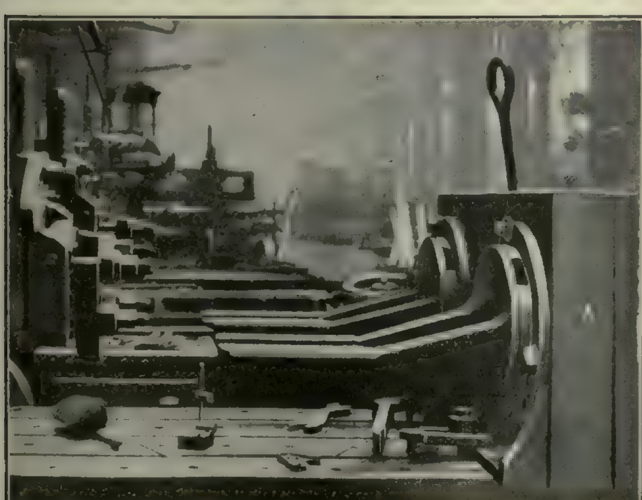


FIG. 1—PLANING GUIDES ON STEAM-CHEST

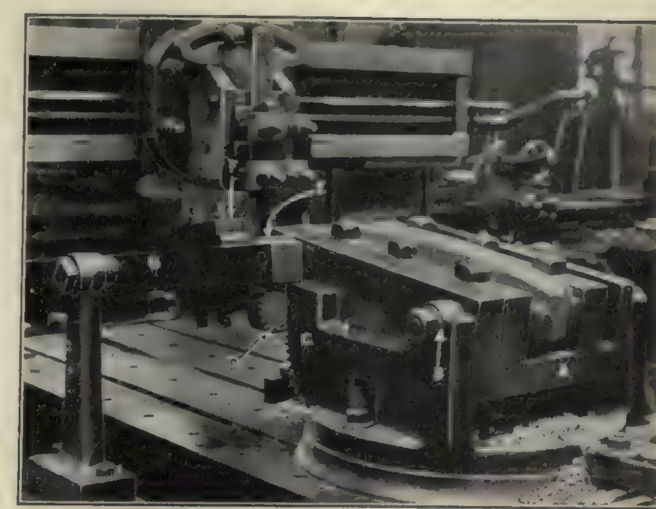


FIG. 2—A RADIUS PLANING DEVICE

which is fitted with a substantial fixture as at *A*, with dowels to locate the heads so that the guides will be level and in planing position. The fixture holds two steam-chest heads so as to utilize both heads of the planer and makes it possible to plane the steam chest heads at a considerable saving of time over the older method.

There are many devices for planing locomotive valve motion links and link blocks. The one used in this shop is shown in Fig. 2. It consists of a chuck body *A* which holds the work and is pivoted at *B*. The frame or base in which the chuck swings has a gear segment on each side at *C* into which mesh pinions as at *D*.

At the back end of the chuck the trunnion carries the jaw *F* which fits over the inclined bar *G*. The angle

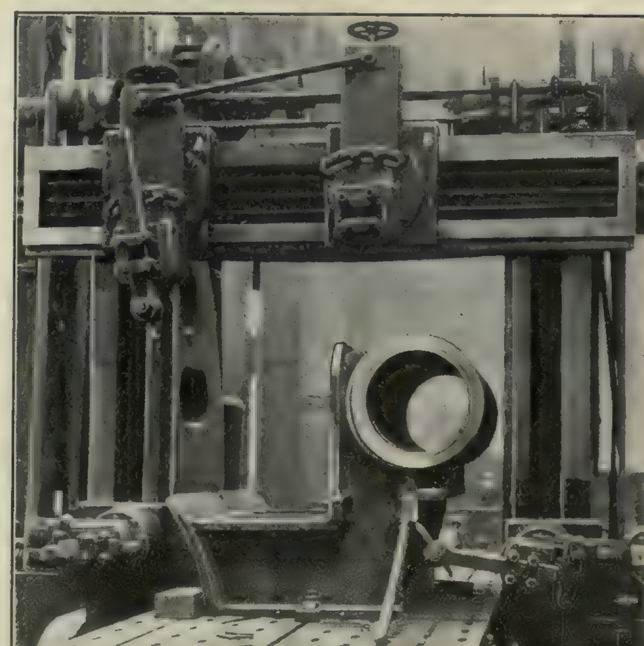


FIG. 3—A CYLINDER PLANING JOB

to which this bar is set determines the amount of movement of the chuck and with it, the radius of the link. As the planer table moves back and forth the jaw *F* slides up and down the inclined bar and moves the chuck up and down, swinging it from the pivot.

A typical railroad shop job is shown in Fig. 3, which gives an idea as to why machining time is not always as rapid as we would expect on regular work. The

shape of the locomotive half-saddle makes it a very awkward piece to handle and no one can expect good planing time when the tool must be set as shown, to reach up underneath the cylinder to plane a seat for the frame. There is still much to be learned in the design of locomotive parts so that they can be more easily machined.

The connection between the two heads on the upper rail is for planing the radius in the saddle where the boiler fits. The head *A* is clamped to the rail in the proper position and the screws which fasten the swiveling part of the head loosened sufficiently to allow it to turn easily. The feed of the other head *B* is then thrown in so as to travel to the left. The connecting bar swivels the stationary head to the left and swings the tool through an arc, the radius of which depends on the distance from the point of the tool to the center of the swivel.

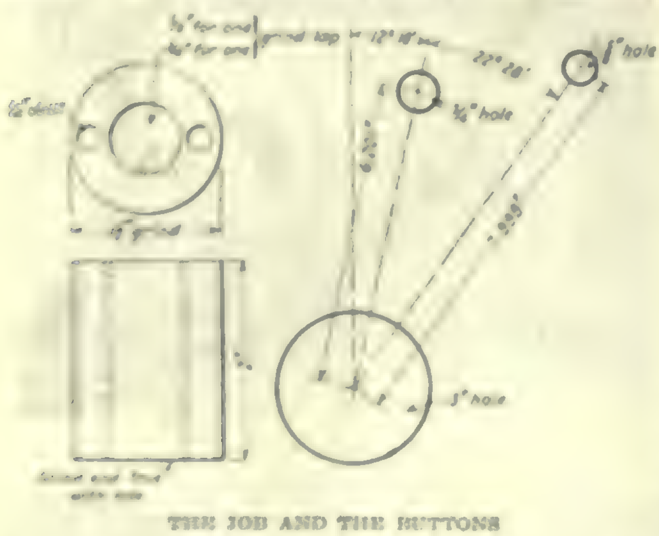
Bushings Used as Buttons for Locating Holes Accurately

By Harrie M. Pike

Several years ago while the writer was working on jigs and fixtures in connection with engines for airplanes, he was shown the following kink for locating holes accurately upon work that is too large and heavy to be buttoned and bored in the usual manner.

The holes in question were to be jigged in the hub of the engine flywheel, and bore an important relation to the timing gear, so important in fact that no tolerance at all was allowed in locating them. Upon a smaller piece of work that could be swung up in a lathe or handled on the table of an ordinary toolroom milling machine, this part of the work would have presented no difficulty; but as such procedure was out of the question, some other method had to be devised.

The holes were laid out on radial lines extending from the center of the hub, their location being determined in thousandths of an inch from the center and in degrees and minutes of arc from a given radial. Hollow buttons, or bushings, were made as shown in the sketch. The internal diameter was ground accurately



THE JOB AND THE BUTTONS

to the size of the hole to be made and the outer diameter was ground to a standard size, leaving sufficient thickness of wall to accommodate the two small holes for the attaching screws.

The bushings were first located approximately and attached to the jig by means of two machine screws fitting loosely in the screw holes. They were then positioned exactly by triangulation and measurement over their outer surfaces with micrometers in the usual way, as would be done with ordinary buttons.

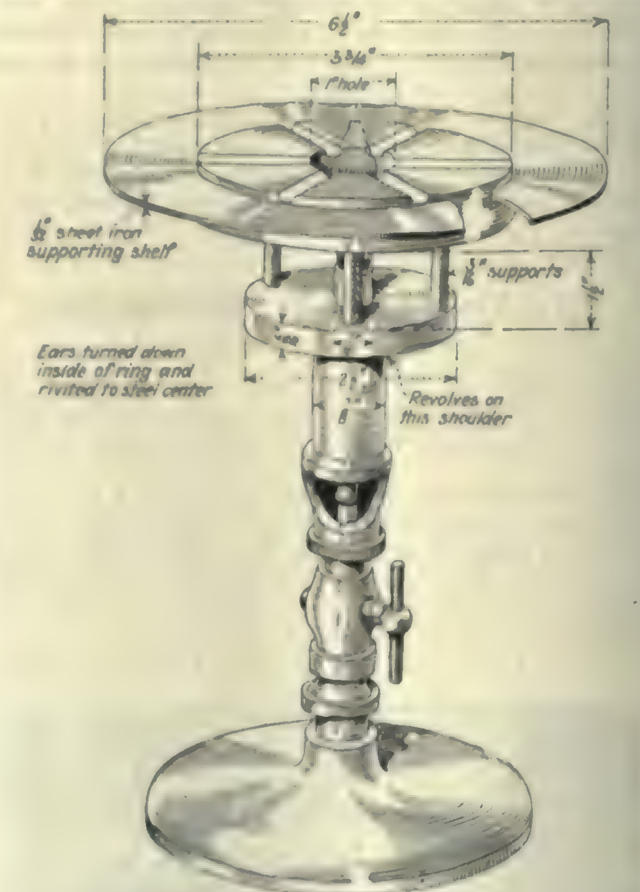
The job was then placed on the table of a true-running drill press and the holes drilled and reamed through the bushings. The total accumulated error was but 0.0002 inch.

An Improvised Hardening Furnace

By Dwight Donald

Fifteen hundred degrees from a small bunsen gas burner can be harnessed up to do a lot of hardening of small parts.

The sketch shows such a burner fitted with a simple metal plate, with several grooves running radially from the open center, attached above a collar which allows the combined apparatus to drop in a central position over the burner. The plate, which has an outer ring of $\frac{1}{16}$-in. sheet metal to reduce weight, can be revolved about the burner for convenience in withdrawing the work from the flame. The sketch furnishes all details.



A BUNSEN BURNER HEATING FURNACE FOR SMALL RODS

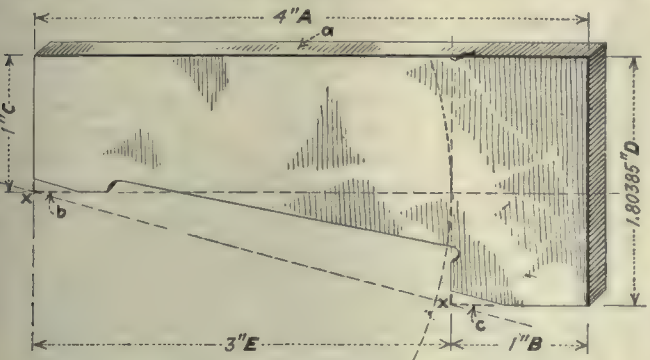
This simple fixture was designed for use in a small shop, to supply an inexpensive and efficient method of hardening the ends of a large number of ¼ in. in diameter rods. The rods are placed in the grooves one at a time with the ends over the center of the flame, are removed in the same sequence when they reach the proper heat and are quenched in the hardening bath.

A continuous heat-treating process at constant temperature, with a resulting uniform hardness of parts, is thus afforded.

What the Mechanic Used Before the Sine-Bar Was Invented

By Amos Ferber

Although the sine-bar in its present well-known form is a comparatively new development, the principle on which it is based is as old as mathematics, and the older mechanics were by no means unfamiliar with the practical application of it, though they may never have applied a name to the device they used. In the sketch may be seen the tool used by the writer for many years before the introduction of the sine-bar for applying the



TANGENT GAGE FOR LAYING OFF ANGLES

trigonometrical function to the development of angles.

Let us say that an angle of 15 deg. (the angle shown in the sketch) is required, and there is no bevel protractor at hand or the protractor is not sufficiently accurate for the purpose.

Take a piece of sheet metal of any size and thickness convenient and cut it roughly to the shape shown in the sketch, making sure that we leave sufficient stock at the essential points to secure accurate measurements. The thickness of the metal is of no importance, except that the thicker it is the more stock there is to cut away and the longer time will be needed to make the device. Metal thin enough to cut with the hand shears may be used if the device is wanted in a hurry and permanency is not a consideration.

After cutting roughly to shape, set the piece in a shaper or vise of a surface grinding machine, and reduce the surfaces *a*, *b* and *c* accurately to parallelism; also make both ends accurately square. The actual length and width of the piece does not matter, but the corners indicated at *x x* must be left sharp, as it is upon these corners that the serviceability of the tool depends.

Now measure the length of the piece over all (dimension *A*) with a micrometer. Next file or grind the inner face of the angle at *c* until dimension *B* subtracted from dimension *A* leaves exactly the chosen radius upon which the angle is computed, in this case 3 in., dimension *E*.

Now grind the under face at *b* until dimension *C* subtracted from dimension *D* leaves exactly the *tangent* of the required angle multiplied by the chosen radius. The angle sought will now be included between the longer surface *a* and a straight-edge laid across the sharp corners *x x* as indicated by the dotted lines.

The tool in this shape is available for laying off the angle it represents upon the polished surface of a jig or fixture, but the sharp corners could not be expected to stand up very well if the tool were to be banged around a milling or grinding machine very much in setting up work. To avoid impairment of its accuracy and preserve the tool for continued use, set it in the vise of the grinder with the corners uppermost and carefully level these corners by means of a sensitive indicator. You may now grind away as much of the corners as may be necessary to secure a permanent bearing surface, without affecting the included angle.

If this tool were to have a name, it should be called a "tangent gage," as the sine of the angle is not considered.

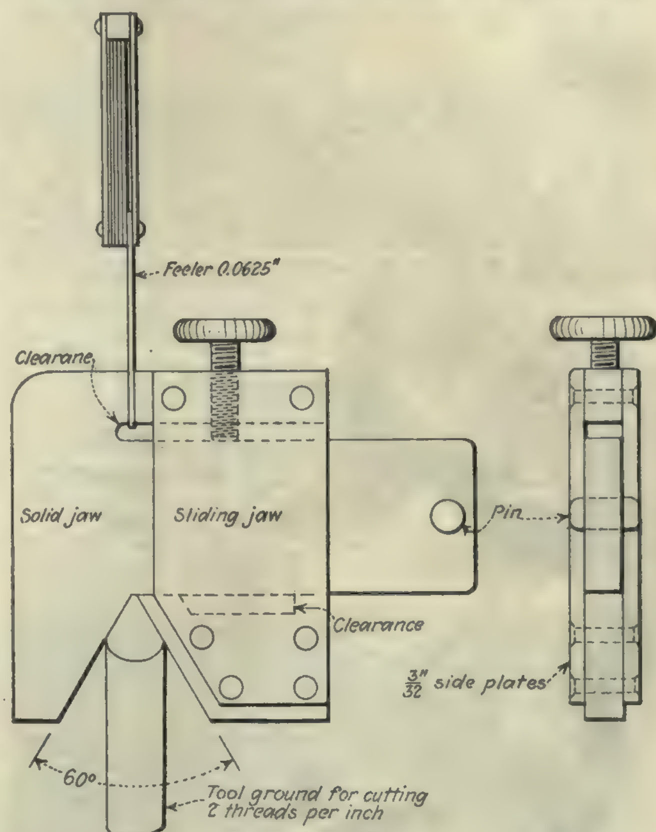
Form Gage for U.S.F. Thread Tools

By Joe V. Romig

An adjustable gage for use in forming thread tools to cut U.S.F. threads is shown in the accompanying sketch.

The shear, one of the setting jaws and the fixed angular jaw are made in one piece. The sliding jaw is made up of four pieces, the thin side plates being riveted to the angular jaw face and to the top piece so as to leave just sufficient space for the assembled part to slide over the shear without shake. A small knurled setscrew in the top of the sliding jaw preserves the setting. Note that a clearance space is left at the point where the angular jaw bears upon the shear.

The setting jaws should be so made as to touch at the instant the space at the apex of the angle disappears.



GAGE FOR U.S.F. THREAD TOOLS

A good way to do this is to make them a trifle too long and fit them by lapping between the surfaces, testing as the work proceeds with an accurate center gage.

To set the gage to any given size of U.S.F. tool it is necessary only to provide a feeler gage of a thickness equal to the width of flat (⅛ of the pitch), and close the setting jaws upon it.

Air Cylinder for Jigs and Fixtures

By Charles B. Johnson

The relative merits of hand- and pneumatically-operated tools are not generally understood by the average tool designer who has had little experience in the design of air-operated equipment. Many designers regard the designing and building of a pneumatically-operated fixture, jig or attachment as something justifiable only when the first cost is not to be considered and when an unlimited number of parts are to be produced.

In designing a pneumatically-operated tool the first question to be answered is, can the piece be located by air? The best arrangement for locating is by means of suitable push rods for moving the piece to its proper locating seat. These rods are operated by a cylinder large enough to seat the piece firmly. For clamping, a larger cylinder is used, as more power is required to hold the piece in place than merely to locate it.

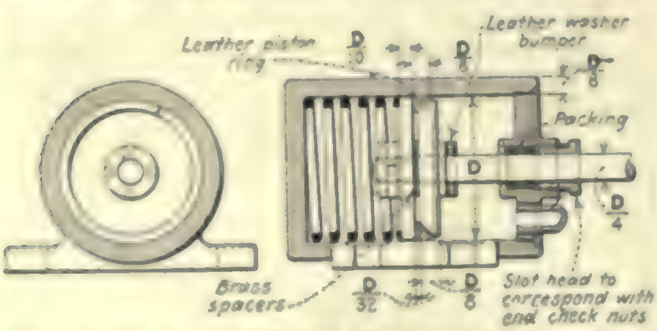
The next thing to be determined is the amount of pressure required to hold the piece firmly in place while the operation is performed. A close approximation of the pressure required may be secured by calculating the probable pressure exerted by the clamping arrangement if the tool were hand-operated. In other words, if a ½-in. clamping bolt were to be used, the pneumatic tool must exert an equivalent amount of pressure.

When this pressure has been determined or assumed, the piston diameter D is secured by using the formula:

$$D = 2\sqrt{\frac{P}{201}}$$

The calculated pressure is P; 201 is a constant. The efficiency of the air is taken care of in this formula. Ordinarily the efficiency of an air cylinder is from 70 to 80 per cent.

The next important decision is whether the cylinder is to be detachable or incorporated in the casting. Cylinders up to 2 in. in diameter are cast in the base if



DETAILS OF AN AIR CYLINDER FOR JIGS AND FIXTURES

a minimum amount of pressure is required and if there is no objection to the piston rod and clamping arrangement projecting outside of the solid base casting. The cylinder is formed by counterboring holes for the piston head and the necessary spring. The hole is tapped to receive a plug which closes the end of the cylinder, and the piston rod operates through this plug.

Cylinders over 2 in. in diameter are usually made detachable. The principal advantages of this method are many. The base casting may be cored, eliminating much superfluous weight, and the cylinder may be placed in the most convenient place for operating the clamping mechanism. The piston rod may be easily aligned, and the cylinder may be taken apart for repairing, or may be used for more than one piece of equipment.

The accompanying illustration shows a simple cylinder with dimensions proportional to the diameter. The cylinder is a bronze casting, the base of which is wide enough to allow the use of a screwdriver or wrench in tightening the screws which hold the cylinder to the base casting. The screw slots should be wide enough to allow shifting in aligning the piston rod. The cylinder itself is counterbored for the piston head and is threaded for the large plug which forms one end of the cylinder.

The large plug has a boss on both sides for counterboring and tapping the space allowed for the packing and the smaller plug. The smaller plug guides the piston rod, compresses the packing and prevents the leakage of air. Its head should be slotted to correspond with the end-check nuts and should be made long enough to allow adjustment for wear. The boss on the outside of the large plug should be milled either square or hexagonal for wrench adjustment. The larger plug is reamed a few thousandths of an inch large (usually about 0.010 in.) to allow the necessary clearance for aligning or operating. The leakage of air is prevented by the smaller plug and the packing.

The pipe furnishing the air supply is commonly tapped into the large plug. The intake and exhaust of the air is controlled by a simple three-way valve located in the pipe line.

The piston head is made with a good sliding-fit in the cylinder and is held in place by two nuts, one of which acts as a check. The leather packing and several brass spacers of varying thickness are placed between the piston head and the backing plate which is held in place by the collar. This collar may be driven on or pinned to the piston rod. When the packing becomes worn, it may be tightened by removing the larger plug, withdrawing the entire mechanism from the cylinder, taking off the end nuts and removing spacers enough to decrease the distance between the backing plate and piston head, and thus forcing the packing ring to expand by moving it up the angle on the backing plate. By inserting enough spacers, this adjustment may be made a number of times, thereby eliminating one of the principal objections to air cylinders.

The spring is for releasing the clamps and should be just strong enough to accomplish this. The outside diameter of the spring must be small enough to allow sufficient clearance to operate during its compression.

When only a small diameter spring is necessary, due to the ease with which the clamping mechanism releases, provision should be made for holding the spring exactly in the center of the cylinder. This will prevent the spring from dropping to the bottom of the cylinder, and from exerting an unequal pressure, which would have a tendency to tip the piston head and make it bind. The best means for holding the spring in the center is to tap or press a small piece of drill rod in the rear of the cylinder. The piece should not be long enough to strike the end of the piston rod when the piston head is moved sufficiently to operate the clamps.

The pipe line should be as straight as possible and the check valve should be placed between the three-way valve and the air supply. An exhaust hole usually ¼-in. in diameter should be located behind the piston. Because of the great friction, wedge systems of levers and clamps should be avoided.

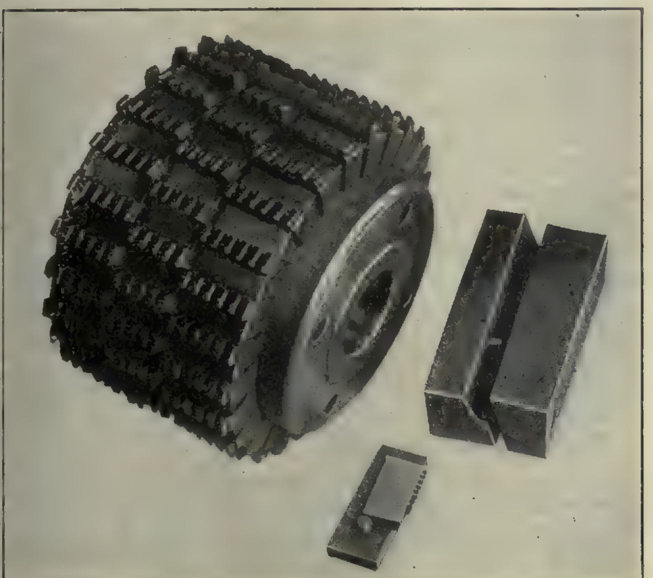
If care is taken to design air clamping mechanisms with due reference to the pressure involved, both in the cylinder and in the spring used for returning the piston, satisfactory results will be secured.

An Inserted Blade Cutter of Exacting Requirements

By Milton Wright

The illustration shows a cutter with inserted blades of high-speed steel that is made in a manner somewhat unusual when the purpose it is to serve is considered. The serrations of the blades do not constitute a helix but are in separate planes, the cutter being used to form the rack teeth on the bar of a large monkey wrench.

The cutter is 5¾ in. in diameter by 3¾ in. long when assembled, being made in three 1¼-in. sections with 24 blades to each section. The sections are keyed to a shouldered bushing and are clamped tightly together by the ring nut of the bushing, so that when assembled the cutter may be handled on and off the milling machine arbor as a single piece.



INSERTED BLADE MILLING CUTTER

The individual blades are 1.250 in. long and 5/16 in. thick at one end, being wedge-shaped, or tapered, to an angle of 2 deg., and are held in the slots only by the pressure of the drive fit. This method of holding is common enough in cutters that are used only for surface milling or facing and the blades of which can be ground in position after assembling, but when the tool is called upon to mill the teeth of a rack in which no variation can be permitted and the blades are completely finished before they are set into the body, it is quite another matter, and involves careful and painstaking workmanship.

The blades are made to form and size, plus grinding allowance, and the teeth are cut in them with a single piece hob of small diameter. For this latter operation the blades are held in the special vise jaws shown to the right in the illustration; the angle at which they are presented to the hob being 10 deg., which provides the necessary relief without any further backing off. No side clearance is allowed.

After hardening, the blades are ground to thickness and taper, and in this operation extreme accuracy is required; a variation of 0.0001 in. being sufficient to throw the teeth out of register. The only special tools required are the little tapered "parallel" upon which the extra blade is shown in the picture, and a gage into which each blade is fitted. The work is held for grinding upon a magnetic chuck. These blades are made up in quantities without reference to the body of the cutter and are interchangeable.

The cutter shown is one of many such cutters that are in constant service in the factory, there being as many bushings as there are manufacturing machines. Any blade fits any slot in any section of cutter and the sections are used in whatever combination may be convenient. It is this interchangeability throughout a large set of tools, the requirements of which are so exacting, that renders the method of construction unusual.

The staggered position of the blades in the assembly is for the purpose of making the cut as nearly continuous as possible and avoiding the chatter that would be caused by the intermittent action if the entire tooth face were parallel to the axis of rotation. To secure this effect in assembling it is necessary only to select three sections the keyways of which are not in the same relation to the blade positions.

These cutters are in service in the factory of Billings & Spencer and were designed by W. R. Croke, superintendent of the tool department.

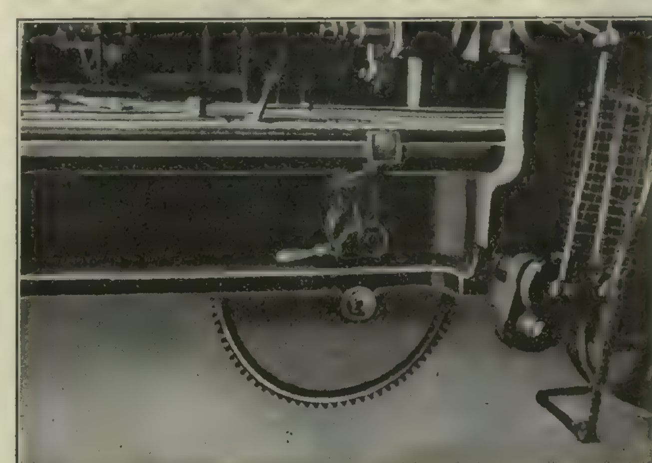
Guarding the Bull Gear of a Planer

By Donald A. Hampson

The factory inspection department of New York State has recently called attention to a hazard which has hitherto remained unguarded—that of the spoked type of bull gear and its mating point with the pinion. Official attention to these hazards was directed through several accidents occuring at about the same time. The fact that the injured men apparently went out of their way to get caught, does not relieve the employer of responsibility.

In the illustration may be seen a simple but effective way of protecting the spoked wheel. The hazard in any kind of a spoked wheel lies in the possibility of an arm or a foot being thrust through and getting caught against a stationary part of the machine, resulting in a broken bone, if nothing more serious. If the spokes can be converted into a web, the hazard no longer exists. A notable example of such conversion may be seen on job presses in printing plants where wheels with slender arms are made safe by the application of paper disks.

The planer shown in the foreground is one of a



GUARD FOR BULL WHEEL

group having the bull wheels exposed, that was protected by screwing together circles cut from ½-in. boards, one circle on each side of the arms. Protection is as complete as the appearance is neat.

Where the gear and pinion mesh, there exists a danger point on the return stroke of the planer. This may be protected by a piece of sheet metal wide enough to include several teeth on each gear, and with tabs extending on each side to where they may be caught under the bolts of the bearings caps. It requires more of a fender than a guard such as would be needed where the gears are on top near to working positions of the hands. A more elaborate design would be a hood to completely surround both gears, but the expense of constructing and the difficulty of fastening underneath seem hardly warranted when the simpler design affords safety.

Pattern for Gas Engine Pistons

By James H. Yates

All repair men know the difficulty of securing good clean castings for gas engine pistons when they are poured from the regular melt in conjunction with regular foundry work. If the pattern is made in accordance with the following suggestions a better result will be obtained in many cases:

A core print is made to extend outward from the pattern, as shown at *A*, for a distance of about ¾ in. all around. The core itself rests upon this extension in the mold, thus centering the core and insuring perfect alignment and even thickness of the piston wall. It is advisable to make the pattern somewhat longer than the finished piston is to be, say ½ in., so that any dirt that may rise from the mold will be in that part of the casting that is to be machined off.

PATTERN FOR GAS ENGINE PISTONS

The main advantage of this method lies in casting the piston with the head downward so that there will be good, clean, close-grained iron at the head where it is most essential.

Selling a Tough Customer—Discussion

By F. P. Terry

The contribution by Hiram Strong under the above heading, page 893, Vol. 56, of *American Machinist*, provides interesting reading, as does any method that shows a way of overcoming a probable but un-get-at-able customer. Mr. Strong's success with "Bill Jones" appears to be due principally to the fact that he did not "sell him," but actually took considerable pains to see that he was not sold.

There are many Bill Joneses scattered about the world, and it is probably as well that this is so. As a brother salesman once told me, "They are sent by the Almighty just to try us," and in dealing with them no doubt many salesmen are found wanting simply because they lack initiative and resource. There is no standardized method that I ever heard of for this type of customer beyond "weighing him up" and then bucking in, letting him see by the best possible means that his abuse has as much effect as water on a duck's back. This also requires nerve, otherwise no ice will be cut. With these qualifications and a reliable tool that will stand the test of wide publicity and come up to the standard set for it, no salesman need despair but that Bill Jones will be landed in due course.

My first experience of this type happened some years ago when I knew little of the game, but how I overcame this Bill Jones may be of interest. He occupied, and still does, the position of manager of a large firm, and, quite unknown to me, he had a "grouse" up against us for a previous transaction. On producing my card, the way his face worked when reading it and then tearing it into a hundred pieces, convinced me that I would be safer elsewhere, and no doubt a timid man would have bolted for the door. I simply kept one eye on it and stood my ground, but not for long, as he burst out with a lot of Bill Jones abuse about my firm and myself, and in addition gave me one minute to get out and threatened that should I ever visit him again, amongst other tortures I would be shot. With a pleasant good-day I retired, and once safely into the street some imp in my brain set to work to overcome him.

Before my next journey I had particulars of our previous trouble, which from ignorance more than anything else was not to our credit, but as it happened before my time I saw no reason why I should stop calling, and I could not shake off the aforesaid imp that would impress me with the credit sure to follow in bringing him back to the fold, which actually happened much quicker than I ever dreamed of.

Before my second visit I had a real slap-bang cut-and-dried story to put before him, but I will not repeat it here, as, like the curate's sermon, when required it was not on tap, and a very good job too. I walked boldly into the office, and like all other Bill Joneses, he had a good memory for faces and didn't want my card. He thundered out, "What the — are you doing here, didn't I — well tell you never to come in that — door again?" After a lot more unprintable language which completely upset my programme, at the first opportunity I meekly replied, "I just called to see if you were dead." Further explanations were demanded, and I added that I knew perfectly well that he would never buy anything from us and my only chance was when a new manager came along, which wouldn't be in his lifetime. His attitude changed immediately, and beyond his reply that he wouldn't have any damn fool wandering around the country wishing him dead, we soon drifted into ordinary conversation.

To cut the story short, I was soon seated in his private office and left with an order. Other orders have followed since and today I number him among my very best friends. We have laughed many times over the incident, and probably he may laugh again as he reads the *American Machinist*.

Other similar stories could be told, but the above satisfied me once and for all time that the cut-and-dried method is useless, and above all as this journal proclaims, "Only reliable products can be continually advertised." It naturally follows that it is only the same that can be continually sold, after which it is only a matter of the right salesman.

Editorial

Standardization and Exports

TOO many manufacturers have considered all efforts at standardization as unnecessary frills which had little or no commercial value. The report of Oscar R. Wikander, who represented the American Engineering Standards Committee at conferences concerning international standards for ball bearings, shows clearly just how standardization is going to directly affect export trade. His example of the 700 locomotives being built for Russia points out very clearly the handicap which must be overcome by American locomotive builders before they can compete for locomotives of this class.

It does not matter so much from the economic point of view whether the standards be German or American, so long as they are good standards. For the best standards must and will become international as time goes on and we become more and more inter-dependent. What does matter is that the country which first adopts *good* standards and gets them into use, will have the jump on all the rest when it comes to repeat orders.

We have led the world in interchangeable manufacture which requires certain standards within the shop doing the work. But we have been slow in adopting standards throughout any big industry except that of automobile building.

Unless we wake up to the importance of standardization we are likely to have inquiries from foreign countries for goods made to German or other standards. And if we are to be content to follow rather than lead in the work of standardization, we should at least keep posted as to what German standards are so as to be able to bid intelligently if asked to do so. As the leading manufacturing nation of the globe we should do our share in the work of standardization which is very evidently well under way.

Our Fallen Idols

WE USED to think of locomotive engineers and firemen as a superior kind of workers, the cream of labor, a kind of aristocracy; not because they were richer, or better educated or possessed greater skill or ability, but because we recognized in them men of character. We saw that they had ideals, beyond and above their wages. We instinctively admired their devotion to duty. We were not surprised to read of an engineer sticking to his post in the face of death, refusing to save himself, his last act saving his passengers.

In the days when unions were not so common and not so generally accepted, when a large portion of the public was opposed to them and their activities, the brotherhoods received almost universal sympathy. They too, were of a higher order, more constructive, never rowdy, never breathing hatred for others, though always properly alert for chances to improve their condition.

When these brotherhoods made demands, we naturally wished that they might succeed, for we wanted our heroes to prosper. We were with them, as they deserved.

And now—engineers and firemen leaving their trains in the desert, exposing women and children, mothers-to-be, aged folks and babies to suffering and death. Not in the heat of passion, not even in the face of danger, but cold-bloodedly, wickedly, meanly. They sold their reputation, their manhood, their honor for a mess of pottage for their friends. The captain deserting the ship in time of danger, for the sake of a few dollars! The disgusting performance challenges the power of the English language.

We hoped that it was the action of a few, wondering meanwhile why these few should all be found in one location—in the desert. We waited anxiously the words of scathing denunciation to be pronounced by the heads of their brotherhoods. We expected their unions to kick out the rotten members, as unfit to associate with the rest of them. We felt almost sure that the heads of the brotherhoods would issue a proclamation to the world at large, condemning such unspeakable conduct and asserting that it was far from the ideals of the majority.

Instead, they announced that the strike—mind, they called this cowardly act a strike—that the strike was unauthorized, and that the leaders are to be discharged as such, thus proclaiming that the men are mere puppets, irresponsibles and that the union heads are the real union.

How our idols are fallen!

Just Suppose

JUST suppose a superintendent should tell his men, that being all good mechanics, there was no sense in telling them how much allowance there should be between a shaft and its bearing; nor how tight a drive should be between the axle and the car wheel. Suppose he told them that each should do his own hardening, and that he might choose a temperature best suited to his personality and disposition. Suppose he allowed each man to select a bar from the steel rack instead of handing him his material according to specifications. Wouldn't you immediately inquire as to the location of the nearest insane asylum?

But suppose you met a superintendent, who allows each man to grind his own tools according to his notions, and probably never twice the same way, who declares that each man knows best what he needs for his work, though there may be ten men doing the same job and all with differently ground tools. Suppose you meet such a man, do you shake your head and say sadly: "Poor fellow—do you think it is the heat?"

And suppose you came into a shop where things are made in quantities, and many machines working on the same operation, but with different feeds, speeds and tools, because, as the super says, each man knows best his own conditions, wouldn't you wonder about that?

You have been in shops where every man selects his own feeds and speeds—and grinds his own tools according to his own ideas. Suppose we go a step further and let every man select his own dimensions and fits.

Oh, well, now, you know, this is foolishness. Well, perhaps, but—

Just suppose.

Shop Equipment News

Oilgear High-Speed Hydraulic Broaching Machine

An hydraulic broaching machine for operating at high speed has recently been placed on the market by the Oilgear Co., Milwaukee, Wis., a general view of the machine being shown in Fig. 1. The machine is stated to have a great capacity for work, chiefly because of the wide range of speeds available with the maximum at 360 in. per minute, the ease of selection and adjustment of the speed, and the independent operation of the automatic controls for both the cutting and return strokes. The overall efficiency is stated to be high, ranging from 70 to 90 per cent, as no power is wasted in gears or screw drives.

A standard Type-MD, variable-delivery pump, similar in design and operation to those used in the Oilgear variable speed drives previously described in *American Machinist*, delivers a steady flow of oil to a double-acting cylinder, whose piston rod is connected to a sliding head which operates on ways in a U-shaped trough of the usual design. A close view of the mechanism is shown in Fig. 2. The amount of oil delivered to the cylinder depends on the length of the pump stroke, and this length can be varied from zero to a maximum. As the speed of piston travel depends on the amount of oil pumped into the cylinder, this speed can be changed at will merely by changing the pump stroke. The cutting stroke is started without shock and the pull is steady.

Very slight variations of speed within the limits of 48 and 360 in. per minute are easily obtainable. The right speed may be quickly selected for different materials and different broaches. The speed of the return stroke is adjustable independently of that selected for the cutting stroke. Automatic stops are provided which can be set for any desired length of stroke. There is no over-running, so that the broach will be pulled beyond the reducing bushings and be caught on the reverse. Little effort is needed to reverse the machine, as there are no heavy clutches to shift. Simply pressing down on a small push-button operates the reverse, or the control can be set for automatic reversal. An emergency lever enables the operator to stop the machine instantly at any point of the stroke.

Quick-acting relief valves prevent damage to the broach. These valves, one of which is placed on the cutting end and one on the return end, automatically relieve the pressure and stop the machine whenever the pressure builds up to a predetermined point. The machine is driven by vertical belt from a lineshaft or motor. The motor may be mounted above the main cylinder on an adjustable support.

The following actual production figures are given as representative of those obtainable. The work consisted

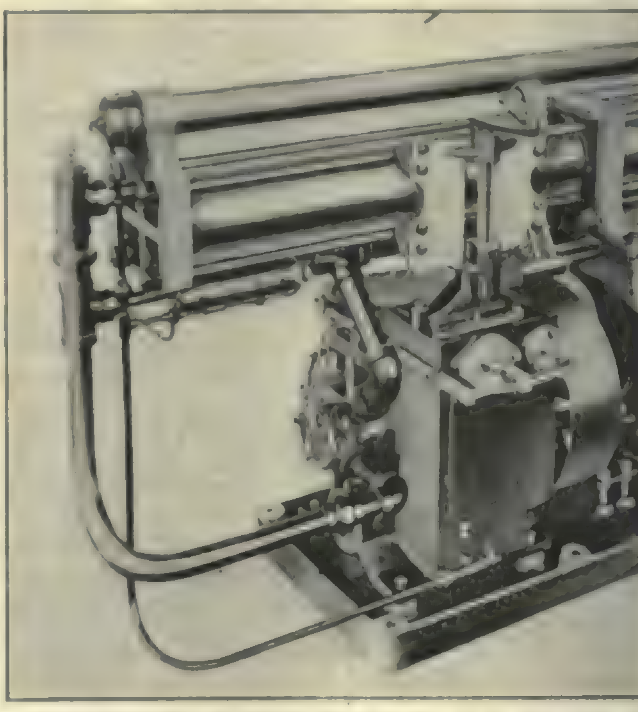


FIG. 2—DRIVING MECHANISM OF OILGEAR BROACHING MACHINE

of broaching four solid keys in a differential bevel gear of 1½-in. bore, 2 in. long, and made of 0.22 per cent carbon steel. The cutting speed was 288 in. per minute and the return speed 312 in. per minute. There were two broaches in the set, and the draws per hour averaged 145. The maximum horsepower used was 5½ for a cutting time of 6½ seconds.

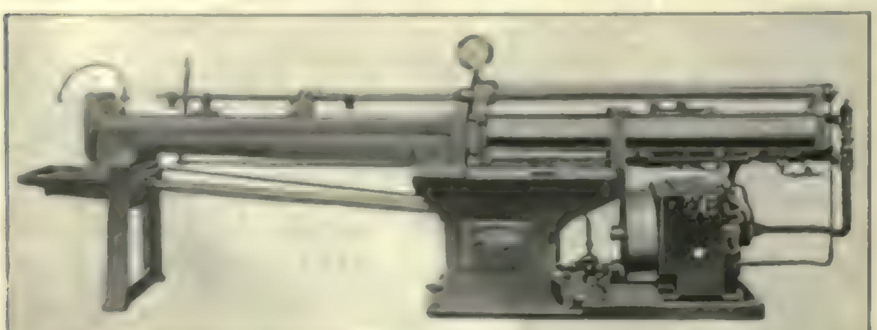


FIG. 1—OILGEAR HIGH-SPEED HYDRAULIC BROACHING MACHINE

The principal specifications of the machine are as follows: Pulling capacity, 16,000 lb. (equivalent to that required by a 2-in. square broach designed according to standard practice). Speed range for either cutting or return strokes, 48 to 360 in. per minute. Stroke, 56 in. Diameter of hole in faceplate, 5 in. Vertical adjustment of drawing head, 1⅞ in. above and 1⅞ in. below center. Driving pulley, 18 in. in diameter by 5 in. face. Speed of pulley, 600 r.p.m. Motor size recommended, 10 hp. Floor space, 16 ft. by 26 in. Net weight, 2,900 pounds.

Erratum

Under the heading of "Cleveland Double-Ended Automatic Threading Machine" on page 313 of *American Machinist*, the capacity of the machine was wrongly given as $\frac{15}{16}$ in. in diameter, due to a typographical error. The capacity should have been stated as $1\frac{5}{16}$ in., as the machine is adaptable to threading large staybolts.

Syracuse Portable 9-Inch Disk Sander

The Syracuse Sander Manufacturing Co., Inc., Syracuse, N. Y., is now marketing the 9-in. motor-driven disk sander shown in the accompanying illustration. The machine is suited to general work, being fitted with garnet paper disks for sanding wood and grinding brass and aluminum, while emery cloth is used for iron and steel.

SYRACUSE 9-INCH DISK SANDER

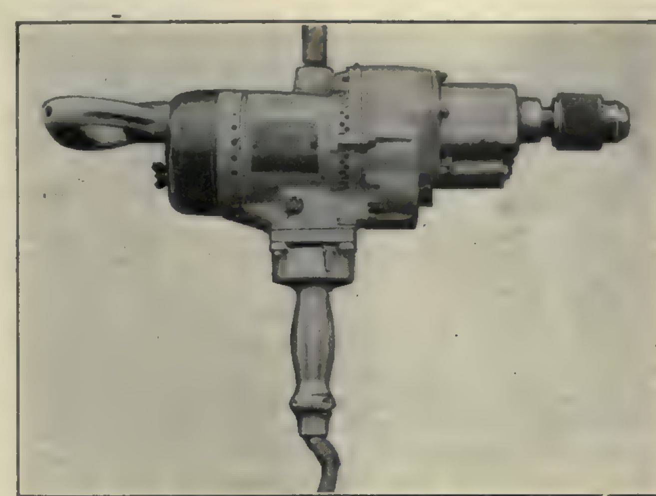
The machine is mounted on a pedestal and is easily portable. It can be connected to any convenient light socket, the motor being furnished to suit the type of current available. The disk is driven directly by a $\frac{1}{6}$-hp. G.E. enclosed motor running at 1,725 r.p.m. A tumbler switch is provided on the end of the motor. The table is $5\frac{1}{4}$x10 in. in size and 38 in. from the floor. It may be tilted 45 deg. down and 15 deg. up. A thumbscrew serves to tighten the table securely at any angle, the setting being shown on a plate graduated in degrees and mounted on the side of the machine. The table is equipped with a graduated angle gage.

The entire head is mounted on a pedestal by means of a swivel joint, so that the work can be easily turned toward the light. A canvas bag is attached to the table for catching the dust thrown from the disk.

"Independent" Reversible Portable Electric Drill

The Independent Pneumatic Tool Co., Chicago, Ill., manufacturers of the "Thor" line of pneumatic and electric tools, has just placed on the market the reversible portable electric drill herewith illustrated. The direction of motion is reversed mechanically, so as to eliminate the electric troubles that may occur when the reverse is obtained electrically. The motor runs always in the same direction and is not subjected to the shock which results from reversing the current with the motor running at speed and under load. The mechanical reversing device is located in the gear case.

The reversing gear is equipped with a locking device which can be shifted instantly to permit of three motions as follows: The first motion is a locked constant forward motion for general drilling, reaming, stud driving, nut tightening and tube rolling; the second is a locked constant reverse motion for backing off nuts and backing out studs and tube rollers; and the third is a neutral position which allows the spindle to slip into forward motion when the machine is pressed forward against the work, and to slip into the reverse motion as the machine is withdrawn from the work. This last is an automatic action that follows the operator's movements and makes the tool suitable for work such as wood boring, tapping, and flue rolling, where drive by power in both directions is required.



"INDEPENDENT" REVERSIBLE ELECTRIC DRILL

Although here applied to an electric drill, the reversing mechanism is adaptable to both electric and pneumatic tools of all sizes. The maker stresses particularly the durability of the device.

Diamond Alloy Cutting Metal

A non-ferrous alloy for metal cutting that possesses unusual hardness and resistance to wear has been placed on the market under the name of "Diamond Alloy." The product is being manufactured by the Diamond Alloy Division of the Kent-Owens Machine Co., Toledo, Ohio, which concern has taken it over recently from the Diamond Alloy Tool Co., St. Louis, Mo. The alloy is being sold by P. H. Biggs, 1235 West 9th St., Cleveland, Ohio.

The alloy is composed of such metals as chromium, molybdenum and tungsten, melted together in such proportions as to produce a hard, fine-grained, homogeneous alloy. It is claimed to possess an unusual degree of resistance to wear, holding a keen cutting edge under the most severe conditions without any tendency to crumble even under an intermittent cut; also to possess a great heat resisting quality, as tools made of it will operate at such high speeds and feeds as to bring the cutting end of the tool almost to the point of fusion without any tendency to soften. Since the alloy is non-ferrous, it is also non-magnetic, a desirable property for many forms of cutting tools.

One of the most predominating features of the alloy is the fact that it can be cast in permanent molds into a great variety of forms such as milling cutters, end mills, reamers and similar tools. It maintains a uniform composition of permanent hardness, necessitating only a grinding operation to complete the finished tools, all heat treatments being eliminated.

Another feature lies in the ability to cast the alloy

around a tough steel center, thereby making a tool that is stronger and will stand much more abuse than a tool made completely of the cutting material. Thus the center of a milling cutter may be made of chrome-nickel steel, with the ring of Diamond Alloy cutting teeth cast around the steel.

The alloy can also be welded to steel. A strip of it can be welded to a chrome-nickel steel backing to make what is known as laminated tool bits, to be used in the standard toolholders.

The following examples show high rates of production that are stated to have been obtained in actual practice with tools made from this alloy. In milling cast iron, the cutter was run at a speed of 370 ft. per minute, with a cut $\frac{1}{4}$ in. deep and a table feed of 15 in. per minute. In turning 0.35 to 0.40 per cent carbon machine steel, the tool was operated at 285 ft. per minute with a cut $\frac{1}{4}$ in. deep and a feed of $\frac{1}{16}$ in. per revolution. In machining a chrome-nickel steel shaft, the speed was 125 ft. per minute with a cut $\frac{3}{16}$ in. deep and a feed of $\frac{1}{32}$ in. per revolution.

A toolholder designated as the "Super" toolholder has been developed for use in conjunction with various forms of cutter bits made of the Diamond Alloy. This holder is made in nine different sizes, the section ranging from $\frac{3}{8}$ x $\frac{5}{8}$ in. up to $1\frac{1}{4}$ x $2\frac{1}{4}$ in. in size.

The cutter bits are made with a taper shank which fits into a corresponding taper socket in the toolholder. The taper being a very gradual one, the pressure of the cut forces the tool bit tightly into the socket, so that no other clamping is necessary. With a single-point bit, the tool can be adapted as a right-hand, straight or left-hand tool, by simply changing the position of the tool bit in the holder.

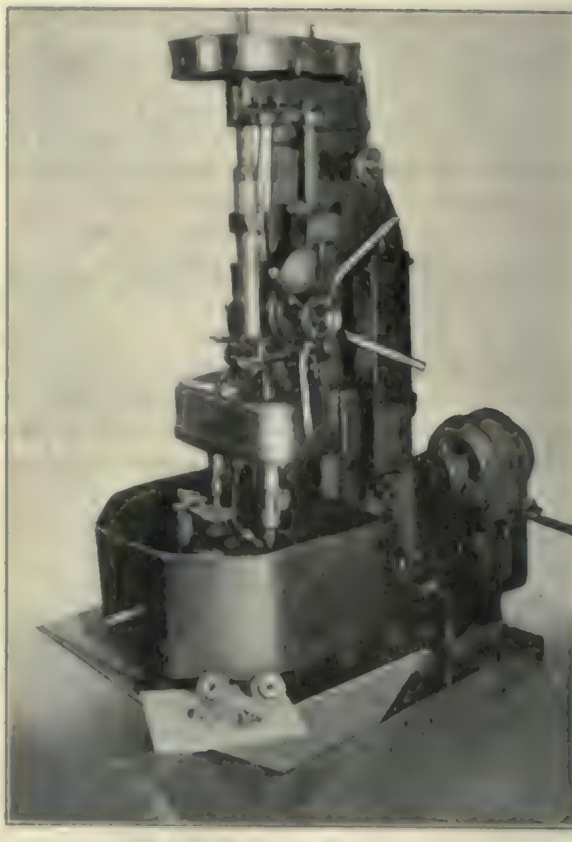
Rockford Rotary-Table Drilling Machine

An upright drilling machine especially fitted for multiple-operation work on small parts is shown in the accompanying illustration. The work that can be seen lying on the edge of the coolant trough of the machine consists in this case of parts of a universal joint. The special attachments for handling the joint have recently been placed on the market by the Rockford Drilling Machine Co., Rockford, Ill.

The machine is a standard 20-in., box-column Rockford drilling machine having capacity for a 2-in. high-speed steel drill when drilling steel. It is driven through a silent chain from an electric motor mounted in the rear. The speed can be changed by the use of interchangeable pick-off gears, and four changes of feed are provided by means of a gear box.

A four-station rotary table having an indexing plunger worked by a treadle is applied to the regular table. This rotary table is indexed by hand after the locating plunger is pulled out of position. The table carries four two-jaw chucks, with the jaws formed to suit the work. By means of an extended wrench, the chuck screws can be tightened from outside the chip guard.

The chucks are aligned under three work spindles so that three operations are performed simultaneously while the fourth chuck is being loaded. A finished piece is thus removed at each indexing. A special three-spindle head driven and fed by means of the spindle of the drilling machine is equipped with a V-shaped gibbed slide running on the ways of the column, and is counterweighted. A positive micrometer adjustment



ROCKFORD DRILLING MACHINE WITH ROTARY TABLE

stop on the quill serves as a depth gage. A drill bushing support is provided under the spindle on the left.

On the work shown the first spindle rough drills the hole, which is $\frac{3}{4}$ in. in diameter and $2\frac{3}{8}$ in. in length, the second spindle rough taper reams and faces, and the third spindle finish taper reams the hole. A production of 250 pieces per 10-hr. day is obtained.

Doctors vs. Draftsmen

By Charles W. Lee

Some years ago I called on a lady of various attainments, inasmuch as she was a successful physician, a man-hater, and my aunt, and told her that I was about to become her fellow citizen, having just gotten a job (which she called "accepted a position") in her fair city.

"Fine!" she said, "and of what will your new work consist?"

"Making drawings of machinery."

"Is it possible? It is beyond my comprehension how a man"—remember that she was a man-hater and imagine the emphasis on "man"—"can be satisfied not only to spend his time making marks on sheets of paper, but to make a business of it!"

"Neither," said I, "is it within my understanding how a woman"—emphasis on "woman"—"can be satisfied to spend her life doing up powders in little pieces of paper!"

"Ah, but I have to know what is in the powders, and why."

"Precisely so, and I have to know where to put the lines, and why."

Which, strange as it may seem, especially to married men, closed the discussion.

News Section

Aeronautical Chamber of Commerce Elects Officers

At the annual meeting of the board of governors, Aeronautical Chamber of Commerce of America, 501 Fifth Ave., today, the following officers were elected: president, Inglis M. Uppercu, Aeromarine Plane and Motor Co., Keyport, N. J.; first vice-president, Charles L. Lawrence, Lawrence Aero-Engine Corporation, New York City; second vice-president, C. C. Witmer, Airship Manufacturing Co. of America, Hammondsport, New York; third vice-president, Lawrence B. Sperry, Lawrence Sperry Aircraft Co., Farmingdale, L. I.; treasurer, Charles H. Colvin, Pioneer Instrument Co., Brooklyn, N. Y.; general manager and assistant treasurer, S. S. Bradley; secretary, Luther K. Bell; assistant secretary, Owen A. Shannon.

Increases in the Board of Governors from eleven to fifteen were made as follows: I. M. Uppercu; G. M. Williams, general manager, Dayton Wright Co., Dayton, Ohio; W. C. Young, Goodyear Tire and Rubber Co., Akron, Ohio; Charles L. Lawrence.

Steady growth by the Aeronautical Chamber of Commerce was reported, recent additions to the membership including Goodrich Rubber Co., Akron, Ohio; Goodyear Tire and Rubber Co., Akron, Ohio; Wolverine Lubricants Co. of New York, New York; Rich Tool Co., Chicago, Ill.; Mosler Metal Products Corporation, Mt. Vernon, N. Y.

Steel Engineers' Convention Opens in Cleveland Sept. 11

The Association of Iron and Steel Electrical Engineers, through its secretary, John F. Kelley, has just made public the official program of its sixteenth annual convention and exhibit which will be held September 11 to 15, in the Cleveland Public Hall, Cleveland, Ohio.

The attendance this year is expected to exceed all previous records and engineers from the steel industry throughout the country will be present. Manufacturers of mechanical and electrical apparatus applicable to the iron and steel industry will demonstrate their products, close to one hundred manufacturing companies having taken space for exhibiting their equipment.

The exposition will be held on the first floor of the new public auditorium and the technical sessions will be held in the lecture hall in the same building.

A very elaborate program has been prepared for the technical sessions. Among those who will present papers are the following:

Dr. Charles P. Steinmetz, chief consulting engineer, General Electric Co.; B. G. Lamme, chief consulting engineer, Westinghouse Electric and Manufacturing Co.; A. G. Witting, assistant chief engineer, Illinois Steel Co.; F. C. Watson, electrical superintendent, International Nickel Co.; D. M. Petty, electrical superintendent, Lehigh Plant, Bethlehem Steel Co.; L. W. Heller. general superintendent power stations, Duquesne Light Co.; R. B. Gerhardt, electrical superintendent, Bethlehem Steel Co.; D. B. Rushmore, consulting engineer, General Electric Co.; and F. W. Cramer, engineer of tests, Cambria Steel Co.

Machinery News from Abroad

According to official figures just published at Budapest for the first six months of the present year, the exports of Hungarian made machinery have largely increased against the same period of the preceding year, nearly 60,000 quintals more than during the first six months of 1921. Half of the machines exported were agricultural machines and implements, the larger part of which went to Jugoslavia. A considerable number of steam locomotives and flour mill machinery was exported to Poland. The total exports of machinery during the first half year 1922 were as follows:

Machines and apparatus, 98,717 quintals valued at 1,411,000,000 Hungarian crowns; and electrical machinery, 16,026 quintals valued at 1,133,000,000 crowns.

As compared with the exports of other branches of the machinery industries, the exports of textile machinery from Great Britain have largely increased again, as will be seen from the following table:

	Weight in tons	*Total value*
1913	178,084	£8,282,000
1919	65,920	8,427,000
1920	63,614	9,159,000
1921	156,995	25,149,000

The per ton value of these exports in 1913 was £46.5, while in 1921, the per ton value was £160.

The increase in price is remarkable. Large orders were placed not only by India, China, and Japan, but also by the British dominions and South America. On the other hand, the exports to Russia, which in 1913 amounted to 15,308 tons, amounted in 1921 to only 3 tons. Germany, which in 1913 bought British textile machinery to the amount of 13,917 tons, received in 1921 only 341 tons.

A report from Budapest is to the effect that the German iron master, Hugo Stinnes, has just formed a company with headquarters at the Hungarian capital and a capital of 30 million Hungarian crowns for the purpose of exporting iron, steel and machinery.

The first locomotive built since the revolution in Russia has just left the St. Petersburg Railway shops. The cost of construction of this locomotive was no less than 75 milliards of Soviet rubles (75,000,000,000 rubles).

Branch Secretaries of National Metal Trades Meet

All but four of the twenty-four local branch secretaries of the National Metal Trades Association met August 16 and 17 at Milwaukee (Wis.) Athletic Club for their semi-annual conference.

The meeting was opened by W. W. Coleman of the Bucyrus Co., president of the National organization, who gave an interesting and instructive talk on the political history of Milwaukee and Wisconsin. Mr. Coleman pointed out that immigrants of a radical and socialistic tendency were in the majority among the early settlers. At one time a bill was introduced in the state legislature which required that all property be divided every Saturday, or oftener if necessary. It was defeated. His address was unusual in that much that he said has never before been compiled.

The visiting secretaries were surprised to learn that for many years the metal trades have predominated in the industrial activity of Milwaukee instead of the brewing industry. Interesting and educational papers were read and discussed by the secretaries including "An Up-to-Date Employment Bureau" by Chester M. Culver, "Objections to Legislation Favoring Unemployment and Health Insurance and Old Age Pensions" by J. M. Manly, "Experience of the Grand Rapids Branch of the National Metal Trades Association with their Mutual Workmen's Compensation Insurance Bureau" by A. W. Blodgett, "Comparative Wage Schedules" by W. J. Cronin, "What is Normal" by Lewis Atherton, "Legislation" by H. A. Jansen, "Superintendents' and Foremen's Clubs" by Paul Blatchford, "Need and Value of Economic Education of Employees" by Donald Tulloch, and "Turnover—Causes and Remedy" by T. G. Silkman.

A committee was appointed by Chairman Fairbairn to devise an improved and more comprehensive comparative statement of wages paid in the various localities, than that which has heretofore been issued by the local branches and the national office of the association.

The result of the survey recently completed by the Association in regard to industrial betterment work was presented in tabulated form showing the results accomplished.

In addition to national president Coleman, H. J. Wiegand of the Cutler-Hammer Co., who is president of the Milwaukee branch; Commissioner Sayre, Counselor Hibbard and Secretary Fischer of the National Metal Trades Association and some ten secretaries of closely allied associations; J. B. Dean of the American Tool Works Co., Paul T. Horton, of the Case Crane and Engineering Co., and J. W. O'Leary of Arthur J. O'Leary and Son Co., who are members of the executive committee of the national association, were present.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE

Editor, *Commerce and Finance*, New York

LOS ANGELES, CAL., Sept. 3, 1922.

FROM what I have seen and heard in San Francisco and Los Angeles, as well as in the fertile valleys through which one passes in going from one of these great cities to the other, I conclude that this region is almost immune to the depressing influences which are felt from time to time in other parts of the country. The fact is that much of the country's liquid wealth is being brought here by travelers who come as tourists and remain as residents. There is, therefore, an abnormal growth which severely taxes the facilities provided, although they are being increased with marvelous rapidity and enterprise. The result is great building activity, good trade and great prosperity in almost every branch of business.

Among those merchants who are engaged in the increasing foreign trade between the Pacific Coast and the Orient there is some apprehension lest the tariff bill will reduce our exports to Asia, Australia and New Zealand, but only those who look far ahead are much concerned over such a possibility and for the present at least the majority of the people seem happy and contented. From the number of automobiles that are to be seen on the excellent roads which cover the state and the crowded condition of the tourist camps that are to be found in every community it would seem that almost every one is making a motor trip, but the well filled hotels negate this idea and I am leaving here tonight in the belief that everyone in California is travelling either by motor or by train.

The primary political campaign which has resulted in the nomination of Hiram Johnson to succeed himself as U. S. Senator has been fought with much bitterness and has absorbed public attention for the last two or three weeks, but now that it is ended a period of quiescence is to be expected until the pre-election contest begins in October.

The most important indication of the course of business last week was to be found in the stock market. The collective mind seems to be wiser than any individual and as read in the trend of stock prices its prescience has become so proverbial that we say "the ticker never lies." In connection with other influences at work on business and prices, therefore, I consider it of first importance that both railway and industrial stocks last week reached high levels for the current upward movement, which is now nearly a year old, and that as many as sixty-five stocks recorded new high prices in a single day. These records were made despite the abandonment of efforts to settle the rail strike and the assurance that we face an autumn of transportation congestion and of high priced coal.

Coincidentally raw commodity and wholesale prices are in the main distinctly firmer, and retail prices, a buyer tells me, "are getting stiffer every day." There seems to be a great fear in many quarters that the ultimate consumer will not pay these prices, but the crops will bring in more money to the farmers, all our labor is employed, wagers are rising in many places, and it is my belief that the strength of the stock market expresses the confidence of the omniscient collective mind that trade will be of good volume and profitable for many months to come. It will be recalled that after the culmination of the last bull market in stocks in November, 1919, six months elapsed before deflation began in commodities, and I am inclined to think that the end of this rise in stocks is not very near while money remains so plentiful and cheap.

The wage advance announced by the United States Steel Corporation, which I commented on last week, has aroused wide discussion as to whether it is a momentary maladjustment portending unbalanced prices, and will therefore restrict business because those who receive low prices for their goods cannot pay high prices for what they buy, or whether it is an indication of rising wages and prices and expanding business everywhere. Those who hold the former view point to the downward tendency of wheat and some of the other crops as proof that the wage advance is not a move toward general readjustment, but this seems to me statistical jugglery because farm products as a whole are higher than they were last year and the declines are exceptions, not the rule. On the other hand wage increases have been reported in many other industries, notably the New England cotton mills, which are returning to the scale that prevailed before the strike. And as all industry will have to pay more for coal and for metal products, and later for other supplies, a general rise in prices and wages, appears to me extremely probable.

As for the belief that this inflation will be restrained by the refusal of consumers to buy, that seems to me to disregard the lessons of the past three years, in which it has been clearly demonstrated that people will buy anything as long as they think it is going higher, and that they do not refuse to buy until they have been repeatedly warned by rising interest rates and falling stock prices that commodities cannot go up forever.

As if we were not heading naturally into a period of secondary inflation, the savants in Washington are doing their best to put us there. A real menace is discoverable in the falling off of Federal tax receipts. For the fiscal year ended June 30 they were $3,197,451,083 against $4,595,357,062 in 1921. For July they were $46,000,000 below the same month last year. Expenditures have shown no such decrease and our tax burdens, though inordinate, are insufficient to pay the cost of government, and higher taxes, in some form, or continued government borrowing is inevitable. Nevertheless, Congress has put through a bonus bill which quite possibly will be passed over the President's veto, and which will add nearly $100,000,000 a year to our expenses immediately and about $4,000,000,000 before we are through with it. President Harding is confident the ship subsidy is not yet dead. In addition, Congress has passed a tariff which will raise price and wage levels. State governmental expenses and taxes are the heaviest in our time, and we have yet to reap the full harvest of the extensive county and municipal borrowing of the past year.

The inflationary effect of all these influences has often been touched on in these letters, and it is sufficient to say that the boom I have been expecting, meretricious and undesirable as it may be, seems to be fairly upon us.

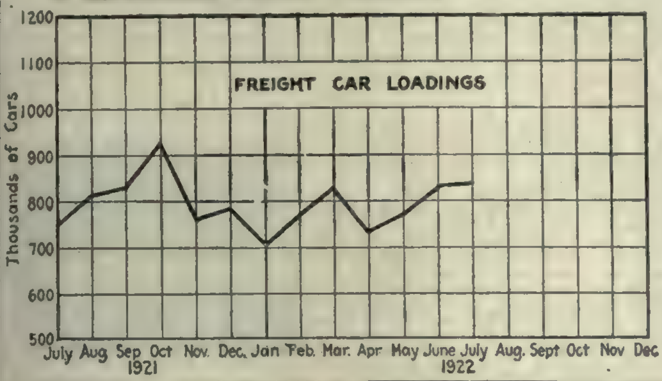
Sugar advanced sensationally last week as the strength of the statistical position asserted itself over the fear that consumptive channels were clogged. Coffee is slightly higher. Iron and steel have shown their expected advance.

The government report placing the condition of the cotton crop at 57 was just about in line with expectations and a general willingness to take profits resulted in a brief convulsion during which prices dropped 80 points. The indicated crop of 10,575,000 bales is small in comparison to probable needs, but mill men, despite good trade, are still uncertain whether they can sell goods manufactured out of cotton costing more than 22 cents a pound.

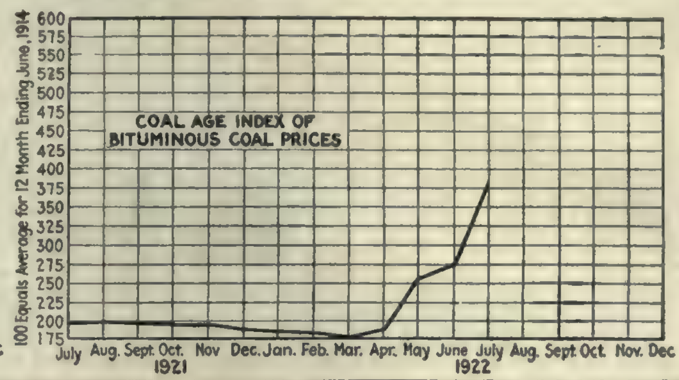
Other commodities are firm, Mr. Ford's denunciation of coal prices is timely and vigorous and his assertion that operators have conspired to raise prices through the strike reflects an opinion widely prevalent in the Northwest, but it is likely to have little effect on prices. The money markets are unchanged, and the Federal Reserve ratio shows but a small decline to 79.2 per cent.

Germany has been granted a provisional six months' respite in reparation payments which has brought about a recovery in the mark to 85 cents a thousand, and the international emergency is met just in time, as emergencies generally are. That has been proven true many times during the past few years, and it is extremely likely that if any of the factors restraining confidence on this side of the Atlantic becomes so serious as to constitute an emergency they will be promptly obliterated.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



AMERICAN FOREIGN TRADE for the month of July shows that the value of exports was $30,000,000 below the June total. Imports also declined, being $9,000,000 less than the importations in the month previous. Cotton shipments abroad appear to be responsible for the decline in exports, July shipments totaling 373,742 bales, or a decline of about 118,000 bales in the thirty-day period. Exports of iron and steel continue light.

Railroad earnings, according to reports filed with the Interstate Commerce Commission, show a net operating income of $46,263,000 for 104 railroads of Class 1, representing a mileage of 141,380. In the corresponding month of last year, these same roads reported a net of $43,938,000.

Commercial paper rates remain unchanged around 4 per cent. The market appears to be somewhat firmer. The downward movement in the volume of commercial loans which has been going on steadily since the first of the year, appears to have ceased. In the United States since the beginning of 1921, the decline has been continuous from a point around 10 billions of dollars to around 7 billions at the current date.

Crop reports forecast a corn yield of over 3 billions of bushels. This, if fulfilled, will mark the fourth time in the country's history that a crop as large has been harvested. Cotton was estimated at 11,449,000 bales on July 25 by the Government, as compared with an actual yield in 1921 of 7,958,000 bales. On that date the condition was estimated at 70.8 per cent of normal as compared with 64.7 per cent a year ago.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0280	$0.0261	$0.0270
Cold finished shafting	per lb	0.0365	0.0340	0.0415
Brass rods	per lb	0.166	0.1750	0.1433
Solder (½ and ½)	per lb	0.22	0.217	0.18
Cotton waste	per lb	0.115	0.11	0.102
Washers, cast iron (½ in.)	per 100 lb.	4.00	3.83	4.06
Emergy, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	....
Lard cutting oil	per gal	0.575	0.575	....
Machine oil	per gal	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

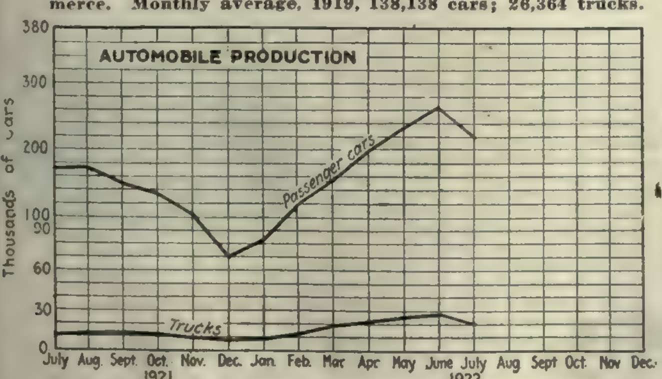
World wholesale prices on basic commodities, using the 1913 average as equivalent to 100, show increases in many countries in July as compared with June. The index for the United States is 155. The *Economist* computes that of Great Britain as being 163. Franee is reported as being around 325, Italy at 537, Japan at 201, Canada at 166 and Germany at 13,935. In the case of Germany the increase in July alone was 52.5 per cent.

Construction contracts awarded for buildings of all classes during July in 27 northeastern states totaled $350,000,000, an increase of 2 per cent over June awards and an increase of 65 per cent over the total for July, 1921.

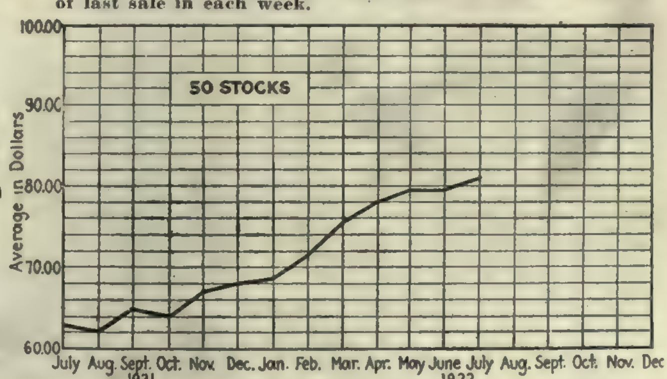
Cotton spinning activity during July was somewhat increased, 31,975,269 spindles being operated during the month as compared with 31,877,015 in the month previous.

Loading of revenue freight on the railroads of the country totaled 856,219 cars during the week which ended on Aug. 19, which was an increase of 3,639 cars compared with the preceding week. This represents an increase of 41,072 cars over the corresponding week in 1921, but a decrease of 111,884 cars compared with the corresponding week in 1920. Coal loadings during the week totaled 81,959 cars, an increase of 2,600 over the previous week.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Monthly average, 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



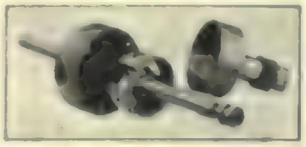
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Clutch, Friction, for Geared-Head Lathes

Greaves-Klusman Tool Co., Cincinnati, Ohio

"American Machinist," June 8, 1922

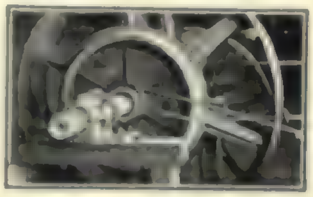


The ring of the clutch expands at both sides. The expanders are in the center of the clutch ring, operating to produce pressure directly on the toggle levers. Adjustment of the levers is by means of eccentric studs, so that the same leverage can always be maintained. The driving hub is in one piece for both the forward and reverse clutches, giving a long bearing on the shaft and a long driving key. The clutch has a 50 per cent wider face, larger diameters on some sizes, and greater belt speed than in the former model.

Clutch, Pneumatic, Dickson

Rogers Foundry and Manufacturing Co., Joplin, Mo.

"American Machinist," June 15, 1922



Two disks with cork-covered conical faces on their periphery are closely fitted on a hub. They are driven by pins through a triangular plate which is a part of the hub. Air can be fed through the hub between the disks while the hub is revolving. The action of the air forces the conical surfaces into contact with the outer case, which has similar conical faces. Pins in the disks are fitted with springs to release the clutch. The clutch is especially adapted to fields where remote control or clutches of large horsepower are required. The 16-in. clutch is rated at 165 hp. at 100 r.p.m., and uses air at a pressure of 3 lb. per square inch.

Grinder, Tool, Ball-Bearing

Fafnir Bearing Co., New Britain, Conn.

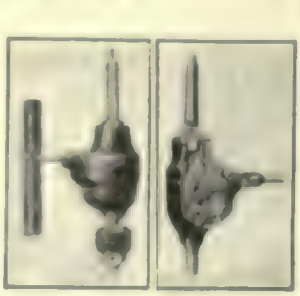
"American Machinist," June 15, 1922

The machine may be furnished on a pedestal or with a bracket for bolting to a post, or with a plate for bench mounting. The chief feature is the method of mounting the spindle on Fafnir ball bearings. The spindle can be driven by belt directly from the lineshaft, so that it is not necessary to start and stop each time the grinder is used. Adjustable toolrests, water pot and wheel guards are furnished.

Chuck, Tapping, Back-Geared, Single Spindle, Models E and F

Landau Machine & Drill Press Company, 45 W. 18th Street, New York, N. Y.

"American Machinist," June 15, 1922



The use of back gears in this chuck allows a much higher speed for the reversal of the tap than for the forward speed. The main drive is fitted with ball bearings and the standard tap holding chuck is used. The ratio of the reverse speed to the forward speed is 3:1 in the Model E. The chuck takes Nos. 1 and 2 Morse tapers, and has a capacity up to [illegible]-in. taps. The Model F is similar to the Model E, but the speed of the reversal is [illegible] times the forward speed and the capacity is from [illegible] to [illegible] in. [illegible] the breakage of the taps.

Trailer, Wheel and Platform

Elwell-Parker Electric Co., Cleveland, Ohio

"American Machinist," June 15, 1922

The trailer is for use with electric elevating platform trucks and tractors. The front wheels are of the swivel type, and are 10 in. in diameter. The fixed rear wheels are carried in yokes riveted to the top and to the side and are 15 in. in diameter. The trailer can be provided with end or side standards, and with a hook and eye or chain coupler. It may be equipped with four casters, or the wheels may be fitted with 10- and 15-in. solid rubber tires. The clearance between the wheels is sufficient to allow the lift truck to be driven beneath the platform. Capacity, 6,000 lb. Weight, 600 pounds.

Drilling and Tapping Machine, Sensitive, Multiple, Quick-Change

Landau Machine and Drill Press Co., 45 West 18th St., New York, N. Y.

"American Machinist," June 15, 1922

The machine provides both low and high speeds, and can be driven by means of either tight and loose pulleys or by a ½-hp. motor. Each spindle is a complete unit, may be used individually with the remaining spindles idle, and is readily adjustable both radially and vertically. The head has a travel of 3½ inches. Speeds: drilling, 500, 900 and 1,800 r.p.m.; reverse for tapping, 600, 1,000 and 1,800 r.p.m. Capacity: drilling, up to ¼ in.; tapping, No. 10 x 32. Maximum spindle spread, 4½ in. Minimum center distance, ⅞ in. Weight: motor-driven, 360 lb.; belt-driven, 300 pounds.

Chucks, Tapping, Plain, Models G & B

Landau Machine and Drill Press Co., 45 West 18th St. New York, N. Y.

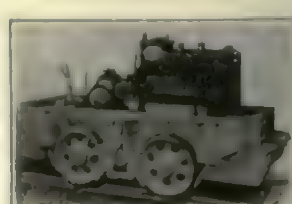
"American Machinist," June 15, 1922

The simple Model G friction device, shown at the left, is for holding taps so as to prevent breakage in case a hard spot is encountered in the work. It can be used with the Models B and E tapping chucks, as well as with standard tapping machines. It is made with a tapered shank for use on drilling machines and lathes, or with a straight shank and a reversing sleeve for use in a turret head. At the right is shown the Model B single-spindle tapping chuck that can be driven directly from the main spindle of a drilling machine. It is fitted with ball bearings. The spindle reverses at higher speed than when feeding downward. Capacity, up to ¼ inch.

Locomotive, Industrial, Gasoline, Motor-Driven, Atlas-Cletrac

Atlas Car & Manufacturing Company, Cleveland, Ohio.

"American Machinist," June 15, 1922



The locomotive is intended for general hauling around industrial plants and for road construction. The driving mechanism consists of the complete power plant of the Model F tractor made by the Cleveland Tractor Co. The 18-hp. motor has four cylinders, and can be run on either gasoline or kerosene. A washing device removes dust from the air fed to the motor. Reversal is accomplished by means of a jaw clutch and speed control by the throttle. A cab enclosing the mechanism and the operator can be mounted on the frame. Wheel base, 34 in. Gage, 24 in. or wider. Maximum speed, 8 m.p.h. Draw-bar pull at 4.8 m.p.h., 800 lb. Weight, 4,000 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

The Tariff Situation

WASHINGTON CORRESPONDENCE

Driving at top speed, Republican conferees on the tariff bill have considered and tentatively agreed upon more than half of the amendments to rates which were made by the Senate. Working seven hours daily, and with prospects of night sessions, the conferees have declared that their report will be submitted to Congress by the middle of September.

In making this record of speed, however, the conferees have passed over until the end of the bill all highly controversial points in the measure. The question of the basis of valuation to be used in determining ad valorem rates will not be disposed of until the last. The House used American valuation as its basis—the value of a comparable American article. The Senate used foreign valuation, which has been the basis of all previous tariff measures. In proceeding with discussion of rates, the conferees are using the Senate basis of foreign valuation, but with experts of the Tariff Commission keeping a parallel column translating such duties into terms of the American wholesale selling price of the imported article. This is the so-called Burgess plan, suggested by William Burgess, now a member of the Tariff Commission, and which was considered and rejected by the Senate finance committee when the bill first came from the House more than a year ago. If this plan finally were adopted by the conferees, it would change every ad valorem rate in the bill—and ad valorem rates constitute about 22 per cent of all rates in the bill—and would destroy any accurate basis of comparison with previous tariff laws.

VIGOROUS CONTEST EXPECTED

Nothing as to definite agreements on rates is being given out by the Republican conferees. The Democratic conferees are excluded from the sessions and no meetings are being held with reporters, as was done during conference on the tax bill.

Senator McCumber, however, has stated definitely that in the chemical schedule the conferees passed over coal-tar products, which rates were increased heavily in the Senate by the Bursum amendment, raising the figures and placing them on the basis of American valuation. He also stated that white arsenic on which the House placed a duty of 25 per cent and the Senate finance committee recommended 2 cents per pound but which was placed on the free list by vote of the Senate, had been passed over. It is expected that in the cotton schedule, the additional duty of 4 per cent imposed by the Senate upon yarns and cloths treated with vat dyes, will be passed over until the dye rates in the chemical schedule are determined.

While no authoritative information has been given out by the conferees, it is the general understanding in the corridors of both Houses of Congress that the conferees have made some reductions in the chemical schedule and in the metals schedule, the latter being in manufactured articles. The cutlery rates were passed over, it is understood.

When the conferees do take up the coal-tar rates in the chemical schedule, a vigorous contest is expected. Senator Smoot is opposed to anything like the rates imposed by the Bursum amendment. Somewhat significant of the fight he proposes to wage in the conference was the fact that on the day the bill passed the Senate, the Utah senator secured adoption of an amendment to the flexible tariff provision of the administrative section which would empower the President to make effective a change in rates of coal-tar products on 15 days notice, whereas 60 days notice is required before changes on any other products shall go into effect.

On the other hand, Senator McCumber heartily favors the high rates of the Bursum amendment, and Senator McLean, the third Senate conferee of the Republicans, voted for the high rates and is an ardent protectionist.

Republican leaders in both the House and Senate predict that the new tariff bill will be on the statute books by Oct. 1.

Strikes Retard Southern Industries

While the coal and railroad strikes are seriously retarding industrial operations over the entire Southeast, conditions in the iron and steel business are not being seriously affected as yet, according to the Southern Metal Trades Association, of Atlanta. Building operations are being somewhat retarded, as the situation has become acute in the lumber and brick industries. Many smaller lumber plants have shut down entirely, while all have curtailed production to some extent. Brick plants are being operated on a curtailed basis. There are hundreds of carloads of lumber on the side tracks in Southeastern railroad yards, and millions of brick in the brick yards that cannot be shipped because of the car shortage.

According to Robert Gregg, president of the Atlantic Steel Co., of Atlanta, the iron and steel industries of this immediate section are in very good shape with the outlook for the future better than it has been in the past three years.

The iron market at Birmingham, Ala., reached $25 the latter part of August, which, the Southern Metal Trades Association advises, is the highest price paid since the war. The lots sold at this price ranged from carloads to 200 tons, and were for spot and fourth quarter delivery. Pig iron prices for 1923 delivery are expected to be above $21 to $22 per ton for No. 2 foundry. No sales have been made as yet, however, for 1923 delivery. The present spot average is above $21. The price tendency is upward due to the strikes.

There are now 23 iron stacks active in the Alabama district as compared with 20 on July 1, and about 25 per cent that production at this time a year ago.

Production in the Alabama district the last half of the year is expected to greatly exceed that of the first six months, when official tonnage was 963,019 tons. For the last six months of 1922 production will probably double that of the same period in 1921, when the tonnage was only 548,183 tons.

Washington Notes

BY PAUL WOOTON

During July inspectors of the Interstate Commerce Commission inspected 4,085 locomotives throughout the country. Of that number only 169 were found to be in such condition as to be classed as "not safe to operate"; 2,456 disclosed defects of varied character, more or less serious, while 1,295 others possessed defects of a character such as to give cause for no immediate concern, but which, according to the best practice, should have attention. The report, called for by a Senate resolution, is a disappointment to the unions which inspired it, who expected it to disclose a much higher percentage of bad-order locomotives.

The Commission took advantage of the opportunity to present certain pertinent facts in connection with locomotive boiler inspection. As required by the act, the United States is divided into fifty locomotive-boiler inspection districts. One inspector is assigned to each district. There are 70,000 locomotives coming within the purview of the act. A determination as to the extent to which the act currently is being violated would involve ascertainment of the condition of each locomotive and information as to the use being made of it. Conditions of locomotives vary from day to day. It will be impossible for Interstate Commerce Commission inspectors to make any such determination. The 70,000 locomotives are housed or repaired at 4,600 different points and are operated over more than 265,000 miles of track. While it is obvious that it is impossible to report on the condition of all locomotives, the Commission expresses the opinion that the boiler inspection act has been recently violated. At the same time the Commission points out that it is absolutely impossible to report accurately on the extent of such violations.

The reports from the boiler inspectors of the Commission indicate, the report says, "a very general let-down in the matter of inspection by the carriers which gives cause for concern."

The Commission points out that it is the use of a locomotive which is not in proper condition and not the condition itself which is a violation of the law. Attention also is called to the fact that the appropriation for boiler inspection for the current fiscal year is $290,000. Of that amount, the maximum legal expenditure in any one month is $24,166.66. This was cited to show that inspectors can render only a general service, designed to bring about compliance on the part of the carriers with the terms of the act.

The hope that Mr. Ford will not find it necessary to close his plants on account of coal prices was expressed today by Secretary Hoover. He called attention to the fact that Mr. Ford has signified his willingness to pay $4.50 for coal. Mr. Hoover expressed the opinion that the price would not be greatly in excess of that figure on September 16, the date set for the closing of the Ford factories. Even should Mr. Ford have to pay $6.50 per ton for coal after the 16th, Mr. Hoover pointed out that this would not be a heavy tax on his business since at the present rate of his output the added

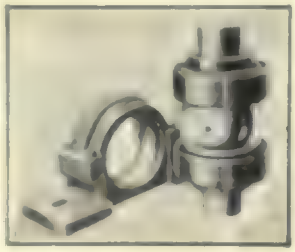
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Pillow Block, Self-aligning, Double-Ball Bearing

Fafnir Bearing Co., New Britain, Conn.

"American Machinist," June 22, 1922



The block is nearly frictionless since both radial and end-thrust loads are carried by the balls. It has the minimum distance possible from the base to the shaft center and automatically aligns without affecting the ball bearings. The outer bearing ring is mounted against a shoulder near the end of the box. The box contains no bolts, screws nor adjustments. It is secured endwise on the shaft by means of two collars fitted with setscrews and lugs which engage corresponding slots cut in the wide inner flange of the ball bearing. The block is of special use on large sizes of fans and blowers.

Grinder, Pneumatic, Portable

Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y.

"American Machinist," June 22, 1922

The wire brush that can be used in place of a grinding wheel makes the equipment adaptable to removing rust, paint and scale from steel and iron surfaces. An oil separator has been fitted to the grinder to feed the lubricant for the bearings. It consists of a perforated cylindrical steel shell attached to the inner end of the grinding spindle. This shell revolving around the vent tube separates the oil from the oil-laden air leaving the motor, and throws it back into the mechanism. The separator is applicable to the larger sizes of the "Little Giant" grinders.

Saw, Bench, Portable, "Rapid"

Triangle Metal Products Corp., 31 Dartmouth St., Rochester, N. Y.

"American Machinist," June 22, 1922

The machine is made in two sizes. A ¼-hp. 110-volt enclosed motor arranged for either a.c. or d.c. drives the saw through worm gearing. The speed of the saw is ordinarily 110 r.p.m. The saw is hollow ground and is $\frac{1}{32}$ in. in thickness and 3½ in. in diameter. It is covered by a guard. The work-holding device is equipped with handles. It clamps and holds either round, square or hexagon stock. A stop for adjusting the length of the piece cut is also provided. The saws used are interchangeable. Capacity: No. 1 machine, from ⅛ to ½ in. in diameter; No. 2, from ¼ to 1 in. in diameter. Weight, 40 pounds.

Milling Machine, Die, Vertical-Spindle

Billings & Spencer Co., Hartford, Conn.

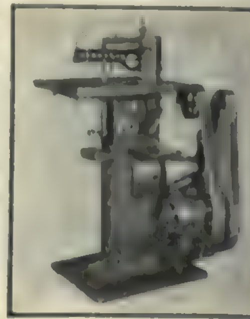
"American Machinist," June 22, 1922

The machine is for milling dies and similar work of irregular outline. Four changes of spindle speed ranging from 241 to 926 r.p.m. are provided in the gear box and are controlled by two levers. The spindle has a lever-operated collet, and special collets are furnished for ⅛-, ¼-, ⅜-, ½- and ⅝-in. diameter shanks. A double sliding carriage forms the upper part of the machine. The cross and traverse movements may be operated either independently or in conjunction. Capacity, 2½ to 11½ in. wide, any length. Carriage movement: traverse, 11 in.; cross, 4½ in. Floor space, 40 x 18 in. Weight, 1,000 pounds.

Filing Machine, High-Power, Large-Capacity

Oliver Machinery Co., Grand Rapids, Mich.

"American Machinist," June 22, 1922



The length of the stroke is adjustable from ¼ to 7 in. by means of an accessible eccentric inside the column. The table has diagonal grooves for filings and tilts for draft or clearance in all four directions. The work-clamping arm swings over the table. The head relieves the file $\frac{1}{32}$ in. on the up stroke. A pump with a swinging nozzle blows away the filings. An overhead support arm for filing closed-bottom dies, a lower support clamp for filing closed-top dies, and a sawing attachment with upper and lower arms for holding hacksaws, can be furnished. The motor required has ½ hp. at 1,800 r.p.m. Capacity, files 3 to 14 in. std. or special. Table, 20 x 24 in. Slide, 18 in. long. Floor space, 22 x 38 in. Weight, 700 pounds.

Tapping Attachment, High-Speed, Sensitive, Etteo

Eastern Tube and Tool Co., 594 Johnson Ave., Brooklyn, N. Y.

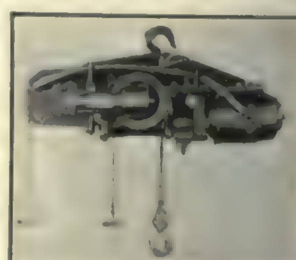
"American Machinist," June 22, 1922

The tapping spindle is driven through friction clutches on both the forward and the reverse motion, and is fitted over a projection on the shank for most of its length. The thrust of the cut is transmitted directly back to the machine spindle. Pressure placed on the drilling machine spindle regulates the tap speed in the forward direction. As soon as the tap encounters an obstruction, the clutch slips. When the spindle is raised, the tap reverses at twice the forward speed. A special type of tap-holding chuck that gives the tap a slight play is furnished. Capacity, $\frac{5}{16}$ in. in steel and ⅜ in. in cast iron or brass. Weight, 3¾ pounds.

Hoist, Electric, "Everedy" Type-S

Reading Chain and Block Corp., Reading, Pa.

"American Machinist," June 22, 1922

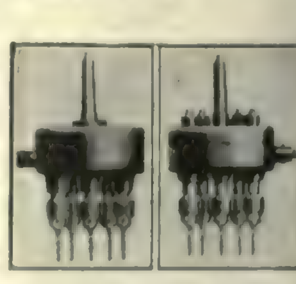


The hoist is intended to replace hand-power chain hoists and requires little headroom. It is light in weight and runs at high speed. A mechanical motor brake operates in conjunction with the control lever, and an adjustable automatic limit stop acts at both the bottom and top limits. The hoist is balanced, so that the lifting hook is always central with the point of suspension. The rope is guarded to prevent overwinding. The hoist may be controlled by pendant cords or by a push-button switch. It is made in sizes for lifting loads from 500 to 4,000 lb. at high speed.

Heads, Drilling and Tapping, Multiple-Spindle, Models K & H

Landau Machine and Drill Press Co., 45 W. 18th St., New York, N. Y.

"American Machinist," June 22, 1922



The Model H head, shown at the right, operates on the principle of the Models E & F back-geared tapping chucks, and has five tapping spindles equally spaced from the center. The reversal speed is four times as fast as the forward speed. Standard chucks are employed to hold taps up to ½ in. Clutches disengage when too great a strain is placed on the taps. Shown at the left is the Model K head for drilling the holes before the Model H is used. It is similar to the Model H, although not fitted with a reversing mechanism. The drilling spindles have standard taper shanks for carrying the drills.

Clip, paste on 3 x 5-in. cards and file as desired

coal cost at very most would be $1.50 per automobile.

That the administration has at no time favored putting the Government in the coal business was indicated when Secretary Hoover declared emphatically today that the Cabinet never has seriously discussed the seizure of either anthracite or bituminous mines.

Mr. Hoover stated that no less than 25,000 cars loaded with non-union coal are awaiting movement. None of the coal mined under the drastic priority requiring one-half of all non-union coal sent to the lakes has reached the lower lake ports as yet, he declared.

There is no estimating the coal tonnage the railroads can handle under present conditions, Mr. Hoover stated. He does think, however, that they can handle enough to take care of the country's current needs.

Convention of Eleventh Annual Safety Congress

More than 3,000 safety experts registered at the eleventh annual safety congress which was held at Detroit, Aug. 28 to Sept. 1. The first day's session was preceded by four days of intensive "Safety First" campaigning by the Public Safety Bureau of the Detroit police department. During the week there were more than 230 speakers, representing industrial, public and educational forces now active in national and local safety campaigns.

Resolutions were passed by the National Safety Council advocating:

1. The safeguarding of all dangerous machinery and places according to standard methods of proved value.
2. The development of industrial equipment and processes along lines of inherent safety to eliminate accident hazards and increase production efficiency.
3. The education of all workmen and their supervisors in safe methods and habits of work.
4. The training in safety of all school children, as well as students in colleges and universities, both for their own protection and as an object lesson in good citizenship.
5. The adoption and enforcement of laws and ordinances for the safeguarding of vehicular traffic and the protection of law abiding drivers and pedestrians against the thoughtlessness and recklessness of the few.
6. The mobilization of all community forces through state and city safety councils for achieving these ends through the overwhelming force of enlightened public opinion.

A night parade of automobiles, demonstrating types of safety headlights, the annual mechanical safety exhibit, and showing of the latest traffic and accident prevention films were among the features of the convention. Better health and working conditions for industrial employees, elimination of all waste traceable to accidents, a better public safety atmosphere for all cities where traffic problems are menaces to citizens, a nation-wide appeal for more attention to the principles of safety first, and a general campaign against accidents that threaten industry, are a few of the planks in the 1923 platform.

In order that each member might be enabled to devote his time to that phase of safety engineering in which he is most interested, the meetings were divided into sections as follows: drop forge; metals; automotive; cement; chemical; mining; packers and tanners; paper and pulp; public utilities and electric railways; rubber; steam railroads; textiles; woodworking; engineering. Organization and section meetings were also held, including a meeting of the taxicab and transfer department, a special meeting for the consideration of standardization of traffic codes and signals, and a meeting of conductors, porters and yard workers of the Pullman Co., which was held at noon in the Michigan Central yards, Harry Guilbert, director of safety for the Pullman Co., in charge.

At a meeting of the executive council, the following officers were elected: President, Marcus A. Dow, general safety agent of the New York Central lines; Vice-president in charge of industrial safety, Chas. B. Auel, Westinghouse Electric Co., East Pittsburgh, Pa.; Vice-president in charge of public safety, David Van Schaak, Aetna Life Insurance Co., New York City; Vice-president in charge of sectional activities, George T. Fonda, Fonda & Tolsted, Washington, D. C.; Vice-president in charge of local councils, L. A. De Blois, Delaware Safety Council, Wilmington, Delaware; Treasurer and chairman of finance committee, Homer Niez, Commonwealth Edison Co.; managing director and secretary, Wm. H. Cameron.

The Coal Strike Situation

WASHINGTON CORRESPONDENCE

Principle emphasis is being placed by those opposed to legislation looking to the control of coal prices and distribution on the argument that such control no longer is needed. Many law makers are of the opinion that the situation is such that it can take care of itself. Those who favor the legislation might be willing to accept the argument if they were sure that the railroads could function at a high rate of efficiency. With the uncertainty as to railroad operation, however, they contend that this control must be established. They contend that at the end of price control in 1919 everyone was confident the situation would take care of itself but they point to the profiteering in coal in 1920 as a glaring instance wherein the Government did not function in the protection of the public. They think the country is in much the same frame of mind now but they deprecate statements intended to create a false sense of security at this time.

They point out that the emergency will not have passed until coal starts moving to the northwest at the rate of one million tons a week; until prices show a definite downward tendency and until the anthracite mines are in operation and careful attention has been given the problem of substitution for that portion of the anthracite production which cannot be made up. Before the situation can improve very rapidly, it is believed, the railroads must be in a position to transport nine million tons of bituminous and one million seven hundred thousand net tons of anthracite per week. Theoretically at least all stocks of coal now have been wiped out. Whatever stocks there may be are known to be negligible and too low to enter the Winter with safety.

Business Items

The Pawling & Harnischfeger Co., Milwaukee, announces the appointment of the Seifreat-Woodruff Co., with offices at Dayton and Cincinnati, as its machine tool representative, covering the lower section of Ohio, with counties bordering the Ohio River in the State of Kentucky.

The Worthington Pump and Machinery Co., Holyoke, Mass., reports that its Deane Steam Pump plant had a more successful month in July than in any other month since October, 1920. A full force, it is expected, will be employed within a short time.

The Bay State Tap and Die Co., of Mansfield, Mass., has recently purchased the plant of the Blanck Twist Drill Co., at Taunton, Mass., and will utilize same as a branch plant.

The West Point Iron Works, operating a large foundry and machine shop at West Point, Ga., announces the establishment of a branch district office at Columbus, Ga., 19 Thirteenth St., in charge of J. P. BRADFIELD.

The McWane Cast Iron Pipe Co., a new corporation formed in Birmingham a few months ago, following the purchase recently of an extensive acreage in the eastern part of the city, makes the announcement that construction of a new plant will begin at once. The company has been operating in the plant of the Southern Pipe and Foundry Co. The new plant will have a capacity of 8,000 feet of pipe daily, and will be ready by March of next year.

The Chicago Railway Equipment Co., Grand Rapids, Mich., has arranged for an increase in capital from $2,500,000 to $3,000,000.

The Westfield Machine Co., Westfield, Mass., suffered a loss of $10,000 by a fire which swept their factory on Aug. 15. Part of the plant was used for the making of radio apparatus, and much completed stock in the department was destroyed.

The Lucey Manufacturing Co., of Texas, has recently opened new headquarters for the State of Texas, at 1514 Magnolia Building, Dallas, Tex., according to Clyde V. Wallis, of the Chamber of Commerce of that city.

The Ashtabula Steel Co. has started fifty per cent operations with its new plant at Ashtabula, Ohio. The company has eight mills for the production of sheets, specializing in black and galvanized, 12 to 30 gage. ROBERT LOCK is president.

The Pawling & Harnischfeger Co., Milwaukee, announces that it has appointed the Cleveland Duplex Machinery Co., Cleveland, Ohio, G. J. HAWKEY, president, as its Cleveland representative, for its line of machine tools in the northern section of Ohio.

The C. A. Spotz, Inc., 41 Bank Street, Stamford, Conn., recently incorporated under the laws of Connecticut, to engage in the manufacture and deal in machinery, tools, etc., organized the past week, electing the following

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

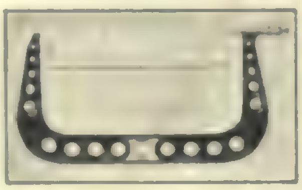
Planer, Crank, Heavy-duty, Short-stroke
Newton Machine Tool Works, Inc., Philadelphia, Pa.
"American Machinist," June 22, 1922

The machine is made with either one or two heads on the crossrail. It handles work [illegible] in. high and [illegible] in. wide. The length of the stroke, with 24 in. as the maximum, can be set from the operating side. Speeds of from 6 to 35½ strokes per min. are provided by the gear box. The table has an adjustment of 20 in. along the bed and is controlled by a lever. The feed motion is of the double-cycle type. It operates on the return stroke of the table and gives cross, down and angular feeds. The crossrail is raised and lowered by power derived from the small vertical belt. The planer is suitable for machining die blocks, forming dies, locomotive crossheads, shoes and wedges.

Drive, Slow-speed, for Boring Mill
Cincinnati Planer Co., Cincinnati, Ohio
"American Machinist," June 22, 1922

The mechanism has been developed to provide slow speed for the boring mill made by the firm. A speed as slow as ¼ r.p.m. is obtainable. In the position shown the reducing gears are operating and the table would move at slow speed. By sliding the small upper gear into the clutch of the larger gear, direct drive can be obtained so as to utilize the regular speeds of the boring mill. A special cover protects all of the gearing, and also the shifter rod for sliding the gear into engagement. The arrangement makes the machine capable of both high and low speed, and does not interfere with the operation in either range.

Micrometer, "Rex"
Brown & Sharpe Manufacturing Co., Providence, R. I.
"American Machinist," June 22, 1922

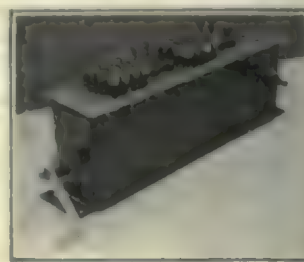


The micrometers are furnished for either English or metric measure and include twenty-four sizes to take measurements up to 24 in. or 600 mm. They can be furnished either with or without rubber grips or clamping rings to clamp the spindle and to preserve the setting. The frame is of I-section and rectangular in shape. In the larger sizes, the frames are reinforced and holes [illegible] the weight. The larger sized micrometers can be provided with finished wooden cases. The tools can be furnished singly or in sets.

Shear, Slitting, and Bar-Cutter, Universal
Buffalo Forge Co., Buffalo, N. Y.
"American Machinist," June 29, 1922

The machine is intended particularly for use where a punch is not needed, as in iron shops or warehouses. The shear is equipped with 10-in. knives, which can cut either plates ½-in. thick and of any length [illegible]. The machine may be operated at the rate of thirty strokes per minute. The bar-cutter has standard [illegible] knives, or special knives can be furnished. Approximately 2-hp. is required to operate the machine. Length, 4 ft. [illegible] in. Width, 2 ft. [illegible] in. Height, 4 ft. [illegible] in. Weight, [illegible] pounds.

Lubricator, Machine Tool, Force-Feed, Automatic
Madison-Kipp Corp., Madison, Wis.
"American Machinist," June 22, 1922

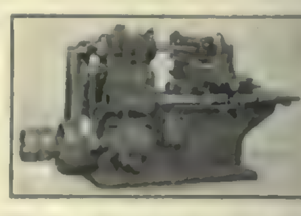


The lubricator consists of a reservoir and cover and is driven by the machine it lubricates. Fixed to the cover and working in the oil are the pumping units for measuring and forcing the oil to the feed outlets and bearings. Either four or eight positions can be lubricated from each pumping unit. The amount of oil fed can be regulated by changing the speed of the lubricator drive shaft, or each set of eight feeds can be adjusted by means of one slotted-head screw on the top of the lubricator. The drive may be of the ratchet type requiring a reciprocating motion, or by pulleys from a rotating shaft of the machine. The lubricator may have two compartments for two different grades of oil.

Flexible-Shaft Outfit, Radial-Arm
Stow Manufacturing Co., Inc., Binghamton, N. Y.
"American Machinist," June 22, 1922

A large flexible shaft is driven from a lineshaft without the use of an individual motor. The chief feature is the pivoted horizontal arm, which enables the operator to work over a large area. The outfit is adapted particularly to use in garages, repair shops and vulcanizing plants. Besides being used for grinding and buffing, it can be employed for drilling, or for operating a screwdriver. It can be supplied in various sizes to suit different classes of work.

Grinding Machine, Cylinder, No. 50
Heald Machine Co., Worcester, Mass.
"American Machinist," June 29, 1922



The machine may be furnished for belt or motor drive. It is more massive in construction than the former model, and has a wider work table with a $\frac{5}{16}$-in. vertical adjustment. Power for reciprocating the table is transmitted through an hydraulically operated mechanism, giving minute speed variations of from zero to 15 ft. per minute. The relative movement of the eccentric grinding head is derived from a belt running over a pair of three-step cones and shifted by means of a lever on the front. The cross-slide, directly upon which the work is mounted, has a movement of 28 in. at right angles to the table traverse. Floor space, 73 x 123 in. Weight, 5,000 pounds.

Reamer, Expansion, Inserted-Blade, "Mirr-O-Ream"
Samuel Hocking & Son, Lancaster, Pa.
"American Machinist," June 29, 1922

The size is adjusted by moving the blades along the slots, the depth of which decreases from the front end to the shank end of the tool. The blades are ground with a double relief, and at a greater angle near the back edge to increase the relief and prevent dragging. They are held in place at each end by "steady-rings." The tool is made in seventeen sizes, and can be furnished in sets. Smallest size: adjustment, $\frac{13}{16}$ to $\frac{15}{16}$ in. in diameter; length of blades, 1¾ in.; overall length, 5¼ in. Largest size: adjustment, 3¾ to $4\frac{1}{16}$ in. in diameter; blade length, 7½ in.; overall length, 24 inches.

Clip, paste on 3 x 5-in. cards and file as desired

officials: C. A. Spotz, of Greenwich, Conn., president; H. M. Rice, of New York City, vice-president; A. H. Emery, Jr., of Glenbrook, Conn., secretary; and Carleton Pratt, of New York City, treasurer.

The Pawling & Harnischfeger Co., Milwaukee, Wis., announces that the Cadillac Machinery Co., Detroit, C. L. CAMPBELL, president, is representing it in the machine tool line in the State of Michigan with the exception of counties bordering on Lake Michigan and the extreme northern section of the State.

The Alabama Machinery and Supply Co., Montgomery, Ala., has filed a petition requesting permission to increase its capital from $100,000 to $200,000, in order to provide for the expansion of its plant and properties during the coming year.

The International Derrick and Equipment Co., Toledo, Ohio, manufacturers of oil field machinery, has recently opened Texas headquarters in the Southland Life Building, Dallas, Tex.

The Liberty Tool and Die Corp., Rochester, N. Y., has been incorporated with a capital of $10,000. The organizers are C. F. Hallick, C. H. Meyer and F. E. Wagner, all of Rochester.

W. A. Jones Foundry & Machine Co., manufacturer of speed reducers and power transmitting machinery, Chicago, Ill., announces the opening of a branch sales and engineering office at 2482 University Ave., St. Paul, Minn., with C. F. Ford in charge.

The American Thermometer Co., Columbia, Pa., has sold its machinery and plant equipment to Harry K. Smith and John Minnick of Wrightsville, Pa., who, it is reported, will remove it to Wrightsville, where a new factory is being erected.

The Hendry Machine and Engineering Co., Fort Meyers, Fla., according to B. L. Hendry, president, expects to operate a machine shop and marine ways specializing in ship work. LANIER HENDRY is vice-president of the company, and W. F. LUSK, secretary and treasurer. The capital is $50,000.

The H. B. Smith Co., Westfield, Mass., has resumed work in its foundries after a period of inactivity lasting fifteen weeks due to a strike of the employees.

The Lamar Welding Co. has been organized in Atlanta and has taken over the plant of the Standard Gas Products Co., formerly the Bird-Wilcox Co., one of the largest welding shops in the South. John Lamar is president of the company.

The Elwood Foundry, Inc., Elwood, Ind., it is announced by Richard F. Broadbent, receiver, will be sold at a public sale at an early date. The personal property consists of electric motors, drill presses, an electric traveling crane, tools, appliances, a large quantity of machinery for tool making and office furniture.

The New York, Chicago and St. Louis (Nickel Plate) Railroad Co. has been granted permission by the Interstate Commerce Commission to issue and sell, at not less than par, $8,663,000 of its second and improvement bonds, to enable it to pay off a debt of $1,000,000 owed to the Government, to retire funded debts falling due in 1922, and to reimburse its treasury for improvements and betterments paid out of current funds.

The Illinois Tool Works, Chicago, Ill., has appointed the Commercial Steel and Supply Co., Plymouth Building, Cleveland, as its representative in the Cleveland district.

Stringer Brothers, Chicago, Ill., manufacturers of plumbing specialties and supplies, have under construction at Gadsden, Ala., an addition to their Alabama plant. Two units are being added that will increase the floor space by 7,000 square feet.

The Oliver Rim Co., Atlanta, Ga., manufacturer of automobile rims, has filed a voluntary petition in bankruptcy. W. A. Fuller, of Atlanta, has been named receiver.

The T. Murphy Iron Works, Jacksonville, Fla., through its president, Frank Murphy, announces the sale of its plant and properties to the Merrill-Stevens Drydock and Repair Co., also of Jacksonville. The Murphy company was originally founded in 1880.

The E. L. Gee and Co., Nashville, Tenn., advise that due to a steady improvement in recent months in the sale of machinery supplies, machinery, etc., over the southeast, it has been found necessary to practically double capacity of its plant.

The New Britain Hardware Manufacturing Co., New Britain, Conn., has incorporated under the laws of Connecticut to engage in the manufacture of all kinds of cutlery, hardware, small tools, etc. The concern will be capitalized at $10,000, and the incorporators are: Anthony Perzanowski, John Kulesza and Alex Hermanowski, all New Britain men. The concern will operate a plant on Washington Street, New Britain.

The Reeves Pulley Co., Columbus, Ind., announces the appointment of Manning, Maxwell & Moore, Inc., 99 Chauncey St., Boston, Mass., as its agent for the New England territory. A complete and separate variable speed department has been installed, and a large stock of variable speed transmissions, as well as parts, will be carried.

The Springfield Ornamental Iron Co., West Springfield, Mass., has entered upon active production at its plant, turning out ornamental steel and bronze work. G. G. Gerke, 26 Maple Terrace, Mittineague, Mass., is head of the corporation, which has a capital of $20,000. Associated with him is G. Olsen, former owner of the Worcester Ornamental Works, O. W. Peterson and Alden Carlson.

The Chamber of Commerce, Birmingham, Ala., has announced an unusual plan to be carried out during the coming year to advertise the industries of that city. Full page ads will be devoted to each of the separate businesses or industries that are included in the membership of the chamber. For instance, there will be one advertisement of the iron and steel industries, one of the general machinery and supply business, etc.

The Scheid Engineering Corporation, 90 West Street, New York City, has been appointed metropolitan and export representative for the Franklin Moore Co., Winsted, Conn., manufacturer of material handling machinery for industrial plants.

Chas. Eisler, Newark, N. J., has moved his factory and offices from 15 Kirk Alley to 756 S. 13th St., where he has a well-equipped factory containing 6,000 sq.ft. of floor space in a modern brick building recently put up at a cost of $30,000.

The Buol Machine Co., 168 Arch St., New Britain, Conn., is now being organized to engage in the manufacture of special machinery and to conduct a general machine business at the address mentioned. ABRAHAM BUOL, for many years connected with the New Britain Machine Co., as superintendent, is the directing head of the new concern.

The Hartford Valve Manufacturing Co., of Hartford, Conn., recently incorporated under the laws of Connecticut, to engage in the manufacture of valves, heating appliances, etc., organized the past week by the election of the following officers: Mitchell S. Little, president; Michael H. Flynn, secretary and treasurer. These two, together with H. Bissell Carey, form the board of directors.

The Pacific Development Co., New York City, for the year ended Dec. 31, 1921, reports a total income of $514,779 and a deficit of $6,547,239 after writing off bad debts.

The Union Hardware Co., manufacturer of hardware, small tools, etc., of Torrington, Conn., filed a certificate with the Secretary of the State of Connecticut during the week, increasing the company's capital stock from $600,000 to $2,100,000.

The Dawson Variety Co., Dawson, Ga., suffered a loss of several thousand dollars, caused by a fire which completely destroyed its machine shops on August 10.

The Hunter Saw and Machine Co., Pittsburgh, Pa., announces that it has opened an office in the Manhattan Building, Chicago, Ill., where they will carry a complete stock of metal cutting circular saw blades, as well as pneumatic hammer rivet sets and chisel blanks. Paul W. Wendt will be in charge.

The M. S. Little Manufacturing Co., 151 New Park Ave., Hartford, Conn., and the A. J. Beaton Manufacturing Co., of New Britain, Conn., both manufacturers of plumbing and heating tools, specialities, etc., will on September 6th, merge into one company, using the name of the M. S. Little Manufacturing Co. The machinery and stock of the Beaton concern will be removed to the Hartford plant of the Little Manufacturing Co., and the Beaton Co. will be dissolved. Lack of space for expansion of the A. J. Beaton Company is given as the main reason for the consolidation of the two companies.

The Diamant Tool and Manufacturing Co., Inc., 91-97 Runyon St., Newark, N. J., has appointed Samuel W. Hay's Sons, 1410 Keenan Building, Pittsburgh, Pa., its exclusive representative in connection with the sale of Diamant standard punch and die sets,

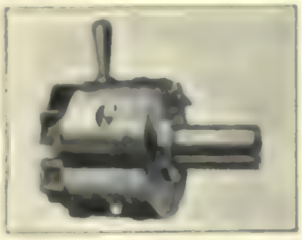
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

[illegible], Automatic

[illegible] Machine Co., [illegible], Pa.

"American Machinist," June 29, 1922



The [illegible] can be used on practically all makes of [illegible] [illegible] and hand screw machines. [illegible] are supported on the face of the head and are easily removable. The head [illegible] the regular [illegible] [illegible] and can be [illegible] in styles and sizes of [illegible] to suit the requirements. It is automatically opened by [illegible] the forward motion of the carriage and is closed by hand. The correct sizes for the roughing and finishing cuts are obtained on the [illegible] [illegible] and [illegible] heads by the movement of the [illegible]-pin lever. The cutters are adjusted by means of an adjusting screw to give the proper diameter of work. Each head is graduated for all sizes within its range of bolts, and provides for both right- and left-hand threads and right-hand pipe threads.

Threading Dial, "[illegible]"

James M. Colten, 29 Wolffe St., Yonkers, N. Y.

"American Machinist," June 29, 1922

The dial is for attachment to lathes doing threading work. It is shown both attached to and separate from a lathe carriage. Only two screws are used in securing it to the carriage. The device consists of a cast-iron bracket carrying a [illegible] [illegible], a [illegible] dial, steel shaft and a brass worm gear suited to the pitch and thread form of the lead screw on which it runs. The dial can be used when cutting threads having a fractional number of turns per inch. The dial aids in working close to a shoulder or boring to depth. When a lathe is equipped with the dial, it is not necessary to have a reversing belt.

Gages, Micro, Cylinder and Piston-Ring

[illegible] and Co., 275 Broadway, New York, N. Y.

"American Machinist," June 29, 1922

The cylinder micro-gage, shown at the left, consists of one fixed pin and one adjustable pin mounted in a holder. The [illegible] lengths of the two pins equal the standard diameter of the cylinder, and a thickness gage can be inserted between the two pins to measure an oversize. A thickness gage can be furnished. The ring gage shown at the right is for use in fitting piston rings. A ring is fitted to the engine cylinder, and then placed in the ring gage, and the opening measured by a thickness gage. By [illegible] the measurement for all the rings, correct fits can be [illegible]. The device can be furnished in standard sizes [illegible] for any make of car.

Grinding Machine, Surface, Open-Side, 6 x 10 x 36-In.

Norton Co., Worcester, Mass.

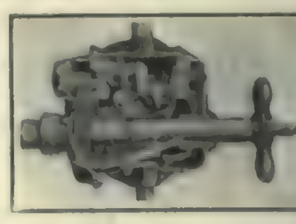
"American Machinist," June 29, 1922

The spindle is provided with [illegible] [illegible] and thumbscrew adjustments for both [illegible] and end thrust. The wheel spindle, driven by a 15-hp. motor mounted at the rear, runs at 1,242 r.p.m. The table runs at a speed of [illegible] ft. per minute. The [illegible] [illegible] [illegible] [illegible] when the power [illegible] is disengaged. The [illegible] has two hand-operated feeds with a ratio of 1 to 14. The vertical feed of the wheel can be power operated. A feed of 0.00025 in. is given for each graduation on the index [illegible]

Drill, Pneumatic, Hand Portable

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

"American Machinist," June 29, 1922

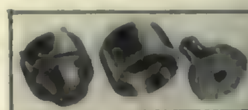


An oil vent that is applicable to most sizes and types of the "Little Giant" pneumatic drills is attached inside the drill. It consists chiefly of a sliding plunger conical at each end that prevents oil leakage. The piston and connecting rod units or toggles are made interchangeable in the drill, and can be assembled and disassembled without dismantling the entire drill. The connecting rod is fitted to the piston by means of a ball and socket joint. Two of them are secured in place on each crankpin by means of hinged split collars which provide a large opening for the lubricant to reach the crankpin bearings. The mechanism is 20 per cent lighter in weight than the former model.

Chuck, Combined Collet and Step

Hartford Special Machinery Co., Hartford, Conn.

"American Machinist," June 29, 1922



The chuck is intended for use on lathes and similar machines not provided with a through hole in the spindle, and for use also where a drawbar is undesirable. It is equipped with small collets and step chuck, shown in the top view, and with a large closing ring and step collet, shown below. The same body is used for either combination, and is screwed to a small faceplate fitted to the spindle nose of the machine. Internal collets are provided to hold all commercial sizes of round stock up to 1 in. in diameter. Two sizes of closing rings are furnished with the chuck, and the larger size holds work up to 5 in. in diameter.

Lathe, Heavy-Duty, Rapid-Production, 11-in.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

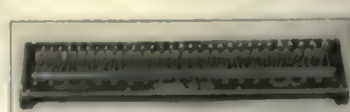
"American Machinist," June 29, 1922

The headstock is of the selective speed type, and provides six speed changes of from 50 to 250 r.p.m., controlled by two change levers. The spindle has a large hole for holding work and for mounting draw-in or expansion chucks. A plain block rest and toolpost are provided and a turret toolpost can be furnished. The feed box is of the automobile change-gear type, and provides nine feeds from 0.008 to 0.092 in. per revolution controlled by two levers. Capacity: diameters, up to 13½ in.; lengths, up to 18½ in. Bed length, 4 ft. Weight, 1,340 pounds.

Drill Gage and Holder, "Quikbak"

Harry Faltermayer, 1615 Sansom St., Philadelphia, Pa.

"American Machinist," June 29, 1922



The device has holes in which straight-shank twist drills can be held vertically, and a tapered V-slot for measuring their size. An etched brass plate with raised markings forms the cover plate. The drill shank is inserted in the slot and then moved down as far as possible toward the small end of the V. The guide line at the point where the drill stops leads to the proper hole, which is marked with both the drills' gage number and size in decimals of an inch. On the front side of the slot is a scale graduated in thousandths of an inch on which the diameter of the part inserted in the V can be read. Bench space, 13½ x 3½ inches.

Clip, paste on 3 x 5-in. cards and file as desired

in the territory covered by the counties of Allegheny, Westmoreland, Washington, Armstrong, Indiana, Cambria, Somerset, Fayette and Beaver in the state of Pennsylvania.

The Apex Electrical Manufacturing Co., Cleveland, Ohio, has purchased factory site at East 75th Street and Bessemer Ave., for the motor division and foundry department.

Personals

J. H. CONNOLLY, formerly plant engineer of the Remington Arms and Ammunition Co., Bridgeport,, Conn., and later vice president and production manager of the N. C. L. Engineering Corporation, of Providence, R. I., has been appointed general manager of the Standard Machinery Co., of Auburn, R. I.

J. L. STONE, sales manager of the Elgin Machine Tool Co., has resigned to accept a position on the sales staff of the Thermalene Gas Corporation, Kankakee, Ill., in Chicago and vicinity.

W. IRVING BULLARD, vice-president of the E. H. Jacobs Manufacturing Co., manufacturers of mill supplies, Danielson, Conn., will sail September 30, for Brazil, where he will attend the International Centennial Exposition at Rio de Janiero as a delegate of the states of Connecticut and Massachusetts, as well as for the American Bankers Association, National Association of Cotton Manufacturers, and the National Council of the American Cotton Manufacturers. Mrs. Bullard will accompany him, as will his son and daughter.

H. J. SWANSON, formerly sales manager of the Detroit Machine Tool Co., manufacturers of the Detroit centerless grinding machine, resigned from that position on Sept. 1, and has accepted the position of general sales manager with the Peerless Machine Co., Racine, Wis., manufacturers of the Peerless universal shaping saws. Mr. Swanson's connections with the Detroit Machine Tool Co. extended over a period of six years. His work included the positions of machine designer, road work and sales manager.

R. R. JONES, chief engineer of the Firestone Tire and Rubber Co., has been named chairman of the Akron section of the American Society of Mechanical Engineers. J. C. SPROULL will serve as vice-chairman of the Akron section while W. R. GILLIAM will act as secretary.

ROBERT C. YATES, well known in the forging industry and for many years identified with the Union Drop Forge Co. of Chicago, has resigned to become general manager of the Interstate Drop Forge Co. of Milwaukee. Mr. Yates was formerly connected with the American Locomotive Co. at Schenectady, and the Bethlehem Steel Co., as manager of the Chicago district office.

W. J. HOWARD and G. T. KEY, JR., both of Montgomery, Ala., have organized the Standard Electric Machine Works and established a plant in that city at Coosa and Bibb Sts. Mr. Howard has been chief engineer for the Durham Public Public Service Co., Durham, N. C., while Mr. Key has been master mechanic with the American Agricultural Chemical Co. The new company will specialize in heavy electrical construction work.

JOHN J. CURRY has been appointed mechanical superintendent of Plant D, of the New Departure Manufacturing Co., Meriden, Conn.

W. B. STRAHAN, West Palm Beach, Fla., suffered a loss of $10,000 a few days ago in a fire which destroyed his machine shops in that city.

D. C. GRIFFITHS, formerly with the M. B. Austin Co., and D. B. GRAZE, a specialist on power apparatus, have opened offices in the Marshall Building, Cleveland, Ohio, as manufacturers' agents, to handle the distribution of electrical material in the State of Ohio, for the M. B. Austin Co., Appleton Rubber Co., and portions of the state for the S. H. Couch Co., Inc.

E. F. LINDGREN has been named manager of the southeastern plant of the Air Reduction Sales Co., Birmingham, Ala., succeeding H. G. BOYNER. The company recently moved its plant from Atlanta to Birmingham where a new plant is being established.

Obituary

HOWARD C. NOBLE, president of the North & Judd Manufacturing Co., New Britain, Conn., manufacturers of hardware, tools, etc., died at the Hartford Hospital, Aug. 24, 1922. Mr. Noble was born in Kent, Conn., Oct. 13, 1851, and entered the employ of the North & Judd Manufacturing Co., when twenty years of age, as a bookkeeper. He rose steadily through various offices in the company, being treasurer and vice-president, until he was elected the president in July, 1918. Mr. Noble leaves a wife, a son, and two daughters.

Book Reviews

Machine Tool Operation, Part II. By Henry E. Burghardt. 438 pages, $4\frac{3}{4}$ x $7\frac{1}{2}$ in. Amply illustrated with half-tones and line drawings. Published by the McGraw-Hill Book Co., Inc., New York City. Price $2.75.

As in part one, this book gives information to the apprentice and the student of trade schools and similar educational institutions which will enable him to do machine work intelligently and which will assist him in becoming a real machinist.

The book is written in language which can be understood by any boy who has learned to read. Simple terms are used and everything is explained in a plain and straightforward manner and without the use of mathematics.

The first part, the one devoted to drill presses and drilling, is particularly meritorious and complete. As we go further into the book we find that this completeness tapers down somewhat. The chapters on shapers and planers are perhaps of a somewhat lower order than those on drilling and milling, but this is merely a matter of comparison. We should not say that the chapters on planers and shapers are less good, but that those on drilling and milling are better.

Every boy who desires to become a machinist, and with due respect for most finished machinists, every man who works in the machine shop, can gain by reading this book. It should be remembered, however, that the book should not be read like a novel but that every chapter and every part should be studied and carefully digested.

Trade Catalogs

Core Oven Equipment. The Whiting Corporation, 945 Monadnock Block, Chicago, Ill. A new publication, known as catalog No. 163, containing 23 pages. This catalog is descriptive of the company's line of core oven equipment for foundry work and contains numerous illustrations showing typical installations as well as useful general information regarding core ovens, racks, bricks, etc.

Trucks and Turntables. The Whiting Corporation, 945 Monadnock Block, Chicago, Ill. A new publication, known as catalog No. 164, containing numerous illustrations and descriptive matter on the company's extensive line of trucks and turntables for foundry, shop yard, and other industrial uses.

Milling Machines. The Ingersoll Milling Machine Co., Rockford, Ill. A special folder containing eight special illustrations showing impeller bodies for blowers being milled accurately in four passes, as well as the tools and set-up used in accomplishing the work.

Ladles. The Whiting Corporation, 945 Monadnock Block, Chicago, Ill. A new publication, known as Catalog No. 161, of 31 pages. The catalog contains complete information with numerous illustrations of the company's extension line of ladles for all classes of foundry work with suggestions as to operation and maintenance.

"Once Upon a Time." The Copper and Brass Research Association, 25 Broadway, New York City. "Once Upon a Time" is the title of a picture-playlet in seven scenes just issued by the Copper and Brass Research Association for distribution among home-owners. The first "scene" shows a man and wife selecting a building site, following which is a scene showing the debate with the architect where the substitution of inferior metals for brass and copper is decided upon. The resulting rust-loss and inconvenience are depicted in a series of scenes indicating the effect on piping, leaders and gutters and roof. The last scene shows the house "for sale cheap," following which is a diagram of a "real house" which the home-owner then built himself, showing 14 places where copper and brass should be used in building.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society of Mechanical Engineers, regional meeting, Sept. 25, 26 and 27, 1922, Hotel Kimball, Springfield, Mass. Secretary Calvin W. Rice, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Buck Falls, Pa., (Delaware Water Gap).

National Machine Tool Builders' Association. Annual convention, New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922. Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

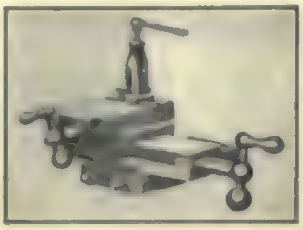
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinder, Flat-Front Motor, Bench, Model 76
Forbes & Myers, 172 Union St., Worcester, Mass.
"American Machinist," June 29, 1922

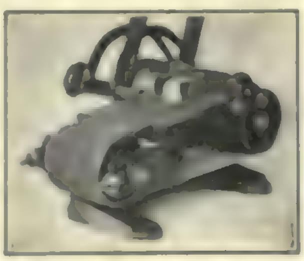
The squirrel-cage induction motor has windings on the back of the stator only. It has ½ hp. and can be operated on either two- or three-phase, [illegible] current of 110, 220, 440 or [illegible] volts. The 6-inch wheels project 1½ in. beyond the front of the motor, so that three-fourths of the abrasive can be worn down before the wheel is even with the front of the motor. Flat tool-rests adjustable in two directions are mounted on the front of the machine. A stand can be furnished to raise the spindle 40 in. above the floor. Spindle diameter, ¾ in.; height above bench, 4½ in. Weight: bench type, 35 lb.; with stand, 140 pounds.

Slide Rest, 11-In.
[illegible] Machine Co., West Newton, Mass.
"American Machinist," June 29, 1922



The rest is for lathe use and can be swiveled or held firmly in position. A tapered hub on the rest fits in a tapered hole in the base, and a sliding segment is clamped by means of two collar screws. The feed screws have 10-pitch square threads. The swivel is graduated, and a standard toolpost is provided. All bearing surfaces are scraped, and the rest is finished all over. A lateral travel of 5¾ in. and a cross travel of 2½ in. are provided.

Grinder, Belt, Bench-Type
Coats Machine Tool Co., Inc., 110 W. 40th St., New York, N. Y.
"American Machinist," June 29, 1922



The grinder is used for finishing flat surfaces on small metal parts and castings. It carries a jointless woven abrasive belt 4 in. wide and 36 in. long that travels over a flat table 10x5¼ in. in size. A positive motion of the front band pulley is obtained by means of two nuts. The loose pulley is reduced in diameter, [illegible] the strain on the driving belt when the machine is not running. It runs on a cast-iron apron extending from the base castings. The detachable graduated work rest or [illegible] can be swung through 45 deg. to either side. Weight, 60 pounds.

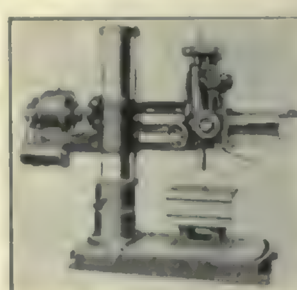
Milling Machine, Continuous, Rotary-Table, 30-In.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
"American Machinist," June 29, 1922

The machine is ordinarily equipped with two spindles mounted on the cutter head, but it can be equipped with one. The tub or chip guard for the table can be furnished for use with coolant. The machine can be driven by a single pulley, or by a 7½-hp. motor running at 1,200 r.p.m. and mounted at the top. The distance of the rotary table from the spindle can be adjusted. Two types of feed [illegible] are provided for the table, one [illegible] and one with an [illegible] feed and rapid traverse. The feeds and speeds are varied by means of [illegible] change gears. [illegible] up to 10 in. in diameter can be [illegible].

Grinding Machine, Internal, Cylinder, Automatic, M.S.O., Type FN-10
Marburg Bros., Inc., 90 West St., New York, N. Y.
"American Machinist," June 29, 1922

The work remains stationary while the grinding head is reciprocated automatically. The head slides on the bed and is moved longitudinally by automatic feed, while the speed is changed by means of cone pulleys. The spindle both rotates around its own axis and revolves about another axis parallel to its own, the eccentricity being adjustable either automatically or by hand. Interchangeable grinding spindles and spindle arms are furnished, and an exhaust fan and flexible hose for removing the dust from the cut. The machine is built in seven sizes for grinding cylinders of from 1 to 2 in. up to 32 in. in diameter, and of lengths up to 80 in. The larger sizes of the machine are for use on steam engine cylinders.

Drilling Machine, Radial, Motor-on-Arm Drive
Morris Machine Tool Co., Cincinnati, Ohio
"American Machinist," June 29, 1922



The motor is mounted on an extension at the back of the swinging arm, which construction simplifies the drive mechanism, balances the weight of the head, and makes it easier to raise and lower the arm on the column. The elevating mechanism is in operation only when the arm is being raised or lowered. The vertical screw is stationary. A safety mechanism disengages the clutch when the arm has reached the upper and lower limits of travel. The controller is mounted below the motor within easy reach. The head has spindle speeds of 26 to 450 r.p.m. and is of the same style as that of the standard drilling machine.

Gage, Piston, Aligning
Stevens & Co., 375 Broadway, New York, N. Y.
"American Machinist," June 29, 1922

The gage is for use in aligning automotive pistons on their connecting rods, and is for mounting on a bench. Any twist or bend in the connecting rod can be detected by fitting the large end of the rod on the arbor and placing the piston against either the edge or the flat side of the vertical straightedge. The device serves also for trial fitting the connecting-rod bearings on the crankshaft. Arbors can be furnished for any size of bearing required, and weigh from 6 to 8 lb., depending on the size. Height, 19 in. Weight, 19 pounds.

Grinding Machine, (Re-), Autopart, 18x72-In.
Norton Company, Worcester, Mass.
"American Machinist," June 29, 1922

This machine provides a greater capacity than the standard 18x55-in. machine, and is applicable to a greater variety of work. The dimensions of the wheelslide, headstock, footstock and other principal members are the same as in the other model. The machine has a power-driven table traverse, and is arranged for drive by belt from a lineshaft or from a motor placed in the rear of the machine. It can be adapted to all sorts of cylindrical grinding.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Kan., Wichita—The Auto Repairing & Machine Wks., 614 East Murdock St., B. M. Dawson, Purch. Agt.—one drill press (power).

Kan., Wichita—J. C. Conley, 623 Murdock St.—power lathe, drill press, emery stand, shafting, pulleys, hangers, bearings and small tools for machine shop.

Kan., Wichita—De Long Machine Co., 705 East Murdock St., J. F. De Long, Purch. Agt.—lathe, power drill press, emery stand, cutters, grinders for automobile cylinders (used).

Kan., Wichita—G. Humphrey, 625 East Murdock St.—drill press, lathe, emery stand and small tools.

Mass., Boston—The Boston Sand & Gravel Co., 88 Broad St., P. F. Ayer, Secy.—additional equipment for machine shop under construction at East Boston.

Mass., Boston—T. Noonan & Sons Co., 38 Portland St., manufacturer of barbers' supplies—one engine lathe 12 or 14 in., with full equipment (used).

Mass., Norfolk Downs (Boston P. O.)—W. A. Hiscock, machine shop—one pair 4 or 5 ft. x 15 or 18 in. gap power shear, 10 gauge capacity (used).

Mich., Wyandotte—The All Metal Products Co., 12th and Sycamore Sts.—three No. 1 Townsend riveting machines.

Minn., Albert Lea—A. R. Jensen—complete machinery equipment for auto repair shop.

Minn., St. Paul—H. Slawik, 1730 Marshall Ave.—equipment for auto repair shop under construction.

Mo., Joplin—Inter-State Billiard Supply Co., 413 Main St., E. E. Johnson, Purch. Agt.—power lathe.

N. Y., Brooklyn—The Imperial Hardware Mfg. Co., 511 Flushing Ave.—one No. 19 Bliss press, also small rolling machine for rolling U shaped channels.

N. Y., Brooklyn—J. G. Knight & Co., 1034 Dean St., electrical goods—one No. 5 V. and O. geared press with 4 in. stroke.

N. Y., Elmira—Bolton Motor Co., 125 Railroad Ave.—machinery and equipment, incl. tools for large modern auto service station under construction.

N. Y., Elmira—Goldsmith Tire & Service Co., 214 Baldwin St., J. T. Goldsmith, Member of Firm—machinery and equipment for proposed addition to tire and repair station.

N. Y., Jamestown—General Metalsmiths Inc., 313 Prendergast Ave., B. C. Davis, Mgr.—complete machinery and equipment for factory for the manufacture of architectural, mortuary and industrial bronze and copper products.

N. Y., Lockport—Bd. of Educ., East Ave.—complete metal working machinery and equipment for shop in Chestnut St. School.

N. Y., Rochester—W. Gray, 17 Carlton St.—one medium sized drill press.

N. Y., Syracuse—The Globe Malleable Iron & Steel Co., East End, H. E. Elmer, Treas. and Genl. Mgr.—machinery and equipment for proposed addition to plant for the manufacture of special patented fuel oil engines.

N. D., Williston—Monroe Bros., auto repair shop—one arbor press.

O., Lima—The Lima Locomotive Wks., South Main St.—eight 6 ft. radial drilling machines; one 90 in., one 42 in., one 36 in. and one 20 in. vertical boring mills; also one 20 in. x 10 ft. axle lathe.

O., Lisbon—National Razor Mfg. Co.—machine shop equipment for proposed shop.

Pa., Bareville—J. W. Miller—machinery and equipment for proposed auto radiator and metal works shop.

Pa., Ellwood City—Ellwood Steel Corp.—wire drawing and nail machines, for the Sharon Pressed Steel Co., recently purchased.

Pa., Phila.—Bd. of Educ., 19th and Chestnut Sts., M. Savage, Dir. of Supplies—three speed lathes, 2 for 12 in. and 1 for 43 in. woodwork; 2 engine lathes, 10 in. swing, 24 in. centers; one 3 jaw chuck, and one 4 jaw chuck; 1 drill press ½ in. (all motor connected).

Pa., Phila.—H. Kaiser & Co., Inc., 23rd and Race Sts.—metal working machinery for auto body factory, dies, presses, cutters, etc.

Va., Richmond—McMichle & McMahon, 4 South 5th St.—power pipe threading machine for heating and plumbing.

W. Va., Wheeling—Centre Fdry. & Machine Co., 2011 Main St.—additional tools for plant Warwood, W. Va.

Wis., Marinette—H. A. White, 2000 Hall Ave.—machinery for auto repair shop.

Wis., Prescott—J. A. Miller—equipment and machinery for auto repair shop (proposed).

Machinery Wanted

Ark., Poyen—A. B. Cunningham—equipment for sawmill and power house.

D. C., Washington—The International Shoe Heel Corp.—machinery and equipment for proposed branch plant in Aylmer, Ont.

Ill., Chicago—Van Housen's Favor Co., 81 West Lake St. and 189 North Clark St., T. Van Housen, Purch. Agt.—one power cutter.

Ind., Brazil—A. E. Warde—equipment for job printing.

Ind., Evansville—The Speedy Photo Co., Box 178—one multicolor printing press.

Kan., Wichita—W. H. Osborn, 1065 North Waco St.—power press.

Kan., Wichita—M. Quinius, 209 Sedgwick St., printer—one job printing press (power).

La., Bunkie—The Bunkie Record (newspaper)—one power cylinder press.

Minn., Federal Dam—O. B. Poore, saw mill products—short log sawmill or regular saw mill, or parts of saw mill, such as headblocks, setworks, carriage, saw mandril, feedworks; also engine lathe, 8 to 10 in. swing, 4 to 6 in. bed.

Mo., Joplin—Machinery & Supply Corp., Joplin St., machine shop—two 75 hp. electric hoists, one 150 hp. Bessemer gas engine, one 65 hp. Bessemer gas engine, two 801 ft. Chicago pneumatic compressor, one 100 hp. Fairbanks-Morse Y oil engine, 25 cycle, 2,200 volt motors.

Mo., Mountain Grove—Mountain Grove Laundry—washer, extractor, belting and hangers for laundry.

Mo., St. Louis—Gruenwaelders Print Shop, 720 Pine St., A. Gruenwaelder, Purch. Agt.—one 7 x 11 ft. or 8 x 12 ft. power job press.

N. J., Trenton—The Bergougnan Rubber Co., J. Grenier, Vice Pres.—vulcanizers and other rubber making machinery for curing and mill departments.

N. Y., Buffalo—Dynamo & Motor Exchange, 41 Court St.—equipment for motor and electrical repair shop, at 45 Elm St.

N. Y., Buffalo—The Sikes Chair Co., 500 Clinton St.—some new machinery for factory partially destroyed by fire.

N. Y., Clarence—Bd. of Educ.—machinery and equipment for vocational department in proposed school.

N. Y., North Tonawanda—Pierce-Brown Fdry. Co., S. Brown, Officer—machinery and equipment for proposed addition to foundry plant.

N. Y., Rochester—Atlantic Supply House, 61-65 Front St.—one belt driven ice breaker (used or new).

O., Bucyrus—Woodruff Printing Co., job printers, A. Woodruff, Purch. Agt.—job press (power).

O., Cleveland—The Fisher Body Ohio Co., East 140th St. and Coit Rd.—equipment for proposed factory in Flint, Mich.

O., Columbus—Eureka Stone & Marble Co., 179 West Maple St., P. McDonough, Vice Pres. and Genl. Mgr.—special machinery for making sandstone shapers and cutters.

O., Columbus—Finks Bakery, 234 South 4th St., H. Fink, Mgr.—complete equipment for bakery including mixers, etc.

O., Poland—Bd. of Educ. (Springfield Rural School District), J. A. Withers, Clk.—complete vocational machinery and equipment for proposed school to be constructed at Petersburg, O.

Okla., Oklahoma City—Scotch Tone Co., 2 West 6th St., W. P. Westfall, Purch. Agt.—power job printing press and power paper cutter.

Pa., Bradford—W. P. Brinton, Jr., 183 Kennedy St.—one small belt driven double end air compressor.

Pa., Coatesville—Coatesville Boiler Works—machinery and equipment for plant.

Pa., Conshohocken—Montgomery Fdry. & Fittings Co.—equipment for proposed 100 ton foundry addition.

Pa., New Brighton—Damascus Crucible Steel Casting Co.—machinery and equipment for proposed branch plant at Hammond, Ind.

Pa., New Cumberland—A. Hanker—machinery and equipment for proposed plant for the manufacture of a patent window with locking and lifting devices.

Pa., Phila.—Eagle Knitting Mills, 12th and Arch Sts., M. B. Goldberg, Purch. Agt.—full fashion hosiery machines and winders.

Pa., Phila.—Finkelstein Bros., 303 South St.—shoe machinery for factory.

Pa., Phila.—Globe Ticket Co., 112 North 12th St.—printing machinery for proposed plant.

Pa., Phila.—F. Pearson & Co., Inc., 1011 Chestnut St., N. Albrecht, Purch. Agt.—looms for the manufacture of plush in proposed factory.

Pa., Phila.—Ricards Mfg. Co., 614 Market St.—punches, cutters and machines for the manufacture of leather and canvas goods.

Pa., Phila. — Unique Knitting Co., 1324 North Lawrence St., N. R. Kline, Purch. Agt.—latch needle machines, ribbing machines and loopers for the manufacture of hosiery.

R. I., Providence—The City Bd. of Contract & Supply—delivering and erecting 2 portal gantry cranes of the revolving hammer head type, at Municipal Wharf, Fields Point.

S. D., Fairfax—The Advertiser (newspaper)—one No. 5 linotype.

Tenn., Manchester—Coffee County, N. H. Meriwether, Co. Engr.—complete crushing plant and miscellaneous road building machinery, for construction of county road system.

Wash., Aberdeen—The Port of Grays Harbor, office of Comn., 206 East Wishkah St., F. H. Lamb, Pres., J. A. Vance, Secy.—will receive bids until Sept. 23, for one 5 ton lumber handling mill type crane, equipped with lumber grapple 75 ft. span. Further information on application.

W. Va., Glen White—E. E. White Coal Co.—additional mining and handling machinery, etc., for proposed $300,000 improvement program.

W. Va., Huntington—C. F. Wilcoxen, 9th St.—one 10 ft. power brake for sheet metal works.

Wis., Peshtigo—Thompson Bros., manufacturer of pleasure boats—woodworking machinery.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances — No. 2 foundry iron up $3 in Birmingham; advances also reported in Pittsburgh, Philadelphia, Cincinnati and Chicago. Wage advance of 20 per cent plus increased fuel costs, reflected in higher steel quotations both at mills and warehouses. Steel rails and tin plates form the only two exceptions to the general advance in price. A minimum of $1.90 on shapes and plates has been established by the leading interest, but independents generally are quoting $4@$5 per ton above this rate. A maximum of $2@$2.25 per 100 lb., f.o.b. Pittsburgh, has applied on actual sales during the week.

Tin quoted at 33c. as against 32½c. per lb. in New York. Lead now 5.62c.@5.65c. as compared with 5.55c.@5.60c. per lb., in St. Louis. All fabricated brass and copper, up ½c. per lb. in New York warehouses.

Linseed oil (5 bbl. lots), 99c. as against 97c. per gal., in Chicago; no change in New York and Cleveland.

Declines—Slight tendency to shade zinc prices; quotations unchanged in East St. Louis. No other declines reported in New York, Cleveland or Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	28.27
Southern Ohio No. 2	32.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.44
BIRMINGHAM	
No. 2 Foundry	27.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	31.17
Basic	31.14
Grey Forge	31.50
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	33.00
Basic	26.00
Bessemer	30.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	7.5	5.0	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]@2.60	4.03	3.50	4.00
No. 12	2.[illegible]@2.65	4.08	3.55	4.05
No. 14	2.[illegible]@2.70	4.13	3.60	4.10
No. 16	2.75@2.90	4.23	3.70	4.20
Black				
Nos. 17 and 21.	3.00@3.25	4.40	4.05	4.70
Nos. 22 and 24.	3.05@3.30	4.45	4.10	4.70
Nos. 25 and 26.	3.10@3.35	4.50	4.15	4.75
No. 28	3.15@3.40	4.60	4.25	4.85
Galvanized				
Nos. 10 and 11.	3.15@3.40	4.60	4.10	4.85
Nos. 12 and 14.	3.25@3.50	4.70	4.20	4.95
Nos. 17 and 21.	3.55@3.80	5.00	4.50	....
Nos. 22 and 24.	3.70@3.95	5.15	4.80	5.40
No. 26	3.85@4.10	5.30	4.95	5.55
No. 28	4.15@4.40	5.60	5.25	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	44½	29½
LAP WELD					
2	61	49½	2	39½	25½
2½ to 6	65	53½	2½ to 4	42½	29½
7 to 8	62	49½	4½ to 6	42½	29½
9 to 12	61	48½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	44½	30½
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	40½	27½
2½ to 4	63	52½	2½ to 4	43½	31½
4½ to 6	62	51½	4½ to 6	42½	30½
7 to 8	58	45½	7 to 8	35½	23½
9 to 12	52	39½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded.	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.14	3.50	3.90
Cold rolled strip steel	6.50	8.25	7.25
Floor plates	5.20	4.91	5.50
Cold finished shafting or screw	3.65	3.45	3.70
Cold finished flats, squares	4.15	3.95	4.20
Structural shapes (base)	3.04	2.76	2.90
Soft steel bars (base)	2.94	2.66	2.80
Soft steel bar shapes (base)	2.94	2.66	2.80
Soft steel bands (base)	3.74	3.06	3.55
Tank plates (base)	3.04	2.76	2.90
Bar iron (2.35 at mill)	2.94	2.21	2.80
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
3/32	8.00		12@13
1/8	6.50		11@12
3/16 to 1/4	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	33.00
Lead (up to carlots), St. Louis 5.62@5.65; New York	6.20
Zinc (up to carlots), St. Louis 6.25; New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	19.00
Antimony (Chinese), ton spot	5.50	7.50	6.50
Copper sheets, base	21.50	21.50@21.75	23.00
Copper wire (carlots)	15.75	17.50	16.25
Copper bars (ton lots)	20.00	22.50	19.50
Copper tubing (100-lb. lots)	24.75	24.50	23.00
Brass sheets (100-lb. lots)	18.25	19.50	18.75
Brass tubing (100-lb. lots)	22.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.75	17.50	15.75
Brass wire (carlots)	18.75	19.50	.....
Zinc sheets (casks)	9.00	9.00	.....
Solder (½ and ½), (caselots)	23.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.75	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.25	11.50
Copper, heavy, and wire	11.75	11.75	11.25
Copper, light, and bottoms	9.75	10.00	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.25	6.25
No. 1 yellow brass turnings	6.50	6.25	6.75
Zinc	3.00	3.50	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.10	.10
Wiping cloths, 13½x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.14	.99
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville... per net ton		11.50	
Coke, prompt foundry, Connellsville... per net ton	14.50@15.00		

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50-10%
1⅛ and 1¼x3 in. up to 12 in.	25%	65%	50-10-10%
With cold punched sq. nuts	30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	....	$4.00 off
Button head bolts, with hex. nuts	20%	$3.90 net	.....
Hex. head and hex. nut bolts	25%	....	65-5%
Lag screws, coach screws	45%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	....	55%
Tap bolts, hex. head, list plus	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70-10%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.00	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	55%	65%	60%
Rivets, tinned	55%	65%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$4.50	$3.50	$3.35
Cone heads, ditto (net)	4.60	3.60	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	30-5%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

B. C., Vancouver—The Harbor Comrs., [illegible] Fowler St., A. D. Swan, 10 Phillips Place, Montreal, P. Q., Engr.—will receive bids until Oct. [illegible] for [illegible] equipment of new pier on [illegible] Inlet, including the following, all electrically operated:
- Eight 3 ton cranes.
- Four 3 ton freight elevators.
- Four 1,[illegible] lb. escalators, [illegible] ft. rise.
- Four [illegible] ton capstans at [illegible] ft. a min.
- Four tractors and trailers, particulars to be submitted by bidders.

Ont., Goderich—Goderich Evaporator Co.—[illegible] equipment for new evaporator and also for cannery (proposed).

Ont., Grimsby Beach—The Grimsby [illegible] & Terra Cotta Co.—prices wanted on new machinery for plant damaged by fire.

Ont., London—The London Curling Club, F. [illegible], Secy.—Artificial Ice Arena—prices wanted for installing artificial ice plant.

Ont., North Bay—W. Milne & Sons—one 12 in. double edge band saw, edgers, trimmers, planers, all electrically driven for mill to be rebuilt, at Trout Mills.

Ont., Port Arthur—The Thunder Bay Paper Co., J. E. Schmaled, Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis., Purch. Agt.—ground wood trailing screen, primary centrifugal screen, one 54 in. standard wet machine, for use on ground wood pulp, one 600 ton hydraulic press.

Que., Montreal—Mount Royal Metal Co., Mill and Oak Sts., G. H. R. Hutchins, Purch. Agt., 31 St. Nichols St.—complete equipment for foundry.

Sask., Regina—The Imperial Oil, Ltd.—equipment for oil refinery, capacity 3,500 bbls., at Calgary, Alta. (proposed).

Metal Working Shops

Calif., Berkeley—B. Porter, c/o J. W. Plachek, Archt., 2014 Shattuck Ave., will soon award the contract for the construction of a 1 story garage and auto salesroom, on Durant and Shattuck Ave.

Calif., Oakland — California Foundries Co., foot of 19th Ave., awarded the contract for the construction of a 1 story foundry. Estimated cost $8,000.

Calif., San Francisco—J. Weisbein, c/o H. C. Baumann, Archt., 251 Kearny St., awarded the contract for the construction of a 1 story garage and battery service station, on 8th Ave. and Geary St. Estimated cost $22,000. Noted Aug. 17.

Ill., Chicago—E. C. Frazier, Archt., 30 North Dearborn St., is preparing plans and will soon receive bids for the construction of a 1 story, 100 x 120 ft. garage, at 1215-23 West Harrison St., for J. A. Hannah, 1045 Fulton Market. Estimated cost $50,-000.

Ill., Chicago—H. A. Mulder, Archt., 140 South Dearborn St., is receiving bids for the construction of a 1 story, 125 x 130 ft. garage, on Clark St. near Devon St., for D. R. Guthman, 6730 North Clark St. Estimated cost $60,000.

Ind., East Chicago—The International Lead Refining Co., 151st St. and McCook Ave., plans to build a 1 story, 50 x 100 ft. lead refinery. Estimated cost $27,000. Private plans.

Ind., Ft. Wayne—J. E. Ford, Douglass and Harrison Sts., plans to build a 2 story, 150 x 250 ft. garage, on Main St. Estimated cost $75,000. C. R. Weatherhogg, [illegible] Trust Bldg., Archt.

Ind., Indianapolis—The Conduit Automobile Co., 314 North Delaware St., plans to build a 3 story, 62 x 210 ft. automobile sales and service station, on North Meridian Ave. Estimated cost $150,000. F. B. Hunter, State Life Bldg., Archt.

Ind., Indianapolis—Dusenburg Motor Co., 515 Lemcke Bldg., plans to build a 1 story, [illegible] ft. auto factory, on South Harding St. Estimated cost $[illegible]. Private plans.

Ind., Indianapolis—[illegible] Sales Co., North Meridian St., plans to build a 3 story automobile sales and service station. Estimated cost $150,000. Rubush & Hunter, Archts. Noted Aug. [illegible]

Ind., Richmond—The [illegible] Gear Co., c/o [illegible], Archt., Richmond, plans to build a 1 story, 100 x 600 ft. gear factory, on [illegible] St. Estimated cost $35,000.

La., New Orleans—The Amer. Can Co., [illegible] and Tchoupitoulas Sts., awarded the contract for the construction of a 4 story, 221 x [illegible] ft. assembling and distributing warehouse, with [illegible] x 60 ft. tower, on Cortez and [illegible] Sts.

Mass., East Boston (Boston P. O.)—The Boston Sand & Gravel Co., 88 Broad St., Boston, is building a 1 story, 40 x 80 ft. machine shop, on Condor St., here. Estimated cost $10,000. P. F. Ayer, Secy.

Mich., Detroit—The Studebaker Corp., Brush and Piquette Aves., awarded the contract for the construction of a 4 story, 95 x 208 ft. automobile plant addition, on Jefferson and Clark Aves.

Mich., Flint—The Fisher Body Ohio Co., East 140th St. and Coit Rd., Cleveland, O., had plans prepared for the construction of a 2 story, 202 x 401 ft. factory for the manufacture of auto bodies, on Wilcox St., here. A. Kahn, 1,000 Marquette Bldg., Archt.

Mich., Jackson—The Hayes Wheel Co., Jackson and Douglas Sts., awarded the contract for the construction of a 1 story, 50 x 60 ft. factory, and a 1 story 100 x 160 ft. power house. Estimated cost $250,000.

N. Y., Elmira—The Decker Automobile Co., 109 West Church St., is receiving bids for remodeling and also constructing an addition to its 2 story building, including a new salesroom on the first floor. Estimated cost $40,000. O. Dochstader, 374 West 1st St., Archt.

N. Y., Jamestown—General Metalsmiths Inc., 313 Prendergast Ave., awarded the contract for the construction of a 1 story, 60 x 250 ft. factory, on Hopkins Ave., for the manufacture of architectural, mortuary, and industrial bronze and copper products. Estimated cost $150,000.

N. Y., New York—The Dept. of Plant & Structures, Municipal Bldg., plans to build a repair shop at 16th St. and Ave. C, for the Dept. of Street Cleaning, and will soon award the contract for clearing of site, excavating, sheeting and bracing for the foundation of same.

N. Y., New York—A. Jawitz Realty Co., c/o J. Fisher, Archt. and Engr., 25 Ave. A, will build a 1 story, 100 x 200 ft. garage on East 173rd St. Estimated cost $75,000.

N. Y., New York—J. Pearlbinder, c/o C. Kreymborg, Archt. and Engr., 2534 Marion Ave., will build a garage, on Westchester Ave. Estimated cost $100,000.

N. Y., Rochester—W. Steele & Sons Co., Archts., 16th and Arch Sts., Phila., will receive bids until Sept. 9 for the construction of a factory, on Plymouth Ave. near Barton St., here, for the Electric Storage Battery Co., 181 South Clinton St.

N. Y., St. George—The Dept. of Police, R. E. Enright, Comr., 240 Center St., New York, will soon award the contract for the construction of a 2 story garage for the 66th Precinct Police Station, on Richmond Terrace and Wall St., here.

N. Y., Tonawanda—Jewett & Co., Military Rd., Buffalo, awarded the contract for the construction of a 2 story, 56 x 262 ft. plant, for the manufacture of stoves and ranges, here, to replace the one recently destroyed by fire. Noted Aug. 24.

O., Cleveland—The Amer. Shipbuilding Co., 4900 Division Ave., awarded the contract for the construction of a 1 story, 60 x 500 ft. factory. Estimated cost $120,000. M. E. Tarr, Pres.

O., Cleveland—J. Bookatz, 656 East 99th St., awarded the contract for the construction of a 1 story, 66 x 120 ft. garage, on Superior Ave. near 103rd St. Estimated cost $50,000.

O., Cleveland—H. H. Bramson, Cadillac Bldg., awarded the contract for the construction of a 1 story, 75 x 115 ft. garage and stores, at 725 East 125th St. Estimated cost $40,000.

O., Cleveland—S. Richland, 8228 Quincey Ave., had plans prepared for the construction of a 1 story, 56 x 100 ft. garage on East 103rd St. and St. Clair Ave. Estimated cost $40,000. M. Altschuld, 5116 Woodland Ave., Archt.

O., Cleveland — The Yeiser Co., 1162 Holmden Ave., (automatic faucets) awarded the contract for the construction of a 1 story, 28 x 84 ft. machine shop. Estimated cost $40,000.

O., East Cleveland (Cleveland P. O.)—A. M. Gordon, 207 Schofield Bldg., had plans prepared for the construction of a 2 story, 41 x 177 ft. garage, on Lakefront Ave. Estimated cost $60,000. A. F. Janowitz, Permanent Bldg., Cleveland, Archt.

O., Youngstown—Youngstown Boiler & Tank Co., Ft. of Mahoning Ave., awarded the contract for the construction of a 1 story addition to boiler factory. Estimated cost $50,000. Architect not announced.

Pa., Oil City—W. H. Crosby, Archt., Masonic Bldg., is receiving bids for the construction of a 2 story, 70 x 80 ft. garage for E. M. Bowen, (Ford Agency), Oil City. Estimated cost $40,000.

Pa., Phila.—Zorbey & Hollaway, 4713 North Broad St., are receiving bids for the construction of a 1 story 20 x 34 ft. and a 100 x 147 ft. garage, on 15th St. and Wyoming Ave. Estimated cost $75,000. C. F. Parker, 5018 Schuyler St., Archt.

Pa., Pittsburgh—The Englert Mfg. Co., 2133 East Carson St., is having plans prepared for the construction of a 2 story, 68 x 120 ft. battery factory, on South 25th and Jane Sts. H. Lang, 1617 Brownsville Rd., Archt.

Pa., Pittsburgh—The Stroh Steel Hardening Process Co., Westinghouse Bldg., plans to build a steel foundry addition, on Chateau and Ridge Sts. Estimated cost $250,000. Private plans.

Pa., Starbrick (Warren P. O.)—The Warren Steel Car Co., awarded the contract for the construction of a 1 story, 90 x 260 ft. factory, near Warren. Estimated cost $75,000. Noted Aug. 17.

Pa., York—The York Mfg. Co., plans to build a 5 story, 60 x 100 ft. addition to its plant for the manufacture of ice and refrigerating machinery. Estimated cost $300,000. Architect's name withheld.

W. Va., Huntington—J. J. West, Archt., 611 9th Ave., will remodel and build a 1 story, 90 x 115 ft. addition to garage and bakery, for Stroehmann Baking Co., 5th St. and 7th Ave. Estimated cost $100,000.

W. Va., Logan—R. E. Matticks, is having plans prepared for the construction of a 2 story, 52 x 120 ft. garage and repair shop. Estimated cost $40,000. Meanor & Handloser, Robson-Pritchard Bldg., Huntington, W. Va., Archts.

Wis., Bear Creek—H. A. Rasmussen will build a 1 story, 50 x 90 ft. garage. Estimated cost $40,000.

Wis., Marinette—H. A. White, 2,000 Hall Ave., awarded the contract for the construction of a 1 story, 117 x 117 ft. garage and repair shop. Estimated cost $40,000.

Wis., Prescott—J. A. Miller, awarded the contract for the construction of a 1 and 2 story, 50 x 70 ft. garage. Estimated cost $40,000.

Wis., West Allis — The Allis-Chalmers Mfg. Co., National Ave., manufacturers of machinery, awarded the contract for the construction of a 1 story, 176 x 406 ft. carpenter shop.

General Manufacturing

Mass., Cambridge—The Cambridge Rubber Co., 748 Main St., awarded the contract for the construction of a 4 story, 83 x 102 ft. factory. Estimated cost $100,000.

Mass., East Boston—The Boston & Lockport Block Co., 100 Condor St., awarded the contract for the construction of a 1 story, 90 x 170 ft. factory. Estimated cost $35,000.

Mass., Malden—The Yale Knitting Co., Sherman St., awarded the contract for the construction of a 4 story knitting plant addition. Estimated cost $40,000. Noted March 9.

Mass., Waltham—Watkins-Potter Press, 77 Washington St., N., Boston, awarded the contract for the construction of a 1 story, 90 x 160 ft. printing plant, here. Estimated cost $60,000.

N. Y., Buffalo—The Sikes Chair Co., 500 Clinton St., plans to rebuild a portion of its factory destroyed by fire. Estimated cost $20,000. Architect not announced.

N. Y., Geneva—The Standard Optical Co., 172 Lyceum St., plans to repair and to rebuild portion of its plant, destroyed by flood. Estimated cost $5,000. Architect not announced.

N. Y., Niagara Falls—The Carborundum Co., Buffalo Ave. and 18th St., awarded the contract for the construction of a 4 story, 50 x 57 ft. grain storage building.

N. Y., Woodhaven (Jamaica P. O.)—The Proper Silk Hosiery Mills, Inc., 276 5th Ave., New York, awarded the contract for the construction of a 3 story, 50 x 202 ft. factory for the manufacture of hosiery here. Estimated cost $100,000.

Pa., Glenshaw—L. B. Duff, Engr., 712 Magee Bldg., Pittsburgh, is receiving bids for the construction of a 2 story, 64 x 112 ft. warehouse and manufacturing plant, at Wittmer Station, for the Ball Chemical Co., c/o Engineer. Estimated cost $50,000. Noted Aug. 24.

American Machinist

Volume 57 NEW YORK, SEPTEMBER 14, 1922 Number 11

Nickel and Its Alloys

The First Article—Commercial Uses of Malleable Nickel—How Various Percentages of Nickel Affect Steel—Production of the Copper-Nickel Alloys

By PAUL D. MERICA
Director of Research, International Nickel Company

IF ONE were asked to characterize in a few words those properties which make nickel of commercial value—the properties which it possesses not only in itself but which, remarkably enough, it is able to impart to its alloys—the answer might well be: *Mechanical toughness, resistance to corrosion, heat resistance* and *decolorizing power.* These typical characteristics are well illustrated in four groups of nickel alloys, namely, nickel steels, monel metal, nickel-chromium alloys, and nickel or german silver. There are, of course, many other commercially valuable properties, often of a special nature, which distinguish this metal in its combination with others, but these four are the most prominent, and, if we may so personalize the metal, are the most expressive of its inner nature.

Source and Production of Nickel

These physical properties of the nickel alloys are intimately related to their structural or metallographic characteristics. Nickel has the habit of forming those peculiarly intimate combinations with other metals, which we call solid solutions; and it forms such solutions in alloying with iron and copper, our two principal alloy base metals. Such alloys are not merely in mechanical combination. They are actually in atomic combination and consequently display the properties peculiar to such arrangements. So extensive is this power of taking up other metals in a solid solution, that one is tempted to regard nickel as a sort of universal solid flux or solvent for metals. Nickel alloys with iron, copper, cobalt, chromium, manganese, the platinum metals and, to a more limited extent, with zinc, aluminum, tin, silicon, antimony, arsenic, molybdenum and tungsten.

Like many other prized possessions of society today, nickel was once rather an outcast among metals and at various times was even regarded as a positive pest. In the middle ages, the name "Kupfernickel" or "Devil's Copper" was applied in contempt to a nickel mineral which seemed to contain the valuable metal, copper, but did not. Even in the early history of the nickel industry in this country (1870-1890), the presence of nickel in the copper ores of Sudbury, Ontario, Canada, was regarded merely as an annoyance, as it occasioned additional refining difficulties and increased the cost of the copper extracted. Not indeed until the middle of the 19th century were the properties of nickel sufficiently known and valued. It then began to attain commercial standing, although, unrecognized as such, nickel was used on copper-nickel coinage and in Chinese packfong in the earliest times.

Most of the world's supply of nickel today comes from the copper-nickel-iron sulphide ores of Sudbury, Ontario, which are mined and smelted in Canada and are refined into refined nickel and copper either there, in this country, or in Wales. From the same ores and essentially by the same processes, the International Nickel Co. refines an intermediate copper-nickel sulphide or matte directly to its monel metal, without the separation of the copper and nickel of the original ore.

Metallic nickel, so refined, appears on the market in the following forms:

Nickel blocks or ingots weigh 25 or 50 lb. and contain about 99 per cent nickel. They are used for remelting in the production of alloys.

Nickel shot is also used for remelting and is produced by pouring molten nickel into water. A pure variety containing little carbon ("X" shot) is used in the manufacture of copper-nickel alloys and steel, and another variety with about 0.5 per cent carbon is used in the manufacture of nickel-platers' anodes. The former contains 99 per cent nickel, the latter about 98.5 per cent.

Electro-nickel cathodes consist of a very pure variety containing 99.8 per cent nickel and are used in remelting in the making of copper-nickel and special alloys.

Malleable nickel is produced in the usual commercial form of rods, sheet, strip, wire and welded tubes for commercial fabrication. It contains from 94 to 99 per cent nickel, together with additions of manganese, to adapt it better to its particular commercial uses. Castings contain from 97 to 98 per cent.

How Brittle Nickel Becomes Malleable

Nickel produced by melting in the usual manner either in the reverberatory furnace or in the crucible is not in general malleable either hot or cold. But it can be made malleable by the addition of magnesium or manganese to the molten metal just before pouring it into ingots or castings, a fact discovered by Fleitman. These additions produce a most remarkable change in the mechanical properties of nickel. Without them, the metal is absolutely brittle and will hardly undergo the slightest deformation. After these additions have been made, it can be worked with the greatest ease and possesses a degree of malleability which, of all the base metals, perhaps only copper surpasses.

Therefore, in the production of nickel for mechanical fabrication these precautions are always taken, and the product is usually distinguished from the non-malleable products such as shot and blocks by the term "malleable." Nickel castings are also made of the malleable metal.

Some of the more important useful properties of malleable nickel are given in Table I. Its principal properties are a high resistance to corrosion, a pleasing color and appearance after polishing or buffing, and

a relative hardness together with a high degree of ductility and malleability, electrical properties and a resistance to oxidation at high temperatures.

Nickel is used largely abroad and to a limited extent in this country in the form of cooking utensils, cast, stamped or spun. For similar reasons many other ornamental household stampings and fittings are produced from nickel strip and sheet.

Nickel wire is chiefly used for motor ignition spark plug points, owing to its resistance to the action of the gases of combustion at high temperatures. Thus one of the well-known spark plugs carries both the center and shell electrode of nickel wire which in this case contains from 2 to 6 per cent manganese. It has been found that the addition of manganese in this case increases the life of the spark point.

Some malleable nickel is produced in the form of castings for digesting and evaporating apparatus for the chemical industry. Rabble shoes of cast nickel have long been in use in the furnaces of the International Nickel Co. for roasting mattes and sulphides, because of their superior resistance to deterioration under the combined action of the high temperature (1,500 deg. F.) and the furnace gases containing sulphur.

The fabrication of malleable nickel, that is, the casting, forging, machining, drawing, stamping, spinning and welding is essentially similar to that of monel metal, which will be described in a later article. The only difference is that of degree and is occasioned by the fact that nickel has a higher melting point than monel metal and hence is hot-forged advantageously at a somewhat higher temperature of about 2,000 to 2,150 deg. F. It is also somewhat softer than monel metal and gives less difficulty in cold-working or machining.

The use of nickel in commercial steel was first described in detail by James Riley in 1889 and has since developed into one of the principal, if not the principal commercial applications of the metal. It is impossible to discuss the details of the manufacture and uses of the nickel steels within the few paragraphs which may be devoted to them here, and for further detailed information, the reader is referred to: Bullens, "Steel [illegible]t Treatment, 1918"; Hibbard, "Manufacture [illegible] Alloy Steels, 1920"; Circular No. 100 of [illegible] Standards, 1921.

[illegible]aking, from 1 to 5.0 per cent of nickel [illegible]el both with and without small amounts [illegible]elements, such as chromium, and more [illegible]um, to increase its strength and [illegible]ly after appropriate heat-treatment.

The addition of nickel to a structural steel containing from 0.2 to 0.4 per cent of carbon increases the tensile strength of the steel in the hot-rolled, unheat-treated condition, by approximately 5,000 lb. per square inch for each per cent of nickel and without the loss of ductility. It is, however, after the heat-treatment that the superiority of nickel or nickel-chromium steels is evident. This is illustrated by the figures in Table II, which give the average tensile properties of two steels exactly similar, except that one contained 3.5 per cent nickel, and the other, none.

The beneficial effects of nickel are intensified in the presence of other elements, particularly chromium, and nickel-chromium steels are therefore more widely used today for heat-treated automobile and other forgings than are the simple nickel steels.

In Table III are given the compositions of nickel steel now in commercial use. The simple 3.5 per cent nickel steel was the first composition to be developed and is still adjudged by some to be the best. It is used for structural bridge and other work in the unheat-treated condition and for large heat-treated forgings such as those made for ordnance parts. In Figs. 1 and 2 charts show the physical properties of this steel as well as those of a typical nickel-chromium steel in the heat-treated condition.

The nickel-chromium steels may well be called the automobile steels since they are associated with the engineering development of this industry. They are used for axles, shafts, pins, knuckles, bolts and gears.

TABLE I. SPECIAL PHYSICAL PROPERTIES OF COMMERCIAL MALLEABLE NICKEL

	Tensile Properties					
	Yield Point In 1,000 Lb. Per Sq.In.	Tensile Strength In 1,000 Lb. Per Sq.In.	Elongation In 2 in. Per Cent	Reduction Of Area Per Cent	Scleroscope Universal Hammer	Brinell 10 mm. Ball 3,000 kg. Load
Sheet						
Annealed	15 to 25	65 to 75	35 to 45	40 to 60	12 to 14	80 to 100
Hard rolled	85 to 105	90 to 110	1 to 2	20 to 40	30 to 40	150 to 250
Wire						
Annealed	20 to 30	65 to 75	20 to 30	40 to 60	....	....
Hard drawn	....	120 to 140	1 to 2	....	....	....
Rods						
Hot rolled	20 to 30	70 to 80	40 to 50	50 to 70	15 to 18	100 to 130
Castings	20 to 30	50 to 60	20 to 30	....	....	....

Density: 0.319 lb. per cubic inch or nearly equal to that of copper.
Melting point: about 2,625 deg. F.
Coefficient of thermal expansion: 0.0000072 per degree F. (from 60 to 210 deg. F.), or only slightly greater than that of steel.
Electrical resistance: 64 ohm per mil. ft. (for 99 per cent nickel) at 75 deg. F.
Temperature coefficient of electrical resistance: 0.0023 per degree F.
Magnetic properties: About one-half as magnetic as cast iron up to 600 deg. F. when it becomes non-magnetic.
Optical reflection: About 65 per cent compared with about 95 per cent for polished silver and 55 per cent for polished steel.
Young's modulus of elasticity: 30,000,000 lb. per square inch.

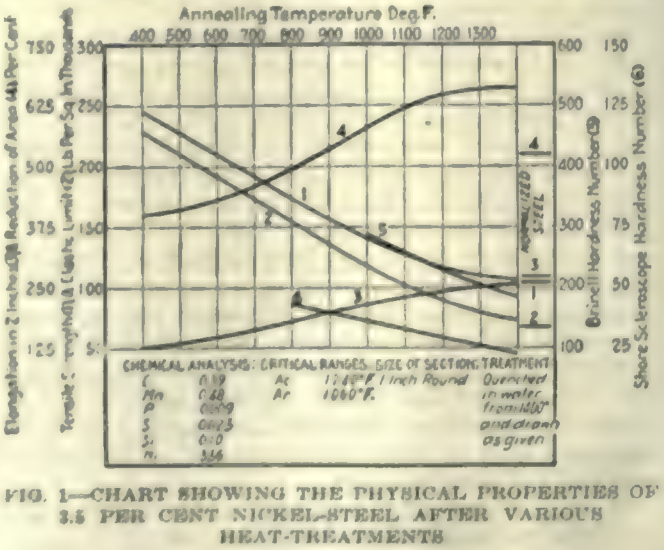


FIG. 1—CHART SHOWING THE PHYSICAL PROPERTIES OF 3.5 PER CENT NICKEL-STEEL AFTER VARIOUS HEAT-TREATMENTS

The lower nickel content steels are used for casehardened pins, rollers and gears. The high nickel-chromium steels are also used almost exclusively for armor plate and armor piercing projectiles. Fig. 3 shows a Liberty engine crankshaft forged of nickel-chromium steel.

The presence of nickel in the steel used for casehard-

TABLE II. AVERAGE TENSILE PROPERTIES OF STEEL WITH AND WITHOUT NICKEL

	Yield Point Lb. Per Sq.In.	Tensile Strength Lb. Per Sq.In.	Elongation In 2 in. Per Cent	Reduction Of Area Per Cent
0.40% carbon steel...	53,000	90,000	25	62.5
0.40% carbon, 3.5% nickel steel........	83,000	108,000	25	66.0

ening tends to restrain the grain growth of the core during the heating, to produce a uniform zone of carburization or case, and consequently, to prevent brittleness in the casehardened parts. The nickel steels are for this reason very largely used for casehardened parts such as the bearings of chains and for gears. The use of the high nickel steels for casehardening makes possible

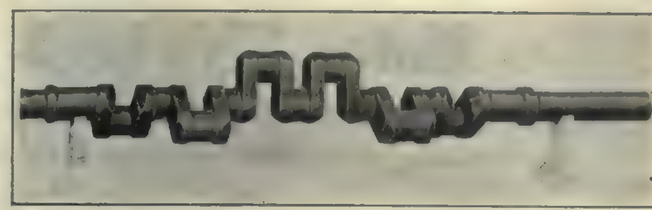


FIG. 3—A LIBERTY ENGINE CRANKSHAFT FORGING OF MEDIUM NICKEL-CHROMIUM STEEL

ments in which thermal changes of dimensions must be avoided. These steels also manifest unique elastic-thermal characteristics which should make them valuable in the construction of instruments of precision (see Chevenard in Comptes Rendus, Vol. 170, p. 1,499).

Next in importance to the nickel steels are the series of commercial alloys which nickel forms with copper and brass, namely monel metal, constantan, cupro-nickel and nickel silver. These alloys are all characterized by ductility and toughness, resistance to corrosion and white color, these properties being exhibited roughly in proportion to the nickel content of the alloy.

TABLE III. COMPOSITIONS OF COMMERCIAL NICKEL STEEL

Steel	Nickel Per Cent	Chromium Per Cent	Carbon Per Cent	Commercial Uses
3.5% Nickel steel............	3 to 3.5	....	0.2 to 0.4	Structural purposes, heat-treated forgings, gun forgings
Nickel-chromium steel				
Low.....................	1.5	0.5	0.2 to 0.5	Casehardening, heat-treated forgings.
Medium..................	1.5 to 3.5	0.5 to 1.5	0.2 to 0.5	Heat-treated forgings.
High....................	3.5	1.5	0.4 to 0.5	Heat-treated forgings and gears.
Nickel steel for casehardening				
Low.....................	1.5 to 3.5	....	0.1 to 0.2	Parts that require case-hardening.
High....................	5 to 7	....	0.1 to 0.15	Parts that require case-hardening.
Ferro-nickel steel............	25 to 38	....	0.3 to 0.5	Valves, boiler tubes, rheostats, non-expanding steel, invar.

the production of a self- or air-hardening case that does not require quenching.

The nickel steels containing 25 per cent and more of nickel are interesting in that they are not subjected to a heat-treatment in the usual sense, but have peculiar properties in the natural state. They are extremely tough and resistant to corrosion and are comparatively difficult to machine. They have been used for marine boiler tubes and today constitute a variety of "stainless" steels which generally contain also some chromium.

The steel containing about 36 per cent nickel is called invar and exhibits practically no thermal expansion between room temperature and 110 deg. F. Invar is used for measuring tapes, chronometers and instru-

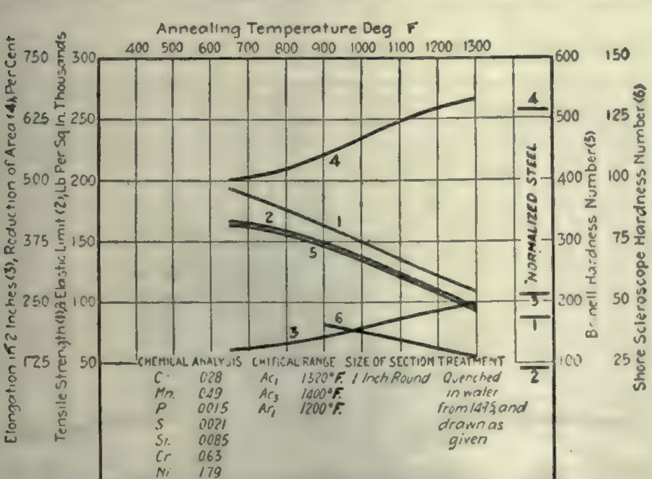


FIG. 2—CHART SHOWING THE PHYSICAL PROPERTIES OF A LOW NICKEL-CHROMIUM STEEL AFTER VARIOUS HEAT-TREATMENTS

Of these, constantan is produced in the form of wire or strip. It is used largely for electrical purposes and consequently is described in a later article under that head. Cupro-nickel and nickel silver are produced by the brass manufacturers largely in the form of sheet and wire but also in seamless tubes.

Coinage "bronze" (the term bronze, is a misnomer as it contains no tin) consists of from 22 to 25 per cent

TABLE IV. TENSILE PROPERTIES OF CUPRO-NICKEL

	Tensile Strength Lb. Per Sq.In.	Elongation Per Cent
Annealed......................	45,000 to 50,000	30 to 40
Cold-rolled....................	75,000 to 80,000	2 to 3

nickel and the balance of copper, and is probably one of the oldest alloys known. Strangely enough the modern compositions used for this purpose, such as in the present U. S. five-cent piece, are practically identical with those used in Asia Minor 2,000 years ago.

Cupro-nickel, containing 15 per cent nickel and the balance of copper, is used chiefly for bullet jackets and has properties similar to those of coinage bronze although the former is not as white in color as the latter. It is used for this purpose chiefly on account of its white color, resistance to corrosion and remarkable ductility and malleability which enormously facilitates fabrication by rolling and drawing. As an instance of this, may be noted the fact that cupro-nickel may be rolled from a cast bar, 1.25 in. thick to a 0.040-in. sheet without intermediate annealing.

In Table IV are given the typical tensile properties of cupro-nickel. In cold rolling or drawing these alloys, they may be annealed at about 1,300 deg. F. in a muffle furnace, if possible, or otherwise protected against oxidation from the furnace gases.

Motor Flywheels on the Libby Lathe

Machining Flywheels in a Modern Automobile Plant—Methods of Turning, Boring and Facing—How the Work Is Chucked

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

THE machining of automobile flywheels is an operation of considerable importance, not alone because of the relatively high cost of the operation, but also because there are very nearly as many methods of machining as there are designs of flywheels. One of the largest manufacturers of automobiles, who has recently built the first half of a $15,000,000 plant in the Middle West, has solved the problem in the manner described below.

All the turning and boring operations are performed on Libby lathes, using an attachment which can be seen in Fig. 1. The attachment consists of a countershaft which drives, through the universal shaft *A*, Fig. 1, the vertical toolrest or slide *B*, Fig. 2. Power is transmitted to the shaft through a set of bevel gears at the upper end, and from the shaft to the toolslide through a differential at the lower end. One of the gears in the differential can be seen at *C*, in Fig. 3. The differential drives the shaft carrying the larger of the two change gears *D*, Fig. 3, and these change gears in turn drive a worm and worm wheel which turn the short lead screw that feeds the toolslide *B*.

The lever *E*, Figs. 2 and 4, controls the reverse gear by which the toolslide is made to feed upward, the idea being that the tool can be returning to its original position while the boring operation is being performed, an economical and efficient arrangement.

The operator rarely uses this, howeve, as it takes only a couple of seconds to return the slide to position by means of the handwheel *F*. This wheel is also used to set the tools before locking the feed in. The automatic feed is applied by meshing the worm with the

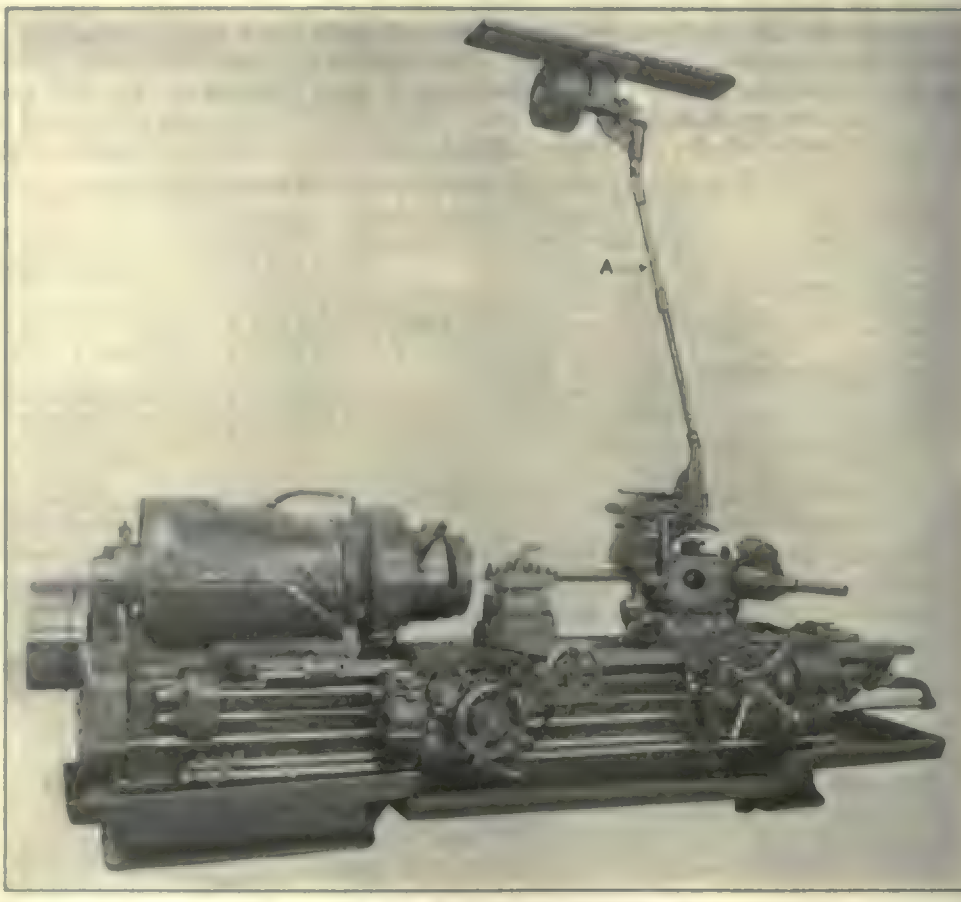
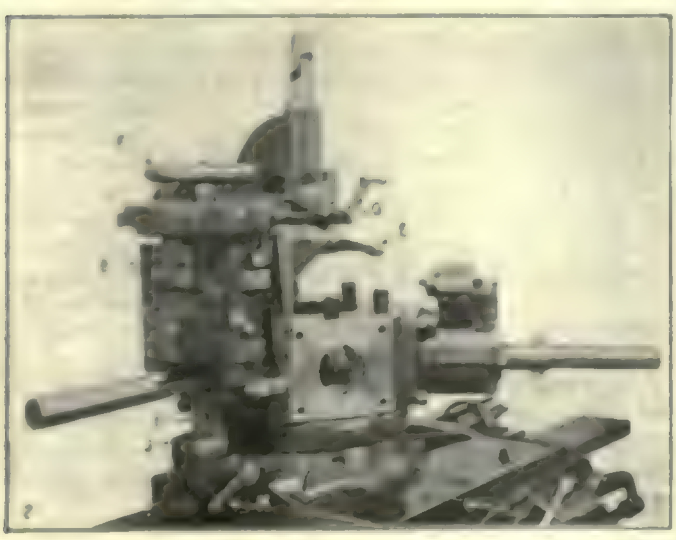


FIG. 1—LIBBY LATHE WITH TURRET TOOLSLIDE ATTACHMENT



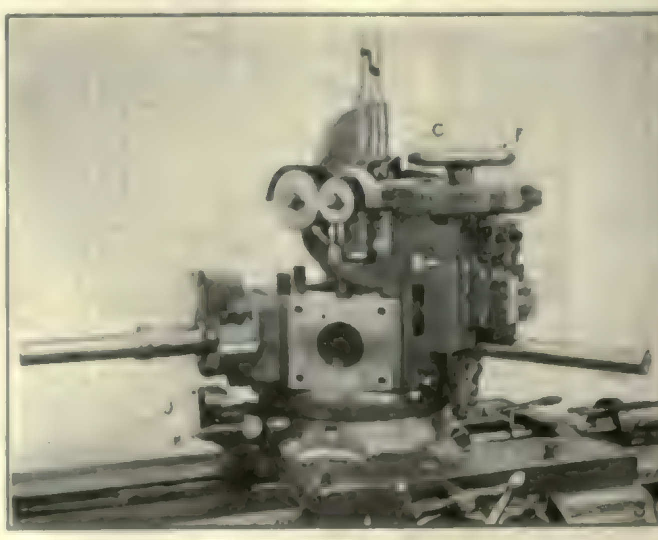


FIG. 2—MECHANISM OF TURRET TOOLSLIDE. FIG. 3—REAR VIEW, SHOWING CHANGE GEARS

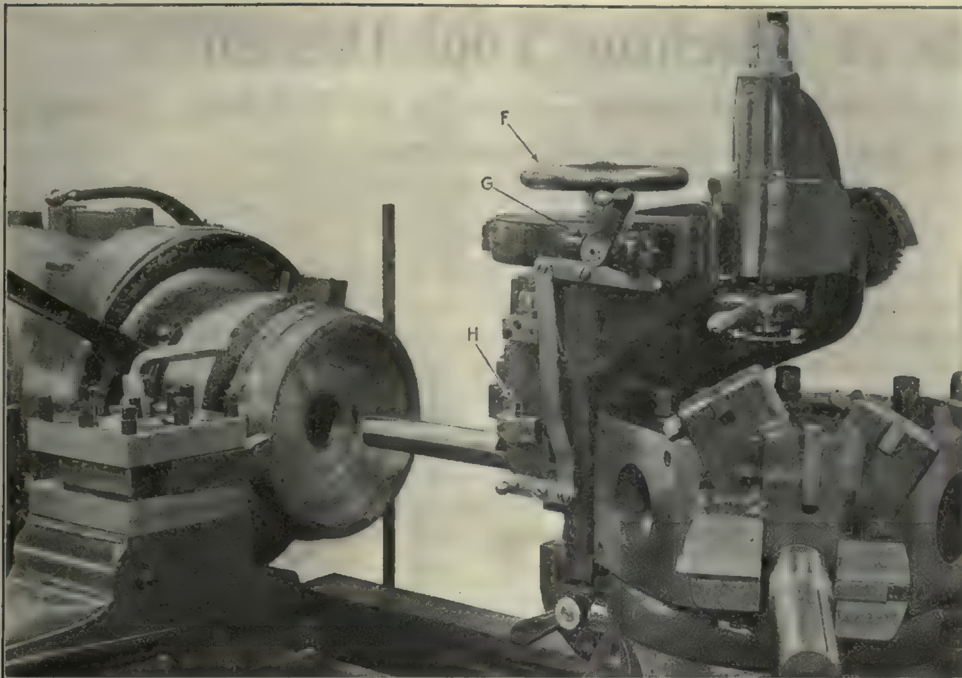


FIG. 4—TOOLS IN POSITION FOR FIRST OPERATION

wheel, which is done by means of the level *G*. The stop *H* releases the worm when the cut is through.

The first action of the operator after swinging the turret around so that the tools are in position, is to set the tool in the cross-slide turret as shown in Fig. 4, so that it will be turning the outside diameter of the wheel while the boring and facing operations are proceeding. Then the block *I*, Figs. 2, 3 and 5, is locked against the underside of the block *J* by means of the cam lever *K*. This holds the slide firmly so that the opportunity for "weave" is reduced to a minimum. The operator now forces the tools in the turret tool-

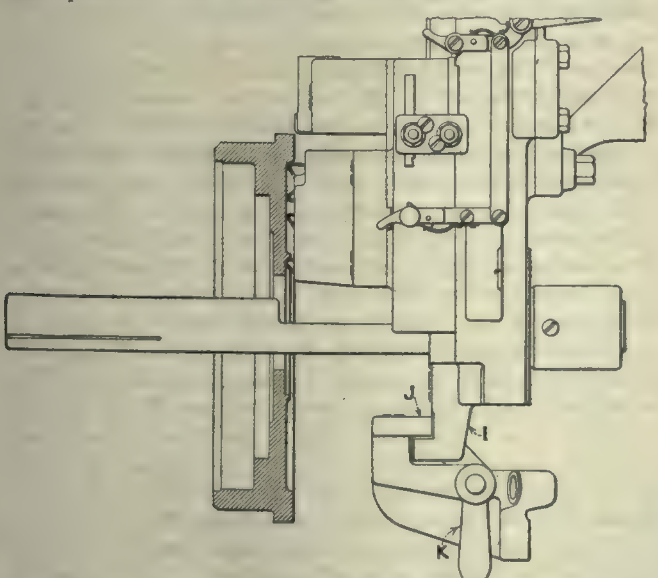


FIG. 5—CROSS-SECTION OF FLYWHEEL SHOWING OPERATION OF TOOLS

slide straight into the work until a stop is reached, then the feed is applied and the tools begin to feed downward. The multiplicity of tools reduces the amount of metal to be removed by each tool, so that the cut is through in an incredibly short time.

The set-up shown in Figs. 2 and 4 is for performing the first operation—that of boring and facing the rim and facing the inside of the flange. The inside of the rim is bored by the upper one of the four tools in the lower block, and when the tool is in far enough the feed is thrown in and the toolslide begins to travel downward, each tool facing a section as it goes. The single tool in the upper block faces the rim while the other four tools face the inside of the flange. While this is taking place, the turning operation is completed and the operator withdraws the cross-slide turret tool from the work.

After the first operation is done, the wheel is faced on the opposite side in a similar manner, using the set-up shown in Fig. 5. These tools are fed into the work in the same manner until the proper depth is reached, then the tools are fed down for the short distance necessary to finish the surface. Three machines are employed on the first operation, each of which finishes a wheel in approximately seven minutes. This is, with the proper allowance, a production of approximately sixty-nine wheels per day (nine hours) per machine, or 207 wheels per day total. The second operation takes about five minutes, which is a production of twelve per hour, or, with the same allowance, approximately 100 per day. Two machines on this operation, however, together with the three on the first operation, produce the present requirements—205 finished flywheels per day.

The boring operations are performed with the aid of Davis adjustable boring bars. The Davis bar is made with a micrometer adjustment which allows the tools to be set almost instantly to take care of wear on the cutting edge. A great deal of time is saved also by using Barker wrenchless chucks, which are so designed that the flywheel can be chucked lightly, trued and tightened while running.

Understudies

By Robert Grimshaw

The concern that does not know who will step into A's shoes if he dies, and who will take the place of A's successor, is in a parlous state, which is comparable to that of an automobile without a spare tire and a few other necessary replacement parts. It is to the advantage of every one on the force to know who is his predetermined substitute in case of absence, or his successor in case of death, or of the dissolution of his connection with the firm.

Many a man is brought in from the outside to fill an upper position because the man in the position below —who would be available if replaced—must be kept where he is, because he is indispensable there.

At West Point the value of understudies is well understood. Every cadet fills every rank in turn, so that in an emergency he can be corporal or captain.

Methods of Machine Tool Design

Third Section of Chapter on Machine Tool Clutches—Shear Pin and Ball Safety Clutches—The Cone Clutch—The Single Plate Clutch

By A. L. De LEEUW
Consulting Editor, American Machinist.

SAFETY clutches are used to prevent breakage by accident or by overload. The simplest device used for this purpose is the so-called "breaking pin," which is merely a pin of mild steel inserted in hardened bushings. The bushings are located in the driving and driven member respectively. They are hardened and have sharp edges at the point where they come together. When the drive requires more power than is permissible, the bushings will shear the pin off. This device has been elaborated in some cases by the use of a number of bushings and pins. In this case the bushings are arranged for various sizes of pins, so that a great many combinations are possible. If, for instance, the pins were made in diameters of 0.100 in., 0.120 in., 0.140 in., and 0.160 in., and if we call these pins *A*, *B*, *C* and *D* respectively, we could use *A*, or *B*, or *C*, or *D* alone, or we might use *A* and *C*, or *A* and *B*, etc. As the shearing resistance is proportional to the square of the diameter of the pin and as the pins have proportions of 5, 6, 7 and 8, we would have as our smallest resistance the square of 5, and as our largest resistance the sum of the squares of 5, 6, 7 and 8. The minimum resistance then would be 25, and the maximum 174, or almost seven times as much. This arrangement works better on paper than in reality, as it would require the constant attendance of an engineer to have the proper pins in position for every job.

There is another objection to this arrangement, namely that there is a considerable interval between the moment when the pin begins to shear off and the moment when it is completely sheared off, so that breakage of some machine element may occur before the breaking pin can do its duty. Still another difficulty

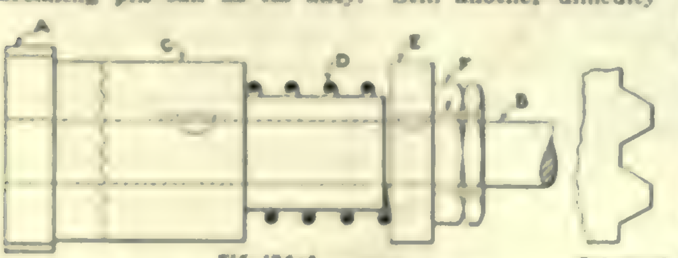


FIG. 134—TOOTHED TYPE OF SAFETY CLUTCH

lies in the fact that a temporary overload, though not sufficient to shear the pin completely, may be sufficient to shear it partially, and after a number of times the pin may be sheared off so far that it finally lets go under a load much below the critical one. The first objection might be overcome by placing the shearing pin in a relatively fast-running member, which would reduce the time element. On the other hand, when this is done there will be a number of shafts, gears, etc., between the member which carries the breaking pin and the point where the excessive load may be applied.

Take, as example, the universal shaft of a milling machine which makes 20 or 30 or even more revolutions per inch feed. If a breaking pin is applied to this universal shaft, there will be a number of shafts and gears and screws between this pin and the point where the danger lies. Each of these shafts or screws may offer at times a somewhat excessive amount of friction, thus increasing the load; and this might cause the breaking pin to give way before there is any real danger. This leads to delay and annoyance. To have a breaking pin perform properly it should be applied as close as possible to the point where the overload may be originated.

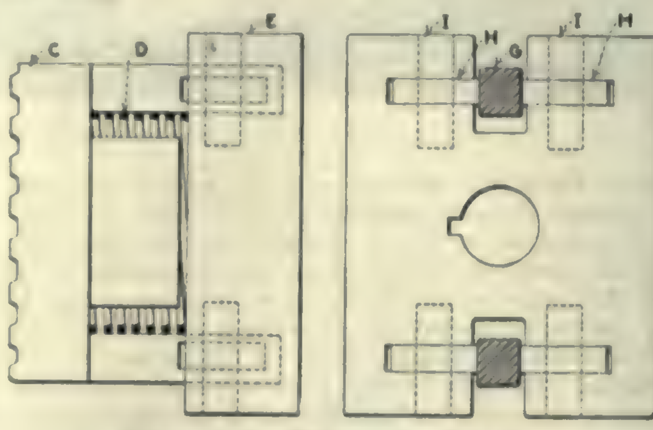


FIG. 135—MODIFICATION OF FIG. 134

A safety clutch is shown in Fig. 134-A. Any friction clutch may be considered as a safety clutch, but it is not always advisable or possible to employ friction clutches. The clutch shown here acts at all times as a positive clutch, except at the moment when it lets go. In this sketch *A* is the driving member which transmits its motion to shaft *B* by means of the driven member *C*, which is keyed to that shaft. *A* and *C* are provided with teeth of a shape shown in Fig. 134-B. The angle of the teeth is such that a relatively small amount of pressure of spring *D* will permit *A* to transmit a relatively large amount of power. The spring is adjustable by means of the nuts *F* and rests against a collar *E* which is also keyed to the shaft. The depth of the teeth of the two clutch members is only about $\frac{1}{32}$ in. The angle may vary, but may be made from 25 to 30 deg. with the axis. The surfaces of the clutch teeth are hardened and should be smooth. If the surface is rough or the angle less than 25 deg., there is danger that the clutch may refuse to work. Assuming that this angle is 25 deg. and the depth of the clutch teeth $\frac{1}{32}$ in., we find that the clutch teeth of member *A* must travel a distance of $\frac{1}{32}$ x tan 25 deg. before the clutch is entirely disengaged. This amounts to 0.0186 in. Supposing that these clutch teeth are on a diameter of 2 in., then member *A* will have traveled through an arc equal to $\frac{0.0186}{2 \times 3.1416}$ of a revolution to disengage itself. This is equal to 3/1,000ths of a revolution, approximately. If the shaft on which the clutch is located makes 20 revolutions for 1 in. feed of the table or saddle, then the

For the author's forthcoming book.

table or saddle will travel $\frac{3}{20,000}$ in. before the clutch is disengaged. It is safe to say that no breakage will occur within such a short amount of travel. When the clutch disengages, the load is entirely removed, so that member *B* will at once jump into position again. This causes a rattling sound, notifying the operator that he should stop the machine.

The steep angle of the teeth was chosen in order to reduce the required pressure of the spring to a mini-

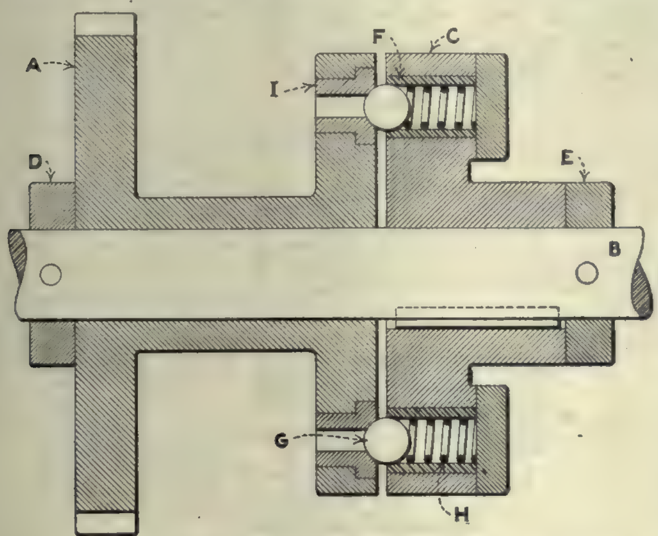


FIG. 136—BALL AND SPRING SAFETY CLUTCH

mum. If the angle chosen were equal to the friction angle there would be no action. It is only because 25 deg. is more than the friction angle that the clutch works at all. However, it is not this angle of the teeth alone which prevents the clutch from operating. The friction of the clutch member *C* against the key in the shaft is another element which may prevent the clutch from acting. As the tangential pressure on the clutch teeth is very great and as the pressure on the key is even greater, it will be found that even with an angle of 25 deg. the clutch may refuse to act. To overcome this, a construction as shown in Fig. 135 may be employed. The spring is again indicated by the letter *D*, and it rests against a collar *E* and a clutch member *C*. The elements which are not shown are the same as in Fig. 134. The member *C* has been provided with two tails or prongs, shown in section and indicated by the letter *G*. These prongs bear against rollers *H*, which turn around pins *I*. By making the rollers as large and the pins as small as possible the frictional resistance against axial movement of the prongs can be very much reduced. The entire arrangement may be enclosed so as to protect it against dirt, etc.

Ball Type of Safety Clutch

A safety clutch of somewhat different construction is shown in Fig. 136 in which *A* is the driving member, *B* the shaft to be driven through the member *C* which is keyed to the shaft. Endwise motion of the two members, *A* and *C*, is prevented by the collars *D* and *E*. The member *C* has a number of holes in which hardened bushings *F* are driven. Balls *G* rest against springs *H* and are kept from moving by the bushings *I* in member *A*. These bushings have a shape so as partly or entirely to envelop a section of the ball. When the pressure on *A* exceeds a certain amount the balls will be pressed back into bushings *F*. The pressure required depends on the number of balls, the pressure of the springs behind the balls, and the angle at which the ball is attacked. If bushing *I* were bearing against the equatorial plane of the ball there would be no tendency to push it back into the bushing. If, on the other hand, *I* should envelop only the polar region of the ball, a small amount of pressure would be sufficient to force the ball back.

There are a number of objections to this construction. In the first place it is not possible, or at least not practical, to adjust all springs to the same pressure. Neither would it be practical to make an adjusting arrangement behind each one of the springs; so that if any adjustment is required it would have to be secured by pushing member *C* forward, just as was done in the other safety clutch. However, the amount of adjustment is necessarily extremely small, because the distance between the members *A* and *C* can be only a small part of the radius of the ball.

Another objection lies in the fact that, if there is a momentary overload which causes the clutch to act, it will be very doubtful whether the clutch starts driving again. This is due to the fact that the moment the ball begins to move, it offers a more and more favorable angle to the bushing *I*. If, for instance, a pressure of 100 lb. were required initially, then a pressure of only 50 lb. will be required after the ball has moved back a small distance, and still less when it has moved a little further. The full pressure, then, is only required when the ball is in its position of rest. When member *A* rotates and pushes the balls back, they will jump again into the bushings *I* at the first chance, but they will require only a small amount of pressure to be pushed out again, except at the infinitesimal period when they are in the central position. The momentum of the parts is sufficient to bring *A* over that infinitesimal element of time, so that the clutch will keep on rattling until the machine stops.

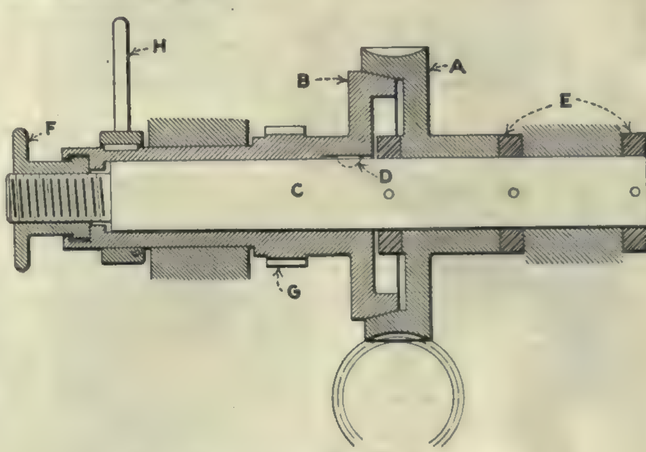


FIG. 137—ORDINARY CONE CLUTCH

Still another disadvantage lies in the fact that unless the holes in both members are located with extraordinary precision, some of the balls will be bearing against a corner of the bushings *I*, and this condition changes as soon as member *A* has rotated a fraction of a revolution in relation to member *C*, so that we will have a different clutch as soon as any movement has taken place.

Friction clutches, their construction and calculation, have been described in many ways and do not need to be touched on here, except in so far as their use in machine tools puts certain requirements in the foreground. The various types of friction clutches used

in machine tool construction are the cone clutch, the expanding ring clutch, the single disk clutch, and the multiple disk clutch. There are a great many variations of each of these types in existence. In a machine tool friction clutches must have great handiness of operation, smoothness of action, ease of adjustment, and lasting qualities.

One of the simplest and most commonly used clutches is the cone clutch. Fig. 137 shows the essential features of such a clutch as applied to a machine tool. *A* is the driving member, in this case a worm wheel; *B* is driven. This member *B* is shown here as sliding on shaft *C* and on the key *D*. The shaft itself is held against endwise movement by the collars *E*. In order to engage the clutch the handwheel *F* is turned, which moves member *B* in an axial direction. The important part of this construction is that the entire arrangement is self-contained and that no pressure is brought to bear on any of the parts except those seated on the shaft. There is, therefore, no undue friction when the clutch is engaged.

A pinion *G* which is part of, or mounted on, member *B* transmits the movement of the clutch to other members of the mechanism. The angle of the cone may be such as to make the arrangement self-releasing. An angle of more than 15 deg. with the axis will accomplish this object; 12 deg. is doubtful. It will release sometimes, but not always. Ten degrees is fairly safe for a non-releasing clutch. The smaller angle will give greater power capacity, so that wherever possible the smaller angle should be used. A means for releasing the clutch is shown in Fig. 137, though the sketch does not show the details of construction—merely the principle. Part of the sleeve envelops a flange of the handwheel *F*. In order to assemble these parts the enveloping part of the sleeve should have been made separate.

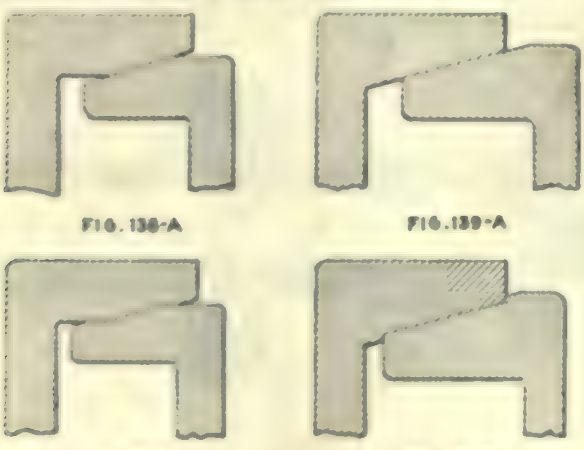


FIG. 138-A FIG. 139-A

FIG. 138-B FIG. 139-B

FIGS. 138 AND 139—METHODS OF CUTTING CLUTCH SURFACES

A handwheel *H* is shown keyed to the sleeve, providing for hand movement when the clutch is out.

In Fig. 138-A is shown the proper way of making the male and female conical surfaces, while Fig. 138-B shows the manner in which these surfaces would wear. Fig. 139-A, on the other hand, shows the wrong way of making the surfaces, and Fig. 139-B shows the way in which these surfaces would wear. The illustration shows clearly how shoulders would be formed in the latter case, which would prevent proper clutch action.

The essentials of a single plate friction clutch are shown in Fig. 140. A pulley *A* runs on the hub of a bracket *B* and is provided with friction surfaces *C-C*. A member *D* bears against one of the friction surfaces whereas one arm of a lever *E* bears against the other surface. By forcing lever *E* down in the direction of arrow No. 1, the friction surfaces *C-C* are clamped between the member *D* and the short arm of the lever. The arm E is moved by the conical surface of a member *F* which slides on the shaft *G*, to which shaft the member *D* also is keyed. The construction of this type of clutch is so well known that it would not have been mentioned here but for the fact that a good deal of trouble may be met unless a couple of details have been properly taken care of.

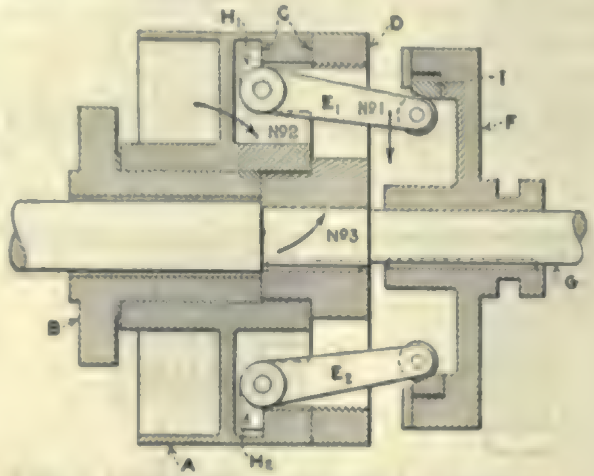


FIG. 140—SINGLE PLATE CLUTCH ASSEMBLY

If there were only one lever *E*, then the movement of the member *F* would cause the pulley to cock on its bearing and, at the same time, there would be a tendency for the shaft to bend and bind in its bearing. The two tendencies are represented by the two arrows Nos. 2 and 3. This tendency will be completely overcome if there are two levers diametrically opposed to each other and acting simultaneously. As a rule, clutches of this kind are made with two, and often with more levers. Such levers are properly spaced, but often no provision is made to make all the levers act simultaneously.

It can readily be seen that if the roller in E_1 is somewhat larger or smaller than the one in E_2; if the short lever arm H_1 has a worm a little more or less than the arm H_2, there will be more or less pressure on the one than on the other, and then this will cause again the same tendency as if there were only a single lever. To overcome this unavoidable condition of unequal action of the two lever arms, the sliding member *F* is provided with a ring *I* which is made floating, that is, its outside diameter is somewhat smaller than the inside diameter of the member *F*. The amount of clearance is sufficient to compensate for any inequality which may be met in the levers *E*.

Another item which is quite essential to the proper action of such a clutch is that the member *F* must be keyed to the shaft in order to retain the proper relation between *F* and *E*. If *F* were loose on the shaft the member *D* might be taken along by the pulley before *F* starts to turn, in which case the rollers in the levers *E* would have a sideways sliding movement over the ring *I*, which would cause wear of the rollers, of the ring, and a possible distortion of the pins around which the levers fit.

It will be noticed that member *D* consists of two

pieces—a central part provided with lugs in which the levers E are pivoted, and a ring which is screwed onto this central part. This construction provides the necessary adjustment for wear. Some provision must be made to lock this ring in position after adjustment.

Care should be taken to make member F on ring I deep enough so that the rollers of levers E rest against the cylindrical part of ring I when the clutch functions. Unless this is properly attended to the clutch will have a tendency to disengage itself.

The centrifugal action causes no trouble with this construction of clutch, because the levers E do not revolve except when they are pressed hard against ring I. There is no centrifugal force acting when the clutch is disengaged, that is, when the pulley only is revolving.

When the clutch is standing still and in a position as shown in the sketch—that is, with lever E_1 at the top—there is a tendency for the long arm of this lever to drop, thus causing a slight amount of pressure against the friction surfaces. Under certain conditions this might cause trouble, so that it is well to make provision

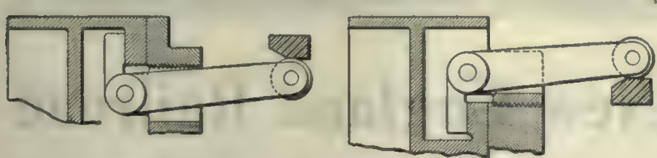


FIG. 141 FIG. 142

FIG. 141 AND 142—MALE AND FEMALE ENGAGING RINGS

against such a possibility either by a compression spring between the members E_1 and E_2 or in any other way which holds the rollers against the ring I. As a compression spring would have a tendency to throw the two lever arms apart, it is very essential to limit the movement of member F to the right so as always to have the rollers against the ring I.

In Fig. 141 is shown the same arrangement of a clutch, except that the ring I has a male taper; while Fig. 142 shows the same arrangement as that of Fig. 140. The two figures are set side by side so as to bring out the fact that it is possible to have a friction surface of larger diameter with the female taper.

This type of friction clutch can be made with three levers without changing the construction in any other respect. It is not possible, however, to use more than three levers without making some special arrangement to cause these levers to act in unison. The reason why two or three levers can be employed without special provision lies in the fact that it is always possible to find a circle on which two or more given points are located. To construct a clutch with four levers, it would be necessary to divide these levers into two groups; say, numbers one and three, and two and four. The member I was made in the form of a ring because it is an easy way to make it. It would have been sufficient, however, to have two shoes, one against each of the rollers, made in such a way that they can slide on the diameter, and connected so as to form one single member. Such a construction is diagrammatically shown in Fig. 143. By having two such sets of shoes we can operate four arms; by making one set of shoes with three, and the other set with two taper surfaces, we might operate five, etc. Such a construction, however, will seldom, if ever, be required.

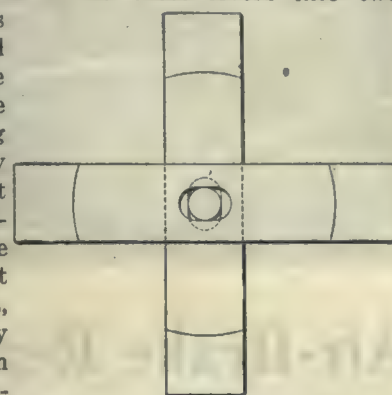


FIG. 143—DIAGRAM OF ARMS AND SHOE TO REPLACE OPERATING RING

The friction plate of the pulley might be a rim without altering the essentials of the single plate clutch. However, such an arrangement is not frequently used in machine tools and is not to be recommended where a neat appearance counts.

Putting Limits on All Dimensions

By John Thomas

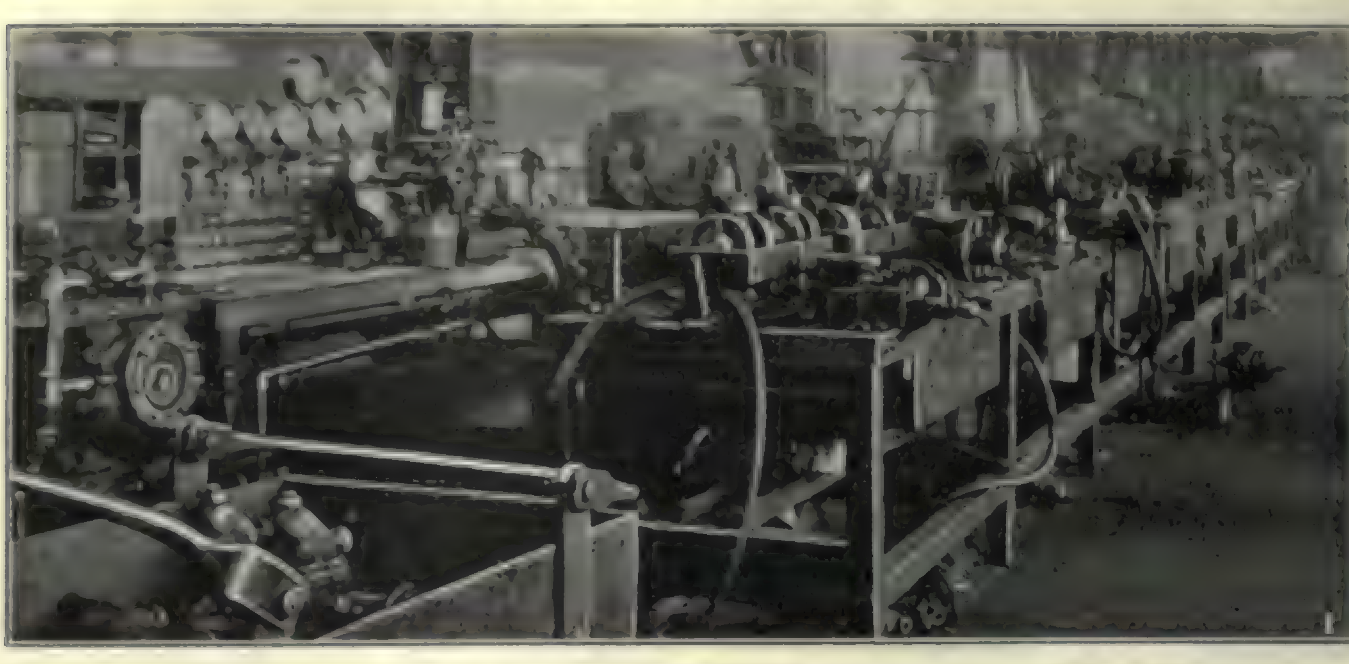
On page 848, Vol. 56 of *American Machinist*, Mr. Gregory takes exception to my suggestion that we put limits on all dimensions on drawings intended for use in the shop. He has selected, as an example, the manufacture of a single machine, and in this particular case there might be some excuse for not going to the trouble of dimensioning as suggested. Yet even for a single machine, the time spent in the drawing room in placing the proper limits on each dimension of each part of the machine might very easily be repaid in time saved in the shop.

The production of duplicate parts is utterly impossible without limits, and the tendency today in shops doing such work is certainly toward removing all chance of spoiled work due to drawings having dimensions about which there can be any question.

Interpretations of drawings will vary and one must get away from the idea of expecting the shop man to rely on his judgment as to what is a proper tolerance on a given dimension. There are mechanics who have had enough experience and have enough common sense to be able to make a piece of work from a drawing that has no limits, which will come as near to what is wanted as anyone can wish; but they are scarce.

Mr. Gregory spoke of the foreman talking things over with his assistants. I wonder if he has ever made a mental calculation of just what such talks cost. It doesn't take very long for 3 or 4 high-priced men to talk away several dollars worth of time. A full set of limits on the drawings will do away with the necessity of most of these talks. It is true that the automobile shops have a large force of inspectors to see that work is made up to certain standards. But these inspectors usually have a drawing, with limits. If the work does not conform to these limits, it is not passed.

Data as to the proper limits should be collected and be instantly available. The various handbooks contain a large amount of such information; but if it cannot be found there, then the draftman should hunt it up and put it on file for the next time. The terms "sliding fit," "press fit," "running fit," etc., can and must be translated into figures which can be put on the drawing in the form of limits. As the majority of mechanics working in our shops today have no idea what some of these terms mean, such a note on a drawing would mean nothing to them.



Air-Brake Repairs on a New England Railroad

Unusually Complete and Efficient Equipment for Handling Air Pumps, Triple Valves and other Air-Brake Parts

By FRED H. COLVIN
Editor, American Machinist

NO ONE who is at all familiar with the construction of air-brake apparatus can help but marvel at the almost universally good performance which it gives. When we consider the rather complex construction of the engineer's valve and the triple valves, and that the latter are under the cars exposed to all sorts of temperature changes as well as mechanical damage, the wonder is that they do not give trouble much more frequently than they do. And they perform in spite of rather inadequate facilities for overhaul and repairs in many places.

In the Readville shop of the New York, New Haven & Hartford Railroad much attention has been given to equipment and to facilities for handling the air-brake apparatus as it comes off the locomotives for overhauling. The foreman of the air-brake department keeps a man or two down in the shop where locomotives are stripped for repairs, whose duty it is to take care of the air-brake parts, to see that they are properly cleaned in the soda tanks and to keep the stuff all together. In this way the parts come up to the air-brake department on the second floor in condition to

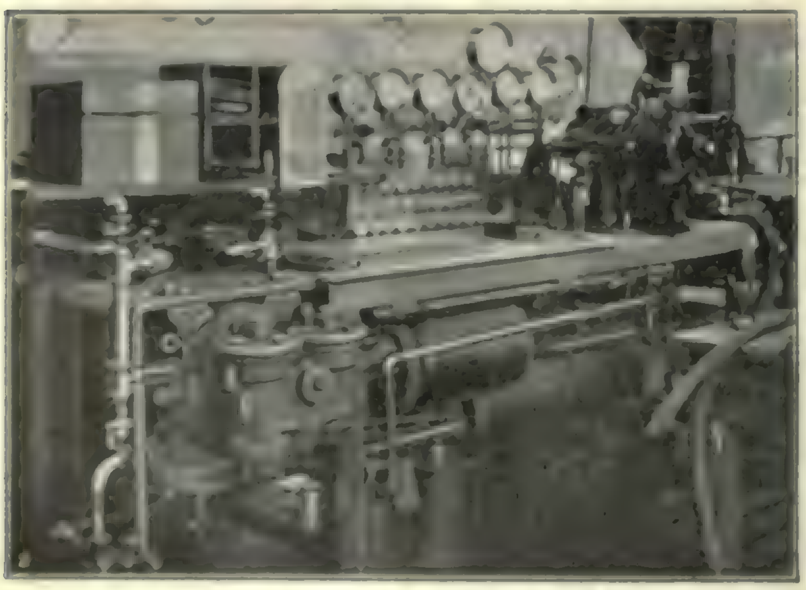
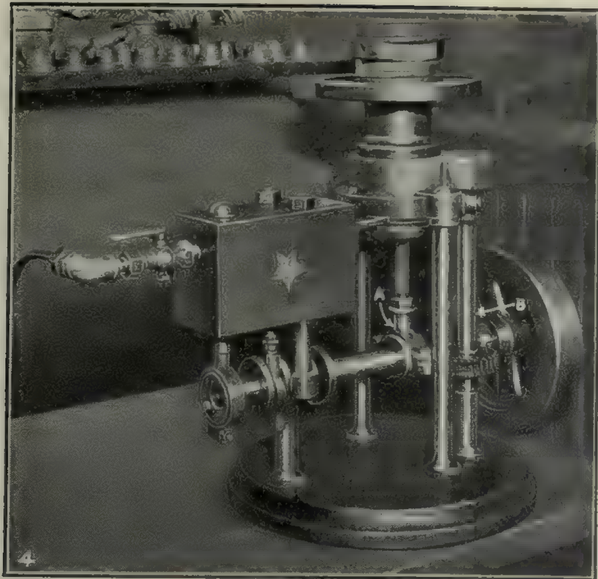


FIG. 1—THE AIR-BRAKE VALVE REPAIR BENCH. FIG. 2—EQUIPMENT OF THE TESTING BENCH.
FIG. 3—A LAPPING FIXTURE HAVING RECIPROCATING MOTION



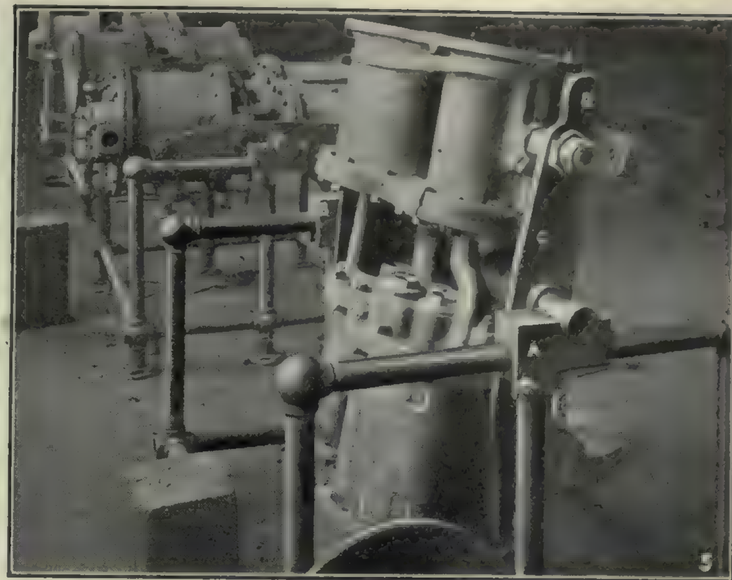


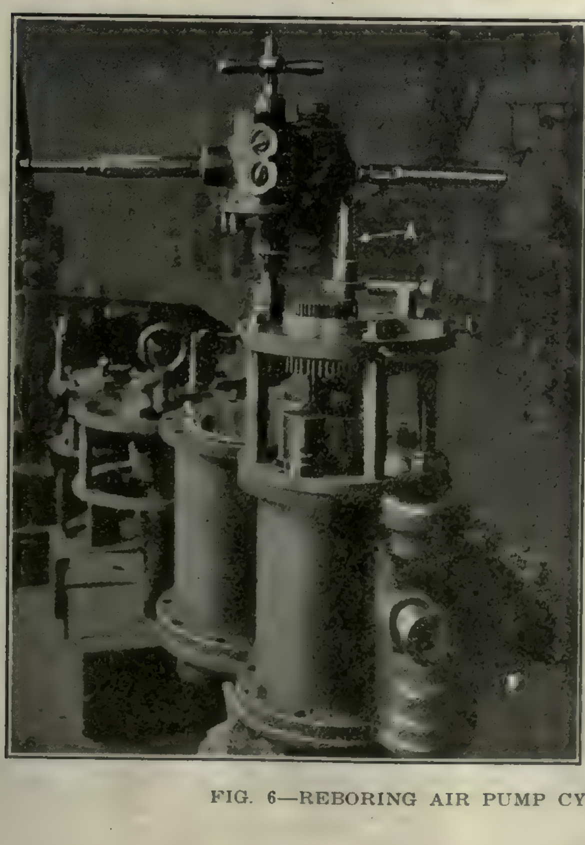
FIG. 4—LAPPING FIXTURE WITH RECIPROCATING ROTARY MOTIONS. FIG. 5—FRAME FOR THE HANDLING OF AIR PUMPS

be immediately handled by the experts who look after this work. The air-brake parts are kept together in large steel baskets or tanks which the traveling crane picks up from below, depositing them in the air-brake department without further handling.

One of these steel tanks is shown in the foreground of Fig. 1, having been just delivered. Here the various parts are sorted out and distributed to the different groups who will handle them. The long bench at the right has a small, narrow-gage track down the center carrying miniature gondola cars into which the small parts are placed. The cars can be run to any point on the bench enabling the men on either side of the bench to reach any part easily or keep it in one of the cars when it is not actually in their hands for work. The bench carries a full equipment of vises and small special devices for grinding and lapping valves and small pistons. Air hose at each place supplies air jets for cleaning small parts.

At the left is a very complete testing bench which is shown more in detail in Fig. 2. This view shows a large Pullman valve in place for testing. The bench contains all the necessary connections for testing any sort of valve belonging to air-brake installation in use on this road.

One of the special devices for lapping a brake-valve piston, and shown in Fig. 3, is provided with belt-driven reciprocating motion by which the piston is made to travel back and forth until the job is done. The valve is held against end movement by two studs, one of



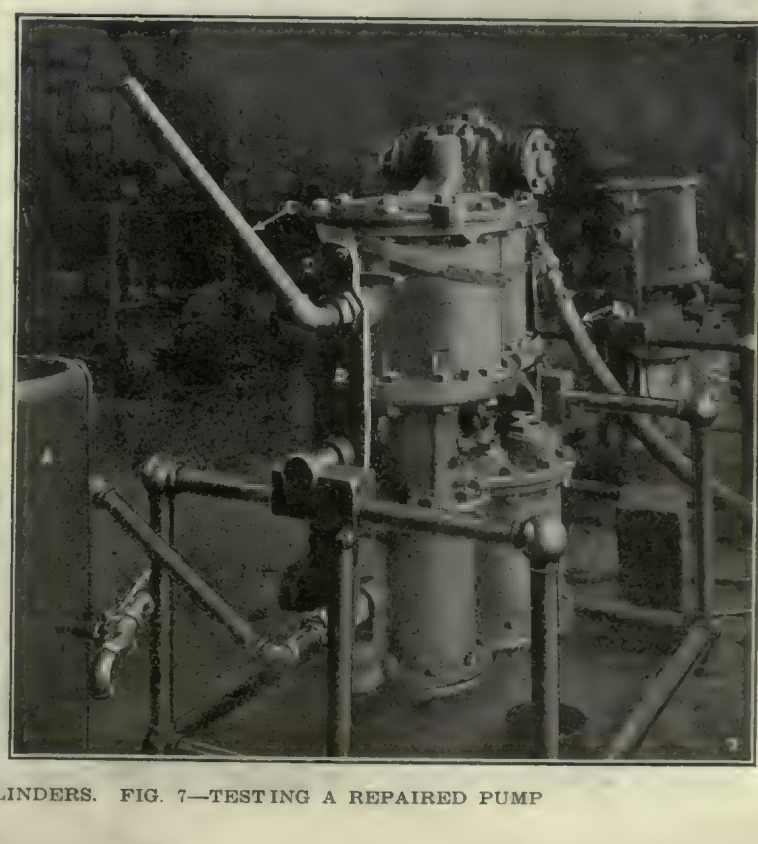


FIG. 6—REBORING AIR PUMP CYLINDERS. FIG. 7—TESTING A REPAIRED PUMP

which is shown at *A*. Instead of screwing on a nut, a taper key is dropped into a slot in each stud and tapped gently into place. This enables the work to be handled more easily and quickly than if bolts and nuts were used.

A lapping device which has both rotary and reciprocating motions is shown in Fig. 4 and consists of a small, air-driven engine with a heavy flywheel. The lap is reciprocated by the eccentric *A* and the work is rotated by gears, the pinion being attached to the upper end of the worm-driven shaft *B*.

The method of handling air pumps is of interest. First there is a frame made up of piping with trunnion or bearing blocks on each side as at *A* and *B*, Fig. 5. Side frames *C*, with trunnions at or near the center, are bolted to each side of the pumps, utilizing the inlet and exhaust openings for this purpose. The whole pump is then swung into position on the frame as shown. This arrangement allows the pump to be swung into any desired position for examination and repair. The pump can be located in a horizontal position by bringing the end of the side frame at *D* against a stop on the standard and locked by a latch on the opposite end of the side frame.

In case the cylinders are worn so badly as to need reboring they are taken off and bored by the special, portable boring machine shown in Fig. 6, which is held in place by the studs shown. The boring machine is driven by a standard air drill, either through a train of gearing or direct, by placing it on the central taper shank *A*. Direct driving is only for running the cutter head back out of the work, whether for a second cut or to remove it from the work. As shown, the cutter head is just above the end of the cylinder.

There are several sizes of these boring heads and frames so as to accommodate all sizes of pumps. They do a very satisfactory job of boring and make the pumps as good as new, so far as the bore is concerned at least.

After re-assembling, the pumps are given a thorough test as to performance and capacity. They are driven by air to avoid getting steam in the shop, but they pump directly into a pressure tank as shown at *A* in Fig. 7. The air pressure for driving the pump is delivered through the hose *B* and the exhaust is open to the shop through the pipe *C*. This view shows how the connections of the side frames are utilized for the air when it comes to testing. It also shows the latch at *D* previously referred to for locking the pump in a horizontal position in the frame. This department is very complete and we regret not being able to give proper credit for its equipment.

A Modern Method of Dip Brazing

Furnace and Materials that Produce the Best Results—Preparing and Testing the Mixture for Temperature—Instructions for Dipping the Parts

By C. A. VanDusen

DIP brazing probably first came into extensive use with the inception of the bicycle, and is now commonly employed in the motorcycle and aircraft industries. It is also employed to a great extent in the manufacture of certain automobile parts. In the writer's opinion, if the advantages of this method of building up parts from sheet steel and tubing were more commonly understood, it would be adopted to a greater extent in other industries.

In the airplane industry, fittings are manufactured very largely by being built up of sheet metal stampings which consist of a large number of various pieces of steel fastened together by either spot-welding, riveting or tack-welding with an acetylene torch. They are then brazed either by the open-fire method or by dip brazing. The tools to produce a dip brazed airplane fitting are shown in Figs. 1 and 2. The fitting itself is shown in Fig. 3. It is built up of sheet metal with the exception of part *A* which is a drop forging.

Open-fire brazing is commonly used in machine shops everywhere, and nearly all mechanics are familiar with the process. In this article, therefore, we will take up only the dip brazing methods with which the writer has had experience in the manufacture of aircraft parts, although the open-fire method is also used in the aircraft industry, for large parts and for small quantity production.

Previous to the assembly of the parts, all surfaces that are to be fastened together must be clean and free from oil or scale. The parts may then be fastened together by using one or a combination of more than one of the above methods. It is essential that they be securely fastened in order that the rapid expansion caused by immersion in the molten spelter during the brazing operation, will not loosen any of the various parts.

Before description of the dip brazing operation is given, it might be well to outline the equipment and material necessary to obtain satisfactory results. For small work, and even for fittings of considerable size, we have found that an ordinary metal melting furnace, crucible type, is very satisfactory. A furnace taking a No. 40 graphite crucible has been used by the writer with considerable success. The only difference between the two furnaces, is that the opening in the top of the furnace more closely fits the top edge of the crucible than in the regulation metal melting furnace, which must always have an opening large enough to permit the removal of the crucible when the castings are being poured.

It is always advisable to select the smallest type of crucible that will cover the range of work proposed, because it is necessary to keep the crucible almost full of spelter during the brazing operation. In using the No. 40 crucible, several hours are required to bring the metal to a molten state. It may be readily understood that if we were dip brazing very small parts, we could save a considerable amount of time each day by

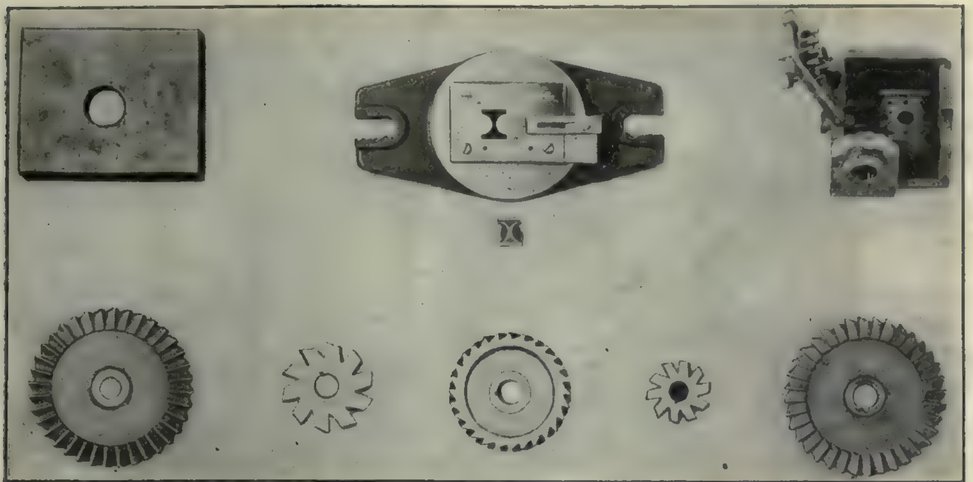


FIG. 1—TOOLS TO PRODUCE A DIP BRAZED AIRPLANE FITTING

using a smaller crucible, which would not require so long a time to reach the necessary heat.

Furnaces for dip brazing are sometimes equipped with specially shaped crucibles. However, this should be resorted to only when the shape of the pieces to be brazed are such that it is not economically possible to use the standard shapes. The special shapes are more expensive and are sometimes difficult to obtain for quick delivery or in some sudden emergency.

Previous to using, the crucibles should be seasoned from three to five months in a warm dry place such as on the top of a heat-treated furnace. It is necessary that the temperature during the seasoning process be not less than 100 deg., but it is not necessary that this temperature should be constant both day and night. The purpose of this seasoning is to expel all moisture from the walls of the crucible and thus to prevent cracks in the crucible from what a foundryman would call greenness.

The brazing spelter from which we have obtained the most satisfactory results is known to the trade as the "long grain, lump spelter" and may be obtained from any of the well-known dealers in brass or from the brass manufacturers. Almost any kind of a flux that is suitable for open-fire brazing may be used, and may be obtained as a rule from any dealer in welding and brazing materials.

If it is necessary to use zinc for the purpose of reducing the copper content in the spelter alloy (as described later), only the purest commercial zinc obtainable should be used. Under no circumstances should scrap zinc which contains foreign matter and oxide be used, as such zinc has a tendency to make the molten metal dirty and to interfere with its free flow.

Starting with a cold furnace, we should bring it up to heat slowly with the crucible filled with broken lumps of spelter. As the material melts, more material should be added with a gradually increased heat, until the crucible is filled within 2 in. of the top with the molten metal.

After the spelter has been heated in the crucible to the molten state described above, enough flux (which is in a powdered form) should be slowly poured on the molten spelter to make approximately 1 to 1½ in. of melted flux, and to cover the surface of the spelter in the crucible.

Test pieces of sheet metal approximately 1½ x 8 in. and ⅛ in. thick are dipped in the crucible to determine if the spelter is at the required heat. Inasmuch as great care must be taken not to burn the spelter, up to this point, the experienced operator always keeps the temperature of the furnace below the temperature required for brazing. Then he gradually increases the heat, until the test pieces show that he has obtained the required temperature.

The experienced operator judges the temperature of the bath by the freedom with which the spelter flows on the test pieces and also by the color of the spelter upon cooling. If the temperature of the bath is correct, the spelter will flow freely and will be of a light yellow color when cold. If by any chance the furnace should become too hot, the spelter may still flow freely and give a smooth surface, but upon cooling it will have a dark brownish yellow appearance. If this occurs, it is necessary to add more zinc until the satisfactory color is obtained. In adding the zinc, care must be taken not to get too much zinc in the alloy, as an excess amount weakens the strength of the joint.

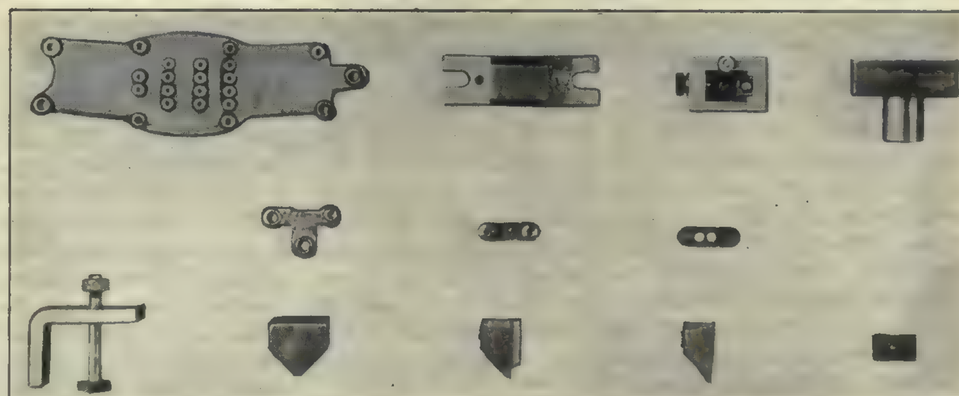


FIG. 2—TOOLS TO PRODUCE A DIP BRAZED AIRPLANE FITTING

The piece to be brazed should be hung on low carbon-steel wire hooks, should be dipped into the pot by means of an ordinary pair of tongs, and should be completely submerged in the molten spelter. The operator from time to time

FIG. 3—AIRPLANE FITTING WHICH HAS BEEN DIP BRAZED

should raise the pieces above the surface. When the temperature of the fitting and the temperature of the spelter are approximately the same, the fitting should then be taken out of the molten spelter, and should be briskly shaken to remove the excess spelter which would otherwise congeal and form heavy lumps that must be removed later.

It is difficult to set a given length of time during which fittings of various thicknesses should remain in the molten metal. For a small fitting, even though it is of the same thickness and of the same metal as a larger fitting, heats much more rapidly because it has a smaller total mass of material to absorb the heat.

It will be noted in the dip brazing operations, that when a large fitting is inserted in the bath, the temperature of the molten metal in the crucible drops almost immediately, due to the rapid absorption of the heat by the large fitting. A small piece of the same thickness, although it absorbs the heat just as rapidly, does not have a large enough mass to affect so noticeably the temperature of the molten metal.

FIG. 4—DIP BRAZING FURNACE IN OPERATION

This operation is dependent upon the experience of the operator. If the piece is left in the crucible too long, the thin projections on the piece will burn off. If it is not left long enough, the joints may not be properly brazed, although the work may look all right on the outside. If the metal has thoroughly run into the joints, it will have the appearance of having flown freely at the points where the surfaces meet, and an examination at this point, after brazing, will show the experienced inspector whether the brazing operation has been properly performed.

Surface and Color

Another point which determines the quality of the workmanship, is that a properly brazed fitting will show a smooth uniform surface of a light yellow color. A rough, pimpled, darkish yellow surface indicates that either the heat was too high or there was not enough zinc in the spelter.

It will, therefore, be seen that in dip brazing operations the experience of the operator is a primary consideration and can be obtained only by actual experiments with the various sizes and gages of fittings. However, this experience can be acquired in a comparatively short time by an intelligent operator. It is recommended, however, that for the initial experiments, unimportant or rejected fittings should be dipped, as the operator may spoil a considerable number of pieces, while securing the necessary experience.

In Fig. 4 is shown a dip brazing furnace in operation. Pieces of a variety of sizes are piled on the top of the furnace and benches to await the brazing operation. The larger pieces are only dipped at the points where they are fastened together.

Our practice is to slightly pre-heat all fittings before dipping them. We do this by laying the fittings on the top of the furnace, keeping it covered with parts as shown in Fig. 4. After each operation, a new part is placed on the top of the furnace. We group the parts in lots according to size, wherever possible, so that the operator is enabled to work faster and to obtain more uniform results.

Difficulty will perhaps be experienced in obtaining good results at first. However, if the above instructions are carefully observed a comparatively small amount of practice will bring success.

The information given in this article is the result of a number of year's experience in dip brazing, and was obtained from actual experience. No data could be secured from any of the publications except the rather vague information that dip brazing was accomplished by dipping the parts to be brazed in a pot of molten brass. This information the writer obtained from a book after a search through all the available sources of information, including the public library of one of our larger cities.

Bonus Succeeds in Packard Plant

The vice-president in charge of manufacturing at the Packard Motor Car Co., Detroit, Mich, reports that the company has instituted a departmental bonus system for rewarding effort of employees and encouraging better workmanship. Under this plan a careful time study is made of the work in a department, and a standard of production is fixed at 80 per cent of the possibilities of the department working at maximum efficiency. As this arbitrary figure is exceeded, the bonus applies upon the wage scale of the men according to the number of points by which they exceed it. When an eleven-point gain is shown, the men receive a bonus of 11 per cent figured upon the basis of their fixed salary.

Bonus applies to every man in the department from sweepers to foreman, thereby encouraging everyone to give his best efforts. In starting the system, departments were selected that had been on a piece-work basis, in some cases for 15 years. Results of the plan are said to be a reduction of overtime and more careful workmamhip.

Steel for Forge Welding

How Material and Workmanship Affect the Welding Quality—Chemical Composition and Physical Properties Required—Finishing After Welding

By FRANK N. SPELLER

Presented at the Spring Meeting, Atlanta, Ga., May 8 to 11, 1922, of the American Society of Mechanical Engineers.

THE welding quality of steel, and the strength and reliability of such welds, depend on a number of factors, which include principally: Method of manufacture, composition, susceptibility to heat, fluxing quality, the mechanical appliances for handling and controlling the work, and the skill of the operator. There are so many factors present affecting the results that it is often difficult to determine which of these predominates in any particular case. This article discusses particularly the characteristics of steel for forge welding, with a brief reference to other factors.

Method of Manufacture. Wrought iron is most easily welded, probably on account of the presence of about one and one-half per cent of easily fusible cinder, which enables the metal to be welded at a comparatively low temperature and protects it from injurious oxidation at high temperature. For this reason wrought iron can usually be welded without much difficulty, but on account of the presence of this cinder internal defects such as laminations and blisters are more likely to occur after the metal has been brought up to the welding heat than at any other time. What we term "soft welding steel" may be made by the bessemer or open hearth process and should be made especially for this purpose, *i.e.,* it should have, as far as possible, sufficient of the characteristics of wrought iron to readily form a "welding scale" at the lowest possible temperature. Very highly refined open hearth steels, "ingot iron" or electric steel, are, as a rule, lacking in this respect and so far have not shown as good welding quality as soft welding steel or wrought iron. Possibly these may be improved in this respect, but while these metals possess many advantages for other purposes, they do not at present appear to be so well adapted for forge welding.

> THE METHOD of manufacture, the chemical composition, the fluxing quality, the susceptibility to heat and the welding temperature of steel affect its welding quality.
>
> A steel gives the greatest satisfaction in forge welding when it has either a carbon content of not over 0.15 per cent and a minimum tensile strength of 47,000 lb. per square inch, or a carbon content of not over 0.20 per cent and a minimum tensile strength of 52,000 lb. per square inch.
>
> Suitable material, well trained operators and adequate facilities for the control of operations are necessary for uniformly good results.

Composition. It is well known that comparatively small quantities of nickel, chromium and silicon interfere seriously with welding. Each of these should be under 0.05 per cent. Carbon has a lesser effect and should preferably be low, certainly under 0.30 per cent for any kind of forge welding. The higher the carbon, the lower the melting and burning point of the steel. By the burning point we mean the temperature at which the grain growth has increased to such a degree as to cause actual disintegration and intergranular oxidation of the metal. Sulphur under 0.05 per cent is not harmful and under certain conditions more may be present without injurious results. Phosphorus up to bessemer limits is beneficial to welding.

Self-Fluxing Quality. On heating iron or steel above 1,500 deg. F. an oxide scale is formed. The relation between the fusibility of the oxide scale to the temperature at which the metal "burns" is one of the most important factors determining the suitability of the metal for welding. This scale consists usually of the magnetic oxide of iron (Fe_3O_4) with a certain percentage of "sonims"[1] from the iron (MnO, P_2O_5, SiO_2, etc.) which tend to make the scale more fusible. The method of manufacture and composition of the steel have much to do with the formation of a suitable welding scale. The range of temperature between the melting point of the scale and the burning point of the metal is about 100 deg. F. in good welding steel and distinguishes this class of steel probably more than any other property. In fact, it is this self-fluxing quality which makes possible the commercial welding of iron and steel. Artificial fluxes, such as borax, may be used to lower the melting point of the scale in welding small parts of high-carbon steel, but at present it is not practicable to apply this method when working on a large scale. The fusion of the scale also affords the operator a definite indication of the welding point, giving him close control over the operation.

Susceptibility of Metal to Heat. When normal wrought iron or steel is heated above the upper critical point (about 1,750 deg. F. for soft steel) the grain grows at a rate depending on the temperature and time of heating. When a certain grain size is reached, a disintegration of the metal occurs with intergranular oxidation and the metal becomes "burnt." When this occurs, the metal is red-short and cold-short and is useless for most purposes. The actual temperatures at which iron or steel is burned depends as much on the protective character and fusibility of the welding scale as anything else. High-carbon steels are more susceptible to damage of this kind in welding than the same class of steel of lower carbon. But the carbon is not the only factor, otherwise we might expect highly refined open hearth steel or "ingot iron" to weld as easily as charcoal iron.

The large granular structure caused by the exposure of the metal to the welding temperature may be reduced to a fine structure (unless the metal has been excessively overheated) by a certain amount of mechanical forging applied while the metal is cooling or by reheating the metal to about 30 deg. F. above the upper critical point, followed by cooling in the air, which with soft steel may be comparatively rapid.

Welding Temperature. To produce intercrystalline

[1]Solid non-metallic impurities in steel, H. D. Hibbard, Trans. A. I. M. E., Vol. xli, p. 803 (1910).

union of two pieces of iron it is necessary that the clean surfaces be brought into close contact with a certain pressure. This is possible even at normal temperature with application of sufficient pressure in the certain pressure. This is possible even at normal temperature slightly above the fusing point of the scale with comparatively little pressure, or at a lower temperature if the fusion point of the scale is lowered by the use of artificial fluxes, such as borax. So that the most favorable temperature for welding depends on the material and mechanical facilities. The usual temperature at which soft steel is found to weld satisfactorily ranges from 2,500 to 2,600 deg. Fahrenheit.

The skill and experience of the operator are, of course, considerable factors in all welding. However, these are offset in forge welding to some extent by the facilities given him for controlling the heat and the work.

A number of tests of forge welds (80 in all) made on two rings cut from the ends of hammer-welded pipe about ½ in. thick, compared with the original material taken from the same pipe, 90 deg. from the weld, gave results which are summarized as follows:

Material away from weld—Average transverse tensile test	
Elastic limit, lb. per sq.in.	32,150
Ultimate strength, lb. per sq.in.	52,790
Elongation in 8 in., per cent	29.7
Reduction, per cent	58.6
Efficiency of Weld—Test pieces machined to uniform thickness	
Average of all tests (80 tests), per cent	92.7
Average at extreme end (40 tests), per cent	90.3
Average 2 in. or more away from end (40 tests), per cent	95.0
Minimum at extreme end, per cent	69.0
Minimum 2 in. or more away from end, per cent	82.3

The above steel before welding ranged in tensile strength from about 47,000 to 62,000 lb. per square inch—most of it being under 57,000 lb. and under 0.16 per cent carbon.

Steel Specifications

This brings us to the question of specifications for steel best suited for forge welding. While skillful operators can undoubtedly make a good job of most steels when the carbon does not exceed that of flange quality, it seems desirable, everything considered, to limit the carbon to about 0.15 per cent for important parts where life and valuable property are at stake and a high efficiency of strength of weld is desired.

The present A.S.T.M. specification (A78-21-T) for forge-welding steel calls for steel of not over 0.18 per cent carbon having a minimum tensile strength of 50,000 lb. per square inch. A.S.T.M. Sub-Committee II of Committee A-1 now has under consideration substituting for this two grades of steel having the chemical and physical properties shown in the accompanying table.

Steels of both grades have been forge-welded and used in large quantities with an assumed weld efficiency of 90 per cent. The tests we have made indicate that this figure is warranted for pipe lines, penstocks, tank-car work and similar construction. A somewhat lower efficiency or higher factor of safety should, of course, be used for boilers and class A unfired pressure vessels.

With respect to steel for forge welding, part I, section I, paragraph 186 of the boiler code requires that:

The ultimate strength of a joint which has been properly welded by the forging process, shall be taken as 28,500 lb. per square inch, with steel plates having a range in tensile strength of 47,000 to 55,000 lb. per square inch. Autogenous welding may be used in boilers in cases where the strain is carried by other construction which conforms to the requirements of the code and where the safety of the structure is not dependent upon the strength of the weld.

Section III, paragraph L-29 reads:

The ultimate strength of a joint which has been properly welded by the forging process, shall be taken as 28,500 lb. per square inch, with steel plates having a range in tensile strength of 45,000 to 55,000 lb. per square inch. Autogenous welding may be used in boilers in cases where the strain is carried by other construction which conforms to the requirements of the code and where the safety of the structure is not dependent upon the strength of the weld.

Unfired Pressure Vessels

The proposed section on unfired pressure vessels with reference to forge weldings, paragraphs 5 and 8, reads:

The ultimate strength of a joint which has been properly welded by the forge process shall be taken as 65 per cent of the tensile strength of the plate.

This weld efficiency seems rather low for class A vessels and we believe that it should be still higher for class B vessels.

In paragraphs 2 and 3 of sections I and III, firebox and flange steels are specified *for all parts* of the boiler. There seems to be a conflict in these specifications between the requirements for steel which may be forge-welded, although apparently the intention is to use a steel of lower carbon for this purpose. This would seem to be in line with the best experience, but inasmuch as flange steel has apparently been successfully used for some time in forge-welded boiler construction where part of the stress is carried by riveted straps, there would seem to be no reason for not continuing this practice when the weld is so reinforced.

After the weld has been made, internal strains remain in the metal which should be released by annealing. This may be done by heating the piece uniformly to a red heat (about 1,500 deg. F.) and allowing it to cool in the air. Any objectionable amount of distortion which has occurred in the welding operation should be removed, preferably while the piece is at an annealing heat. Otherwise it should be reformed and then annealed. Nothing has been said as to the method of welding, scarfing, preparation of the plate, or fuel to be used, as these vary considerably and good results have been obtained with widely different methods of working. Some operators prefer one form of scarfing, others none at all. Some use roller welding machines, but the majority use power hammers. Good welding has been done with coke fire, producer gas, natural gas and water gas, the last being best adapted for forge-welding on a large scale.

To produce uniformly a high weld efficiency, the most important considerations are: Suitable material, well-trained operators, and adequate facilities for control of the work.

COMPOSITION AND PROPERTIES OF TWO GRADES OF STEEL

	Grade A	Grade B
Chemical Composition		
Carbon, per cent[1]	not over 0.15	not over 0.20
Manganese, per cent	0.35 to 0.60	0.35 to 0.60
Phosphorus, per cent	0.04	0.04
Sulphur, per cent	0.05	0.05
Physical Tests		
Tensile strength, lb. per sq.in.	not under 47,000	not under 52,000
Yield point, lb. per sq.in.	not under 25,000	0.5 tensile strength
Elongation in 8 in., per cent	not under 26	not under 24

[1] For plates over ¾ in. thick, 0.02 additional carbon is permissible

What Do We Mean by Service?

Webster's Definitions—Suggestions About Standardizing Service—Paying for Demonstrations, Estimates, Quotations—The Cost of Keeping the Customer Sold

By J. K. JONES

THE word "service" is one of the most abused and perverted terms in machine tool and other languages. There are as many interpretations of this term as there are firms in business, each one of which believes that its code is the only correct one.

The writer has studied the matter from various angles and this article is written, not for the sake of argument or with intent to force his views upon others, but merely to present a few facts for consideration.

Webster's definitions supply food for thought in the first place:

(a) "The act of serving or the performing of labor for the benefit of another or at another's command."

This definition is the liberal interpretation and implies willing and cheerful compliance with the customer's wishes in every particular, the substitution of "the customer is always right" for *"ceveat emptor"*—(let the buyer beware). The *benefit* accures to *another*, thus eliminating the thought of profit or gain, and the "labor performed" can be demanded not for value received but as a *right*.

(b) "Attendance of an inferior."

How many large firms today can say that they have never assumed this attitude toward the little fellow in business? Special discounts, cut prices, extra values, are all extended because the small concern wants to get the big business. This is one of the perverted forms of service.

(c) "The deed of one who serves" or "Duty done or required."

Here we find the dignified form that insists on a job well done, using the best of materials and workmanship and honest prices, the same to everyone, allowing a fair return on the investment.

(d) "An office of devotion."

Strange though it may seem there are some businesses that look to the other fellow as a sort of hang dog, supposed to exist merely to supply their needs and gratify their desires. When he goes under because of the demands made upon him, it is merely an incident, poor management, and is simply irritating because another source of supply must be located.

(e) "Duty performed in, or appropriate to an office or charge."

Capital invested in manufacturing represents a *charge* for which the management is responsible to the community. If judiciously used to create wealth or increase the world's store of goods, the duty is efficiently *performed* and constitutes a very definite form of service.

(f) "Useful office—advantage conferred—that which promotes interest or happiness—benefit."

The commoner expression and forms of service are represented in these definitions. Most of the popular and mistaken ideas have arisen from a misconception of the second and last terms. However, it should be noted and remembered that those two items are tempered by the other two with their specific statements. There is no mention made in regard to whose *benefit* the service will accrue, and on the other hand there is no statement as to whether the "advantage conferred" shall be paid for or rendered without money or without price. The popular idea of service seems to be "an *advantage conferred* to the *gain* of the customer and to the *loss* of the merchant or manufacturer." That this view is correct is unsupported by any facts or definitions.

(g) "Act or means of supplying some general demand."

Here is a definition that fits every sales effort and gives the manufacturer an excuse for being. The demand may not be *known*, as is often the case, but whether it exists or is created, the "act or means of supplying" is a form of service that is universally accepted and practiced.

(h) "Scrimmage or engagement."

While not exactly pertaining to the subject in hand, nevertheless this last definition carries a moral suggestion that cannot be ignored. Much of the bad blood spilled in the business world has been shed in obtaining, giving or interpreting service. If more attention was paid to courtesy and promptness, and service, when rendered or asked for, were filled with the spirit of helpfulness, co-operation and willingness, the scrimmage or engagement definition could be safely wiped out of the machine tool dictionary.

An Outline

To attempt to lay out or standardize the forms of service is a hard task on account of all the factors that enter into this great pertinent element of the machine tool industry. Just a simple division of the service and of the machine tool business is suggested here. It is not complete but can be used as a basis for discussion. Many of these items are commonly listed under other headings, but after all they are parts of the service that is rendered.

Before the Sale.—Calls, demonstrations, estimates, quotations, engineering.

After the Sale.—Operation, repairs, new parts, complaints.

General.—Information, catalogs, circulars, photographs.

Before the Sale (The Salesman)

The call of the salesman in response to an inquiry should be called service. He comes as a specialist, not to sell you something that you do not need, but to help you fill a need or to show you where there is a need. His is therefore "a useful office," an "advantage conferred" and may prove a "benefit." He is there as a "means of supplying a demand," or if you please, creating a demand which he can supply. When you draw on his fund of information, you are utilizing the service of the firm he represents. The expense is legitimately borne by the manufacturer and charged to general sales

expense. Of course you pay for this service, as it is included in the selling price. If you do not buy, some one else pays for it. On the other hand, the service rendered is represented in the capital investment, in the fact that the manufacturer has gathered the materials and combined them with good designs and workmanship to give you ready made the tool you need.

Demonstrations

Most firms do not ask you to take their word for the possibilities of their machines. They want to help you pick out the most efficient machine for your job. If your experience is broad enough to say that this or that machine is the right one, you are fortunate. If you hesitate, there is the demonstration, "the performing of labor for the benefit of another or at another's command." You are thus enabled to pick out the best in the market. If you purchase, the charge of demonstrating should be included in the selling price. If not, there should be a *service* charge. Why should others pay the charges for proving that a certain machine is not suited for your work when you were not sure yourself? Of course this is radical, yet is it not simple justice?

A certain firm had several thousand pieces ground for a complete demonstration and decided not to purchase. Why? Because it had a year's supply of parts all nicely finished. Who paid the bills? The incident tells of an isolated case of the liberal interpretation.

Even the simple forms necessary in making estimates and quotations are a distinct service. How else could you determine the selling price of your product or select your machine? "An advantage conferred"—"a benefit." The involved estimate, proposal or quotation goes one step further, as it necessitates the personal attention of engineers, executives, sales and estimating departments.

What has just been said of the involved estimates is particularly true in a large machine tool plant building machines, tools and gages. Suppose you send along a part or blueprint and want a layout of the necessary tools, fixtures, gages and machines necessary for manufacture. Every form of service is involved and why object to a service charge? Perhaps 300 hours are involved; their cost cannot be spread over the sales. When completed your proposal gives you a basis upon which to select your entire equipment. You were not sure of the right way yourself or had no force to handle it, so you sent it on to a firm that you knew had done similar work. There has been considerable thought given to this form of *service* yet there is no standard to go by. Some firms will do such work regardless of the outcome while others refuse unless there is a certainty of obtaining a fixed charge in case the order goes elsewhere.

A large power house equipment concern in New York has a separate branch under a different name, to which all inquiries requiring engineering work are referred. The second firm does the layout work at cost for the customer and just about breaks even, on expense.

"Keeping the customer sold" is the popular method of expressing service, or "that which promotes interest or happiness," and the first problem is seeing that the operation of the machine is clearly understood and appreciated and the directions followed. There is considerable abuse along this line. Consider the tons of literature that have been sent out during the past year to enable purchasers of war machines to get their "white elephants" in operation. Responses to inquiries took many hours of valuable time for which there was no remuneration. "Please send me instructions on how to tool up your turret lathe to cut the enclosed part." "How do you cut left-hand threads on your lathe?" "We have been assigned a machine which we think is called a profiler; how is it used and for what purpose?" "Where are the change gears for the milling machine we purchased from the Blank Co.?" "We were told we could get 25 pieces an hour on your machine, and as we are getting only 15; please send a demonstrator. Such inquiries run on *ad infinitum*.

> SERVICE DOES not mean the giving of something for nothing, the conferring of advantages that no one else can give, the special price inducement or the wasting of time, effort and money in satisfying requests or demands that have no real reason for being. Service is the duty well done, the claim, honestly, willingly and promptly adjusted, the information gladly given, the product well made with honest materials and workmanship, the price that yields a reasonable return on the investment.

The work involved in supplying the wants indicated by the questions quoted is what is popularly called service. So is answering the calls from second-hand dealers for literature to enable them to intelligently offer their stock of used machines. Where do you draw the line? You don't draw it, because you want to save your reputation for fair dealing and promote good will.

Every new machine for a specific purpose should be thoroughly tried out and demonstrated in the plant before it goes out to the customer, and there the responsibility of the manufacturer should end. If it is necessary to train an operator, he should be sent to the manufacturer's plant for instruction, unless the customer is willing to pay for a trainer. The machine will do what you promise under an efficient operator, your instructions are specific, and the production is up to the operator. The machine has a definite potential output regardless of the human element. A poor operator may hamper this output. Who is responsible?

How far shall we go in promoting "interest and happiness," that is service?

Repairs

Are people always fair in assuming that responsibility for a damaged machine belongs to the manufacturer? Does service include remodeling a machine that has failed in service? Many a part comes back tagged with the remarks such as "shows poor hardening." The customer is not always right, yet we replace the part from a mistaken idea of "duty performed in or appropriate to an office or charge." We thus admit the allegation rather than enter the "scrimmage or engagement" stage. I believe there should be a firm policy of saying definitely "we, or you, are in the wrong" and making the adjustment accordingly.

A certain firm wrote for and obtained a layout for tools and a recommendation for a certain type of machine. A used machine of that type was offered them

and they wrote the manufacturer asking him to inspect the used machine and tell them whether or not it would answer the purpose. They were indignant at the thought of a service charge for this work. Again an isolated case but in principle very similar to many others.

New Parts

The matter of supplying new parts may be considered to be part of the "act or means of supplying some general demand" or "duty performed in or appropriate to an office or charge," therefore a service. When a manufacturer has a large diversified line, the item of new parts often causes considerable trouble. It is mighty hard to keep spare parts on hand for all machines, and when a breakdown occurs customers cannot understand the delay in furnishing parts. It is also difficult to understand the higher prices which must be charged when parts have to be made up separately instead of in lots. The only solution to the problem seems to be the establishment of a parts department separated from the regular production, and carrying its own overhead. There would be a tendency toward reduced costs and quicker deliveries.

The "after the war" machines presented a new parts problem. Machines had been overloaded, breakage was high, and used tools were generally sold minus large parts of their equipment, necessitating replacements. Customers expected immediate delivery on parts. When that was impossible it was hard to explain satisfactorily. This end of the service problem is now in much better shape than before, the rough spots have been smoothed over and better relations exist.

Complaints

"The deeds of one who serves or duty done or required." Diplomacy and tact will alleviate the strains of satisfying the demands and requests that come under this heading. There should be some definite policy adopted to suit the conditions common to the particular business. The policy should be elastic enough in its application so that it can be adapted to suit peculiar conditions. Breakages should be carefully examined from all angles, the responsibility fixed and the adjustment made without quibbling, no matter which way the fault lies. Where you are sure the customer is right there is no question as to a prompt settlement. When the shoe is on the other foot there is no need of knuckling under and losing your self respect. Straightforwardness never lost a good customer.

A machine in a certain plant was found to be magnetized. Electrical experts were consulted and a suggested scheme worked out for demagnetization. The machine was demagnetized, but on starting up again it became magnetized once more, proving conclusively that the fault lay in the customer's plant. "Duty was done," there was no more necessity for service, but still other plans and schemes were suggested, and it is assumed that one of them has had a good result. Replacement of the machine would have had no effect.

Information, Catalogs, Photographs, Visitors

The forms of service included under information, catalogs, circulars, photographs and visitors generally come under the head of publicity and refer to those items which cannot properly be classified under the headings "Before the Sale" and "After the Sale." Of course it is assumed that goodwill is created and potential buyers are influenced, yet it sometimes takes a far stretch of the imagination to believe that benefits will ever accrue from some of the requests which come in. Attention has been frequently and thoroughly called to the catalog evil. Free lance technical writers still flood us with requests for "complete data" from which to build up articles and nine times out of ten they never even acknowledge the courtesy when the information is given.

To sum up, it is believed that service does not mean the giving of something for nothing, the conferring of advantages that no one else can give, the special price inducement or the wasting of time, effort and money in satisfying requests or demands that have no real reason for being. Service is the duty well done, the claim, honestly, willingly and promptly adjusted, the information gladly given, the product well made with honest materials and workmanship, the price that yields a reasonable return on the investment, the well informed salesman, the complete "careful attention to detail" proposal or quotation, and the efficient discharge of the obligation that is owed by the management to the country, the community, the customer, the employee and the stockholder.

The policy may vary, but the fundamental rule is still as laid down by the teacher of old, "Do unto others as ye would that they should do to you." Standards must be continually checked up to see that they align with the ideals which should lie behind every industry. Success is assured in good times or bad by the careful attention to detail and development.

Vacations Without Loss of Time

By B. B. Quillen
President, Cincinnati Planer Co.

It is customary in most business concerns to give the executives and the office employees a vacation each year, but it is always a difficult problem to give vacations to the workmen in the shop. First, for the reason that there is such a large number of them, and second, that it is necessary to keep the men on the job to get the necessary production.

We have hit upon an idea that will enable us to give our shop employees a vacation of four days at different periods of the year, without any loss of time.

Our first experiment was for the Fourth of July period, when we closed down on Friday evening, June 30, and remained closed until Wednesday of the following week, July 5. We anticipated this vacation period by working a few minutes extra every day for several weeks, to make up the lost time, and our people certainly did appreciate the opportunity of getting away for four full days.

We propose to repeat this schedule for Labor Day, closing down Thursday evening, Aug. 31, and opening up again on the morning of Sept. 5, giving them another four day vacation, without any loss of time.

This same idea can be put into effect for Thanksgiving and for the Christmas holidays, or any other period of the year, so that the men have ample opportunity to make trips out of town with their families, and have a real vacation three or four times a year without any loss of pay.

The Third Party in Industrial Disputes

Public the Paramount Party—When the Government May Step in—All Strikes Should be Settled Without Stopping Production

By WALTER J. MATHERLY

IN ALL industrial disputes there are three factors. These three factors are the employers, the employees and the public. While the employers and employees are the immediate parties involved, the public as a third party is no less involved. A strike called, carried on and settled in the midst of difficulty and turmoil with the idea of benefiting labor only is a violation of public rights. So also is it a violation of public rights to unnecessarily delay a strike settlement or prolong stubbornly an industrial tie-up with the idea of benefiting capital only. Capital is not the paramount party in industrial disputes; neither is labor. The paramount party is the public or the ultimate consumers of the products turned out by capital and labor. To take any other view of the matter is to disregard common interest.

In support of this position, a writer, representing one of the largest financial institutions in New York City, recently said: "When individual rights or the interests of groups come in conflict, the government, representing the entire body of people, has a right to determine and enforce policies that in its judgment will best serve the interests of society as a whole. This is not capitalistic doctrine; it is the essence of democracy. The capitalists are few, and the class best able to take care of themselves in an emergency. The principle that the government has the right to safeguard the common interests and maintain policies that are essential to social progress is fundamental; it is paramount in all disputes, because it is more important to everybody than any dispute over his own wages or his own property rights possibly can be. It is the principle upon which orderly society is based."

What Are the Workers' Rights?

That the workers have their rights is self-evident. As long as they can secure wage increases or prevent wage reductions without going contrary to public interests or interfering with the rights of private property, there are no valid objections to their doing so. Most people admit that they are entitled to adequate means of subsistence. They are perfectly justified in lawfully striving to raise their standards of living or in lawfully striving to restrain movements battering down their standards of living. There is essentially no reason why they should not be allowed some voice in the determination of the conditions under which they work. They have a right to be treated, not as machines and beasts of burden, but as human beings. If they choose freely to bargain individually, no trade union has a right to interfere. On the other hand, if they choose freely and without the dictation of outside agitators and trade-union organizers to bargain collectively, no employer has a right to interfere.

While labor has its rights, yet, if in the exercise of such rights, the public or the third party is ignored and thereby placed at a disadvantage, the rights of the lesser must give way to the rights of the greater. The public is superior to any one class. No part is larger than the whole. The members of the social organism cannot war against each other and yet work for the advancement of that organism. No minority must be allowed to tyrannize over the majority. "The interests of the many cannot be subordinated to the interests of the few, no matter whether the few are rich, or powerful for some other reason." The greatest good to the greatest numbers must be the standard of action. When larger or smaller groups in comparison with the total population act otherwise, government restraint exercised in favor of the whole people is imperative.

Employers' Rights

Like the employees, the employers have their rights. This no one will attempt to controvert. The employers are entitled to the protection of their property, to contract freely, to be secure in the prosecution of their particular businesses and to deal with labor as they think best. But they are not entitled to stamp out trade-union activities, regardless of the public welfare and violate with impunity the rights of the third party. They are not justified in doing what they please with that which they choose to call their own business and absolutely leave out of account the consumers of their goods. As Floyd W. Parsons in his recent book on "American Business Methods" points out, "the public be damned" policy as well as "the labor be damned" policy has been discarded forever in the operation of American business enterprises. Manufacturers and business men in general who do not recognize this and make the public interest the guiding principle in all their business relations are out of harmony with the times and are coming to be looked upon as public enemies.

In the bituminous and anthracite coal mining industries, there are about 800,000 persons according to the Geological Survey. Something like about 2 per cent of these are operators and officials, and the remainder are workers, clerks and other salaried individuals. Without in any way trying to fix the responsibility for the coal strike either on the few who operate the mines or the many who dig the coal, it is highly significant that here are about 800,000 people crippling the nation's productivity and trespassing more or less upon the rights of 105,000,000 people. What is the conclusion? The conclusion is that the welfare of the 105,000,000 comes first. The 800,000 must give in and the threatened coal famine must be averted. In other words, the minority must be compelled by the government, if necessary, to comply with the wish of the majority.

It has long been recognized that the public has an interest in public service corporations. The fact that public utilities have long been subjected to government regulation proves this. The courts ever since the famous case of Munn vs. Illinois have universally held that certain industries are clothed with a public interest and must be operated in conformity with the public good. In the presence of a coal strike nation-wide in character, it might be profitable to raise the question as to where the line of demarcation lies between public-service industries and private industries.

After all, what is a public utility? Shall the question of monopoly decide the issue? Or shall some other test be used? Is not the coal industry in a certain sense a public utility? Are not coal mines clothed with a public interest? Certainly this industry is closely tied up with the public welfare. Mine operators and workers in settling their disputes must not be permitted to disrupt the activities of the entire nation. Unquestionably, national welfare comes before the welfare of particular industries. Doubly true is this where the industry furnishes a national necessity such as coal.

In the railway industry, there are 400,000 shopmen out on a strike. These striking shopmen as well as the striking miners seem to think that personal rights are superior to public rights. As a current writer expresses it "utterances of some of the leaders among both miners and railroad men have indicated a belief that they have only to tie up the mines and the railroads and wait for a flag of truce from the owners. They expect the industries to gradually shut down, the millions of wage-earners to be thrown out of employment, the transportation of food products to cease, and the population *en masse* to be brought to the verge of starvation, and to actually starve unless the employers give way. Their every utterance indicates that there is no possible relief except from employers."

Policy of Government Interference

"This policy," continues the above writer, "if it is a real policy, is based upon the assumption that the government is either impotent or afraid to take action in such an emergency as they hope to create. The assumption, however, is certain to be disappointed if such a situation ever arises. It is inconceivable that any government, however, composed, would fail to take action under such conditions, and a government that has been maintaining a great organization to feed the starving people of Russia is not likely to allow its own people to starve or freeze. It probably will occasion surprise in some quarters to learn what unanimity there will be on this subject if the issue ever shall be actually joined. The unanimity will not be in behalf of the rights of owners or employers, but in behalf of the rights of the whole body of the people."

Of course, this doctrine of government interference in business is more or less a departure from the individualistic philosophy of the past. In the past, the policy adhered to was *laissez-faire*. Any one who advocated government interference was on the wrong trail. Enlightened self-interest was the basis of all economic motives. If each individual acted for his own best interest, individuals in the aggregate would thereby act for the best interests of all. The third party in so far as industrial matters were concerned received little or no attention. But such philosophy has been outgrown with the coming of large-scale production and the widening of the gap between capital and labor; and on account of these changes, it has become more and more necessary to protect the public and safeguard public rights. All the more is there need for such protection in the face of great national strikes such as the coal and railway strikes which threaten the nation's stability and presage injury to the nation's population.

The acceptance of such philosophy becomes imperative when industrial disputes result or are likely to result in lawlessness and disorder. The government cannot long endure as long as it ignores such outbreaks as recently occurred in Illinois. Regardless of who is to blame for the unfortunate affair in the Illinois coal-mining districts, it is necessary to point out that what happened was not strictly a local matter, but rather involved the general welfare of the State of Illinois and the nation in general. The people there may say through the Associated Press: "This is our business. Sorry, but it is done. Let us alone. We will handle this all right. We're good people to get along with—good as anybody if you mind your own business. We will attend to ours." But is it their business? Do they have a right to defy state and national laws? Are the coal mines in which they work absolutely devoid of all public interest? Such questions must be answered in the negative. As the *Monthly Bulletin* of the National City Bank of New York City points out "The coal mines which they claim the right to control could not be operated without an outside market; the coal could not be moved without the railroads supplied by outside capital, and the population could not obtain the comforts of life to which they are accustomed, if it was not a part of the great industrial system which links all localities and occupations together, and which is dependent at last upon government and the guaranty of law and order."

Strength of Public Opinion

In spite of the terrible outbreak in Illinois, both employers and employees in a measure recognize the rights of the third party in industrial disputes. At the very beginning of their difficulties, each tries to curry public favor. Each attempts to place the responsibility for the strike upon the other. Both often resort to misstatement and exaggeration in order to make out their case. They make charges and counter charges. Sometimes, it seems to the outsider that they care little whether the public gets the real issues or not. Their efforts are directed toward securing the backing of public opinion, regardless more or less of the methods used in arriving at that objective. They know full well that the side which gets the support of public sentiment wins. That is what they want. Their purpose is victory, not necessarily public welfare; and they utilize public opinion as a tool in order to procure a favorable decision, be it right or wrong.

While both employers and employees recognize in a way the rights of the public, in that they know that public opinion turns the tide for or against them, yet they must be shown that what the public is interested in is more than that. They must be shown that the public is interested in justice, square dealings and efficient service, and under no circumstances are any of these things to be sacrificed in order to give advantage to labor over capital or capital over labor.

Finally, there is one outstanding thing that the third party demands, and that is that whatever the differences between capital and labor, such differences must be adjusted without the cessation of work. While no one would deny the employers and the employees the right to drive the best bargain possible, nevertheless the workers must not strike nor the employers resort to a lockout in effecting that bargain. What the consuming public wants and is entitled to have is continuous production, not strikes and lockouts. If any wrangles arise over wages, hours or working conditions, and such will naturally arise from time to time, all of them must be settled without closing down mines and factories, curtailing production and disrupting the industrial system in general. The supreme consideration in all industrial disputes, is not the welfare of the few, but rather the welfare of all.

The Importance of Screw Thread Fits in Assembling

By H. G. Schwoeppe

Among the causes for lost time in the assembling department, one of the most common and by far the most discouraging to the man who aims to do a real day's work for a fair day's pay (and one which the inspection department finds it hard to guard against) is the oversize screw or stud that gets stuck part way home and refuses to budge either way. Nor is it always so much the oversize screw or stud as the undersized or partly tapped hole. The extra work and useless delay thus caused is largely avoidable and strongly emphasizes the importance of holding both studs and taps to close working limits.

Unless all holes are retapped by hand before assembling, undersized holes are not easily noticed; and if found when the assembly is well under way, are often hard to correct. Using drills that are too small, in order to get as full a thread as possible, partly tapping blind holes or using taps that are worn under size, have lost their thread form, or are long or short in the lead, cause most of this trouble.

Holes that are too small make tapping more costly and require more power and time, increase wear and breakage of taps, and often necessitate plugging, welding, re-drilling and tapping. Detail blueprints do not as a rule give the size of tap drills, it being assumed in quantity production shops that the jigs used are fitted with the proper size bushings. In other shops or on such work where no jigs are provided it is assumed that the drilling machine operator ought to have and use a chart or handbook containing this information. Also that he will use his judgment concerning the hardness and toughness of the metal, the depth of the hole and other conditions that affect the process of tapping. But unless the man or the department that does this drilling is required to do the tapping, which is usually not the case, things are apt to drag along with little and at best only temporary and periodic improvement. Unless it is the particular business of some one to watch for and eliminate increases in operating expenses the responsible management rarely becomes aware of the causes, or has sufficient information at hand to improve the situation.

In a certain shop a group of holes in a cast-iron crank case were drilled in one operation on a multiple spindle machine. The bushing provided for one of the holes was too small to allow the use of the proper size drill for commercial tapping on a machine. To permit machine tapping, this particular hole was later drilled in a separate operation and charged to "repairing." As this "repairing" was reported regularly, the cost department investigated and found that the foreman supervising the operation had chosen the least of the evils he expected to encounter in the "red tape" required to make a change in the size of the hole in the bushing.

In this shop the jigs and tools are designed by the tool design department, built and tried out by the tool manufacturing department and O.K.'d by the inspection department. It is quite possible to try out a cleverly designed and carefully built jig under favorable circumstances and pass it for service, only to have it fall down under the acid test of production, for when piece work or other cost-reducing systems furnish the incentive or when later operations under similar inducements depend on the preceding operation, no nursing is possible. It is a decidedly good rule that prevents tampering with, changing or adjusting jigs and gages in the shop by the rank and file of the operating departments.

If the product is held uniform by close inspection, if costs are zealously audited and investigations are thoroughly conducted "murder will out," and indirect, yet appreciable loss will be located so that it can be avoided or minimized in the future.

To further standardize the product, it was decided to purchase all taps to the specified limits of plus or minus 0.001 in. in pitch diameter, to discard them when they reached the low limit and to specify the pitch diameter of all studs and screws on the detail blueprints. Exhaustive and thorough tests were made with taps of different makes on the various metals used in regular production, which resulted in the elimination of the one-drill size for all metals and the use, instead, of the accompanying data, insuring universally good threads of sufficient strength, easily produced at minimum cost.

		Drill Sizes for			
Diam. of Tap	Threads per Inch	Aluminum	Cast Iron	W. I. and Steel	Bronze and Brass
No. 8	32	No. 28	No. 27	No. 26	No. 27
No. 10	24	No. 23	No. 21	No. 20	No. 22
No. 14	20	No. 11	No. 10	No. 9	No. 10
Inches					
1/4	28	No. 6	No. 5	No. 3	No. 6
1/4	20	No. [illegible]	No. 7	No. 6	No. 7
		Inches	Inches		Inches
5/16	24	17/64	17/64	J	17/64
5/16	18	1/4	1/4	F	1/4
3/8	24	21/64	21/64	R	21/64
3/8	16	5/16	5/16	O	5/16
				Inches	
7/16	20	3/8	3/8	25/64	3/8
7/16	14	23/64	23/64	U	23/64
1/2	20	7/16	7/16	29/64	7/16
1/2	13	27/64	27/64	27/64	27/64
9/16	18	31/64	1/2	33/64	1/2
9/16	12	15/32	15/32	31/64	15/32
5/8	18	35/64	9/16	37/64	9/16
5/8	11	17/32	17/32	35/64	17/32
11/16	16	5/8	5/8	41/64	5/8
3/4	16	43/64	11/16	45/64	43/64
3/4	10	5/8	41/64	21/32	5/8
7/8	14	13/16	13/16	53/64	13/16
7/8	9	3/4	49/64	25/32	49/64
1	14	59/64	15/16	61/64	15/16
1	8	27/32	7/8	57/64	7/8

As a large quantity of studs was used and most of them were driven home by air drivers, limits of actual pitch diameter plus or minus 0.001 in. were specified for the nut- or "loose" ends. The pitch diameters for the tight ends were:

For aluminum, actual pitch diameter plus 0.004 in. to 0.006 in.

For cast iron, actual pitch diameter plus 0.002 in. to 0.004 in.

For steel, actual pitch diameter plus 0.001 in. to 0.003 in.

For brass and bronze, actual pitch diameter plus 0.003 in. to 0.005 in.

Except for a few isolated accidents, the scheme worked smoothly, tapping and assembling were speeded up, gave less trouble and the results justified the expense of the experiments and additional cost of taps, studs and screws.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

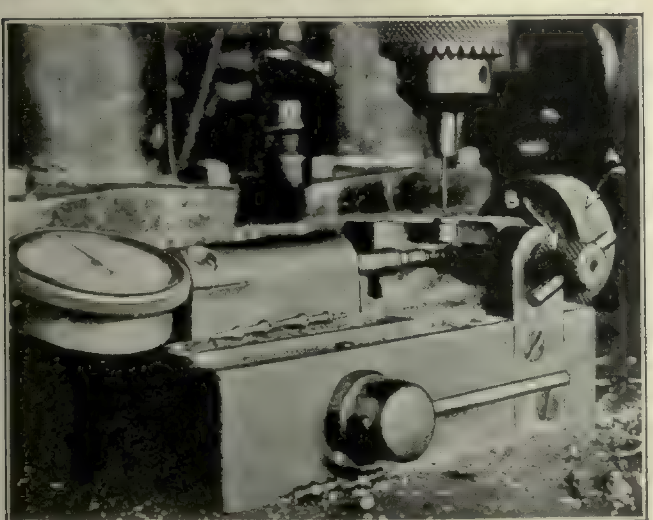
Jig for Assembling Needle Valves

By Robert Mawson

A jig used by the Wheeler-Schebler Carburetor Co., Indianapolis, Ind., for locating and drilling the ball and stem of a ball-type needle valve is shown in the accompanying illustration. The parts are made separately and pinned together, it being essential that the ball shall occupy exactly the same position with respect to the valve end of the stem on all valves, in order that certain adjustments will produce like results in all carburetors regardless of whether they are newly assembled or contain repair parts.

In this jig the valve stem is held between two anvils, one of which is beveled to match the valve end of the stem and the other cup-shaped to match the opposite end. This latter anvil is susceptible to endwise movement by means of the knurled-head screw *A*, while the other has a slight endwise movement against a spring, the position being shown by the pointer of the dial indicator.

The ball is held between two jaws so located as to bring the center of the ball under the drill bushing. The rear jaw is stationary and the front one may be advanced by means of the screw B to grip the ball. In setting up the device a gage is placed between the anvils, and the latter adjusted endwise with the screw *A* to bring the drill hole in the right position, after which the indicator is adjusted to read zero. When the gage is removed the pointer will, of course, fall below the zero position because of the spring pressure.



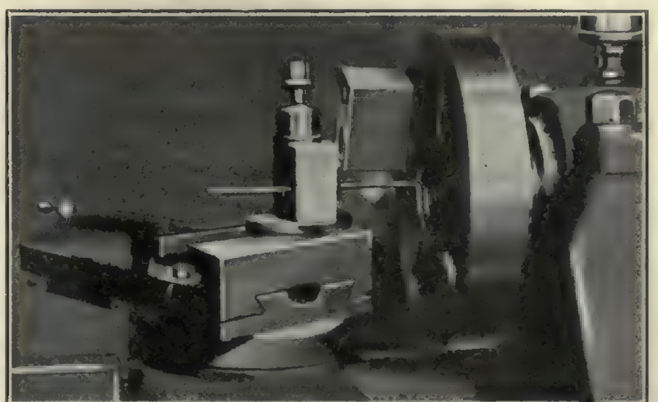
JIG FOR ASSEMBLING BALL-TYPE NEEDLE VALVES

To drill the work a partly assembled ball and stem is placed in position, the ball gripped between the jaws, and the screw *A* advanced until the indicator again registers zero, indicating that the ball is located at the exact predetermined distance from the valve end of the stem.

A Fast Cutting-Off Tool

By Robert Brainerd

Among other radio parts that we have been making were some detector pins, which were to be of brass rod ⅛ in. in diameter and 2 in. long. We used an old lathe for this purpose, employing as the cutting-off tool a 2-in. square high-speed steel block which was tempered and ground across one end. The block was attached to the faceplate by two screws, as shown in the accompanying illustration, with the cutting edge down.



CUTTING OFF PINS IN A LATHE

A holder was made with a block on the front end, a hole being drilled in the block into which any one of several bushings could be slipped, each bushing for a different size rod. The holder was clamped into the toolpost and set with the bushing as close as possible to the edge of the block. The spindle was run at a speed of 1,728 r.p.m. and the stock was fed through by hand, the faceplate acting as a stop. One man cut off 25,000 pieces in three hours with this outfit and the tool hardly showed signs of wear.

To Make a Wooden Chuck Hold Tightly

By Charles G. Spicer

In turning wood patterns or light metal parts it is often necessary to reverse the work and have it run true in order to finish the opposite side. When the nature of the work is such that it can be used, there is no better method for this purpose than the one here described.

Take a piece of wood of suitable size and fasten it to the faceplate of the lathe with three or more wood screws, entering from the back of the plate. Turn a recess into the face of the wood into which the work will fit snugly but not too tight.

When ready to set the work in place, saturate a piece of waste with water and wet the wood at three places equidistantly around the periphery of the recess. Now set the work into the recess quickly and the wet wood will swell and hold it very tightly.

Standard Information for Tool Designers

By Chas. B. Johnson

Many concerns, when providing their engineering and drafting departments with standard data, neglect furnishing the essential measurements of machines used. The almost universal method of securing this information is, when the design of a piece of new equipment for a machine is contemplated, to send the designer into the shop to measure the machine. This he does, making a rough free-hand sketch upon which he places what he considers the necessary dimensions. The result is that after the design is completed he retains the sketch which he has made (and which in all probability is understood by no one except himself) for a short time, after which it either becomes lost or is destroyed. When further equipment is contemplated for the same machine, no information is available except what may be derived from his drawing. If this information, for any reason, is incomplete, it necessitates measuring the machine again. At this time, the chief draftsman, squad leader or other official in charge realizes that the same ground is being covered too many times and possibly suggests that this information be retained in some permanent form.

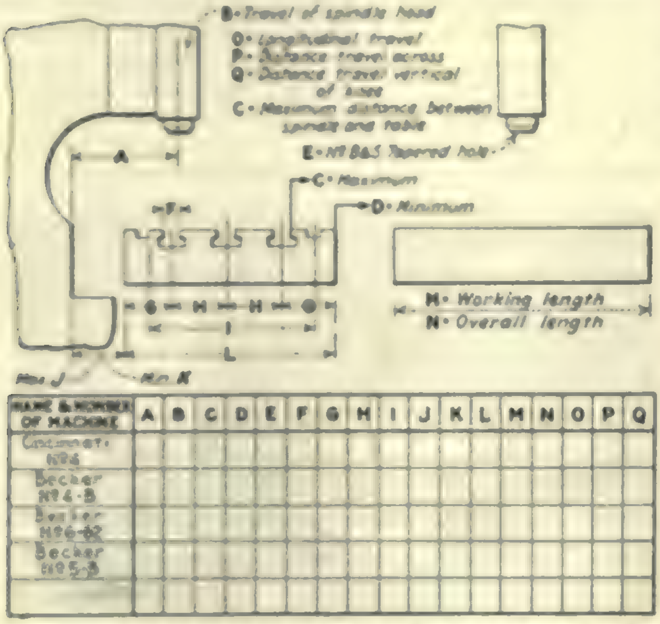


FIG 1—INFORMATION DIAGRAM FOR MILLING MACHINE

Some companies provide sketch blocks of cross-section paper and insist that the designer use these. After the design is approved, the sketches are properly classified, indexed and filed. The result is the accumulation of a mass of sketches (many of them being of similar nature, especially when used on the same machines) which sooner or later is bound to over-crowd the file, making an extended search necessary to find the proper sketch and then the consulting of the man who made it. In case this man is no longer employed and the sketch not readily understood, the designer decides to take a look at the machine and make a new sketch for his own use. This action proves that even under this system the same ground is apt to be covered twice.

A simple and practical way of avoiding this trouble, and at the same time retaining the information in permanent form, may be reached in the following manner. When a new machine is received at the plant, after it has been placed in position, a diagram may be made similar to the one shown in Fig. 1, which is for a vertical milling machine.

The diagram is self-explanatory and gives the principal dimensions that a tool designer would be interested in. It should be made on tracing cloth of a size suitable for the standard data books used, and may be made by a comparatively inexperienced tracer; but the machine should be measured up by some one who is thoroughly competent (preferably a tool designer) to decide upon the dimensions required, and after they are placed on the tracing they should be carefully checked.

Description of Equipment

The information may possibly be secured from a catalog, but the particular dimensions required are usually scattered through a tabulation or description which has little, if any, bearing on the equipment alone, or the machine may have some special features differing from the catalog specifications. The diagram may be made to embrace all machines of that particular type, the dimensions being properly tabulated under their respective letters. After it has been completed and checked, blueprints can be made and placed in all standard data books, thus assuring a certain standardization and making the information always available to every one interested. Similar diagrams may be worked up for horizontal milling machines, profiling machines, etc., in fact, all types of milling machines.

For hand screw machines, the diagram necessarily has to be of a somewhat different form, as is shown in Fig. 2. For presses, the diagrams can be made up giving the length of the stroke, center distances of bolt holes, center line of gate to front of uprights, the possible adjustment and distances between uprights.

These diagrams are inexpensive and have the advantage of making authentic information accessible at all times. The first cost is small and real economy results by a saving of the designer's time. The diagrams are generally received with approbation by those who find it necessary to use them, as they make the preliminary work easier and reduce the possibilities of error to a minimum.

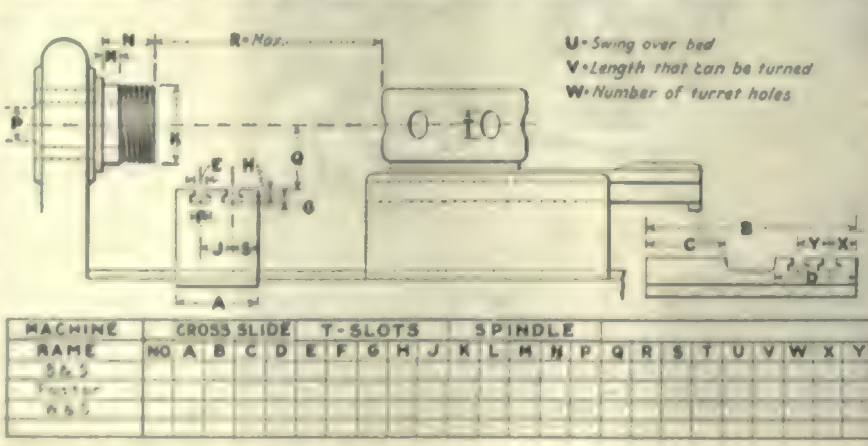


FIG. 2—DIAGRAM FOR HAND SCREW MACHINE

Turning Tool for Welding Arbors

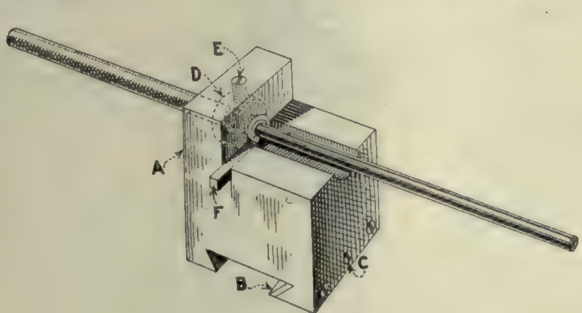
By K. A. Munson

The arbors or mandrels used on an electric welding machine for lap welding the longitudinal seams on some long slender tubes, were straight phosphor bronze rods about 4 in. longer than the tubes to be welded. As the inside diameters of these tubes were not of even fractional dimensions, it was necessary to take the next largest standard size of bronze rod and turn it down to the required size.

The various diameters of arbors ranged from 0.540 to 0.830 in. and the lengths from 15 to 24 in. The requirements were that each arbor should be within 0.002 in. of specified diameter and the diameter should be uniform throughout the length of the arbor.

Many different ways of turning these arbors between centers, supported by a follow rest, were tried out with very little success until one of the old mechanics devised and built the tool shown in the accompanying sketch.

A block of cast iron *A* was shaped out to fit the slide on the compound rest of a small Pratt & Whitney lathe, just in front of the toolpost holder. A gib *B* and setscrews *C* were provided to lock the block in place. A recess was bored in the block on the headstock side to receive the guide bushings *D*. These guide bushings



TOOL FOR TURNING LONG RODS

were of hardened tool steel with different size bores to suit the various sizes of bar stock used, and were secured by means of setscrew *E*. A hole somewhat larger than the largest size of bar stock, but smaller than the outside diameter of the guide block was then bored clear through the block and the block was cut away on top. A toolbit *F* was set in as shown and clamped by a setscrew from the headstock side of block.

When turning up the arbors a 10-ft. bar of stock was passed through the spindle of the lathe and gripped with the collet chuck, allowing about 2 ft. of bar to stick out. The end of the bar was entered into the guide bushing, the tool adjusted and the lathe started. After the tool was finally set to turn the required diameter all that was necessary was to squirt a little oil on the bar and let the feed run to the length for one arbor; then the lathe was stopped, the finished arbor cut off with a hacksaw, a new length of stock drawn out from the collet chuck and the lathe started again.

With the tool properly ground and set, from eight to ten arbors could be turned without regrinding or resetting tool. The arbors came out uniform in diameter and only needed to be polished up a bit with abrasive cloth. The lathe needed no attention during the cut and the operator was free to carry on some other job. Hundreds of arbors were turned successfully in this manner.

Form-Relieved Adjustable Boring Tools

By C. J. Dorer

The operation which the cutters illustrated in Figs. 1 and 2 perform is that of boring the odd-shaped hole in the flange shown in Fig. 3, and at the same time holding the diameters of the three straight portions of the hole to size. The cutters are also used to face the piece. It will be readily seen upon examining Fig. 3 that a hole of this nature could not be made with

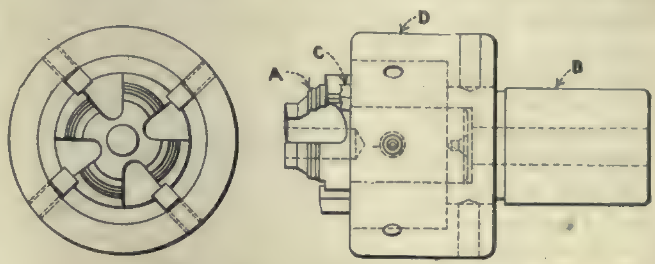


FIG. 1—THE ROUGHING CUTTER

any other than a formed cutter, either round or flat, and that such a cutter would not last long because its size would soon be lost through grinding.

A number of differently designed cutters were tried, but always with a high cost for upkeep and replacement. The cutters now used and shown in Figs. 1 and 2 have been running for over four months and are still in very good condition. They have given surprisingly accurate results and proved very satisfactory both from a standpoint of service and repair cost.

The operation is performed on a hand screw machine. The work, Fig. 3 is of cast iron and is held in a flat two-jaw chuck, being gripped at the lugs *G* on each side.

The roughing cutter, Fig. 1, is a form-relieved cutter with three fly cutters set in for the purpose of cutting the outer recess *A* and forming the face *B* as shown in the section in Fig. 3. The cutter *A*, Fig. 1, is form-relieved and the original sizes were about 0.005 in. under the finished size, allowing from 0.005 in. up for finish with the amount increasing as the cutter is ground. This cutter also has a small shank which extends into the main shank *B*, where it is kept from turning by two setscrews. A small hole extends through the shank so that the cutter can be readily pushed out.

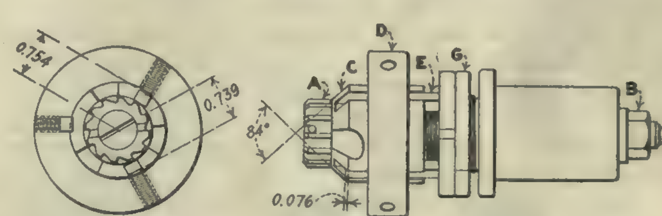


FIG. 2—THE FINISHING CUTTER

The fly cutters *C* are set in slots in the shank and are held in place by setscrews in the collar *D*. They can be easily pulled forward, thus maintaining the depth of outer recess *A* in the work.

It should be noticed that the cutter *A* backs against the shank and that the shank backs against the collar, which is placed against the turret of the machine, thus preventing the parts from slipping back within each other.

The finishing cutter, Fig. 2, is built up, but upon an entirely different principle from that of the roughing cutter. The steps of the work, E and C, Fig. 3, which must be held to size for depth and diameter, are finish bored with a single point tool and the small opening D with a floating end-cutting reamer.

The reamer A, Fig. 2, is held in place on screw B and is driven by a small pin. The reamer floats from 0.005 to 0.007 in.

The form cutter C finish-cuts the angle and is slotted to receive the three fly cutters E. Cutter C is held by screw B and is kept from revolving by two setscrews not illustrated.

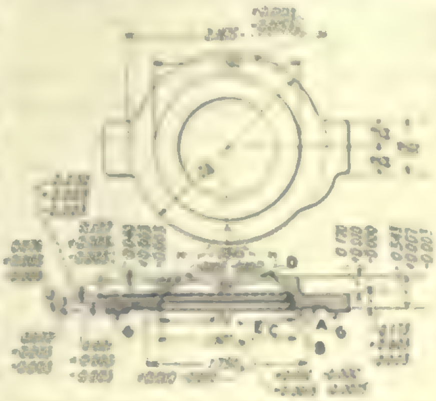


FIG. 3—WORK, SHOWING THE HOLE TO BE MACHINED

The fly cutters are adjustable endwise, and are backed up and pushed forward as they wear by the lock collars G. These cutters are held tight in collar D, a setscrew being applied to each. There is one cutter for each of the two steps E and C of the work. The one that faces B is end cutting only. The two which bore the two steps are both end and side cutting. Thus it is possible to bore the diameter to size and hold the form without continually having to make new form cutters.

The parts back up each other in turn, the shank having a flange which backs against the turret, thus preventing the various parts from pushing back on each other while the cutter is in use.

When the cutting edges of the roughing and finishing cutters are completely worn away they are easily and cheaply replaced with new ones. The shanks will last indefinitely, and in this case, as with most special cutters, the shanks make up approximately two-thirds of the material. It should be noted in both cutters that the cutting edges are all adjustable in relation to each other.

Another Exception to Mr. Donley's Statement

By John Livie

In an article entitled "Catching the Thread by the Jump Method," published on page 970, Vol. 56 of *American Machinist*, B. A. Donley states in part that "in any event it is far quicker than stopping the lathe and scaling for position, which is the only other method possible under the conditions."

Another method is as follows: Set the lathe to cut the thread desired; engage the locknut with the lead screw and place a stop on the shears against the carriage, so that the latter may always be brought back to the same position. Make a chalk mark on the cone pulley and one to match it on the gear guard or other stationary part. Make similar marks on the collar of the lead screw and the adjacent bearing boss. We now have two moving marks and two stationary ones.

At the end of each cut the locknut is opened and the carriage returned to the stop. When the moving marks are both lined up with their respective stationary marks, drop in the locknut and proceed with the cutting.

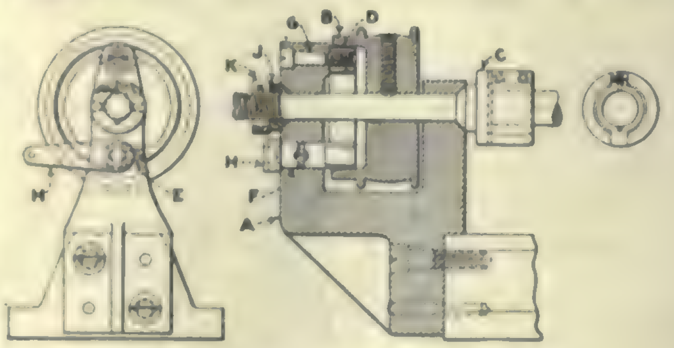
Quill Drive for Bench Lathe

By I. Bernard Black

In the use of quills in watch work it is desirable to stop the machine quickly after the operation on a piece held in the quill has been performed, so that the piece may be replaced by another in the least possible time. As this requires a quick-acting device of some sort, the design here shown was evolved:

In the illustration, part A is the housing for the drive, is made of cast iron, and attached to the bench lathe as shown. Part B is the driving pulley, also made of cast iron and finished all over. Part C is the driving spindle, made of tool steel, hardened and ground, and machined to a running fit in the housing. Part D is the brake band, made of bronze, the outside diameter being machined about 0.018 in. under the diameter of the recess in the pulley; it is held in place by the screw E.

Part F is the brake band shoe, made of tool steel, hardened and ground, machined to a running fit in the housing and held in position by the screw G. Part H is the brake band lever, made of machine steel. The end thrust of the spindle is taken up by the parts J and K.



DESIGN OF QUILL FOR WATCH LATHES

The foot mechanism is so arranged that there is always a pull on the brake band lever, thus causing the brake band shoe to spread the brake band so that it bears against the surface of the recess in the driving pulley. When the operator presses down on the pedal to start the machine, the spring tension on the brake band lever is released and the machine starts; but just as soon as the foot pressure is released the machine stops short, because of the friction set up by the brake band against the inside of the driving pulley.

Soliloquies of Old Mac

By R. McHenry

When drilling rows of small holes in a block of steel, as, for instance, in drilling out the center of a blanking die, set the stop on the drill press so that the drill will stop just short of breaking through. In this way the oil used to lubricate the drill will remain in or on the die instead of being slopped all over the table, the operator, and anything else that happens to be near by. When all the holes are thus drilled to uniform depth the remaining oil may be dumped out, and it is the work of but a few moments to complete the drilling. This method has the added advantage of leaving the under side of the die smooth until the work is almost done.

Chart for Addition and Subtraction of Fractions

BY P. A. DASCHKE

The accompanying chart is carried out to the first whole number, or one, which is far enough to show the principle of construction.

To add two fractions, find one of them at the top margin and the other at the left-hand margin. Follow the vertical and horizontal lines from the fractions to where they intersect. Follow the diagonal line from the intersection and the answer will be found in the margin at either the left or top.

For example: Add $\frac{33}{64}$ and $\frac{15}{32}$. Find $\frac{33}{64}$ at the top margin and $\frac{15}{32}$ at the left-hand margin. Follow the vertical line opposite $\frac{33}{64}$ down to where it intersects with the horizontal line opposite $\frac{15}{32}$. From the intersection of these two lines, follow the diagonal line to either one of the margins where the answer, $\frac{63}{64}$, will be found. The process is outlined in diagram *A* on the chart.

To add mixed numbers greater than one, as $6\frac{5}{8}$ plus $9\frac{3}{4}$, proceed as above by finding the sum of $\frac{5}{8}$ and $\frac{3}{4}$ and carry over the whole number.

To subtract, both fractions are to be taken from the left-hand margin. For example: From $\frac{3}{4}$ in. subtract $\frac{35}{64}$ in. Find $\frac{3}{4}$ and $\frac{35}{64}$ in the left-hand margin. Follow the diagonal line opposite $\frac{3}{4}$ until it intersects with the horizontal line opposite $\frac{35}{64}$. From the intersection of these two lines follow the vertical line to the top and there find $\frac{13}{64}$, the answer. The process is outlined in diagram *B* on the chart.

To subtract mixed numbers, where the subtrahend has a larger fraction than the minuend, the chart must be made to take in a greater range than is shown in the illustration. If $1\frac{59}{64}$ is to be taken from $3\frac{1}{8}$, subtract $\frac{59}{64}$ from $1\frac{1}{8}$, remembering 1 was taken from 3. The answer will be found to be $1\frac{13}{64}$.

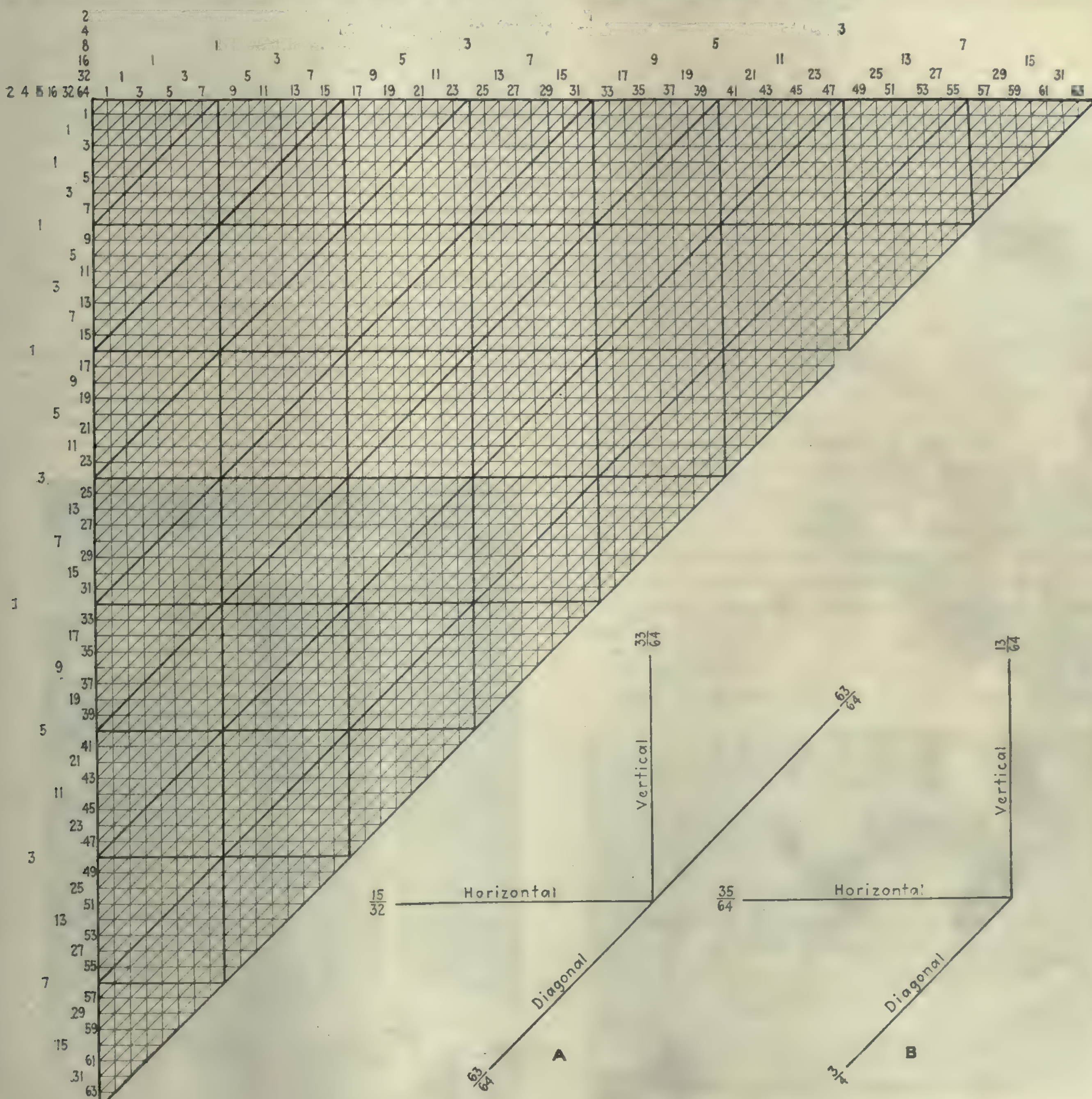


CHART FOR ADDITION AND SUBTRACTION OF FRACTIONS

FIG. 1—POURING COLLAR ON DRIVING BOX

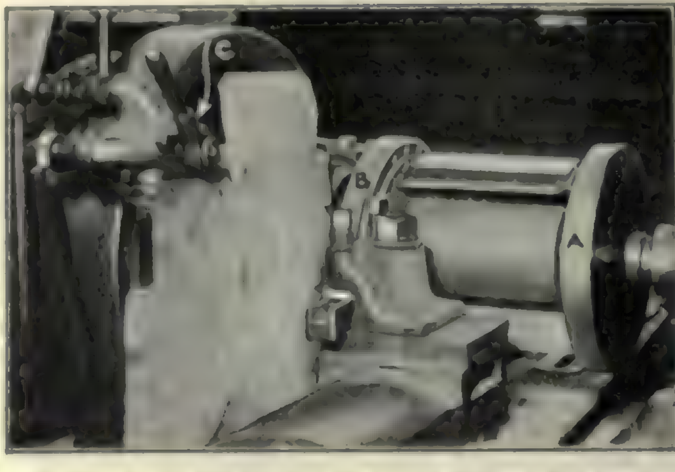


FIG. 3—MANDREL FOR TURNING CROWN BRASSES

Machining Driving Boxes and Hub Collars

By I. B. Rich

At the New York, New Haven & Hartford Railroad shops, Readville, Mass., collars are cast on to the driving boxes as shown in Fig. 1. A board *A* is fitted into the central portion of the driving box and held firmly by the wedge *B*. The board is protected by asbestos and a suitable clay dam built around the outer edge acts as a mold to hold the melted brass as it flows from the furnace. The driving box is placed on a truck for the placing of the board and luting with clay, and is wheeled under the furnace opening when the metal is ready to pour. As shown, the metal has just been poured and the rotary furnace brought back into the melting position.

When the box is cool enough to handle, it goes to the Bullard boring mill, shown in Fig. 2, for boring and facing. The chuck shown has several interesting points. The ends of the body *A* are turned to the same diameter as the boring mill table so there will be no projections that may cause injury to the workman. The jaws *B* are shaped so as to grip the driving box by its planed surfaces, the jaws being controlled by a right- and left-hand screw in the usual way. In addition to the regular jaws there are the auxiliary jaws *C* which bear on the driving box flange and hold the box against any lifting tendency of the cutting tools. The auxiliary jaws are operated by small vertical screws, one being shown at *D*.

A special air-operated chuck for turning crown brasses is shown in Fig. 3. The body of the chuck or mandrel has a collar *A* which carries a toothed surface of hardened steel to grip one end of the brass. The collar *B* slides on the mandrel and carries steel points which grip the brass at the other end, being operated by compressed air, controlled by the three-way valve *C*. Turning this valve to the release position relieves the air pressure and lets the collar *B* slide back to release the brass. Placing another brass in position and turning the valve again throws the collar *B* against the work and holds it firmly while it is being turned.

Another and much larger crown brass is shown in Fig. 4. It is for one of the largest locomotives and has a bearing 12 in. in diameter by 20 in. long. This brass is being turned on a boring mill on account of having no chuck that would handle it in the lathe. The fixture is simply a good size stud or mandrel having a checkered ring at the bottom for gripping the end of the brass. A similar ring at the top is forced against the brass by the large nut on top. As can be seen by the coupling nut *A* the mandrel has been extended.

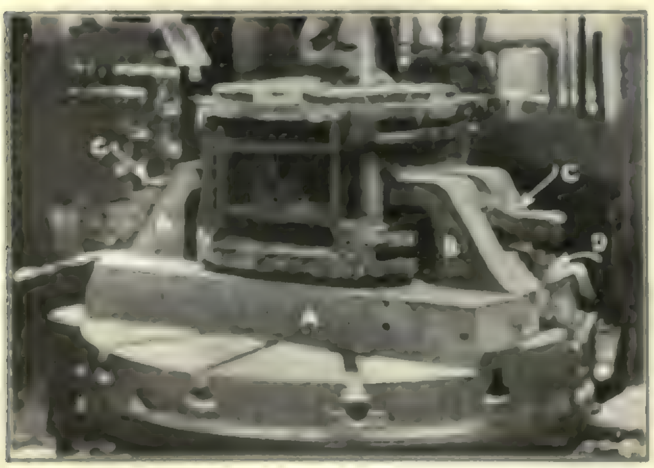


FIG. 2—CHUCK FOR BORING DRIVING BOXES

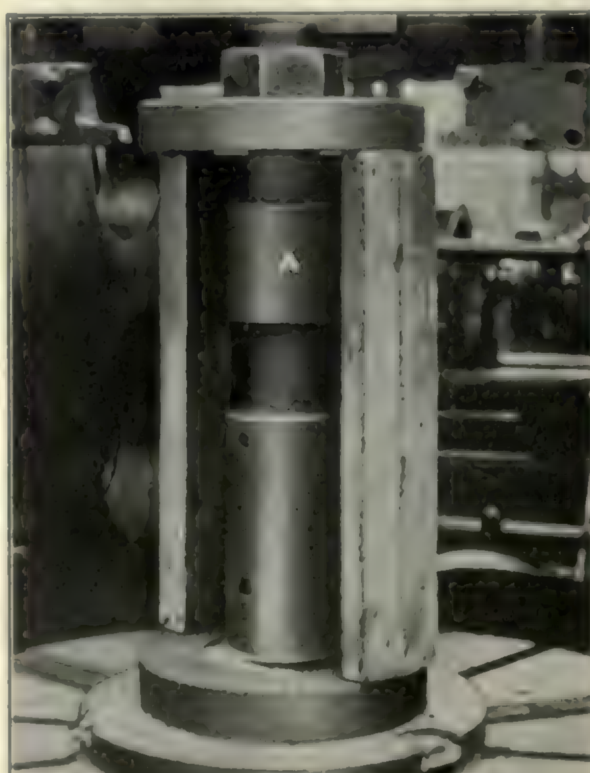
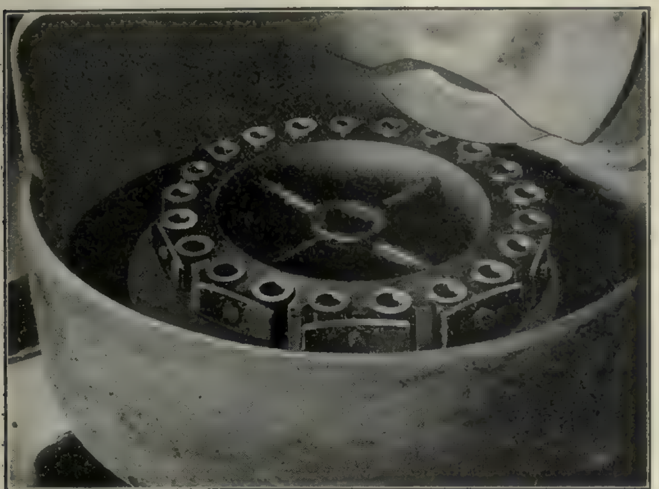


FIG. 4—TURNING A BRASS 20 IN. LONG

Cheap Holder for Grinding Bushings on End

By Hiram Hicks

Having a large number of headed bushings to be ground on one end square with the bore, we took two gear blank castings, bored and faced them, and cut a series of V-shaped notches into the periphery in place of regular gear teeth.



HOLDER FOR GRINDING BUSHINGS

The "teeth" thus formed were of sufficient thickness to allow for a $\frac{3}{8}$-in. capscrew to be tapped into each alternate one, and each screw passed through the center of a short strap by means of which each adjacent pair of bushings was held in the grooves. The holders were used on the magnetic chuck of a Persons-Arter rotary grinder. The two holders enabled the operator to load one while the other load was grinding.

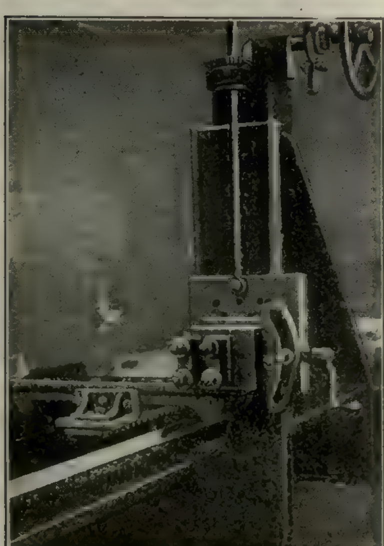
Side-Head Attachment for a Planer

By Fred S. Harger

Having to machine some castings that were too wide to pass between the planer housings, we built the attachment shown in the accompanying illustration.

With the exception of the column and gear bracket, the parts were salvaged from a discarded planer. The elevating screw was flattened at one end and an eye formed for attaching it to the slide of the side-head. As the screw is stationary, the bevel gear at the top was fitted with a threaded bushing and as the gear was confined in the bracket, revolving the gear would either raise or lower the head. Power was applied to the vertical feed through a ratchet and pawl operated by a rod attached to the reversing lever.

The operator had free access to all of the controls.



SIDE PLANING ATTACHMENT

Making the Work Machine Itself

By H. E. Crawford

The attachment shown in the illustration is used to mill the radius around the upper part of the face of our milling-machine columns, and for undercutting the slot in the face.

A shaft of the correct size for a sliding fit is inserted into the over-arm hole, then the body of the mechanism is slipped onto the front end of the shaft and a bracket onto the rear end. The bracket is clamped to the rear bearing hole, as shown. The shaft is held from turning by being keyed to the bracket, and is also clamped by means of the arm-clamp screw handle. The shaft is bored through its entire length to receive a rod which carries the shaft that serves as a journal for the pulley and the pinion that is attached to it. The rod is threaded at the rear end for a nut, and a collar is slipped onto the front end.

The handwheel shaft carries a worm gear that meshes with a wheel keyed to the main shaft. As the housing for the handwheel shaft is a part of the main housing casting, the operation of the worm feeds the main housing around the shaft. The housing contains two spindles which operate simultaneously, being driven through a set of compound gearing; and as the housing is fed around the shaft, either a radius or a circular slot is milled, according to which spindle is used.

ATTACHMENT FOR CIRCULAR MILLING

Best Way to Show Sections Through Ribs

By M. E. Duggan

Referring to the last paragraph of Mr. Sylvester's article on page 28 of *American Machinist*, it is only the very young patternmaker, the fellow who is long on theory and short on practice, who laughs at the plain and easily understood drawing; not the old timer.

A pattern, several coreboxes and a blueprint were sent to our local foundry by a chap down in Lima, Ohio. The molding and core work made quite a complicated job, and that was the reason for sending the print. Everything went along all right until it came to setting the cores, of which there were seven.

Then the trouble began. Much time was spent in puzzling over the drawing without avail. There was too much theory and not enough common sense. Finally a telegram was dispatched to Lima asking the customer to make the matter plain. By the first mail there came a *free-hand sketch* which cleared up the difficulty.

Mr. Sylvester says that to draw correctly the gear that he has chosen as an illustration it would be necessary to cross-hatch the upper arm. He might well have added, "and the gear tooth also."

Editorial

The Railroad Strike Injunction

WE SAW with regret the kind of injunction the government has obtained against the striking shopmen. The *kind* of injunction, we say, for it appears that some overzealous lawyer, anxious to hog all that could be had, has secured an injunction which places the blowing up of railroad trains on a level with putting the thumb to the nose and looking at the same time at a railroad president.

We do not believe that a striker will ever be made to suffer for doing what he would be allowed to do under normal conditions. But why give the public the impression that our government is trying to neutralize the Constitution? Why, indeed, place a weapon in the hand of the agitator, and above all just now, when the situation is obviously mending? Finally, why try to enlist the sympathies of the rest of the labor world and alienate those of the rest of the public?

We want transportation and peace and order. At the same time, to emphasize the fact that our judicial system can make a law say what it was never intended to say, if handled by a clever lawyer, is neither to promote respect for the law nor bring order, peace and transportation.

Modern Tools and the Shopmen's Strike

ALL negotiations having failed, the railroad shopmen's strike settles down to a fight to the finish. The shopmen claim that equipment is deteriorating so rapidly that they will win. The railroad managers claim that there will be plenty of cars to move the crops and what coal is mined, and that shop forces are being recruited back to normal.

Among the recruits are undoubtedly many good machinists who have been used to working in well-equipped shops but have been attracted by the higher wages paid by the railroads. Some of these men are due for a shock when they get into the thick of railroad repair work as done in the average shop. They are going to find tools whose lineage is honorable but very ancient—ancient to the point of decrepitude in some cases. They are going to learn how to employ ingenious makeshifts—as they have been employed in railroad shops for a generation, simply because the management was too penurious or too short-sighted to buy tools adequate for the jobs.

The war taught American industry the wonders that can be accomplished through intensive training and the railroad managements are sure to make the most of our knowledge in this direction. But how much easier the whole job would be if the recruits, many of whom are skilled in the handling of modern machine tools, could be given the kind of tools they are used to and that are really needed for the work to be performed.

If there is any doubt as to the accuracy of our statement one has but to run through the back files of *American Machinist*, or any other machinery journal, to see account after account of such makeshift jobs in railroad shops. Ingenious—yes, but expensive.

If the experiences met by the railroad managements in breaking in men used to modern manufacturing methods rather than average railroad methods serve to awaken them to the poor economy of scrimping on shop equipment, the hardships suffered by the public will not have been entirely useless.

An International Engineering Congress

AN EVENT of unusual importance in the engineering world is the International Congress of Engineering being held at Rio de Janeiro this month. In reply to the official invitation of the Government of Brazil, the leading engineering societies of the United States have appointed delegates to attend the Congress, and have appointed the members of the United States engineering societies in South America to participate as official representatives of the engineers of the United States in a discussion of the engineering problems affecting the commercial development of South America.

Relations between the two Americas should, of course, be fostered in many ways for mutual advantages. It was with such belief that *Ingeniería Internacional* was established by the McGraw-Hill Co., and the influence of that publication has been greatly felt in arranging the present Congress of engineers. It is appropriate that its editor has been appointed as a delegate by some of the engineering societies. The congress is in the nature of a culmination of the policy which has had in view the introduction to South American engineers and business men, of North American engineering and industrial practices and products.

In line with the basic principle of American engineering development the keynote of the Congress is to be the practical treatment of subjects of everyday importance, rather than theoretical and academic discussion. The general subjects to be discussed are:

1. The utilization of fuel resources.
2. The best utilization of water power.
3. Recent advances in irrigation methods.
4. The elimination of waste through the standardization of supplies for agricultural and industrial purposes.
5. Coal as a factor in industrial development.
6. Essentials of a national railroad policy.
7. Intercontinental engineering co-operation.
8. Port developments.
9. Terminal facilities.
10. The iron and steel industry.
11. Rivers and seaports.
12. Industrial and agricultural machinery.

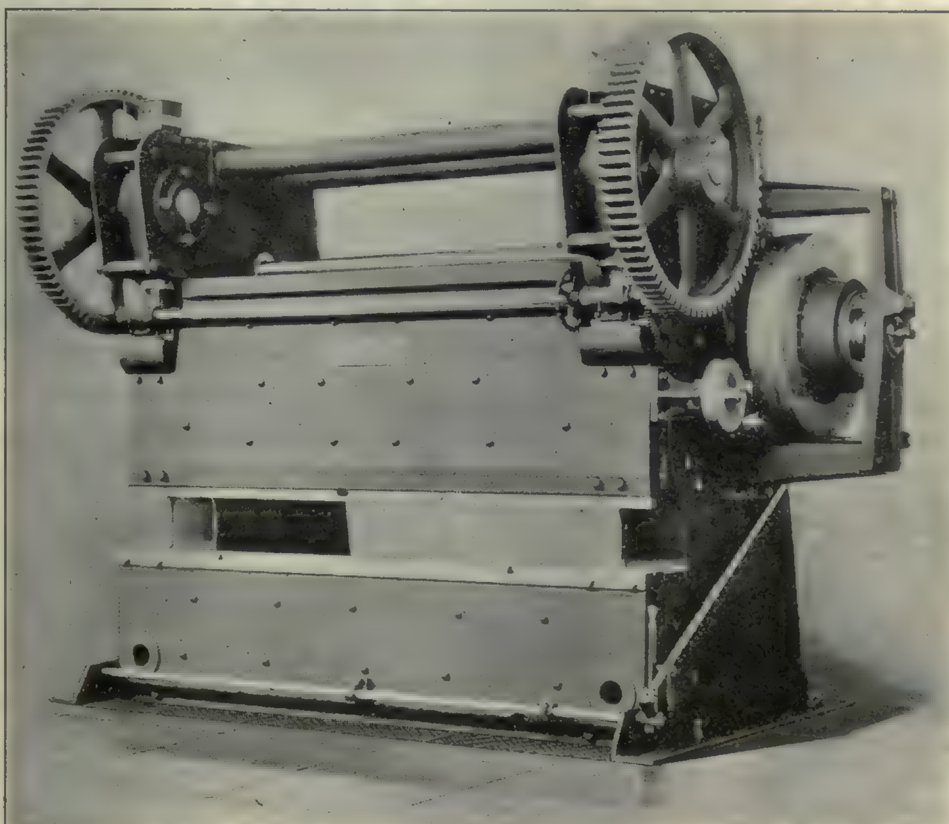
The engineering problems are mainly those falling in the provinces of the civil and mining engineers, but as they are being solved others for the mechanical, electrical and chemical engineers are arising and a strong market for American machinery is developing. The American manufacturers who have had the vision to support the Congress as an important step in improving the contact between the engineers of the world and in establishing good will between the two continents are to be congratulated.

Shop Equipment News

Cincinnati Shaper Co. All-Steel Power Press Brake

A development in the manufacture of heavy power-driven brakes has just been disclosed by the Cincinnati Shaper Co., Cincinnati, Ohio, by the introduction of its "Cincinnati" all-steel press brake shown in the accompanying illustration. The machine incorporates features to increase the strength and ease of operation, without however necessitating any great changes in the shop methods now employed by the user.

The principal departures from standard practice in the design are the adoption of steel plate for the frame and large members and the use of the open-throat type of housing. Another feature not evident in the illustration is the use of electric welding in fabricating and assembling the steel frame members. This construction eliminates to a large extent dependence on bolts and rivets for combining the component parts and unites the various members into one, so as to secure the action of a solid whole rather than of built-up sections. Where bolts are used in solid members to draw the plates down into place, the bolts themselves are welded as well as the plates, so that they become an integral part of the member with no chance of working loose. The necessities of easy erection, of course, demand the use of bolts at certain connections. The number of these connections has been reduced as far as possible, both for simplicity in erection and for securing a powerful machine. The deflection of the machine is claimed to be very slight under full load.


"CINCINNATI" ALL-STEEL POWER PRESS BRAKE

The driving mechanism is completely contained within the housing, and the housings are shipped with the mechanism assembled, so that it is only necessary to place them on their foundations and attach the cross members and the drive shaft. The tool is shipped as four main pieces, with the drive shaft and cross brace in addition, making a total of only six parts which must be assembled. Self-aligning features are incorporated, so that the machine will go together in the customer's shop exactly as assembled on the floor of the factory.

The open-side housings facilitate the handling of material. As most bends are made near the edge of the plate, the full length of the die-holding surface can be utilized. Thus for many classes of work, a machine can be rated with respect to the length of the die-holding surface instead of the distance between housings, which means the use of a narrower, more rigid machine. In addition to freedom from all interference at the front of the machine, there is clear space between the housings at the rear, for convenience in stacking finished work. Where more than one operation is required, the work can be passed back and forth through the machine, avoiding the inconvenience of turning it end for end. The bed and ram are constructed entirely of heavy steel plates and billets, which, together with the cross-ribs, are welded to each other, thus making what are virtually heavy solid steel beams of box section. The housings are framed of steel plate, having cast-steel members interlocked and welded to the plates. These members are provided with heavy trunnions for supporting the bed.

In order to determine definitely what forces must be dealt with in brakes of different capacities, a series of tests on bending and forming various thicknesses of metal under a variety of conditions, was conducted. As the characteristics of all materials entering into the the brake are well known, the whole mechanism could be designed with confidence as to its ultimate performance,

and avoid placing dependence upon castings, the qualities of which are usually unknown and unreliable.

Automatic sight-feed lubrication is provided on all power-driven bearings. The flywheel, clutch, worm and worm wheel for the ram adjusting device, and the power drive for this movement, all run in a bath of oil. All shafts are of high-carbon steel. The eccentric shafts are 0.50 to 0.60 per cent carbon forgings with the eccentrics forged integral with them. All main drive bearings are of special bronze.

A splined trip shaft runs the full length of the machine, and on it is mounted an adjustable treadle which enables the operator to engage the clutch from the most convenient position. The ram is gibbed endways as well as sideways, an essential feature when using the machine as a gang punch.

When the machine is to be motor driven, the motor is mounted on a bracket attached to the housing. The drive is through a belt, held in tension by a weighted idler pulley on the slack side. The machine operates at a greater number of strokes per minute than has been customary in brakes of this type. The flywheel is mounted on high-duty ball bearings with hardened races.

All gears are cut and the pinions are of steel. The clutch is of multiple-disk type operating in oil. A very low unit pressure is used in its operation. It is accessible and simple to adjust. As a means of testing the clutch, while adjusted to pick up the full load under a standing start, that is, with the ram down against the work, it has been repeatedly thrown into engagement when the dies were together, thereby stopping the flywheel in a very short period of time. The clutch has proved its ability to withstand such severe service without injury, it is stated. The great factor of safety with regard to the flywheel and moving parts, in connection with the action of the friction clutch, gives a large factor of safety against accidental injury.

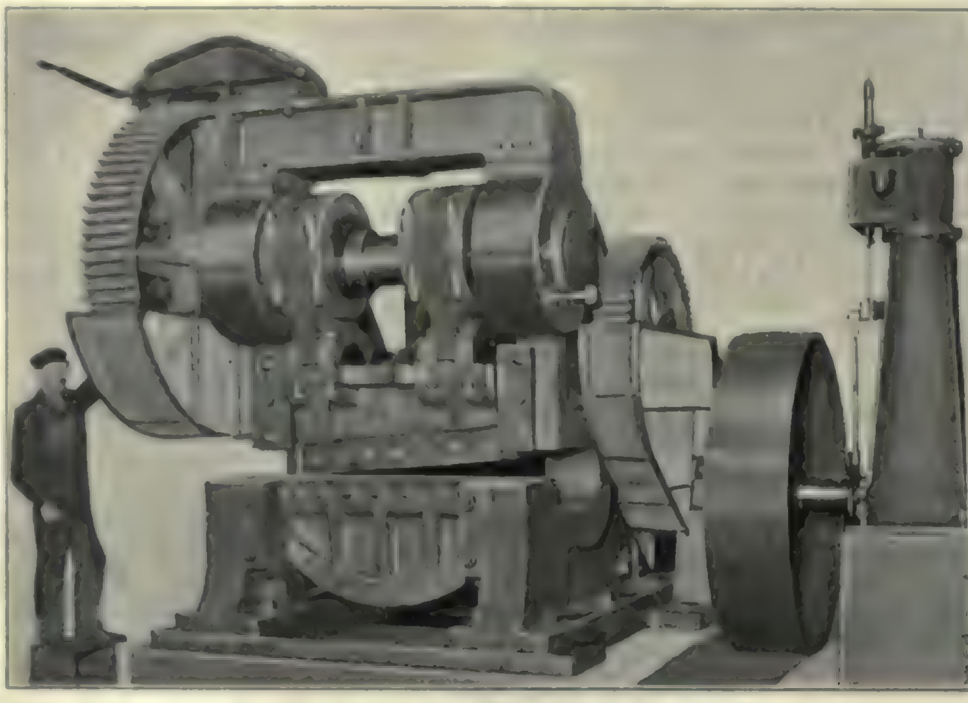
The machine is as simple in design as possible for accomplishing all the operations required of it. The elements are combined to secure rigidity, power, speed and convenience of operation. The small deflection under load is stated to give accuracy of workmanship. The large factor of safety employed throughout gives the strength necessary to prevent breakage under accidental or excessive overloading. Continuous work and the forming of sheets of greater width than the clear distance between housings is made possible by the open-throat construction.

The brake is built in capacities ranging from 80 to 600 tons for working material from 10 gage to ¾ in. in thickness. The widths between housings vary from 6 ft. 6 in. to 14 ft. 6 in., and the weight from 18,000 to 120,000 lb. The first machines to be delivered were a 140-ton brake for the Hamilton Manufacturing Co., Two Rivers, Wis., and a 200-ton brake for the E. F. Hauserman Manufacturing Co., Cleveland, Ohio.

Reading 48-Inch Plate Shear

The large plate shear shown in the acompanying illustration has recently been built by the Reading Iron Co., Scott Foundry Department, Reading, Pa. This shear has the capacity for shearing 1-in. steel plate 48 in. wide. The size of the machine can be appreciated by comparison with the man standing at the side of it.

The shear is arranged for either steam engine or



READING 48-INCH PLATE SHEAR DRIVEN BY STEAM ENGINE

electric motor drive, the shear illustrated being engine driven. The camshaft is 11 in. in diameter in the bearings, and is equipped with an automatic releasing clutch, either for stopping at every up-stroke, leaving the shear open for inserting the plate, or the machine can be operated continuously, at the will of the operator. The shipping weight is 55,000 pounds.

Wallace Electric Bench Glue Pot

An electrically heated glue pot the temperature of which is controlled automatically has recently been placed on the market by J. D. Wallace & Co., 1401 West Jackson Boulevard, Chicago, Ill. The current for the pot may be taken from an electric lighting circuit, and all that is necessary to start the heating is to turn on the switch. After that, the temperature of the pot rises and is maintained between 140 and 150 deg. F., the temperature control requiring no further attention.

The glue is always kept at the proper temperature for use, although it is not cooked sufficiently to injure its holding properties. Even though the current be left on over night, no injury will result either to the pot or the glue. The pot may be employed either as a water bath, or as a hot air or a dry heat pot. It may be used for heating or melting such substances as wax, pitch, sealing compound or resin, that requires a definite working temperature.

The electrical heating element is in the bottom of the pot, although a dead air space is provided below it to prevent injury to the bench on which the pot is placed.

The thermostat contains a sensitive volatile substance that contracts and expands with changes in temperature, so as to operate the control switch when the temperature rises to the upper limit or falls to the lower limit. The water pot is above the thermostat, and the glue container inside this pot.

WALLACE ELECTRIC BENCH GLUE POT

The container is of cast aluminum and fitted with retaining lugs at the top that prevent it from floating when only partially filled. A part of the bail extends across the center of the pot to serve as a brush wiper. The dial gage shown on the side of the pot in the accompanying illustration indicates the temperature. The jewel or window in the base allows the operator to see whether the coil is heated.

Reading 42-Inch Roll Lathe

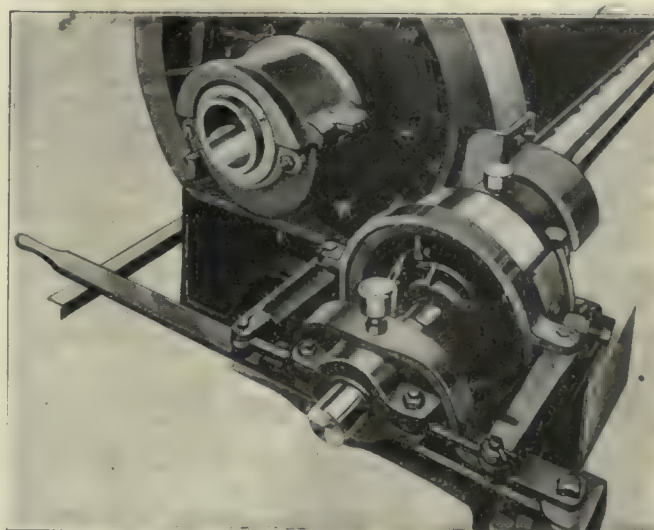
The accompanying illustration shows a large roll lathe recently built by the Reading Iron Co., Scott Foundry Department, Reading, Pa. The machine has a capacity for turning a chilled roll 42 in. in diameter by 120 in. long. It is driven by a 20-hp. variable-speed motor, the speeds of which range from 400 to 600 r.p.m. There is a gear box with two changes of speed, arranged so that the full range of motor speed can be employed with each.

The faceplate speed varies from 0.4 to 1.6 revolutions per minute. The main spindle is $7\frac{3}{4}$ in. in diameter, and the gears are machine cut. The bearings are large. The entire construction is heavy to provide the strength required for the heavy service for which the machine is intended. The total weight of the lathe is 35,000 pounds.

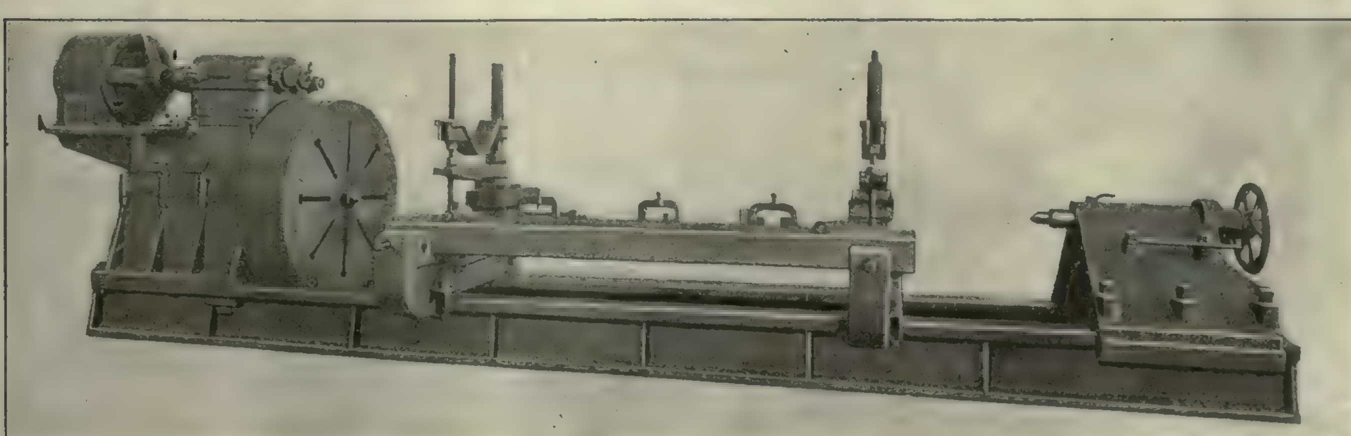
Whiting Combination Clutch and Brake for Tumbling Barrels

In order to promote safety of operation of tumbling barrels and mills, the Whiting Corporation, Harvey, Ill., has recently placed on the market a combination clutch and brake mechanism for use in starting and stopping them. The device, which can be seen attached to the end of a tumbling mill in the accompanying illustration, is simple in construction and controlled by a single hand lever. Shifting the lever toward the mill engages the clutch and starts rotation of the barrel. To stop the barrel, the lever is moved in the reverse direction, passing through the neutral position and to the braking position.

The clutch permits of stopping a loaded mill at exactly the point desired for unloading. The barrel is thus held in position while the unloading is taking place, eliminating the necessity of temporarily bracing the barrel or of placing a bolt in the gearing, as is sometimes done. Even though the barrel is unevenly loaded, it cannot turn when the brake is set.



WHITING CLUTCH AND BRAKE ON TUMBLING BARREL



READING 42-IN. ROLL LATHE

A Rapid Millimeter-Inch Conversion Chart

By Lucien E. Picolet

Your recent note on "Standardized Methods of Translating Inches to Millimeters" recalls an unlooked for difficulty in the translation of a set of metrically dimensioned drawings into inch measurements many months ago, and the evolution of a chart for expeditiously effecting the conversion.

The drawings were relatively of a simple character dimensioned in even millimeters and free of the complication of interchangeability with similar metric parts. With few exceptions, such as gearing, the conversion consisted in a rounding-off to the nearest 64th, or the desired coarser division of an inch.

Foreign engineers who supervised the work had prepared a table covering the range of dimensions needed. When they proceeded to apply their table to actual use, the close application of comparing many hundred metric dimensions with their proper equivalents in inches proved unexpectedly laborious, because it was not alone the conversion to the nearest 64th that was required but, more often, the adoption of a near equivalent in some coarser division.

After some tentative efforts to find a better arrangement of equivalents, the expedient of juxtaposing the divisions of a metric and an inch scale, enlarged about ten times, was adopted with very satisfactory results.

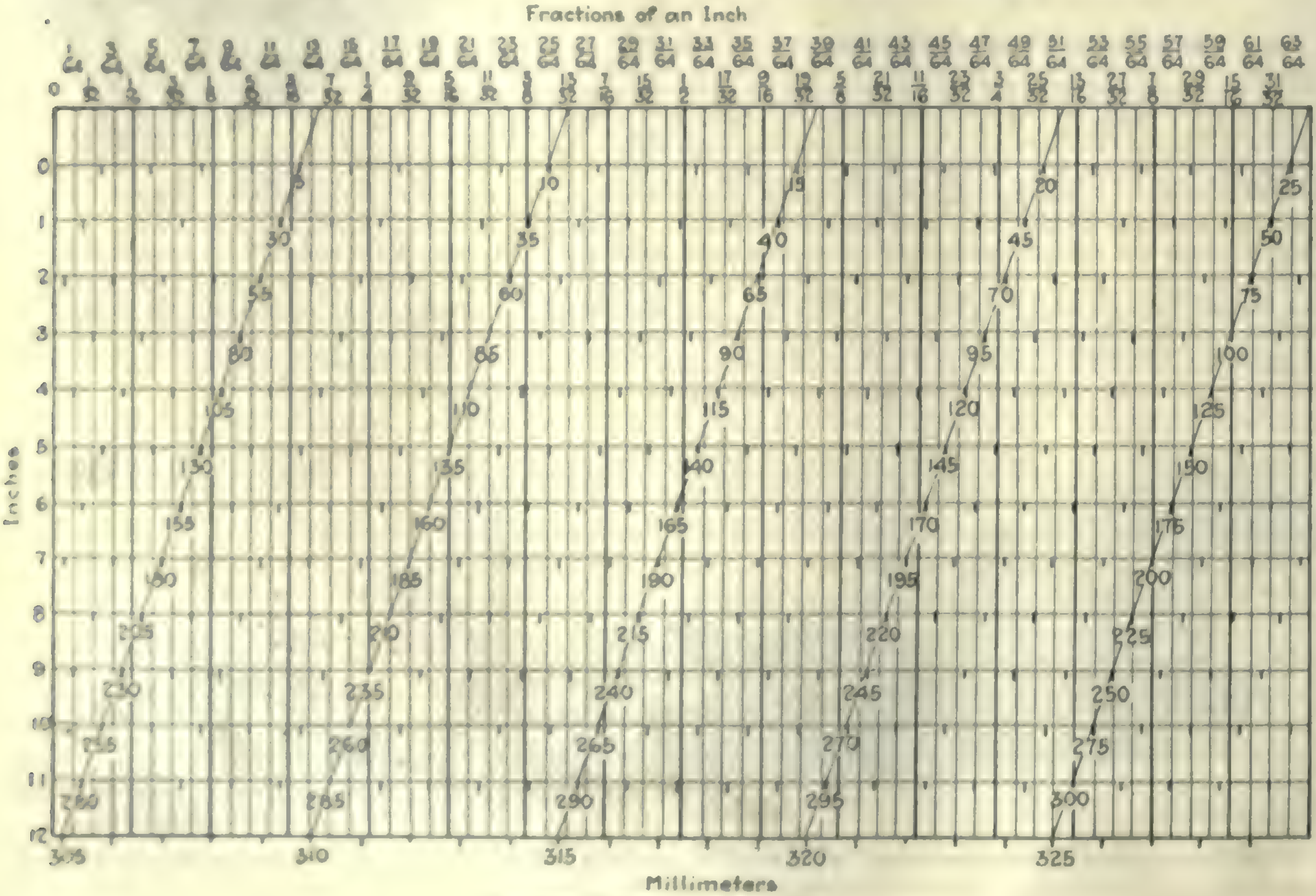
The chart herewith is the first of five sheets, four of which read to 52 in. The fifth sheet gives equivalents by thousands of millimeters from 1,000 to 20,000 millimeters. The top horizontal line represents a length of 1 in. and is divided into 64ths and numbered. The first line below, marked *O*, is divided into corresponding millimeters of which every fifth one is numbered. The succeeding lines, marked 1 in., 2 in., 3 in., etc., are simply a continuation of the metric scale. The chart in fact consists of inch lengths of the two enlarged scales laid one above the other after the manner of the Thatcher slide rule which is many feet in length. The vertical lines pass through the inch divisions and serve to compare the corresponding points on the two scales.

For a given metric reading, its position with respect to the adjacent vertical lines indicates at a glance what fraction to choose and its departure from the metric value. With a table of equivalents this departure must be visualized from arithmetical values.

A value of 25.4 mm. was taken for the inch value and it is readily seen that the addition of 25 mm. to any given value lies on the line immediately below it, 0.4 mm. behind it and all points 25 mm. apart, fall on parallel diagonal lines. The last diagonal passes through the upper right corner of the chart and recedes 0.4 mm. at each horizontal line. At the tenth line marked "9," it intersects at 4 mm. from the end at the 250 mm. point which determines the slope.

With no other object than to fit an odd size of sheet, the length of the chart (25.4 mm.) was taken at 280 mm. The 250-mm. point on that scale then falls at $4\frac{280}{25.4} = 44.1$ mm. from the end of the 9-line.

The sheet with intervals of 1,000 mm. is constructed on the same manner, but the diagonals have a different and opposite slope. That sheet might well be eliminated by the use of an auxiliary table of equivalents at intervals of 10 in. which are all multiples of 254 mm. Indeed all but the first sheet could be thus eliminated and that one need then read only to 10 in.



METRIC CONVERSION CHART

News Section

Bad Order Cars Show Increase

Reports just received from the railroads of the United States by the Car Service Division of the American Railway Association show that 335,575 or 14.8 per cent of the freight cars on line were in need of repairs on August 15.

This was an increase of 10,992 cars over the total number of freight cars in bad order on July 1 when the shopmen's strike began, at which time there were 324,583 cars or 14.3 per cent.

Compared with August 1, this was a decrease of 9,438 cars. On that date, 345,013 cars were in bad order or 15.3 per cent of the cars on line.

The total number of bad order freight cars on August 15 last was 46,865 less than the total in need of repairs on August 15, 1921, and 5,247 less than on June 1, 1922, at which times no strikes of railway employees were in progress.

These tabulations are based on reports received directly by the Car Service Division from roads representing 98.6 per cent of the total mileage of the Class One railroads and owning 99.3 per cent of the cars on line.

Iron and Steel Export Trade For July

July exports of iron and steel were only 159,338 long tons, as compared with 220,112 tons for June, according to figures of the Iron and Steel Division of the Department of Commerce. This shows a decrease of 60,774 tons over June and 71,922 over May.

The only noticeable increase in the July exports over June were barbed wire and woven wire fencing, 1,426 tons, and cast iron pipe and fittings, 1,316 tons. Among the smaller gains were: Structural material, fabricated, 950 tons; wire rope and cable, 287 tons; wire, n.e.s. and manufactures of 223 tons; hoops, bands and strip steel, 206 tons; and black iron sheets, 202 tons. Outstanding losses for July were: Steel rails, 13,753 tons; black steel sheets, 10,995 tons; boiler tubes and welded pipe, 6,888 tons; iron and steel bars and rods other than wire, 5,797 tons; ingots, blooms, billets, sheet bars and skelp, 3,028 tons; structural shapes, plain material, 2,903 tons; plain wire, 1,755 tons; galvanized sheets. 1,383 tons.

Canada was the foremost buyer of American iron and steel, with Japan second. Canada's purchases in July amounted to 48.010 tons, comprised principally of 8,630 tons ingots, blooms, billets, sheet bars and skelp, 6,427 tons iron and steel bars and rods other than wire, 5,780 tons structural shapes, plain material, 3,808 tons iron and steel plates, 3,526 tons black steel sheets, 3,101 tons galvanized sheets, 2,369 tons steel rails and 1,899 tons hoops, bands and strip steel. The most important shipments to Japan were 16,886 tons steel rails, 8,153 tons black steel sheets, 2,746 tons scrap, 1,339 tons tinplate, terneplate, etc., 1,330 tons rail fastenings, switches, frogs, etc., 1,284 tons iron and steel bars, and rods other than wire, and 1,210 tons structural shapes, plain material.

Exporters Make Plans for Annual Convention

Preliminary announcement during the past week by Myron Co. Robinson, president of the American Manufacturers Export Association indicates that plans of a most comprehensive character are being made for the annual convention of the Association which will be held at the Waldorf-Astoria, New York City, Oct. 25 and 26.

The slogan for the convention, "Better Times Through Foreign Trade," furnishes some hint as to the keynote for the general discussions and leading talks which will occupy the morning and afternoon sessions of both days.

The annual banquet will be held in the evening at the Waldorf-Astoria; the subject will be "foreign trade." Alba B. Johnson of Philadelphia, formerly president of the association, will be toastmaster.

President Warren G. Harding has tentatively accepted an invitation to speak on this occasion subject to final acceptance, depending upon pressure of national affairs at the time.

The attendance at the banquet promises to be exceptionally large and will undoubtedly tax the capacity of the banquet room. Reservations are now being made although the invitations have not yet been sent out.

The speakers at the various sessions are now being considered by the chairman of the respective sessions with a view to obtaining the most prominent and best qualified speakers on these subjects.

A further announcement of speakers will be made in the near future.

Fitchburg Industries Exposition

At a meeting held last week, the Fitchburg Chamber of Commerce of Fitchburg, Mass., completed plans for the Manufacturers' and Merchants' Exposition which will be held in the State Armory in that city Sept. 19 to 22 inclusive.

Nearly every industry in Fitchburg and the immediate vicinity has taken space for exhibiting their products, the metal and machine working industries being in the majority.

The exposition has attracted widespread attention and a large attendance is expected. As the committee on manufacturers of the Fitchburg Chamber of Commerce has worked intelligently and well in the planning for Fitchburg's first Manufacturers' and Merchants' Exposition, it is hoped that a full measure of success will crown their efforts. The city proudly boasts of many industries whose products are internationally known.

Manufacture of Aircraft in 1921

The Department of Commerce annouces that the census reports show considerable decrease in the number and value of aircraft manufactured in 1921 as compared with 1919. In 1921, there were 19 establishments reported and the total value of all products was $6,616,988, as compared with 31 establishments and the total value of products of $14,372,643 in 1919. The decrease in the total value of products was 54.0 per cent.

In 1921 as compared with 1919, there was a decrease of 148, or 34.3 per cent, in the number of airplanes manufactured, but there was an increase of $332,888, or 9.6 per cent, in their total value. For seaplanes there were decreases during this period both in their number and value, 222, or 96.5 per cent, and $4,269,948, or 93 per cent, respectively. While this condition reflects the deflation following the war, progress in aircraft development is, nevertheless, proceeding apace, under the energetic activities of the Aeronautical Chamber of Commerce of America.

British Motor Production Still Limited

Assistant Trade Commissioner Park, London, in a report to the Department of Commerce says, the serious dislocations caused by the engineering lockout during the first part of this year in the British automotive industry have proven very difficult to overcome.

The export trade continues to decrease, while imports of foreign cars have steadily increased since the first of the year, despite the 33⅓ per cent import duty. The United States and Canada remain well in the lead in British imports of passenger cars, which are dutiable, while France and Italy are ahead with respect to complete motor trucks, which enter the United Kingdom free. Sales of American cars in the British market have improved steadily and will continue to hold a good market as long as they can give a better value for less money, as is true at the present time in many cases. Recent price reductions have been made by the representatives of several American cars on the market due to satisfactory increases in business.

Cincinnati Metal Trades Hold Picnic

On the afternoon of Sept. 6, the outing of the Cincinnati Metal Trades was held at Langberg Island, Indiana. Automobiles conveyed the excursionists, about sixty members and their guests, to the ground. After lunch, athletic events, a ball game, and a few quieter games were indulged in. Following the sports a chicken dinner was served.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE

Editor, Commerce and Finance, New York

ACROSS the continent and back in the last five weeks——that is my record. I have travelled over 8,000 miles on six different railroads, the Pennsylvania, the Chicago, Burlington and Quincy, the Northern Pacific the Southern Pacific, the Illinois Central and the Louisville and Nashville.

On only one train was I as much as an hour late. All the others were practically on time. This is evidence that in so far as the passenger service is concerned the roads have not been seriously embarrassed by the shopmen's strike and it is, I think, plain that the unions have lost their fight unless the ill advised injunction obtained by the Attorney General shall so strengthen their hands that they can command the cooperation of other labor organizations in something like a general strike. This is unlikely, but it is undeniably true that the drastic inhibitions of the Daugherty injunction are resented by a very large portion of the community and that its effect has been to widen and deepen the gulf between corporate employers and employees.

On my trip I visited Chicago, Minneapolis, Spokane, Seattle, Tacoma, Portland, Oregon, San Francisco, Santa Barbara, Los Angeles, El Paso, Houston, New Orleans, Memphis and Cincinnati In most of these cities I had opportunity to talk with many representative business men.

As I have already reported, the feeling on the Pacific Coast is almost unanimously optimistic.

The cheerfulness everywhere noticeable is largely due to the fact that from Washington to Southern California the producers and merchants are enormously advantaged by the cheap water transportation to Europe, South America and the Atlantic Coast now provided via the Panama Canal.

With the abundant tonnage presently available rates are so low that the railroads no longer attempt to compete with them. The "President Taft" of the "President Line" recently made the trip from New York to San Francisco in 12 days and 18 hours, and there is every prospect that during the coming winter much of the California fruit production as well as a large share of the tourist travel will be handled by the water route. In time of course the effect of the low rates will become an object lesson in the relation between prosperity and cheap transportation that will lead the rest of the country to demand an equality of opportunity in so far as freight rates are concerned.

But because of its great natural advantages the Pacific Coast is nearly always cheerful and it can hardly be regarded as typical of the whole country. Eastward in the great Mississippi Valley and in the Southwest where the cotton is grown there is some weariness among those who have been waiting for the good times that have been promised.

The price of wheat has been disappointing and cotton has declined instead of advancing as the probability of another short crop becomes apparent. Then there is the certainty of very high prices for coal and the probability of much physical and industrial distress in the northern regions where the winter temperatures are low.

Ford's announcement that he will shut down because he can't get coal at reasonable prices has produced a profound impression in the Northwest and while there is but little unemployment at present, a winter of discontent and idleness is expected in many of the manufacturing cities of Ohio, Indiana, Michigan and Wisconsin.

The speeches of the radical politicians who have in many cases been nominated at the primaries have fostered this discontent and the exploitation of European poverty in which many of the candidates have engaged by way of justifying the American isolation that they preach has led many farmers to realize for the first time that the price they get for their crops is to some extent dependent upon the export demand. This is, I think, one of the reasons why the cotton is being so readily sold in Texas and some other cotton states.

The experience of the last two years has been costly as well as educational to the farmer and while he does not say much his actions show that the lessons he has learnt are not as yet forgotten. He is doing a heap of thinking. He feels that the future is somewhat beclouded and while he is able to buy what he really needs his present attitude is one that suggests caution and self restraint rather than the reckless expenditure that is by some thought to be essential to good trade and business activity. Therefore I am not disposed to expect a boom that presupposes agricultural opulence or extravagance. The basic conditions are lacking.

But as one comes further East and gets into what might be called the financial and industrial zone of the country he is impressed by the persistent belief in a period of what has been so often called "secondary inflation."

This belief is predicated upon the abundance of money and bank credit and the theory that high wages and high prices for what labor produces must in time cause an advance all along the line.

It is expected that as prices advance and inventories or sales show profits accrued or realized people will commence to spend or speculate somewhat recklessly. It is upon this theory that the stock market has been sustained and advanced during the strikes. It will probably be vindicated, for those who control the reservoirs and flow of capital accept it and are prepared to lend freely.

As a consequence many large corporations, particularly the railways, are preparing to spend huge sums for improvements and equipment, and there is much new construction in progress everywhere in the East. As one half the population of the nation resides within 500 miles of New York City the dominant feeling in that comparatively small portion of the country's area has a profound effect upon the whole and for the present at least it is probable that the optimism which prevails here and hereabouts will penetrate and lighten the clouds which hang over the agricultural region that drains into the Gulf of Mexico and the South Atlantic.

On both the Pacific and Atlantic slopes a winter of activity and rising prices is expected. The expectation is reasonable. It will probably be realized, but it will be well to remember that rising prices do not create wealth. They are generally a sign of decreased production and impoverishment for it is only by increased production that the individual or the world grows richer.

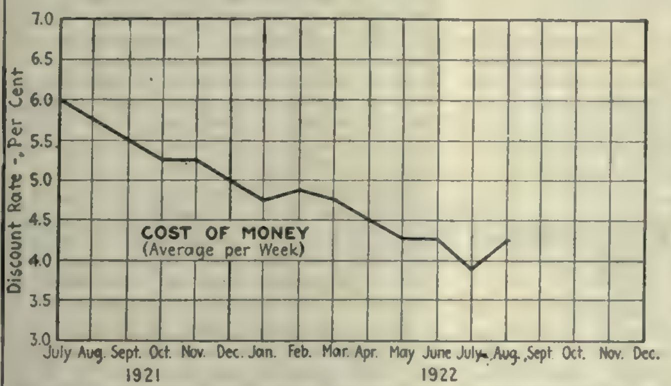
Under the stimulus of easy money and the rapid distribution of revenues raised by taxation or public borrowing we may for a while be able to simulate real prosperity, but the time is rapidly approaching when hard work, economy, and the intelligent development of trade that depends upon low cost production will be essential to our commercial and industrial success.

Progress of French Iron and Steel Industry

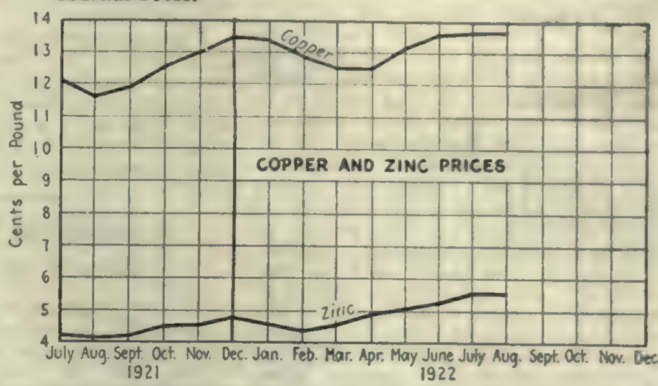
During the first six months of 1922, according to information received by the Department of Commerce from Acting Commercial Attache Butler, Paris, French exports of iron ore reached 4,328,455 metric tons, value 99,000,000 francs, as aginst 2,666,428 tons, value 61,000,000 francs during the first six months of 1921. The exports of iron ore from one period to another increased, especially for Germany (1,160,-058 tons against 505,702 tons). They remain stationary for Belgium and show an increase for the Saar and the Netherlands.

The total French imports for the first half of 1922 of pig iron, wrought iron and steel (including slag) amounted to 391,574 metric tons, value 293,000,000 francs, against 251,232 tons, value 269,-000,000 francs during the corresponding period of 1921. The increase in imports is especially notable for foundry pig iron (34.848 tons during the first six months of 1922, against 15,281 tons during the same period of 1921), for blooms, billets and bars (160,931 tons against 90 072 tons), for hoop iron or steel (19,406 tons against 8,388 tons).

Average weekly rates for 60 and 90 day commercial paper based on New York quotations.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



BUSINESS CONDITIONS, in the United States as reflected in the weekly statement of the Federal Reserve Board issued on September 6, show a slight increase in activity. The twelve banks report bills on hand totaling $593,000,000, an increase of a little over $17,000,000, which is the highest point for a considerable period. The reserve ratio declined from 79.2 per cent on August 30 to 78.3 per cent. The reserve for the Federal Reserve Bank of New York declined from 86.3 per cent to 83.8 per cent. The reserve of the Bank of England shows inprovement during the same period, increasing from 17.64 per cent to 18.30 per cent on September 6.

Industrial works construction contracts awarded in the United States and Canada during August reached a total of $21,660,000, nearly double the total for the four weeks of July. Building contracts were valued at $73,512,000, street and road construction following in second place with $37,035,000. The grand total of all August construction contracted for amounted to $160,130,000 as compared with $119,173,906 in the month of July.

World wheat crop prospects, as estimated by the Department of Agriculture, indicates a yield of 3,019,000,000 bushels. The combined yield of the United States and Canada is placed at 1,125,968,000 bushels as compared with the pre-war average of 883,810,000 bushels. British India and Japan are expected to produce a combined yield of 392,000,000 bushels as against the pre-war average of 375,000,000. Nearly all European countries report decreases as compared with pre-war production.

World international trade in the first half of 1922 according to the National City Bank of New York shows a material decline in stated value when compared with the corresponding period of 1921, and of course a big fall off when compared with the high record year 1920. Official reports of 18 principal countries representing about 60 per cent of the world's normal trade indicates that the stated value of their international commerce in the first half of 1922 is about 13 per cent below that of the same period in 1921.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

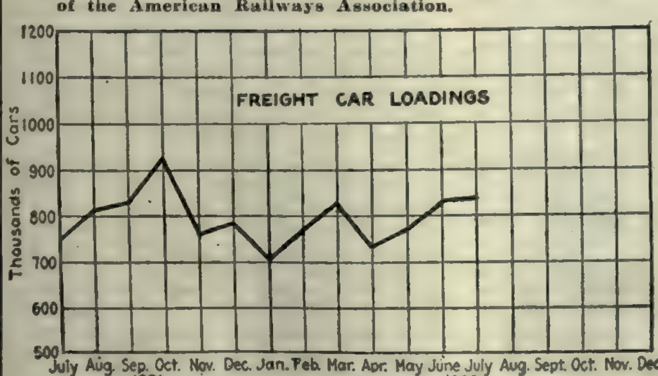
	Unit	Current Price	Four Weeks' Ago	One Year Ago
Soft steel bars..	per lb........	$0.0285	$0.0261	$0.0270
Cold finished shafting......	per lb.........	0.0365	0.0340	0.0415
Brass rods.....	per lb.........	0.170	0.1750	0.1433
Solder (½ and ½)	per lb.........	0.225	0.217	0.18
Cotton waste..	per lb.........	0.115	0.11	0.102
Washers, cast iron (½ in.)...	per 100 lb.	4.00	3.83	4.06
Emergy, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal.......	0.575	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

Pig iron production for August totaled 1,800,000 tons, a decrease of 600,000 tons from the previous month's total. July production showed an increase of 50,000 tons over June.

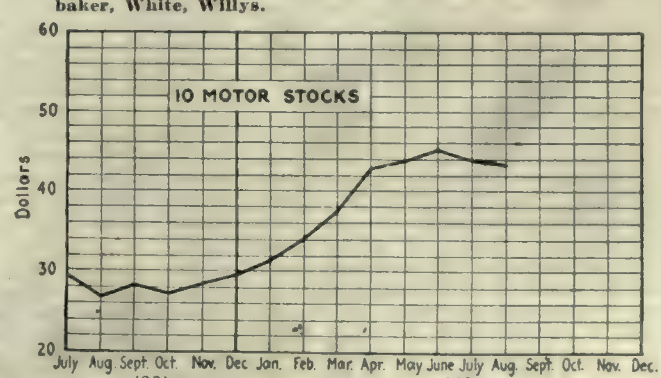
Unfilled tonnage of the U. S. Steel Corporation as of August 31, totaled 5,950,105 tons, an increase over the month of July of 173,000 tons. This compares with the high point reached in April 1921, at which time the forward tonnage totaled 5,845,224 and the low point on February 28 of the current year at which time the unfilled orders amounted to 4,141,069 tons.

Loading of revenue freight on the railroads of the country totaled 890,838 cars during the week which ended on Aug. 26, which was an increase of 34,619 cars compared with the preceding week, and an increase of 61,955 cars over 1921.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Mack, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



Chileans Want American Machinery Catalogs

The American Commercial Attaché at Santiago, Chile, advises the Department of Commerce that although that office receives catalogs from American manufacturers in each mail, it is not collecting them with sufficient rapidity to meet the requests for information which are steadily being received. There is an especially active demand for catalogs of machinery of all kinds, not because of any particular prosperity among Chilean manufacturers, but for the reason that the representation for specialized American machinery is rather lacking in Chile except in certain lines where the makers are represented by their own salesmen or by an unusually alert agency. Many orders for machinery have been placed in Europe simply because of a lack of knowledge of the American product or in default of accessible American catalogs and price lists.

It is suggested that catalogs be sent to the American Commercial Attache at Santiago, Chile, (Casila 27-D, Santiago, Chile), by such American machinery builders as are interested in export trade, and able to furnish satisfactorily the service and packing required by customers in Chile. At present there is particular interest in wood-working machinery, especially that equipped with electric motor drive.

In quoting prices on machines with attached electric drive, the ability to furnish both direct current and alternating current motors—particularly 220 volts—should be indicated and any difference in price should be stated. Both forms of current are at present in use although there is under way a general change toward the use of alternating current motors.

Catalogs should be in Spanish, if possible and preferably in triplicate or quadruplicate. It is well to state the name and address of the agent for Chile, if any.

Southern Industrial Conditions

Reporting for the sixth federal reserve district which comprises the group of southeastern states, the Federal Reserve Bank of Atlanta advises that but for the railroad and coal strikes, industry in the district would likely be experiencing one of the greatest eras of prosperity of the past decade.

Of twenty-four wholesale hardware firms reporting all state that business of late has been less than last year with the exception of three large Atlanta firms which reported a slight increase. Farm implement distributors reporting show equipment sales to be more than 150 per cent better than last year.

Member banks of the system are more optimistic over the outlook than they have been in many months, and financially the district appears to be in very good shape. Failures of late have been considerably less than a year ago. Export business is badly off as railroads do not appear to be taking much interest in the markets. Shipments, furthermore, to southeastern ports are too uncertain at present and not much effort is being made to keep up export.

Textile plants over the district are all operating but due to the coal strike many will likely be compelled to shut down shortly because of lack of fuel. The same is true of the brick and lumber industries.

Pig iron production is gaining steadily and as yet the iron and steel trades are not having to curtail greatly because of the strikes. Building continues active though is being slowed up to some extent due to the inability to obtain prompt shipment of materials.

Automobile Production Heavy in August

Heavy production continued in the automobile industry during August according to reports received from factories by the National Automobile Chamber of Commerce. While the total production for July reached 244,444, estimates based on shipping reports for the first three weeks of August indicate this figure will be exceeded by more than 20,000 machines. Last year August production exceeded July by 4,445 machines, the figures being 176,340 in July and 180,785 in August 1921. Thus, July, 1922, exceeded the same month a year ago by 38 per cent, while August will apparently increase over August, 1921, by something like 50 per cent. Production of cars and trucks for the entire industry during the first seven months of 1922 reached 1,395,066 compared with 1,668,550 for the entire year of 1921.

The export situation continues to show improvement. Passenger car exports in May exceeded April by 8 per cent, and June exceeded May by 15 per cent. The revival of truck business abroad continues to be affected by the disturbed industrial conditions in Europe. Exports in May, however, exceeded April by 36 per cent.

Business Items

The Western Iron Stores Co., Milwaukee, Wis., JOHN A. CAMM, president and general manager, has added to the line of tools that it represents, those of the Rockford Milling Machine Co., Rockford, Ill., and its associated lines, the drilling machines of the Hoefer Manufacturing Co., Freeport, Ill., the sensitive drilling machines of the Edlund Machinery Co., Cortland, N. Y., and the radial drilling machines of the Western Machine Tool Works, Holland, Mich.

The Cropper-Kinney Auto Spring Co. has recently been incorporated at Lebanon, Ohio, a suburb of Cincinnati, with a capital of $50,000. GEORGE CROPPER, for 25 years connected with the Kilburn Wagon Co. is president and treasurer, L. W. KINNEY, for 12 years in charge of the spring factories of the Studebaker Co. is vice-president and general superintendent and A. M. KINNEY is assistant superintendent. The company expects to begin operations October 15 and will manufacture a fine grade of spring under the trade name of "Star Brand."

The Atlanta office of the Bureau of Foreign and Domestic Commerce, through B. C. Getsinger, manager, advises that with the co-operation of southern manufacturers and industrial associations, motion pictures will be made of many southern plants, these pictures to be exhibited in foreign countries as a means of increasing demand for southern made products. Mr. Getsinger requests any reader of the *American Machinist*, interested in the Bureau's plan, to communicate with him at the Atlanta office in the Chamber of Commerce Building. Among the important industries to be filmed will be the iron and steel industries of the Birmingham district.

The Mack Trucks, Inc., for the second quarter of the current year reports net earnings of $1,315,634, after deducting fixed charges, depreciation and taxes. Earnings for the first half of the year now amount to $1,570,632.

The American Steel Foundries Co., in its report for six months ended June 30, 1922, shows a net income of $1,452,-859, which, after deduction of preferred dividends, is equal to $1.89 per share on $20,401,000 common stock of $33⅓ par value, comparing with a net income of $334,775, or six cents per share on the common stock in the same period of 1921.

The Southern Metal Trades Association advises that investigations now in progress at the Bureau of Mines southern experiment station at Tuscaloosa, Ala., cover the physical properties of blast furnace coke, including physical tests, solubility of coke in carbon dioxide, and analysis of blast furnace hearth gas. In the study of reactivity of coke with carbon dioxide, the effect of mesh of coke, temperature, rate of flow of carbon dioxide, and dilution with nitrogen is being further investigated by the station.

The Meldrum-Gabrielson Corporation of Syracuse, N. Y., announces the appointment of WM. BATTERSBY of No. 3325 No. 21st St., Philadelphia, as its exclusive representative for southeastern Pennsylvania and Delaware; and the Kemp Machinery Company of No. 215 N. Calvert St., Baltimore, as its representative in Maryland, District of Columbia and Virginia.

The Canadian National Railway shops in Moncton, N. B., it is expected, will shortly be assigned to work on a new order for two hundred freight cars to be built in that city. During the summer and early fall, most of the work has been on repairs of freight cars. The works were recently inspected by the new minister of railways, W. C. Kennedy. The word that the old board of management is to be retired and a new board appointed was very favorably received as it is believed that under the new regime, the machine shops in Moncton will be favored with much more work than has been the case for the past few years.

The Meldrum-Gabrielson Corporation of Syracuse, N. Y., manufacturer of the Syracuse adjustable limit snap gage, announces the appointment of W. R. WYATT, 50 Church Street, New York, as exclusive representative in the Metropolitan zone and vicinity.

The Belknap Manufacturing Co., 149 Water St., Bridgeport, Conn., manufacturers of steam and water goods, valves, etc., purchased during the week the large machine shop of the old Morris Metal Products Co., on Union Ave., Bridgeport. It was bought from Kenneth W. McNeil, of Bridgeport, who had previously during the week purchased the entire Morris plant from the United States District Court at

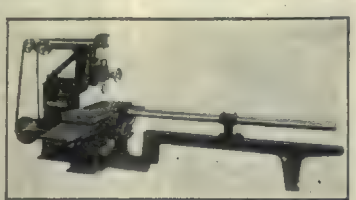
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Machine, Radius, Link

Newton Machine Tool Works, Inc., Philadelphia, Pa.

"American Machinist," June 29, 1922

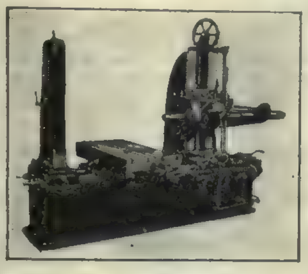


The machine is intended particularly for finishing the reverse links and blocks used on locomotives. The radius can be varied from 18 to 100 in. The table has hand adjustment and is reciprocated automatically by the use of dogs. Three speeds are provided. The spindle head is adjustable on the upright. The spindle has both hand adjustment and an automatic oscillating motion for use with wide-face wheels. The drive is by a 5-hp. motor running at 1,200 r.p.m. or by a single pulley. Distance from the spindle center to column, 7 to 13 in. Table stroke: maximum, 30 in.; minimum, 2 in. Table, 18 x 42 in. Floor space, 14 ft. 3 in. x 9 ft. 6 in. Height overall, 6 ft. $7\frac{1}{2}$ inches.

Boring, Drilling and Milling Machine, Horizontal, No. 3-T

Pawling & Harnischfeger Co., Milwaukee, Wis.

"American Machinist," July 6, 1922

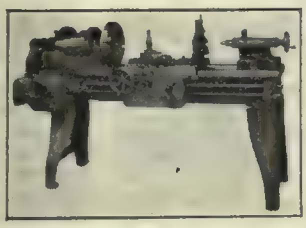


The machine is built for tool work especially. The levers and handwheels which control the starting, stopping, reversing and changing of feeds or speeds by either hand or power, are within easy reach of the operator. Power is applied at the front end and the feed motion at the rear end of the spindle. Sixteen spindle speeds and eight geared feeds are provided. With small faceplate: spindle speeds, 14.5 to 225 r.p.m.; boring feeds, 0.005 to 0.288 in. per spindle revolution; milling feeds, 0.0084 to 0.44 in. per revolution. With large faceplate: spindle speeds, 8.7 to 136 r.p.m.; boring feeds, 0.008 to 0.48 in. per spindle revolution; milling feeds, 0.013 to 0.73 in. per revolution.

Lathes, Engine, Plain and Quick Change, "Standard," 14-, 16-, 18- and 20-In.

John Steptoe Co., Cincinnati, Ohio.

"American Machinist," July 6, 1922



The lathes are equipped with feed rods in addition to lead screws, and in the quick-change model the range of threads and feeds is controlled by two handles. The 18-in. machines are furnished with cabinet legs under the headstock, and the 20-in. ones with cabinet legs at both ends. Bed lengths: For the 14- and 16-in. lathes, 6, 8 and 10 ft.; for the 18- and 20-in. lathes, 6, 8, 10, 12, 14 and 16 ft. Equipment: two faceplates, steadyrest, follow rest, graduated compound rest, gear guards, and countershaft with two friction-clutch pulleys. Extra equipment: taper attachment, thread indicators, draw-in attachment and motor drive.

Grinding and Reboring Machine, Cylinder, Portable

Simplicity Engine and Manufacturing Co., Fort Washington, Wis.

"American Machinist," July 6, 1922

The machine can be used on either open or closed cylinders up to $11\frac{1}{2}$ in. in depth. It is driven by a $1\frac{1}{2}$-hp. motor ordinarily supplied for either 110- or 220-volt alternating or direct current. The boring bar is driven at 40 r.p.m. The grinding spindle inside the bar runs at 5,000 r.p.m., driven by a belt. The downward feed is automatic. The base block has holes for clamping to the cylinder block and the machine itself is pivoted on this base. A boring head with three cutters adjustable simultaneously by means of a central tapered plug, and rings for use in setting the cutter head to size, are furnished. Weight 140 pounds.

Hacksaw Frame, Adjustable, Pistol-Grip, No. 169

L. S. Starrett Co., Athol, Mass.

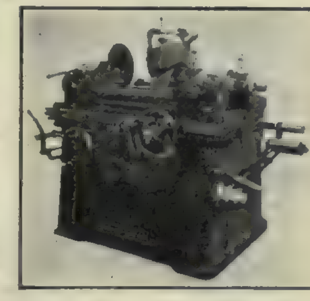
"American Machinist," June 29, 1922

The constant tension maintained by springs on the bolts which hold the blade, in connection with the positive adjustment on the back, enables easy and rapid changing of the blades. The pawl for adjustment is set down inside the frame as low as possible. The back is constructed of steel tubing. By turning the wing nut, the blade may be set to cut in any one of four directions. The frame has a depth of $3\frac{3}{8}$ in. from the cutting edge of the blade. Blades from 8 to 12 in. in length can be used. The checked hard-rubber handle provides plenty of finger room and is comfortable to grip.

Grinding Machine, Cylindrical, Plain, 10 x 18-in.

Norton Co., Worcester, Mass.

"American Machinist," **July 6, 1922**

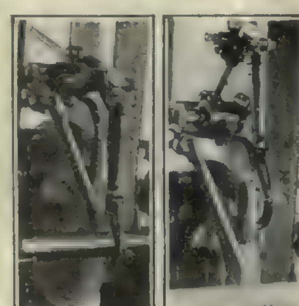


The machine is similar to the other 10-in. grinding machines made by the firm, and has the same headstock, footstock, wheelslide, table-speed frame and wheel-feed mechanism. The floor space is less because of the shortened distance between centers. The wheel spindle can carry a standard grinding wheel up to 18 in. in diameter. Four speeds are provided for the table. Each tooth on the index wheel represents a feed of the wheel of 0.00025 in. The length of work accommodated is 18 in., which gives a capacity for handling a large number of parts used in automobiles and accessories.

Gage, Grinding

Fred J. Pratt, 627 Wayne St., Detroit, Mich.

"American Machinist," July 6, 1922

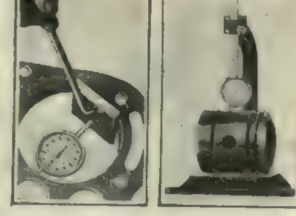


The gage is for determining the size of work being ground, without stopping to use snap gages or micrometers. Heads to fit the work can be interchanged, each having a range of $1\frac{1}{8}$ in., and sizes up to 5 in. can be supplied. Two diamond contact points which do not mark the work, are mounted in the ends of adjustable interchangeable screws, and a third is mounted in the end of the spring-actuated plunger. The indicator is set at an angle of 30 deg. at the top of the column. The gage can be raised and lowered, and can be changed from one machine to another by inserting it in different hangers.

Gages, Cylinder and Piston, Atlas, "Mikro-Indicator"

Geo. H. Wilkins Co., 180 N. Market St., Chicago, Ill.

"American Machinist," July 6, 1922



The cylinder gage at the left consists of a dial gage with two contact points and a saddle with a supporting stud on which the indicator is mounted, and which holds the contact points at a right-angle to the axis of the cylinder. The gage can be used in cylinders from $2\frac{3}{8}$ to 5 in. in diameter and indicates in thousandths of an inch. It can be dismounted from the saddle, and the dial can be set by revolving the bezel. The piston gage at the right, is a bench gage with a range of from 0 to 6 in. The dial indicator is mounted on a sliding scale graduated in inches and sixteenths. Diameter, roundness and uniformity can be checked.

Clip, paste on 3 x 5-in. cards and file as desired

public auction. The property purchased by the Belknap concern consists of a two-story, 190 by 375 ft. brick and steel machine shop. The purchase price paid by the Belknap interests is in the neighborhood of $100,000. The concern is already engaged in moving into the new location.

The American Locomotive Co., in its report for the six months ended June 30, 1922, showed a deficit of $966,780, compared with a net income of $3,901,-043 for the corresponding period of 1921. Gross revenues for the six months were the smallest for any similar period since 1915, amounting to $7,399,934, comparing with $25,989,781 for the corresponding months of 1921.

The Westinghouse Electric and Manufacturing Co., will shortly establish a service and repair plant in Bridgeport, Conn., the company having taken a lease on approximately ten thousand square feet of factory space in the building on Seymour street, Stratford, just over the line of Bridgeport, and belonging to the Bridgeport Engineering Co. The new plant will serve the entire Naugatuck Valley section of Connecticut, and will be under the supervision of L. D. Canfield, district sales manager in charge of the New York territory.

The Morris Metal Products Co. plant at Bridgeport, Conn., was sold August 31, by order of the United States District Court to Kenneth W. McNeil, president of the Karm Terminal Co., Bridgeport, for $220,500. In the property purchased is a large two-story 190 by 375 ft. brick and steel constructed machine shop building.

The Reed-Prentice Co. announces a change of address for its Detroit office to 6326 Cass Ave., opposite the General Motors Building, in which location, it will also maintain a new show room. The branch will be in charge of F. C. McDonald, formerly of the Indianapolis office of the company, assisted by C. B. Barber, formerly superintendent of the Lafayette Motor Corporation. As in the past, the office will also be sales headquarters for the Becker Milling Machine Co., and the Whitcomb-Blaisdell Machine Co.

The Union Foundry and Machine Co., St. John, N. B., one of the oldest machine and repair concerns in the maritime provinces, has received recently at their West St. John plant several new orders for boilers and cranes for handling freight. An extension was lately added to the West St. John plant to take care of increased business resulting from the work on the Trans-Atlantic docks in that city.

The Dover Machinery Co., Providence, R. I., was granted a charter last week by the Secretary of State under which it will engage in a general machinery business. The incorporators are Henry E. Watjen and Harold P. Watjen of Providence and Henry A. Goodrich of East Providence.

The Mehl Machine Tool and Die Co., for the past ten years located at Roselle, New Jersey, engaged in the designing and construction of jigs, fixtures, dies, gages and special machines for manufacturers, has just opened an engineering branch in Cleveland, Ohio. This is in order to keep in closer touch and to better care for the requirements of their increasing number of customers throughout the middle west and render still better service in tool engineering by reason of having an engineering force available for immediate contact and co-operation with their middle western customers. The main plant and office will be retained in Roselle, and the expansion of the organization as reflected in the opening of the new Cleveland engineering branch will, it is expected, be augmented by other branches at points central to other large industrial districts.

The Gray & Davis, Inc., for the six months ended June 30, before depreciation, taxes and interest charges, reports net earnings of $208,506, most of which was earned in June. Operations in that month were at 60 per cent of capacity. Present unfilled orders of the corporation total approximately $3,000,000.

The Atlantic Steel Co. in connection with the "Made-in-Atlanta" Exposition at the Atlanta Auditorium, Sept. 18 to 25, will operate a miniature plant manufacturing barbed wire and nails. Several of the important Atlanta factories will install machinery for the manufacture of their products as one of the educational features of the exposition.

The Queen City Iron and Metal Co., Charlotte, N. C., announces that it has purchased the DuPont Alcohol Plant at Georgetown, S. C.

The Standard Machine Co., 311 Fifth Ave., Nashville, Tenn., is planning the construction of a small machine shop to cost about $5,000.

The International Trade Commission of the Southern Commercial Congress which is to make a tour of the principal European countries during August, September and October, will include in its personnel about sixty prominent business men and manufacturers of the South representing all lines of industry, chiefly the metal trades. They will study business, industrial and agricultural conditions in Europe with a view to further expanding the export trade of Southern manufacturers with the countries to be visited.

The Chattanooga Smelting and Plating Works has been incorporated at Chattanooga, Tenn., by M. W. Wilbur and associates, with a capital stock of $500,000.

T. McAvity and Sons, Ltd., St. John, N. B., are engaged in transferring all the production departments from the old quarters to the buildings on Rothesay Ave., near the One Mile House. The machine shops and iron foundry are now at the Rothesay Ave. plant. The brass shops will follow later. The Rothesay Ave. shops are of concrete and glass. The executive and clerical forces of the production departments are now quartered at the Rothesay Ave. plant.

The National Supply Co., Columbus, Ohio, manufacturers of oil field machinery has recently opened Texas headquarters in the Magnolia Building, Dallas, Tex.

The Herrick Refrigerator and Cold Storage Co., Waterloo, Iowa, manufacturer of refrigerators for store, hotel and family use, announced today the expansion of their factory by the addition of a new heating plant and the erection of a separate office building. Additional land, 120 by 140 feet, fronting on Commercial St., has been purchased, giving the factory an entire block of ground area. The enlargement of the factory has been brought about by increased business and was determined when the full capacity of the factory for the past few months has been insufficient to keep up with orders for their product. H. G. Northey, secretary, states that the volume of business is greater this year than for any similar period in the history of the company. The officers of the company are president, Nathan Northey; secretary and manager, Harry G. Northey, and treasurer, W. E. Ogle.

Personals

Marcus A. Coolidge, president of the Fitchburg Machine Works, Fitchburg, Mass., has just returned from a business trip to Europe.

Geo. R. Woods, general manager of R. S. Stokvis & Son, Inc., New York, will sail on September 16, for a business trip to his home office in Holland.

Charles L. Taylor, president of the Taylor & Fenn Co., returned last Saturday from a business trip to Europe.

A. W. Robbins, for the past few years identified with the ball bearing industry because of his connections with the Standard Roller Bearing Co., and the Bearings Service Co., is now associated with The Bearings Company of America, and will make his headquarters at the Detroit office of the company, located in the Ford Building in that city.

Donald Simonds, formerly associated with the Arcade Malleable Iron Co., Worcester, Mass., is now connected with the Rogers, Brown and Co., pig iron dealers, of Boston.

Lawrence M. Keeler, agent for the Whitin Machine Works, manufacturers of textile mill machinery, Whitinsville, Mass., has left for a business trip through Spain. Mr. Keeler, sailed from New York the past week, and will land at Havre, France.

Allen Ashley, associated with the domestic sales department of the Westinghouse Electric and Manufacturing Co. for ten years and with the foreign sales department of the Allied Machinery Company of America for four years, has established a clearing house to handle surplus machinery and supplies at 152 West 42d St., New York City.

Obituary

John A. Leonard, business manager of the Crane Co., Bridgeport, Conn., plants, died at his home in that city, September 2, after an illness lasting about a year. Mr. Leonard has been with the Crane Co. for a number of years. He was born in Livermore Falls, Me., October 25, 1872, and came to Bridgeport when 10 years old.

William F. Ruwell, for 25 years a well-known machinery expert, whose home was at 3028 Girard Ave., Philadelphia, Pa., died August 31, at his summer home in Sea Isle City of pneumonia. He was 52 years old, and is survived by a widow and four children. Mr. Ruwell was widely known as an

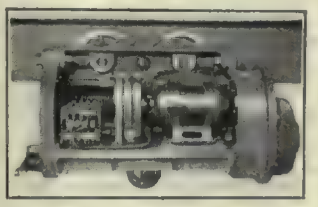
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Hoist, Electric

Standard Electric Crane and Hoist Co., 1420 Chestnut St., Philadelphia, Pa.

"American Machinist," July 6, 1922



The hoist is rugged in construction and the working parts are inclosed in a dust- and weather-proof case. It is supplied with a two- or four-part rope block. When the load block reaches its upper limit of travel the holding brake is automatically applied. The hoist is made in two types, being moved along the rail by hand or by motor. Both types are made in five sizes with from 2,000 to 10,000 lb. hoisting capacity. Motors for either a.c. or d.c. can be furnished. Heights of lift, 15 to 50 ft. Hoisting speeds, 10 to 70 ft. per min. Weight, 1,300 to 2,050 pounds.

Gage, Ring, for Setting Reamers, "Simplex"

Ampco Twist Drill and Tool Co., 18th and Howard Sts., Detroit, Mich.

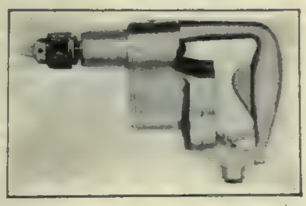
"American Machinist," July 6, 1922

The gages are used in setting expansion reamers of the Critchley type. A reamer may be accurately set to size without the use of a micrometer. A gage of the desired size is merely slipped over the reamer and the blades are expanded until they fit the gage closely. Gages can be furnished in all standard sizes, and in the over- or under-sizes required. They can be supplied singly or in sets, packed in wooden boxes. Sets consisting of Ampco adjustable Critchley reamers and Simplex gages can be supplied, for automotive purposes especially. All the reamers and bushings necessary for work on engine or transmission bearings can be packed in one box.

Drill, Portable, Pneumatic, "Tiny"

Turbine Air Tool Co., 710 Huron Rd., Cleveland, O.

"American Machinist," July 6, 1922



The drill is driven by a small air-operated turbine. The rotor is mounted on ball bearings, but does not touch any other part of the mechanism. Speed reduction is obtained by means of gears. Since all bearings and gears are contained in one housing, a semi-liquid lubricant that need be renewed only every three to six months is employed. The valve is operated by the trigger handle. The part containing the nozzles is easily accessible. Capacity, holes up to $\frac{3}{8}$ in. in metal and $\frac{1}{2}$ in. in wood. Maximum speed, 2,000 r.p.m. Weight, 5 pounds.

Blowpipe Outfit, Gasoline

Ransom & Randolph, Toledo, Ohio

"American Machinist," July 6, 1922

The outfit is for use in soldering by jewelers, electricians, battery-men and automotive mechanics. The blowpipe uses gasoline as fuel by preheating the air. The gas-air ratio is controlled by a lever which directs the air through different ports. This lever is movable through an arc of 90 deg. and at one extreme the gas delivered is rich in fuel value, while at the other extreme it is very lean. The flame at the blowpipe tip covers a wide variation from a jet of about $\frac{1}{8}$ in. in diameter and 1 in. long to an enveloping flame 1 in. in diameter and 6 in. long.

Sub-Head for Hendey Lathes

Hendey Machine Co., Torrington, Conn.

"American Machinist," July 6, 1922

The attachment is used in the cutting of worms, threads, and hobs of unusually rapid lead, and also in connection with the backing-off or relieving of cutters possessing a large number of teeth. The attachment is fitted to the inner Vs of the lathe and is set in place and clamped by means of a clamping bolt. It gives a six-to-one reduction in speed relative to the lathe spindle. A helix which has a lead of one turn in 6 in. may be cut with the same screw gears used for cutting a one-to-one lead.

Truck, Crane, Electric, Industrial

Elwell-Parker Electric Co., Cleveland, Ohio.

"American Machinist," July 6, 1922

The single motor, double-drum hoist handles separate lines to the boom and hook. The crane swings through 180 deg. Current for all motions is furnished from a single battery, and only two motors are used with both controllers located near the operator. The outfit has a crane trip-switch, truck automatic-control, worm drive, four-wheel steer, and pressure lubrication. Lifting capacity without outriggers, 3,000 lb. at 6-ft. radius, 1,000 lb. at 12-ft. radius. Stacking capacity, 12 ft. high with boom set to lift 3,000 lb. at 6-ft. radius.

Hexing and Castellating Machine, Nut

Manufacturers' Consulting Engineers, McCarthy Bldg., Syracuse, N. Y.

"American Machinist," July 6, 1922

The machine is intended for the castellation of nuts and for milling the hex on spark plugs. The work is contained in six collets carried by a revolving turret, and every alternate collet is operated on simultaneously. The turret is automatically oscillated to and from the cutters and is indexed 90 deg. on the back stroke. When a piece of work has been completed it is ejected from its collet. Three cutters are spaced 120 deg. apart and cut simultaneously. The machine is belt driven and is equipped with a clutch for stopping and starting.

Grinding Machine, Crankpin, Model 81-B

Norton Co., Worcester, Mass.

"American Machinist," July 6, 1922

The machine is intended for accurate high-speed work on crankshaft pins. It has a two-speed hand-operated table traverse, the slow speed for truing and the fast speed for moving the table from one pin to another. Six speeds are provided for the work table. The machine is equipped with automatic power infeed for the wheel, independent of the work speed, the rate being arranged to suit the work. A safety device in the wheel-feed mechanism prevents injury to the wheel or crank. The machine is made in four sizes. Swing, 14 in. Work length, 24 to 48 in. Weight, 11,375 to 11,600 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

expert machinist, being considered an authority on paper making and ice manufacturing machinery. The first successful machine for the trimming of stereotype plates to fit the printing presses was perfected by Mr. Ruwell.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Acetylene pressure gages—South Africa. Purchase desired of small nonleakable gages, to register from fractions of a pound upward to 10, 20, and 30 pounds. Quotations, f.o.b. New York. Reference No. [illegible]

Machinery for distilling beer, spirits, and brandy—South Africa. Purchase is desired. Quotations, f.o.b. New York. Payment cash. Reference No. 3429.

Radio telephones—Italy. Mercantile firm desires to secure an agency. Reference No. [illegible]

Automatic machine for attaching snap buttons on cards or cardboard—Switzerland. Purchase desired by a manufacturer. Payment, on receipt of merchandise, or in advance upon guarantee of manufacturer. Correspondence, French. Reference No. 3411.

Vulcanizing machine—Canada. Quotations desired, f.o.b. port of shipment. Terms, cash. Shipment to be by rail. Reference No. 3413.

Woodworking machinery and tools—Australia. Purchase desired for the manufacturing of shop and office fittings, and show cases (not heavy machinery). Quotations, c.i.f. Melbourne. Payment, cash. Catalogues and price lists are requested. Reference No. 3434.

Steel rails and beams, and heavy materials in iron and steel—Sweden. Quotations, c.i.f. Swedish ports. Agency desired from manufacturers. Reference No. 3411.

Machines for engraving and for enameling [illegible]—Spain. Quotations, c.i.f. Barcelona. Correspondence, Spanish or French. Reference No. 3416.

Textiles and textile machinery—France. Representation of American firms is desired in the north of France. Reference No. 3418.

Pop-corn machinery—South Africa. Quotations, c.i.f. vessel at New York. Payment, cash. Desires to purchase several modern machines for street selling. Reference No. 3419.

Machinery, electrical material, motors, etc.—Italy. Agency and purchase desired. Reference No. 3429.

Machines for making brushes—Brazil. Quotations, c.i.f. Para. Terms, cash against documents. Correspondence, Spanish or Portuguese. Catalogues and price lists requested. Reference No. 3421.

Soda-fountain equipment and carbonating machinery generally, and machinery pertaining to the manufacture of soft drinks—South Africa. Samples of essences, acids, and colorings requested. The sole agency is desired. Catalogues should be forwarded. Reference No. 3424.

Machinery for wooden-match factory—Mexico. Quotations, f.o.b. factory or c.i.f. El Paso, Tex. Payment, cash in United States currency. Catalogues and prices requested. Reference No. 3436.

Articles of white metal—Spain. Purchase is desired by a dealer in notions and fancy goods. Quotations, c.i.f. Vigo. Correspondence, Spanish or French. Reference No. [illegible]

Steel and cement (concrete) work—Italy. Agency desired with a view to constructing permanent exhibition buildings in various [illegible]. Quotations, c.i.f. Genoa. Correspondence, French or Italian. Reference No. 3444.

Hardware, textiles, machinery, automobiles, etc.—Argentina. Purchase and agency desired, from manufacturers. Reference No. 3443.

Machines for sewing automobile tires—[illegible]. Quotations, f.o.b. port of shipment. Payment, cash. Correspondence, Spanish. Reference No. 3445.

Cider presses—Canada. Quotations, f.o.b. port of shipment. Terms, cash. Shipment may be by rail. Reference No. 3447.

Iron beams, rails, etc.—Sweden. Agency desired. Quotations, c.i.f. Swedish ports. Terms, cash against documents. Reference No. 3452.

Wire and screws for the manufacture of mattresses—Spain. Quotations, f.o.b. New York or c.i.f. Vigo. Terms, payment against documents. Correspondence, Spanish. Reference No. 3456.

Wooden and steel tackle pulley blocks—Canada. Quotations, f.o.b. port of shipment. Terms, cash. Shipment to be by rail. Reference No. 3459.

Machine for sharpening the beveled sections for blades of mowing machines—France. Quotations, f.o.b. New York. Terms, payment against documents. Correspondence, French. Reference No. 3467.

Tools and machine tools—Belgium. Agency desired. Quotations, c.i.f. Antwerp. Terms, cash against documents. Samples should be forwarded. Reference No. 3471.

Galvanized steel cable, manila hemp rope, hoop iron, tin plates, and machinery for the manufacture of cans, especially automatic machinery—Spain. Quotations, c.i.f. Cadiz. Catalogues are requested. Reference No. 3475.

Tubes, pumps, valves, sanitary goods, machine tools, and small tools—Sweden. Purchase or agency desired. Quotations, f.o.b. New York. Reference No. 3480.

Hardware, mill machinery and parts, lubricating oils, and metal sheets—India. Purchase and agency desired. Quotations, c.i.f. Madras. Reference No. 3481.

Galvanized wire and products, enamel and hollow ware—Panama. Exclusive agency on commission for the sale of goods in Colombia and Panama. Reference No. 3482.

Hardware, tools, kitchen utensils and small machinery—Denmark. Hardware wholesaler desires to be placed in communication with American manufacturers. Reference No. 3483.

Winding machine for attaching loops to whip handles to which lash is attached, and automatic safety-razor blade stroppers without strop—Canada. Quotations, f.o.b. place of shipment. Terms, cash upon arrival of goods. Reference No. 3486.

Foundry pig iron, rails, shipbuilding materials, compressed shafts, tubes, ferro-alloys, dynamo sheets, billets and rods, and electro copper—Sweden. Agency or purchase desired. Quotations, f.o.b. Atlantic ports. Terms, cash against documents. Reference No. 3499.

Engines and motors—Sweden. Agency desired. Quotations, c.i.f. Stockholm or Goteborg. The cheaper-grade articles are desired. Reference No. 3504.

Pamphlets Received

Commerce of Haiti. The Pan-American Union Bulletin on the Commerce of Haiti based on the latest reports from Haitian official sources. Distributed by the Pan-American Union, Washington, D. C.

Proceedings of the National Association of Office Managers. The publication contains the proceedings of the third annual conference of the National Association of Office Managers held in Washington, D. C., May 18-20, 1922. Applications for copies of the proceedings should be made to G. S. Childs, secretary, Alexander Hamilton Institute, Astor Place, New York City.

Trade Catalogs

Battery Charging Equipment. The Hobart Brothers Co., Troy, Ohio. A new folder on the subject of eight-hour constant potential battery charging. The folder describes the company's equipment for this class of work and gives numerous illustrations of characteristic installations in connection with the well-known makes of batteries.

Tumbling Mills. The Whiting Corporation, 945 Monadnock Block, Chicago, Ill. A new publication, known as catalog No. 162, of 31 pages. This catalog contains complete information relative to the numerous styles of tumbling mills made by this company for a variety of purposes. Many interesting illustrations are given of large installations as well as other useful matter on construction details.

Swing Gate Valves. The Schutte and Koerting Co., Philadelphia, Pa. A new publication known as bulletin 8-G describing the new Schutte Regrinding Swing Gate Valve, designed for steam pressures up to 200 lbs. per square inch and temperatures up to 750 deg. Fahrenheit. The bulletin contains cuts showing construction details as well as information regarding its operation.

Jigs, Fixtures, Dies and Gages. The Mehl Machine Tool and Die Co., Roselle, New Jersey. A new edition of the company's general catalog. The publication contains complete information regarding the company's line of service and jigs, fixtures, dies, gages and special machines with numerous illustrations of the class of work produced.

Electric Drills. The Jas. Clark, Jr., Electric Co., Louisville, Ky. An illustrated folder describing the Clark automatic electric drill, as well as other electric specialties made by this company.

Jacobs Chucks. The Jacobs Manufacturing Co., Hartford, Conn. Catalog and price list No. 18 of the very complete line of improved drill chucks, "Super-chucks" and chuck arbors manufactured by this company. In the booklet are included directions for taking apart and assembling Jacobs chucks and recommendations as to the proper model of chuck to use for various machines and purposes. There is also a chart of taper arbor holes as used in these chucks.

Cranes and Hoists. The Northern Engineering Works, Detroit, Mich. Crane and Hoist booklet, No. 24-G, just issued. The booklet contains a collection of illustrations showing typical installations of the company's line of cranes and hoists.

Electric Furnaces. The Electric Furnace Co., Salem, Ohio. A six-page folder illustrating the application of Bailey electric furnaces in the brass foundry industry. Also a six page illustrated letter showing some of the many types of electric enameling, annealing and heat treating furnaces by the company.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society of Mechanical Engineers, regional meeting, Sept. 25, 26 and 27, 1922, Hotel Kimball, Springfield, Mass. Secretary Calvin W. Rice, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. Building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

American Manufacturers Export Association, annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Buck Falls, Pa., (Delaware Water Gap).

National Machine Tool Builders' Association, annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

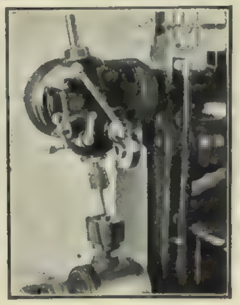
American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922 Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

Condensed-Clipping Index of Equipment

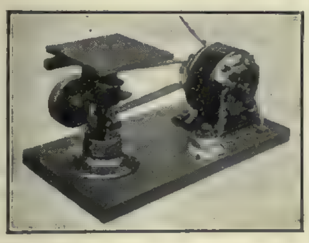
Patented Aug. 20, 1918

Milling and Drilling Attachment, Universal
Rockford Milling Machine Co., Rockford, Ill.
"American Machinist," July 6, 1922



The attachment is mounted on the face of the column above the spindle and receives its drive by a geared connection from the back end of the spindle through a driving sleeve substituted for the overarm. It has two graduated circular bases, placed at right angles to each other and both bases can be swiveled through 360 deg. Its spindle, mounted in a graduated quill, has two feeds, one of which is 48 times faster than the other. Sixteen spindle speeds are obtainable, ranging from 21 to 414 r.p.m. The hole in the spindle is No. 9 B. & S. taper.

Filing Machine, Bench, Motor-Driven, "Hartford"
Robinson Tool Works, Waterbury, Conn.
"American Machinist," July 6, 1922



Some improvements have been made in the machine. The top plate or table now has a double swing so that it can be tilted to angles up to 10 deg. in any direction. An improved dust guard has also been added.

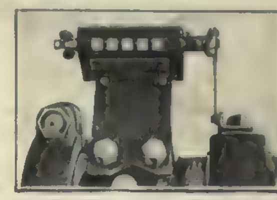
Grinding Machine, Centerless, Cylindrical, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio
"American Machinist," July 13, 1922

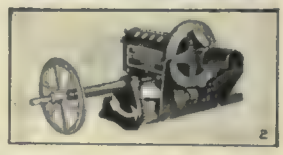
The machine is for finishing straight cylindrical machine parts. It is self contained and can be driven by belt or by a 10- to 15-hp. motor. The work is always held parallel to the grinding wheel axis and is passed transversely between a 20-in. diameter grinding wheel and a 12-in. diameter wheel opposite, which controls the feed and the rotative speed of the work. The axis of the control wheel is set at an angle with that of the grinding wheel, so as to draw the work through the machine. Four speeds are provided for the control wheel to suit the work diameter. A wheel-truing fixture can be mounted on top of the work-rest bracket. Capacity, $\frac{3}{16}$ to 3 in. in diameter, 15 in. in length.

Air Compressor for Small Installations, Single-Stage
Norwalk Iron Works, South Norwalk, Conn.
"American Machinist," July 13, 1922

The air compressor is used in operating hoists, drills and hammers, and may be driven by an independent motor or from a lineshaft. It is built in ten sizes and is of the center-crank, double-action type with a belt and flywheel on opposite ends of the crankshaft. The cylinder overhangs and all valves are accessible. The cylinder and heads are amply water jacketed. The valves are of the multiple-port plate type for high-speed operation. The stuffing box is accessible for adjustment and repacking. Capacity, 57.6 to 748 cu.ft. free air per minute. Cylinder diameter: smallest size, 6 in. with 6 in. stroke; largest size, 18 in. with 12 in. stroke.

Counter, With Measuring Attachment, "Universal Model"
Precision Machine Co., 415 Chestnut St., Milwaukee, Wis.
"American Machinist," July 6, 1922





The counter can be used on practically any machine to find the number of moves made by any part of the machine, or the number of pieces or loads which pass a given point. As shown in the top view, attached to a punch press, it can be used as a revolution or stroke counter. Attached as shown below, it can be used to record the number of feet of thread being wound on a spool. The brass plate connected to the worm wheel side is graduated in feet, and one complete revolution of the wheel records the passing of 100 ft. of material. The counter can be furnished with electrical contacts.

Reamer, Expansion, Piston-Type, "Reamrite"
Cronin-Waddell Co., 104 Portland St., Boston, Mass.
"American Machinist," July 6, 1922

The tool is intended for reaming pin holes in automotive pistons. The slots in which the blades are set are milled slightly wider than necessary to accommodate the thickness of the blades, and the extra space is filled by a liner, or shim, placed back of each blade. With the shims placed ahead of their respective blades, the tool may be ground between centers in a lathe as an ordinary concentric piece of work. Eccentric relief is obtained by reversing the shims to former positions. The reamer is made in seventeen sizes. Range: smallest size, $\frac{15}{32}$ to $\frac{17}{32}$ in.; largest size, $3\frac{5}{16}$ to $3\frac{3}{4}$ in. Blade length, $1\frac{3}{4}$ to 6 in. Overall length, $5\frac{1}{2}$ to 20 inches.

Gage, Thickness, No. 646
Brown & Sharpe Manufacturing Co., Providence, R. I..
"American Machinist," July 13, 1922

The gage contains six blades having respective thicknesses of 0.0015, 0.002, 0.003, 0.004, 0.006 and 0.015 in. The blades can be used either singly or collectively and will give a variety of measurements up to 0.0315 in. The gage is especially suited to the use of motor mechanics and car owners for setting valve tappets, points of distributor heads, spark plugs, joints or parts where there is play or looseness. It has an eyelet at one end so that it can be either carried on a ring or hung up.

Toolholder, Forming
Willard Tool Co., Inc., Stratford, Conn.
"American Machinist," July 13, 1922

The holder is adapted for use on lathes, shapers, planers and screw machines. Two holes are drilled in the cutter, one for the clamping bolt and the other to fit a dowel pin which not only keeps the cutter from turning but properly locates it in the holder after removal for grinding. The toolholder is made of a tough grade of steel. The surface against which the cutter rests is parallel with the under side of the shank. Two sizes of the holders having respective cross-sections of $\frac{1}{2}$ x 1 and $\frac{5}{8}$ x $1\frac{1}{4}$ in. are made to fit ordinary toolposts. Cutters: smaller size, $\frac{1}{4}$ x 1 x $1\frac{1}{2}$ in.; larger size, $\frac{3}{8}$ x $1\frac{1}{4}$ and 2 inches.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—No. 2 foundry iron up $2 in Pittsburgh and Chicago; basic, $4 in Pittsburgh and $1 in Philadelphia; bessemer $2 per gross ton in Pittsburgh, during week. Blue annealed, black, and galvanized steel sheets, all up 10c. per 100 lb., f.o.b. mill. Steel bars, $1.90@$2.25 per 100 lb., f.o.b. Pittsburgh; quotation only nominal, owing to scarcity of material. Mills, however, rapidly increasing production. Shapes and plates quoted by leading interest at minimum of $2; $2.50 obtained, however, on current trading, for prompt deliveries. Structurals, floor plates and cold finished steel advanced 15c. per 100 lb., in Cleveland warehouses.

Metals prices generally firmer. Lead quoted at 6.6c. as against 6.2c. per lb., New York; higher in St. Louis. Chinese antimony ½c.@¾c. per lb. higher, in New York. All fabricated brass and copper products, bolts, nuts, rivets and leather belting higher in Cleveland.

Declines—Cleveland quotes reduction of ½c.@¾c. per lb. in old metals (non-ferrous); also slight reduction in wiping cloths. Linseed oil, $1.01 as against $1.14 per gal., in 5 bbl. lots. No declines in New York or Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.55
Northern Basic	32.27
Southern Ohio No. 2	31.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.44
BIRMINGHAM	
No. 2 Foundry	27.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	34.64
Virginia No. 2	30.17
Basic	32.00
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	30.00
Bessemer	32.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	7.5	5.0	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.60	4.03	3.50	4.00
No. 12	2.60@2.70	4.08	3.55	4.05
No. 14	2.70@2.80	4.13	3.60	4.10
No. 16	2.9 @3.10	4.23	3.70	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.40	4.05	4.70
Nos. 22 and 24.	3.25@3.40	4.45	4.10	4.70
Nos. 25 and 26.	3.30@3.45	4.50	4.15	4.75
No. 28	3.35@3.50	4.60	4.25	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35@3.50	4.60	4.25	4.85
Nos. 12 and 14.	3.45@3.60	4.70	4.35	4.95
Nos. 17 and 21.	3.75@3.90	5.00	4.65	....
Nos. 22 and 24.	3.90@4.05	5.15	4.80	5.40
No. 26	5.05@4.20	5.30	4.95	5.55
No. 28	4.35@4.50	5.60	5.25	5.85

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	39½	24½
LAP WELD					
2	61	49½	2	34½	20½
2½ to 6	65	53½	2½ to 4	37½	24½
7 to 8	62	49½	4½ to 6	37½	24½
9 to 12	61	48½	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	39½	25½
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	35½	22½
2½ to 4	63	52½	2½ to 4	38½	26½
4½ to 6	62	51½	4½ to 6	37½	25½
7 to 8	58	45½	7 to 8	30½	18½
9 to 12	52	39½	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded.	57%	44%	54½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods(base)	6.03	8.00	6.10
Hoop steel	4.14	3.50	3.90
Cold rolled strip steel	6.50	8.25	7.25
Floor plates	5.20	5.06	5.50
Cold finished shafting or screw	3.65	3.60	3.70
Cold finished flats, squares	4.15	4.10	4.20
Structural shapes (base)	3.04	2.91	2.90
Soft steel bars (base)	2.94	2.81	2.80
Soft steel bar shapes (base)	2.94	2.81	2.80
Soft steel bands (base)	3.74	3.61	3.55
Tank plates (base)	3.04	3.10½	2.90
Bar iron (2.45 at mill)	2.94	2.81	2.80
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{1}{16}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.50
Lead (up to carlots), St. Louis ... 6.25; New York	6.60
Zinc (up to carlots), St. Louis ... 6.25; New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	19.00
Antimony (Chinese), on spot	5.75@6	7.75	6.50
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	15.75	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.25	20.50	18.75
Brass tubing (100-lb. lots)	22.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.75	18.50	15.75
Brass wire (carlots)	18.75	19.50	.....
Zinc sheets (casks)	9.00	9.00	.....
Solder (½ and ½), (caselots)	24.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.25	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	11.50
Copper, heavy, and wire	11.75	11.00	11.25
Copper, light, and bottoms	9.75	9.50	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6.25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.50	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.075	.06	.10
Wiping cloths, 13¼x20½, per lb.	.08	.10	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.01	.99
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		11.50@12.00	
Coke, prompt foundry, Connellsville...per net ton		13.00@13.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50-10%
1⅛ and 1¼x3 in. up to 12 in.	25%	50-10-5%	50-10-10%
With cold punched sq. nuts	30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	....	$4.00 off
Button head bolts, with hex. nuts	20%	$3.90 net	.....
Hex. head and hex. nut bolts	25%	....	65-5%
Lag screws, coach screws	45%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	....	55%
Tap bolts, hex. head, list plus	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	50-10-5%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.00	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	55%	60%	60%
Rivets, tinned	55%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$4.50	$3.50	$3.35
Cone heads, ditto (net)	4.60	3.60	3.45
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40-2½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Colo., Denver—The Eaton Metal Products Co., 2[illegible] Walnut St.—multiple punch press suitable for punching No. 12 to 16 steel, one power press 10 to 15 ton, and one trimming roll, 6 to 10 ft. long, capacity of bending ¼ in. metal.

Colo., Denver—The Heath Machine & Welding Co., 1516-20 15th St.—one Heald or Universal cylinder grinder, one Universal Motor and one Wilson or General Electric motor generator welding outfit 175 to 250 amp.

Ill., Chicago—Acme Steel Goods Co., 2840 Archer Ave.—one 28 in. x 8 or 10 ft. all geared lathe complete (used preferred).

Kan., Wichita—Guarantee Motor Co., 2417 East Douglas St., H. F. Cobb, Purch. Agt.—one drill press.

Kan., Wichita—Meridian Trail Garage, 1840 North Lawrence St., E. Fent, Purch. Agt.—[illegible] cylinder grinder and power drill press.

Kan., Wichita—W. Scott, South Douglas and Lincoln Sts., W. Scott, Purch. Agt.—garage equipment, drill press, lathe, belting, hangers, pulleys, bearings, and small tools.

Kan., Wichita—Stock Yards Garage, 2008 North Lawrence St., H. W. Johnson, Purch. Agt.—one power lathe.

Kan., Wichita—L. H. Thomas, 20th and North Lawrence Sts.—one drill press, lathe and emery stand (used).

Kan., Wichita—Wichita Sheet Metal Wks., 1400 East Douglas St.—power lathe and drill press.

Mich., Detroit—The Kessler Sales & Service Co., 4627 Dix Ave.—equipment for auto repair shop.

Mo., St. Louis—D. Segal, 1231 Market St., D. Segal, Purch. Agt.—power lathe and hand tools (used).

Neb., Lincoln—Lincoln Traction Co., Terminal Bldg., A. G. McMasters, Purch. Agt.—one 28 in. traveling head drill press for machine shop.

N. Y., Brooklyn—Mutual Electric & Hardware Mfg. Co., 23 Verandah Pl.—several punch presses.

N. Y., New York City—American Car & Fdry. Co., 165 Bway.—several lathes for proposed foundry at Detroit, Mich.

O., Salem—Canele Machine Co., C. P. Harper, Purch. Agt.—machine tools including grinder, lathe, shaper and drill press.

Pa., Dunmore (Scranton P. O.)—H. M. [illegible]—mechanical and garage equipment.

Pa., Phila.—Belmont Iron Wks., 22nd and Washington Ave.—double angle shears, motor driven, 8 x 8 x ¾ in.

Pa., Phila.—The Commercial Trust Co., City Hall Sq.—one 36 in. Bullard vertical lathe and New Era type lathe.

Va., Richmond—Allen Transfer & Repair Co., 1735 West Cary St.—lathe and drill press.

Wis., Appleton—W. H. St. John, 706 North Van Buren St., Green Bay—auto repair machinery, air tank, etc., for garage.

Wis., Milwaukee—Lighthouse Superintendent, Federal Bldg., M. M. Works, Asst. —[illegible] and bar bending machines.

Wis., Milwaukee—Motor Grinding Co., [illegible] 1115 Wells Bldg.—cylinder grinder.

Ont., Ft. William—[illegible] & Jones—press, [illegible] for garage.

Ont., Milverton—[illegible] Garage & Repair Shop—tools and equipment to replace that which was destroyed by fire.

Que., Montreal—J. Buckley Co., 274 Beaver Hall Hill—one 62 to 72 in. car wheel lathe, one heavy duty belt lathe, 24 to 30 amperes, one boring mill, 72 in. diameter, 2 yoke riveters and one hydraulic press.

Machinery Wanted

Calif., Los Angeles—C. P. Reiniger, 262 South Vine St.—one 29 in. x 4 in. cylinder press and one 26 in. x 30 in. power cutter.

Colo., Denver—Heath & Weld Co., 1516 15th St., A. Heath, Purch. Agt.—welding equipment.

Conn., New Haven—W. Brook, 85 Welton St.—portable saw-rig machine.

Del., Wilmington—The Hearn Oil Co., 3rd and Commerce Sts., C. Hearn, Mgr.—equipment for proposed storage and oil distributing plant at Salisbury, Md.

Ill., Chicago—Ackerman-Quigley Printing Co., A. Ackerman, Purch. Agt.—printing equipment and 2 envelope patching machines.

Ind., Ft. Wayne—C. Honeck & Son, 4021 South Calhoun St., C. Honeck, Purch. Agt. —power job presses and book binding machinery (used).

Ia., Manning—E. Farrell—job power press, paper cutter, linotype, belting, hangers, shafting, pulleys and bearings.

Kan., Wichita—W. A. Bettis, 631 North Main St.—small power cylinder or flat bed press.

Kan., Wichita—City Ice Delivery Co., 315 South Washington St., F. Severns, Purch. Agt.—on large combination saw, planer and cutting off machine for wood working.

Kan., Wichita — W. A. Dilano, 235 Wabash Ave.—wood working machinery including wood lathe, saw, cutting off planer, hangers and belting for power equipment.

Kan., Wichita—Moretino & O'Connor, 221 South Topeka St., A. Moretino, Purch. Agt. —welding equipment for repairing automobiles.

Kan., Wichita—R. W. Parks, 1332 South Wichita St., R. W. Parks, Purch. Agt.—woodworking machinery, including wood lathe, saw, planer, cutting-off machine, sander and belting.

Kan., Wichita—Wichita Auto Spring Works, 141 South Washington St., C. E. Rischel, Purch. Agt.—wood working machinery for wagon repair works.

Ky., Pikeville—Pike County News—one quarto size, 2 revolution, 7 column, cylinder press (used).

Me., Lincoln—Lincoln Worsted Co., A. E. Cooper, Supt.—additional machinery for woolen mill.

Mass., Lowell—Ipswich Mills, Warren St., (manufacturer of cotton and woolen goods, etc.), W. Duckworth, Supt.—additional machinery.

Mass., Springfield—Sterling Textile Co., 52 Quincy St.—yarn scouring machine (used).

Mass., Uxbridge—Waucontuck Worsted Mills—additional machinery for woolen mill.

Mass., Waltham—J. H. Martin, 81 Central St.—machinery and equipment for printing shop (new or used).

Mich., Grand Rapids — Valley City Creamery Co., 666 Lake Dr. S. E.—mechanical equipment for creamery.

Minn., Harris — Harris Co-operative Creamery Co., A. S. Deming, Secy.—butter making and refrigerating equipment for building now in course of construction.

Minn., Minneapolis—Duley Meat Co., 725 Hennepin Ave.—refrigeration machinery.

Minn., Mora — Farmers Co-operative Creamery Co., E. W. Boyle, Purch. Agt.—dairy machinery and cooling equipment.

Mo., Kansas City—Marshall Mfg. Co., 912 Grand Ave., A. Marshall, Purch. Agt.—welding equipment and oxy-acetylene torch.

Mo., Kansas City—Sleek & Warwick Paper Co., 312-314 West 6th St., B. T. Warwick, Purch. Agt.—one 30 in. paper cutter.

Mo., St. Louis—Willis Missouri Floor Co., 4205 Forest Park Blvd., A. Willis, Purch. Agt.—one 38 in. power paper cutter.

N. Y., Brooklyn—H. Chrystal Iron Wks., 98 Van Dyke St.—one 1 ton ice machine with condenser.

N. Y., Dunkirk—Marsh Valve Co., 4th and Brigham Rd.—machinery for factory manufacturing mill supply valves, globes, angles and gates.

N. Y., East Rochester—E. L. Baker, East Rochester Packing Co. Bldg.—machinery and equipment for the manufacture of adhesive products.

N. Y., Elmira—Markle & Peden, Inc., 470 Riverside Ave., W. E. Markle, Pres.—machinery and equipment for a 3 story building at Corning for packing leaf tobacco and other tobacco products.

N. Y., Falconer — Falconer Plate Glass Co.—machinery and equipment for the manufacture of mirrors and plate glass for plant at Youngstown, Pa.

N. Y., Jamestown—Jamestown Novelty Mfg. Co., Jones and Gifford Ave., J. A. Haag, Secy. and Treas.—machinery and equipment for the manufacture of steel bathroom fixtures, finished in white enamel, to be installed in factory on River and Chandler Sts.

N. Y., North Tonawanda—Lenox Furniture Co., Oliver and Miller Sts.—one No. 29-4 power shoe repair sewing machine.

N. Y., Pittsford—G. Burns, Clover St.—one swing cut-off saw.

N. Y., Poughkeepsie—Parker Axles, Inc. —machinery and equipment for proposed factory at York, Pa.

Va., Richmond—Arrow Laundry, 117 East Main St.—complete line of laundry machinery.

Va., Richmond—G. F. Sauers, Brooke Rd. and Broad St. (manufacturer of extracts) —lathe for woodturning.

W. Va., Charlestown—Charlestown Steam Laundry & Dry Cleaning Co.—machinery and equipment for laundry and dry cleaning plant.

W. Va., Huntington—Stroehman Baking Co.—conveying machinery, power equipment and traveling oven.

W. Va., Shinnston—Hughes Coal Co., W. C. Hawkins, Fairmont, Engr.—machinery and equipment for new coal tipple.

Wis., Antigo—H. B. Quackenbush, Main St.—machinery for the manufacture of ice cream.

Wis., Appleton—C. Gerlock, 832 Oneida St.—pasteurizer, bottle washing and filling machines.

Wis., Appleton—St. Elizabeth Hospital Assn., c/o J. Conway, Chn.—laundry equipment and machinery for new hospital.

Wis., Bear Creek—Flanagan Bros.—refrigeration machinery.

Wis., Beaver Dam—Central Wisconsin Canning Co.—pea and corn canning machinery, also conveying machinery, for plant at Rosendale.

Wis., Berlin—J. M. Stabbe—mill and grinding machinery.

Wis., Clintonville—Service Auto Co.—compressor, gas storage tank and pump for garage.

Wis., Eagle River—Strong & Manley—repair machinery, air tank, gas storage tank and pump for garage. Noted Aug. 10.

Wis., Green Bay—Brown County, c/o H. F. Wittig, Court House—laundry machinery, including tumbler and dryer.

Wis., Green Bay—Sisters of Our Lady of Charity, c/o Good Shepherd Home—laundry equipment.

Wis., Milwaukee—E. A. Ertel, 1466 14th St.—electric or belt driven air compressor.

Wis., Milwaukee—Hagner Auto Supply Co., 3725 National Ave., J. Hagner, Purch. Agt.—chain hoist for machine shop use.

Wis., Madison—Vorclone Co., c/o J. T. Blake, 611 South Few St.—special machinery for the manufacture of ventilating equipments and fans, also patented devices.

Wis., Manitowoc—Behnke Vaper Burner Co., c/o A. C. Behnke, 409 Cleveland St.—metal working machinery for the manufacture of vaporizers and burners.

Wis., Manitowoc—A. M. Richter & Sons Co., South 8th and Madison Sts.—power cider presses.

Wis., Milwaukee—M. Hilty Lumber Co., foot of 12th St.—woodworking machinery for millwork.

Wis., Milwaukee—Henning & Quast Corp., 1242 Booth St., O. E. Quast, Purch. Agt.—special wireworking machinery to manufacture fibre brushes.

Wis., Milwaukee—Rademacher & Meyer, 2807 Vliet St.—one joiner, one band saw and other wood working machinery for the manufacture of automobile bodies.

Wis., Milwaukee—L. Schlenvogt & Sons Cheese Co., c/o G. W. Miller, 498 13th Ave.—dairy and cheese making machinery (power).

Wis., Milwaukee—Schmitt Orlow Co., 256 South Water St.—Universal wood worker and band saw.

Wis., Milwaukee—Vollbrecht Cut Stone Co., 16th and Canal Sts., J. Bonnett, Purch. Agt.—machinery for stone cutting.

Wis., Milwaukee—Western Washed Sand & Gravel Co., c/o F. Schub, 940 5th St.—machinery for washing gravel and sand.

Wis., Milwaukee—Wisconsin Soap & Produce Co., c/o J. A. Barly, 257 8th St.—vats and special soap making machinery.

Wis., Neenah—M. Thermansen, 217 West Wisconsin Ave.—electric welding equipment.

Wis., Stevens Point—B. V. Martin, 1303 Main St.—one large size planer.

Wis., Wauwatosa—F. Hartung & Son, Burleigh Rd., R. F. D. Wauwatosa—machinery for crushing and conveying limestone.

Ont., Bridgeburg—Fedders Mfg. Co.—one spot welder.

Ont., Cobalt—O'Brien Silvermine Co.—equipment for electric dryer mill and main shaft house, partially destroyed by fire. Loss $250,000.

Ont., Kitchener—A. H. Koepke, 204 Frederick St.—woodworking equipment for proposed planing mill.

Ont., Kitchener—The School Bd.—equipment for technical school, including wood and iron working tools and machinery.

Ont., Ottawa—Maass Bros., 22 Irving Ave.—one 36 in. x 48 in. brass cylinder laundry washing machine.

Ont., Toronto—Graves-Bigwood Lumber Co., 712 Hamilton Bank Bldg.—planing and saw mill equipment to replace fire loss at Byng Inlet.

Ont., Windsor—Malloney Electrical Co.—machinery and equipment to replace that which was damaged by fire.

Que., Aylmer—Ritchie Bros., J. Ritchie, Purch. Agt.—complete sawmill equipment to replace that which was lost in fire.

B. C., Burnaby—Phillips Hoyt Lumber Co.—equipment for saw and shingle mill.

Metal Working Shops

Ark., Ft. Smith—P. Sheridan, 1107-11 Garrison Ave., awarded the contract for the construction of a 2 story, 72 x 140 ft. garage. Estimated cost $40,000.

Calif., Newman—The Orestimba Union High School Dist. will receive bids until Sept. 16, for the construction of a 1 story workshop. S. Wade, Clk. F. W. Reid, Concord, Archt. Noted **Aug. 29.**

Calif., Oakland—H. V. Glore, 2053 38th Ave., will build a 1 story machine shop on 5th St. near Alice St. Estimated cost $1,500.

Calif., San Francisco—The Bothin Real Estate Co., 604 Mission St., is having plans prepared for the construction of a 3 story garage, on Natoma-Hunter and Sherwood Sts. A. S. Bugbee, 26 Montgomery St., Archt.

Conn., Bridgeport — The Atlas Body Wks., Inc., 147 McKinley Ave., is receiving bids for the construction of a 1 story, 76 x 90 ft. plant addition. Estimated cost $25,000. H. E. Koerner, 164 State St., Archt.

Conn., Hartford—M. S. Little Mfg. Co., New Park Ave., will soon award the contract for the construction of a 1 story, 50 x 65 ft. factory addition for the manufacture of plumbing goods. Estimated cost $15,000.

D. C., Wash.—P. M. Anderson, Engr., 705 Southern Bldg., will receive bids until Sept. 10, for the construction of a 3 story, 76 x 110 ft. garage, workshop and power plant, for the Corby Baking Co., 2301 Georgia Ave., N.W. Estimated cost $75,000. Private plans.

Ind., East Chicago—The International Lead Refining Co., 151st St. and McCook Ave., will build a 1 story, 50 x 100 ft. lead refining plant. Estimated cost $27,000. Noted Sept. 7.

Ind., Indianapolis — Duesenburg Motor Co., 16 South Harding St., will build a 1 story, 60 x 200 ft. auto factory, on South Harding St. Estimated cost $29,000. Noted Sept. 7.

Mass., Dorchester—E. H. Blake, 18 Harvard Ave., will soon award the contract for the construction of a 1 story, 100 x 120 ft. garage and repair shop. Estimated cost $40,000.

Mass., Salem—The Salem Laundry Co., 51 Lafayette St., awarded the contract for the construction of a 2 story, 80 x 140 ft. laundry, garage, etc., on Lafayette St. Estimated cost $125,000.

Mass., West Lynn (Lynn P. O.)—General Electric Co. is having plans prepared for the construction of a 4 story, 122 x 157 ft. addition to its factory. Estimated cost $200,000. Private plans.

Mich., Detroit—The Amer. Car and Fdry. Co., 165 Bway., New York City, will soon receive bids for the construction of a 1 story, 175 x 275 ft., foundry on Russell St., here. Private plans.

Mich., Detroit—Burr-Patterson Co., 4211 Woodward Ave., awarded the contract for the construction of a 2 story, 40 x 106 ft. jewelry factory. Estimated cost $40,000.

Mich., Detroit—The Ford Motor Co., Highland Park, awarded the contract for the construction of a 1 story, 245 x 1570 ft. factory on Livernois Ave. Estimated cost $750,000. Noted July 20.

Mich., Detroit—S. E. Remey, Archt., 1140 Griswold St., will receive bids until Sept. 19, for the construction of a 2 story, 70 x 140 ft. garage and service station on Dix Ave. for the Kessler Sales & Service Co., 4627 Dix Ave. Estimated cost $40,000.

Mich., River Rouge (Detroit P. O.)—Ford Motor Co., Highland Park, awarded the contract for the construction of a 5 story, 60 x 300 ft. addition to its tractor and auto plant. Noted July 27.

Minn., Minneapolis—The Franklin Co-operative Creamery Co., 2601 Franklin Ave., E., awarded the contract for the construction of a 2 story, 28 x 152 x 155 ft. barn and garage, at 2011 North 2nd St. Estimated cost $70,000.

N. Y., Albany—The Electric Supply & Equipment Co., 103 Allyn St., Hartford, Conn., awarded the contract for the construction of a 4 story, 42 x 63 ft. factory on Bway. and Church St. Estimated cost $50,000. Noted Aug. 29.

N. Y., Dunkirk—Marsh Valve Co., 4th and Brigham Rd., plans to build a 2 story, 25 x 35 ft. addition to its factory, for the manufacture of mill supply valves, globes, angles and gates.

N. C., Charlotte—The Saco Lowell Shops, Realty Bldg., awarded the contract for the construction of a home and mechanical building, on Mint and Commerce Sts. Estimated cost $150,000.

Pa., Dunmore (Scranton P. O.)—H. M. Spencer is having plans prepared for the construction of a 2 story, 40 x 300 ft. auto exchange and garage on Drinker St. Estimated cost $100,000. Duckworth Bros., c/o owner, Archts.

Pa., Phila.—Nahn & Greenberg, Morris Bldg., plan to build a 3 story garage and sales room at 1618 North Broad St. Estimated cost $150,000. LeRoy B. Rothschild, 1225 Sansom St., Archt.

N. Y., Rochester—Northeast Electric Co., 348 Whitney St., awarded the contract for the construction of a 2 story, 51 x 90 ft. electrical factory. Estimated cost $30,000. Noted August 29.

Pa., Lancaster—Black Strap Fuel & Potash Products Co., 505 Chestnut St., Phila., has purchased site, here, and plans to erect buildings for the manufacture of special machinery, to obtain potash from waste products. P. G. Hildebrandt, Pres.

Pa., Pittsburgh—The Fairmont Creamery Co., 301 Ferry St., is having plans prepared for the construction of a 5 story, 62 x 72 ft. sales warehouse and a 1 story, 38 x 72 ft. garage, on 25th and Smallman Sts. Estimated cost $150,000. J. J. Howley, 411 Traders Bldg., Scranton, Archt.

Pa., Williamsport—S. T. McCormick, 3rd, Hepburn and West 4th Sts., will receive bids until Oct. 1 for the construction of a 1 story, 100 x 197 ft. garage, on Hepburn and Potter Sts. Estimated cost $100,000.

R. I., Providence—United Electric Railway Co., Union Station, is receiving bids for the construction of a 1 and 2 story, 88 x 250 ft. garage and service station on Melrose and Russell Sts. Estimated cost $100,000. Private plans. Noted Aug. 24.

Wis., Appleton—Herrmann Motor Car Co., 680 College Ave., awarded the contract for the construction of a 2 story, 80 x 80 ft. garage on Superior Ave. Estimated cost $40,000. Noted Aug. 3.

Wis., Appleton—W. H. St. John, 205 North Van Buren St., Green Bay, awarded the contract for the construction of a 1 story, 50 x 102 ft. garage on College Ave., here. Estimated cost $40,000.

Wis., Clintonville—Service Auto Co. plans to build a 1 story, 50 x 120 ft. garage. Estimated cost $40,000.

Wis., Eagle River—Strong & Manley awarded the contract for the construction of a 1 story, 60 x 120 ft. garage. Estimated cost $45,000. Noted Aug. 10.

Wis., Sparta—The Gross-Overland Co., awarded the contract for the construction of a 1 story, 28 x 100 ft. garage. Estimated cost $40,000.

W. Va., Beckley—The Raleigh Motor Co., will build a 3 story, 49 x 146 ft. garage. Estimated cost $60,000. Noted Aug. 3.

Ont., Kitchener—The School Bd. awarded the contract for the construction of a 3 story, 185 x 250 ft. technical school. Estimated cost $375,000.

General Manufacturing

Calif., Burlingame—The Dairy Delivery Co., 3550 19th St., awarded the contract for the construction of a 1 story dairy plant, on San Matteo and Howard Aves. Estimated cost $22,000. Noted Aug. 29.

Calif., Oakland—J. B. Breilh, 1033 39th St., awarded the contract for the construction of a 1 story laundry on 39th St. near Adeline St. Estimated cost $3,600.

Calif., Petaluma—Petaluma Co-operative Creamery Co., Baker and Western Aves., will build a 1 story, 40 x 110 ft. creamery.

Calif., San Francisco—W. Volker & Co., Montgomery St., had plans prepared for alterations and additions to their furniture manufacturing plant, on Howard St. Estimated cost $12,000. W. C. Lowe, Monadnock Bldg., Archt.

Conn., Bridgeport—The Huber Ice Cream Co., 800 Seaview Ave., plans to build a 3 story ice cream manufacturing plant. Estimated cost $150,000.

Conn., Danbury—The Danbury Mfg. Co., 7 New St., plans to build a 3 story, 60 x 100 ft. textile factory on Liberty St. Estimated cost $50,000. Sunderland & Watson, 248 Main St., Archts.

Conn., Norwalk—C. H. Harris, Inc., 116 Main St., awarded the contract for the construction of a 1 story, 111 x 120 ft. addition to its glass factory. Estimated cost $45,000.

D. C., Washington—U. S. Agricultural Dept. awarded the contract for the construction of a refrigerator plant. Estimated cost $15,000.

Ill., Chicago—A. S. Alschuler, Archt., 28 East Jackson St., is preparing plans and will soon receive bids for the construction of a 3 story, 100 x 300 ft. factory, to be built in 3 units for the manufacture of candy, on Cicero and Kinzie Sts., for Brach & Sons, 215 West Ohio St. Estimated cost $1,000,000.

Ill., Chicago—A L. Alschuler, Archt., 28 East Jackson St., is preparing plans and will soon receive bids for the construction of a 4 story, 110 x 275 ft. factory for the manufacture of furniture, on George St. and North Crawford Ave., for Valentine-Seaver Co., 1721 Sedgwick St. Estimated cost $1,000,000.

Ill., Chicago—D. F. Klafter, Archt., 64 West [illegible] St., is receiving bids for the construction of a 1 story, [illegible] x 125 ft. addition to factory, for the Enterprise Parlor Furniture Co., [illegible]-11 West Huron St. Estimated cost $50,000.

Ill., Chicago—R. S. Smith, Archt., 111 West Monroe St., is receiving bids for the construction of a 1 story, 75 x 125 ft. factory at [illegible] Summerdale Ave., for the N[illegible] Loose Leaf Co., 635 Federal St. Estimated cost $40,000.

Ill., Pana—The Wadley Co., West North St., Indianapolis, plans to build a 2 story, 63 x 115 ft. poultry packing plant, here. Estimated cost $40,000. F. A. Winterrowd, Amer. Central Life Bldg., Indianapolis, Archt.

Ind., Bedford—The Indiana Quarries Co plans to build a 1 story stone mill. Estimated cost $100,000. Architect not selected.

Ind., Hammond—H. J. Postlewaite, c/o M. [illegible], Archt., 623 Holman St., plans to build a 2 story, [illegible] x [illegible] ft. printing plant, here. Estimated cost $25,000.

Ind., Indianapolis—The Enquirer Printing & Publishing Co., 107-11 East Ohio St., is receiving bids for the construction of an 83 x 53 ft. printing plant, on East [illegible] St. Estimated cost $225,000. R. N. [illegible], Union Trust Bldg., Archt. Noted July 20.

Ind., Indianapolis—The Gem Laundry Co., awarded the contract for the construction of a 2 story, 67½ x 202½ ft. laundry on North Senate Ave. Estimated cost $35,000. Noted Aug. 10.

Ind., Sheridan—Indiana Condensed Milk Co., Fletcher American Bank, Indianapolis, plans to build a 2 story milk factory, here. Estimated cost $75,000. Architect not announced.

Kan., Kansas City—The City Ice Co., 21st and Campbell Sts., awarded the contract for the construction of an ice plant, for icing railroad cars, including a car icing platform, on 14th and Muncie Sts., plant to have a capacity of [illegible] ton. Estimated cost $[illegible].

Md., Salisbury—Hearn Oil Co., 3rd and [illegible] Sts., Wilmington, Del., plans to build a large storage and distributing plant on Mill St., here. Estimated cost $40,000. C. Hearn, Mgr.

Mass., Mansfield—The Mansfield Bleachery, [illegible] St., awarded the contract for the construction of a 1 story, 50 x 136 ft. addition to its plant. Estimated cost $[illegible].

Mass., Caryville — Taft Woolen Co. awarded the contract for the construction of a 1 story, 62 x 50 ft. picker house. Estimated cost $25,000.

N. J., Trenton—The Magnetic Pigment Co., 601 Cass St., awarded the contract for the construction of a 4 story, 65 x 110 ft. and a 3 story, 40 x 60 ft., addition to its plant. Estimated cost $50,000

N. Y., Jamestown—The International Casement Co., 84 Hopkins Ave., awarded the contract for the construction of a 1 story, 75 x 150 ft. factory addition for the manufacture of steel window frames, etc. Estimated cost $40,000.

N. Y., Jamestown—Jamestown Panel Co., 32-34 Steele St., awarded the contract for the construction of a factory, for the manufacture of panels and woodwork. Estimated cost $8,000. Noted Aug. 29.

N. Y., Rochester—Monroe County Oil Co., Wright St., plans to rebuild portion of its plant recently destroyed by fire. Estimated cost $12,000. Architect not announced.

N. C., Shelby—Dover Mill Co. plans to build a cotton mill. Estimated cost $400,000. J. R. Dover, Pres.

O., Cleveland—The Cleveland Kraut & Pickle Co., 1911 East 22nd St., awarded the contract for the construction of a 2 story, 60 x 50 ft., factory, at 3222 Lakeside Ave. Estimated cost $45,000. Noted July 20.

O., Alliance—The Crescent China Co., awarded the contract for the construction of a 1 story, [illegible] x 700 ft. factory. Estimated cost $[illegible].

O., Cleveland—The Cyclone Fence Co., 1207 Marquette Ave., awarded the contract for the construction of a 1 story, [illegible] x [illegible] ft. factory addition. Estimated cost $10,000.

O., Cleveland—The Wolf Envelope Co., 1749 East 22nd St., awarded the contract for the construction of a 1 story factory addition. Estimated cost $50,000. Noted Aug. 24.

O., Middletown—The Gardner Harvey Paper Co., West 3rd St., awarded the contract for the construction of a manufacturing plant. Estimated cost $125,000. Noted Aug. 24.

Okla., Oklahoma City—Marland Refining Co., 521 South Dewey St., plans to build a gasoline filling station. Estimated cost $50,000. Architect not announced.

Pa., Altoona—The Blair Ice and Cold Storage Co., c/o F. H. Seeley, 3124 5th Ave., plans to build a 3 story, 60 x 100 ft. cold storage plant. C. F. Baker, Atlanta, Ga., Archt.

Pa., Altoona—Caums Ice Cream Factory, awarded the contract for the construction of a 3 story, 25 x 120 ft. addition to its factory, on 5th Ave. and 9th St. Estimated cost $4[illegible],000.

Pa., Cambridge Springs—Blystone Mfg. Co., manufacturer of cement blocks, etc., awarded the contract for the construction of 1 and 2 story, 90 x 250 ft and 40 x 90 ft. buildings. Estimated cost $60,000.

Pa., Erie—Erie Co. Milk Assn., 2028 State St., awarded the contract for the construction of a 3 story warehouse and plant, on French and 20th Sts. Estimated cost $50,000

Pa., Jeannette—American Window Glass Co., Farmers Bank Bldg., Pittsburgh, is having plans prepared for the construction of a 1 story addition to glass plant here. Estimated cost $1,500,000. Private plans.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. Everything possible is done to insure authenticity and timeliness. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving. Your co-operation is invited.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Pa., Johnsonburg—Rolfe Tannery Co. plans to rebuild its tannery destroyed by fire. Estimated cost $150,000.

Pa., Lancaster—The Bayuk Bros., 3rd and Spruce Sts., Phila., awarded the contract for the construction of a 3 story, 76 x 80 ft. factory for the manufacture of cigars, here. Noted Aug. 17.

Pa., Newcastle—Westmoreland Paint & Color Co., Hobart St., Southside, plans to build large additions to its plant for the manufacture of patented "Blue Stone" and other general painting line articles, also to take care of chemicals for steel plants, etc. Architect not announced.

Pa., Phila.—The Atlas Supply Co., Ring and Main Sts., awarded the contract for the construction of a 1 story, 50 x 50 ft. factory, for the manufacture of paste, on High St. and Manayunk Ave. Estimated cost $8,000.

Pa., Phila.—F. Pearson Co., 11th and Chestnut Sts., awarded the contract for the construction of a 5 story, 62 x 160 ft. textile factory, on Leverington and Wilde Sts. Estimated cost $300,000.

Pa., Phila.—The Supplee-Wills Jones Milk Co., 26th and Jefferson Sts., plans to build a 3 story, 128 x 220 ft. dairy building, on Folkrod St. Estimated cost $150,000

Pa., Phila.—C. Wunder, Archt., 1415 Locust St., is receiving bids for the construction of a 4 story, 56 x 99 ft. hosiery factory on 15th and Master Sts., for the Unique Knitting Co., 1324 North Lawrence St. Estimated cost $80,000.

Pa., Pittsburgh—Hardie Bros., 1601 Liberty Ave., awarded the contract for the construction of a 5 story, 100 x 225 ft. candy factory on 14th and Pike Sts. Estimated cost $350,000. Noted June 29.

Pa., Pittsburgh—The Keystone Hair Insulator Co., 1241 Spring Garden Ave., awarded the contract for the construction of a 1 story extension to its manufacturing plant. Estimated cost $39,000.

Pa., Russell—The Warren Sand & Gravel Co. will rebuild its gravel plant on Johnny Run, which was recently destroyed by flood. Estimated cost $5,000.

Pa., Warren—The Crescent Furniture Co. will build a 4 story, 48 x 82 ft. addition to its plant and also dry kilns. Noted Aug. 3.

Pa., Warren—J. T. Nowell, 244 Penna. Ave. W., is having plans prepared for the construction of a 4 story, 55 x 90 ft. printing plant on Liberty St. E. A. Phillips, Warren Trust Bldg., Archt. Noted Aug. 29.

Va., Richmond—Richmond, Fredericksburg & Potomac R.R., Union Station, Broad St., plans to build a coaling station and locomotive terminal in its Acca yards. Estimated cost $900,000. S. B. Rice, Engr. Maintenance of Way.

W. Va., Piedmont—Amer. Coal Co. plans to rebuild its coal tipple which was recently destroyed by fire. Estimated cost $60,000. Architect not announced.

Wis., Berlin—J. M. Stabbe will build a 1 story, 50 x 120 ft. grist mill. Estimated cost $40,000. Private plans.

Wis., Green Bay—Brown County, c/o H. F. Wittig, Court House, plans to build a 1 and 2 story, 62 x 130 ft. laundry. Estimated cost $60,000. Architect not selected.

Wis., Green Bay—Sisters of Our Lady of Charity, c/o Good Shepherd Home, awarded the contract for the construction of a 1 story, 86 x 200 ft. laundry and 36 x 120 ft. boiler house. Estimated cost $70,000.

Wis., La Crosse—Nelson Garment Co., 111 South 2nd St., awarded the contract for the construction of a 1 story, 92 x 160 ft. factory on Cameron St. Estimated cost $60,000. Noted Aug. 10.

Wis., Madison—J. Feldman Paper Box Co., 515 Regent St., awarded the contract for the construction of a 1 story, 60 x 120 ft. factory, on Charter St. Estimated cost $50,000. Noted Aug. 29.

Wis., Milwaukee—M. Hilty Lumber Co., foot of 12th St., is having plans prepared for a 3 story, 102 x 113 ft. factory and power house, at the Grand Ave. viaduct approach. Cahill & Douglas, 217 West Water St., Engrs.

Wis., Peshtigo — Peshtigo Paper Co. awarded the contract for the construction of a 68 x 150 ft. unit to its paper factory. Estimated cost $70,000. J. Sutherland, Pres.

Wis., Peshtigo—Thompson Bros., will build a 3 story, 60 x 100 ft. factory, for the manufacture of pleasure boats. Private plans.

Wis., Rosendale—Central Wisconsin Canning Co., Beaver Dam, awarded the contract for the construction of cannery, here, including 2 story, 60 x 180 ft. warehouse, 2 story, 50 x 80 ft. manufacturing building, 1 story, 40 x 50 ft. boiler house and two 1 story, 30 x 40 ft. miscellaneous buildings. Estimated cost $75,000. Noted Aug. 10.

Alta., Calgary—The Imperial Oil, Ltd., Regina, Sask., plans to build a refinery on 108 acre site, on Bow River, here, capacity 3,500 barrels, to supplant present refinery at Regina. Estimated cost $2,500,000. Engineer not announced.

B. C., Burnaby—Phillips Hoyt Lumber Co., plans to build saw and shingle mill. Estimated cost $60,000.

Ont., Goderich—Goderich Evaporator Co., c/o T. J. Munby, will build a new evaporator, and plans later to erect and equip cannery. Estimated cost $40,000.

Ont., Kitchener—A. H. Koepke, 204 Frederick St., has had plans prepared for the construction of a 2 story, 50 x 100 ft. planing mill.

Ont., London—The London Curling Club plans to rebuild its ice arena destroyed by fire, and install an artificial ice plant. Estimated cost $75,000. F. Ashplant, Secy.

Ont., St. Thomas—City defeated $120,000 bonds for installing new vertical retorts. New plans are to be prepared by R. Christie, Supt. Gas Works, and if work can be reduced to $100,000 it will probably be proceeded with. Interested in prices.

Ont., Trout Mills—W. Milne & Sons North Bay, plans to rebuild sawmill destroyed by fire, here. Estimated cost $100,000.

American Machinist

Volume 57 NEW YORK, SEPTEMBER 21, 1922 Number 12

Using Diamond Tools in Motor Building

Definite Information Concerning the Accuracy, Interchangeability and Long Life Obtained with Diamond Tools in Aluminum, Bronze and Cast Iron

BY G. T. LINTING
Tool Engineer

DURING the late war the writer was chief tool designer for a large motor building plant that experienced great difficulty in boring or reaming the main bearings in the aluminum crankcases of Liberty motors. This motor had a seven-bearing crankshaft and differed from the usual type in having the crankcase cast in upper and lower halves, with one half of each bearing in both parts. The bearings were 3.0000 in. in diameter and from 3 to 5 in. long.

After boring, two halves of the crankcase were bolted together with a reamer bar 3.0000 in. in diameter in place, the bar carrying seven sets of inserted helical blades.

It was found impossible to maintain the bearings to size or in alignment, the variation amounting to as much as 0.002 in. or more in some cases. This variation made it necessary to employ about eighty-five men to scrape the main bearings.

The writer finally hit upon the plan of using an engine lathe, upon the carriage of which was mounted a simple angle-plate fixture, carrying boring bars and driven by a multiple driving head connected to the spindle. The boring bars carried seven diamond-set tools. By diamond-set, I mean that we actually cast small carbon diamonds weighing from 1 to 2 carats in the ends of steel shanks or holders, and inserted the holders in the bars.

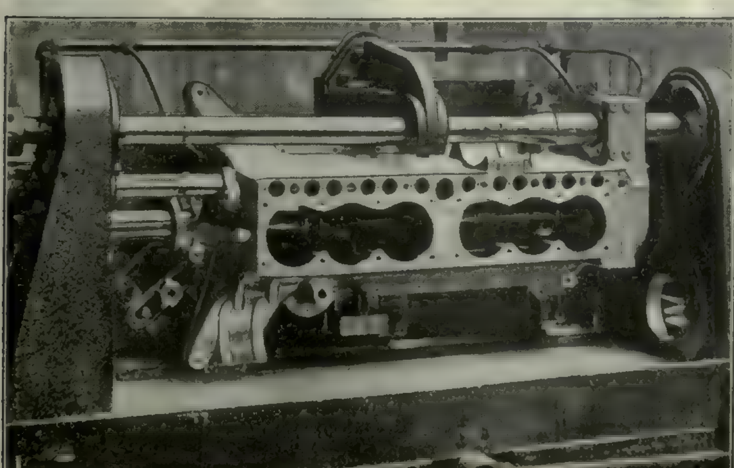
We first roughed out the bore of the crankcase with ordinary high-speed steel tools, leaving from 0.004 to 0.008 in. of the diameter to be taken out by the diamonds. The result was a surprise to everyone. We finish bored the remainder of our Liberty motor crankcases (about 800 upper and 800 lower halves) with the one bar, and without having to sharpen or reset the tools.

Each and every half-hole was of the same size, and all were in alignment. This meant that the bronze backed bearings could be placed in the cases, the halves bolted together with the crankshaft in place and that the job was within the required tolerance. Incidentally, we eliminated all scraping, thus saving the cost of the diamond tools in two days.

The experience gained in boring the Liberty motor crankcases with diamond tools was naturally utilized in other directions after the war. With this in mind the writer designed the boring fixture shown in Figs. 1 and 2 for finish-boring the main bearings in the aluminum crankcase of the Marmon model 34-B, which is the current model.

The holes were first rough and semi-finish bored with common high-speed tools in a lathe fixture like the one shown in Fig. 2. They were then finish-bored with diamond tools in a third fixture. The Marmon crankcase is a three-bearing job, the bearings being about 3½ in. in diameter. The rear bearing is about 4 in. long and the middle and front bearings somewhat shorter.

We used the identical tools, used for boring the Liberty motor cases, without sharpening or resetting. One of these tools bored some 3,000 half-holes. Another bored 5,500 half-holes before needing sharpening, while the third tool at last accounts had bored 7,800 half-holes. It was still going strong, and was apparently as good as the first day it was used. All this was in addition to the 1,800 half-holes bored on the Liberty job. In Fig. 2 is shown part of the boring bar with two of the



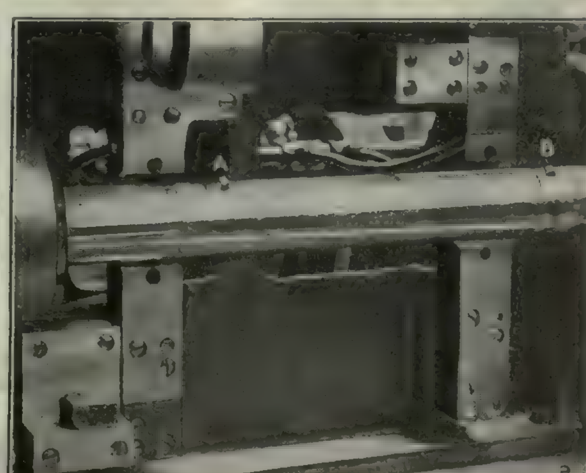
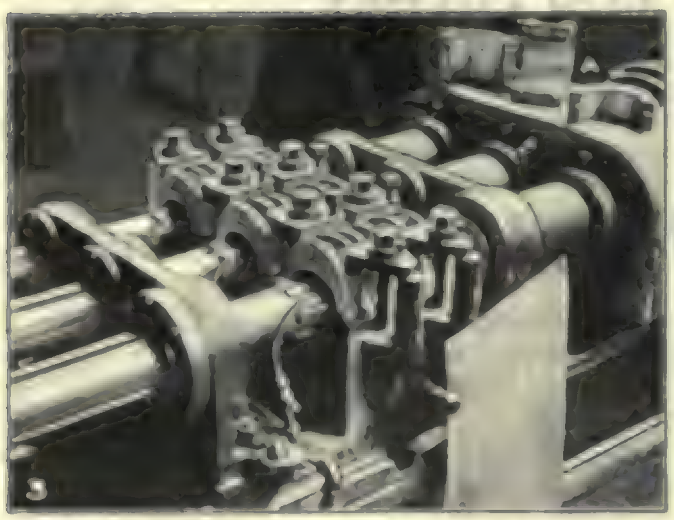


FIG. 1—FINISH BORING MARMON CRANKCASE. FIG. 2—THE BORING BAR AND DIAMOND TOOLS USED



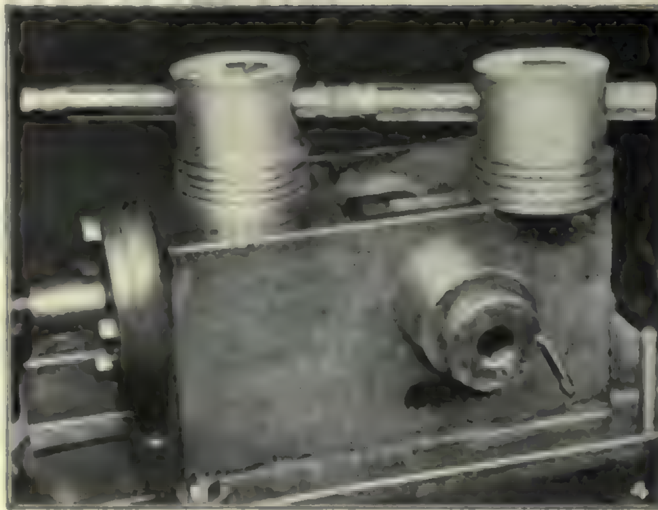


FIG. 3—BORING THE BEARING CAPS IN GROUPS. FIG. 4—FIXTURE AND BAR FOR BORING PISTONS

diamond tools in place at *A* and *B*, while Fig. 1 shows the crankcase in place in the boring fixture.

The great reason for using diamond tools is to be able to bore holes, that do not vary more than 0.0001 in. from the desired size, and to have them straight and in line. This accuracy enables the assembling of the case, bearing shells and caps, without any scraping or fitting whatever. It also makes a far better job than is possible to obtain by any other known method; in fact the Marmon company states that it has never had occasion to replace a single main-bearing shell. The accuracy attained also means absolute interchangeability, as the tools once set need no attention whatever for from 5,000 to 15,000 or more holes. What would this mean in the production in many plants?

The boring of the aluminum main-bearing caps for the Marmon motor is shown in Fig. 3. It will be noted that the caps are bored separately from the case. The caps are rough- and finish-bored, the first two bars leaving 0.004 to 0.008 in. stock, and finished with the third bar, which is equipped with diamond tools. Three of the finished caps are shown on the multiple boring head at *A*. The caps are sent directly to stock from this operation, after inspection.

In Fig. 4 is shown how the Marmon aluminum piston is cross-bored for the piston pin on a small engine lathe equipped with diamond tool boring bar. Two of the piston heads are shown on top of the boring fixture together with the diamond boring bar.

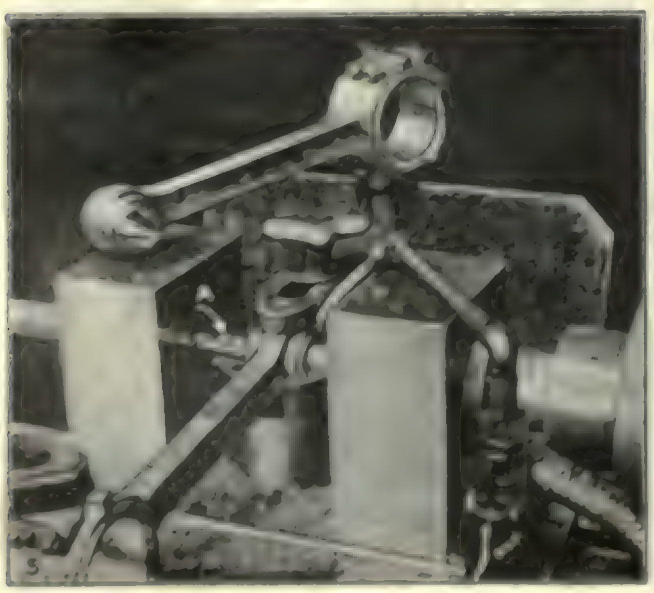
In Fig. 5 is shown how the bronze bushing in the wristpin end of the connecting rod is bored, using the diamond tool at *A*. One of the finished rods is shown on top of the fixture and one in boring position.

Anyone who has had experience knows how hard it is to obtain a round, true hole in bronze. The diamond tool gives the round hole desired and thus eliminates the heavy expense of reamer upkeep.

In Fig. 6 is shown how the Marmon company finishes the joint faces of bearing shells on an ordinary crank shaper. The shells are of cast iron, lined with babbitt. The shaper ram is fitted with a special double toolholder head with micrometer adjustment for each tool. The heads hold the diamond tools, the shanks of which may be seen sticking out of the holders at *A* and *B*.

The faces of the shells are machined to the center, plus or minus 0.0001 in., in this operation. They are machined singly instead of in pairs and are sent to stock after being inspected with an amplifying gage.

A cast-iron crankcase of a Midwest Engine Co. motor is shown in Fig. 7, and Fig. 8 shows the fixture in



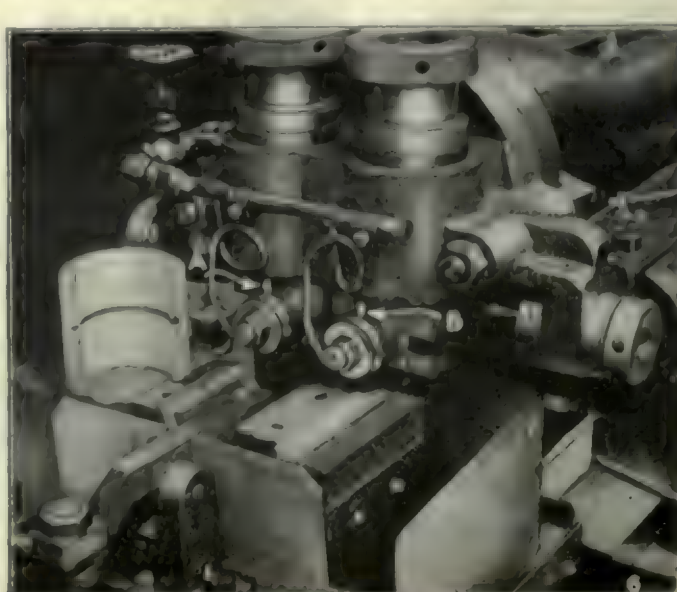
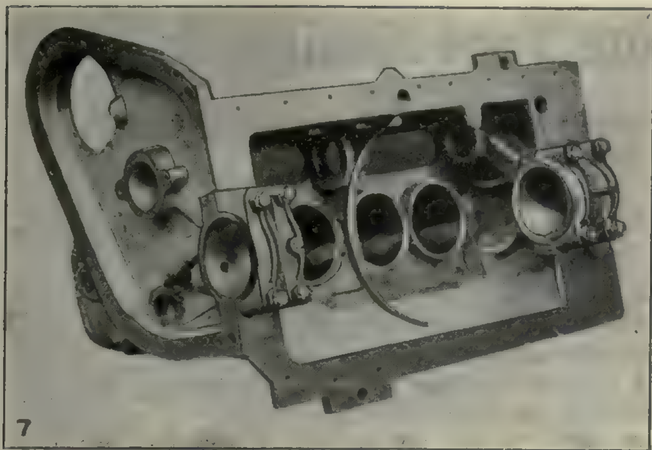


FIG. 5—BORING SMALL END OF CONNECTING ROD. FIG. 6—SURFACING EDGES OF BEARINGS



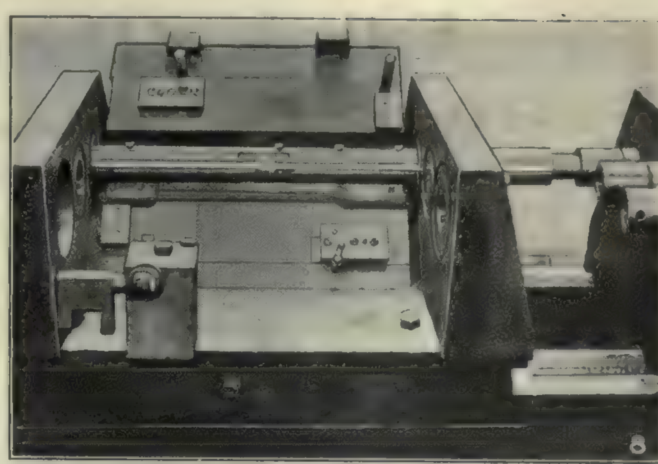


FIG. 7—A MIDWEST CYLINDER BLOCK. FIG. 8—THE FIXTURE FOR BORING THE MIDWEST CYLINDER BLOCK

which it was bored, mounted on the carriage of an engine lathe. The rough- and finish-boring is done with Stellite tools and the sizing with one pass of a diamond tool. In this case the caps are bolted to the crankcase and both are bored together. This job was started in December, 1921, and the original diamonds are still on the job. At the present writing they have never been sharpened, and are apparently good for an indefinite time.

The diamond tools work as well on this cast-iron case as they do on the Marmon aluminum crankcase or on the bronze bushing on the Marmon connecting rod previously mentioned.

Particular attention is called to the extreme simplicity and ruggedness of the fixture and boring bars. Yet they produce work of gage-like precision on a production basis, using only common engine lathes in almost any state of repair, because the boring bars and fixtures are self-contained and are piloted fore and aft the work.

Diamond tools such as here described, can be used very economically in a variety of ways where extreme accuracy is desired. They may also be used for contact points in gages that are subjected to much wear. Used in this way diamonds would last for years, as they would not wear measurably, would not scratch and could be reset if necessary.

The Foreman Pulls a "Boner"

By Robert Tait

This is the time of year when we hear frequent allusions to the "bonehead plays" made by members of the home team, to the infinite disgust of the fans, some of whom are apt to be toolmakers or machinists. But how about the mechanical "boners" which all of us perpetrate at times? No doubt there are but very few of us who have not at some time during our career made such an absolutely foolish error in our work as to cause us to stop and ponder whether or not we were in the normal possession of our faculties.

I was an apprentice in a machine shop at the time, working under a foreman who was one of the finest I have ever known, both as a man and a mechanic. In conversation with some of us one noon hour he casually mentioned that we had to have a small pulley placed at about the center of a 20 ft. length of $1\frac{15}{16}$-in. line shaft which had a coupling keyed to each end and carried a fine collection of iron pulleys of assorted sizes.

A chorus of groans greeted his words. It was always up to the machine shop gang to handle all such jobs and none of us knew who was going to be elected. Suddenly the foreman said, "I have an idea. We don't need that thing for a few days and I will show you fellows how to get a pulley on that shaft without taking it down." Naturally we believed him, for he generally made good, and, as he gave out no further information, we awaited developments with much interest. During his spare time he was seen to saw a piece of cast iron bushing stock in halves lengthwise, dowel it together, bore it to fit the shaft and turn it to the proper pulley diameter. He further reduced the diameter at each end (for a length equal to about one-quarter of the length of the casting), approximately one inch, finishing these ends with a taper of about $\frac{1}{16}$ in. per foot. This part nicely finished, he proceeded to make two steel collars somewhat smaller than the pulley diameter and bored to fit the tapers previously referred to. These also completed, pulley and collars were laid on his desk.

Shortly before noon the next day he instructed a helper to get a ladder and place it against the shaft about where we knew the new pulley was to go. As the power was shut off practically all of the gang who carried their lunches got front seats within sight of the base of operations and awaited results. The boss remarked dryly, "If you like to work half as well as you seem to like to watch me, the shop could get along with a lot less help." By this time he had arrived at the shaft, carrying the precious pulley in one hand, while the two rings and a hammer to drive them home were in his pockets. The suspense among his audience was great by this time, but he never realized what he was doing until, having placed one-half of the bushing under the shaft, he carefully slipped the upper half in place, fished a collar out of his pocket and, as he had it poised in the air the fact that a solid collar would have to go on over the end of a shaft as well as a solid pulley, became apparent to him.

Before coming down from his perch he looked over his audience and, picking out four fellows who seemed to be getting the most enjoyment out of the situation, he gently but firmly conveyed to them the information that they were to come back after supper, take out that length of shafting, remove a coupling and mess of pulleys, place his special pulley at the point designated and get the shaft back in place. This they did quite cheerfully, an irksome task being materially eased by the comedy which they had been privileged to witness.

Methods of Machine Tool Design

Fourth and Last Part of Chapter on Clutches—Split Ring and Multiple Disk Clutches—Clutches Operated by Air, Water or Electricity

By A. L. De Leeuw
Consulting Editor, *American Machinist*

SPLIT ring clutches are used more perhaps than any other kind in machine tool design. Their chief merits are their cheapness of construction and the small amount of space they occupy for a given amount of power to be transmitted. Their chief disadvantages are the fact that they are out of balance, and the difficulty of making proper adjustment. So long as the clutch runs at relatively low speed and is of relatively small diameter, the unbalanced condition is not a serious drawback; but when the clutch runs at a high speed and is of large diameter, this unbalanced condition alone would condemn it for use on machine tools.

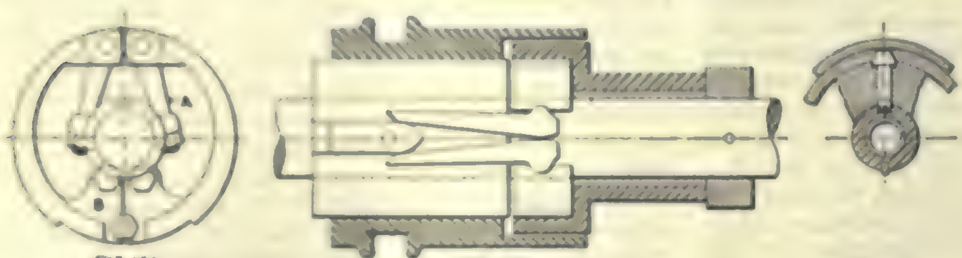


FIG. 144 FIG. 145 FIG. 146

FIG. 144 TO 146—TYPES OF SPLIT RING CLUTCHES

A clutch such as shown in Fig. 144 is particularly hard to balance, especially for dynamic or running balance. It further has the disadvantage that at the points where the levers *A* are attached and where it is attached to the hub *B*, there is a large amount of metal which prevents the split ring from maintaining its true cylindrical shape when expanded, so that only part of the ring is actually useful for the transmission of power. This condition does not prevail with the clutch shown in Fig. 145. The construction of this latter clutch permits of small dimensions, so that the unbalanced condition does not cause serious trouble.

A clutch such as shown in Fig. 146 is not much out of balance, and the entire ring provides bearing surface for the transmission of power. On the other hand, the wedge is liable to stick in the clutch because there is no positive means of withdrawing it, though, of course, this might be provided for. Another disadvantage of this type of clutch is that it permits of but very little adjustment before it becomes necessary to take it apart in order to provide for further adjustment. As a whole, friction clutches of the split ring type are not so satisfactory as those of the single plate type, except for light loads and low speeds.

Multiple disk clutches are not used very much for machine tool design. However, they may be used to advantage where large amounts of power have to be transmitted and where the machine is stopped and started or reversed a great number of times. The reason why they are particularly useful for this latter kind of service is that it is possible to keep the pressure per unit of friction surface very low without getting excessive dimensions of the clutch. Consequently, they are useful for heavy planer and slotter drives, and especially in connection with pneumatic drives.

A multiple disk clutch consists of a number of disks, of which the even numbers are keyed to the driven shaft while the odd numbers are keyed to the driving member, or vice versa. The essential points to look out for are: First, a sufficient amount of surface on the keys; second, a sufficient amount of surface on the plates; third, a means to keep the plates from overheating under conditions of frequent starting and stopping. This latter requirement may be met by the circulation of oil between the plates. Such circulation naturally diminishes the coefficient of friction between the plates, making it necessary to provide a large amount of frictional surface. The point in itself is rather an advantage, provided that there is enough room for large diameter or great length of clutch.

As, even with the best of care, there is always danger that the plates will wear so that metallic particles may get into the bearings, besides causing the plates to weaken gradually, it is well to select frictional surfaces which are not subject to much wear. For this purpose one set of plates—let us say the odd ones—is provided with cored holes in which blocks of wood are fitted. Hickory and beech are particularly useful for this purpose, especially if they have been boiled in paraffin for a number of hours before being put in place.

Such wood blocks again cause the clutch to become longer, but this is no disadvantage, provided the necessary room is to be had, especially since this extra room in an axial direction provides for more room on the keys and permits of making somewhat more clearance space between the plates, thus preventing the plates from touching each other except at the friction surfaces. In Fig. 147 the view *A* shows a diagrammatic view of such

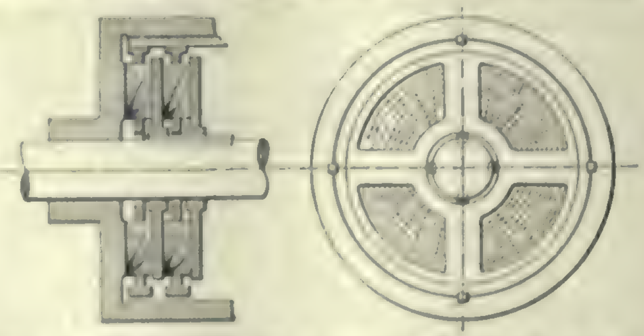


FIG. 147—MULTIPLE DISK CLUTCH FACED WITH WOOD

an arrangement of wood blocks, while *B* shows the form a plate takes when it is provided with these blocks.

There may be occasion to use a multiple disk clutch of smaller size, but when this is done it must not be forgotten that the conditions are the opposite from what is met in automobile construction. In the automobile the clutch is always in, except when pushed out. In the machine tool the clutch should always be out, except when pushed in; or, put in other words, the automobile clutch is self-acting, whereas the machine tool clutch is hand-operated.

Pneumatic, hydraulic and magnetic clutches are misnamed. They are, in reality, friction clutches operated by air, by hydraulic pressure, or by magnetism.

At one time magnetic clutches seemed to promise a great deal for heavy machine tool construction, and were actually used for a number of large planers and slotters. It was soon found, however, that they were unsatisfactory and unreliable. As constructed, the clutch consisted of two members, one rotating freely, the other one keyed to the shaft to be driven. The rotating member contained the coil and was magnetized by this coil. It was made of mild steel and the coil, mounted on a brass or bronze bobbin, was laid in an annular groove. This arrangement is shown in diagrammatic form in Fig. 148. Collector rings were placed on the hub of the bobbin. The part which was keyed to the driven shaft was made as light as possible, so as to reduce its inertia; though, of course, a sufficient amount of metal was required in the flange for the magnetic circuit. When the current was turned on part *A* was magnetized and attracted the armature *B*. The friction between the two members would then drive the shaft. When the current was turned off, member *A* was supposed to lose its magnetism and member *B* was pushed away by means of a spring or some other contrivance.

As a matter of fact, these clutches were only used to any extent for planer drives, so that there would be two members *A* and a double member *B*, as shown in Fig. 149. The two members *A* would run in opposite

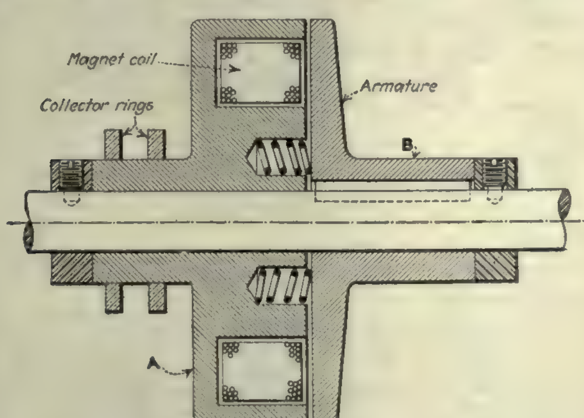


FIG. 148—MAGNETIC CLUTCH OF SIMPLE DESIGN

directions and the member *B* would slide along the shaft from A_1 to A_2, and *vice versa*, according to which of the two was receiving current. The amount of movement *B* had along the shaft had to be kept very small in order to keep the air gap between the magnet and armature to a minimum.

Notwithstanding the small amount of space between the armature and the non-acting magnet, there would be considerable resistance against the magnetic flux when the current was reversed; so that *B* would be attracted to A_2 with very much less force at the beginning of its sliding motion than when it was face to face with the magnet. When this attraction, then, was at a minimum, *B* was still attached to A_1; and though the current was turned off from this latter magnet, yet the residual magnetism was great enough to retard the movement of *B* toward A_2. It was not until the magnetism in A_2 had been built up to practically its full

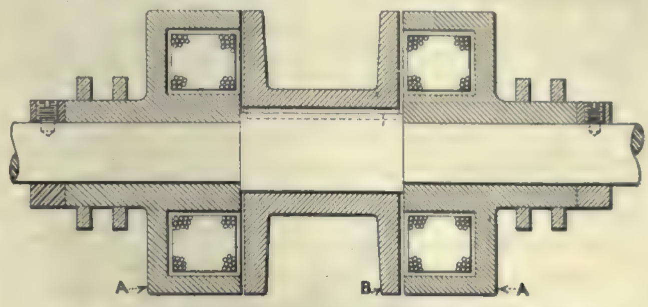


FIG. 149—MAGNETIC CLUTCH FOR PLANER DRIVE

strength that *B* would be released from A_1, and even this did not always take place. Furthermore, when the planer had to be brought to a stop current was turned off from both magnets, but one of them would retain its magnetism sufficiently to cause the planer to continue its stroke, which often caused the table to run off.

Many and various schemes were developed to overcome this unsatisfactory action of the magnetic clutch. Among them was the covering of the magnet face with a thin plate of brass. However, this plate would soon wear out and had, at all times, the disadvantage of reducing materially the magnetic attraction. Another means was to insert corks either in the armature or in the magnet. This also had the disadvantage of reducing the attraction, the amount of cork surface was always too small to sustain the very heavy pressure, and the projecting part of the corks was very soon worn off. These and other difficulties, such for instance as that some dirt or oil on the collector rings might cause other disturbances, have caused the magnetic clutch to be abandoned for planer drives.

A Form of Magnetic Clutch Which Can Be Used

There is another form of magnetic clutch which is really different from the friction clutch because the members which act on each other are not in contact. Such a clutch consists of a rotating magnet, while the driven member is a copper disk separated from the rotating member by a very small distance in the direction of the axis. The rotation of the magnet sets up eddy currents and causes a drag on the copper plate. If another magnet is located on the other side of the copper plate and arranged to turn in the opposite direction when it receives current, it will take the plate along and thus reverse its motion.

The objections to this device lie in the fact that the drag is caused by a difference in the speeds of the magnet and the plate. When the plate has reached its full speed, this difference is a minimum, but when the plate must be started up the difference is a maximum. As part of the energy required to start up the plate is converted into heat, such a device will become very hot when there is frequent reversal or frequent starting and stopping. The difficulties connected with keeping

such a device cool are quite severe. Even at that, this device is more successful than the magnetic clutch first described and might be used in a number of cases.

The amount of energy stored up in the large magnet is quite considerable, so that it takes an appreciable amount of time before it is built up to its full strength. Though this lag is noticeable, it causes no other trouble than that mentioned before, namely that it delays the reversal of the planer a small amount of time. This means simply that the dogs have to be set forward. As a rule, the dog which acts at the end of the cutting stroke does not run past the tappet. When using a magnetic clutch, dog and tappet must be so arranged that such run-over becomes permissible.

FIG. 151—DEVICE FOR ROTATING PARTS TO ALIGN GEAR TEETH

The large amount of energy stored up in the magnet has still another effect which is of more importance than the one mentioned before. At the moment the current is switched over from one magnet to another, practically all of the stored-up energy is discharged instantaneously, causing a heavy arc at the switch. This arcing causes a great deal of trouble with the controlling equipment, even a magnetic blowout failing to overcome it entirely. Not only is there a tendency to destroy the switches and other controlling apparatus, but there is a chance of the insulation of the magnet being punctured by the discharge, so that extreme care must be taken in winding and insulating the coil.

The pneumatic clutch is merely a friction clutch operated by a pneumatic cylinder instead of by a system of levers or toggles. It is chiefly used for planer drives and, of course, must be made double-acting for this purpose. Fig. 150 shows a double-acting pneumatic clutch in diagrammatic form. No details are shown of the clutch part itself. The clutch as represented here is of the multiple plate type. The spaces indicated by *A* and *B* are occupied by the two clutches. The member *C* can slide on the shaft, to which the member *D* is immovably fastened. This member *D* is the piston of the pneumatic cylinder, which is formed by *C*.

A hole *E* in the shaft admits air to one side of the piston. This hole is made large enough so that a pipe *F* can be inserted inside of this hole and still leave room for air to go to chamber *P*. A valve is so arranged that it admits air to *P* and exhausts from *Q* in one position, while in another position it admits air to *Q* and exhausts from *P*. Proper stuffing boxes must be provided at the end of the shaft, and these boxes must be so arranged that they permit the shaft to turn without causing leakage. There are, of course, many other ways in which such a clutch might be arranged, nor is it necessary that the clutch should be of the multiple disk type. As pneumatic devices of various kinds will be taken up at least in principle in a future chapter, we shall go no further into this matter at present.

Hydraulic pressure might be used instead of pneumatic pressure but, though many hydraulic devices are used in machine tools, to the writer's knowledge they have not been used for the purpose of operating clutches. They might be very usefully employed where an extremely slow action in starting is required, because it is possible to control the inrush of water by means of a needle valve to any desired speed. Such needle valves might also be used, and for that matter are used, for pneumatic control; but it is much more difficult to set and maintain the opening to the desired limits when using air than when using water, because the opening is so much smaller to begin with. Furthermore, the abrasive effect of particles of dust carried along with the air current is much greater than corresponding wear in a hydraulic needle valve.

In many cases a brake is required to assist in stopping a machine as quickly as possible, and such brakes are ordinarily arranged to be operated by the same lever which operates the starting clutch. Such brakes are generally of the simplest possible construction, often being merely a conical end of the sliding part of the clutch starting device. This sliding part is naturally keyed on to the shaft which should be stopped. The conical end of this sliding part can be brought against a mating part of the frame or any other stationary member. In other cases a band brake is employed. In still other cases the brake is separate from the starting device and is operated by foot. There is, however, nothing in such a brake which calls for special methods of design. Almost any construction of brake can be employed and, as a rule considerations of location or available space or handiness of operation control the choice of such a braking device.

A brake which is being more and more employed is

FIG. 150—DOUBLE-ACTING PNEUMATIC CLUTCH

the so-called dynamic brake. This is merely an arrangement of the wiring of the motor controlling device, by which the motor becomes a generator the moment it is cut out from the line. The energy it generates is dissipated in some resistance, provided in the controller. By making this resistance *low*, the generator acts almost as if it were short circuited and stops almost instantly,

because it has to overcome an enormous load. By regulating the amount of resistance, the machine can be made to stop as quickly or as slowly as desired.

Where gear shifts are used it is often necessary to have some means of revolving the gears to be shifted in order to make it possible to have the teeth of one gear enter the spaces of another. Sometimes this is accomplished by throwing the friction clutch in and then out again and watching the opportunity when the gears have slowed down sufficiently to make the shift possible. This is rather an uncertain method, especially so if no visible member of the machine is running when the starting clutch has been thrown in. Even when there is such a visible member, its speed is not always an indication of the speed of the gear which should be shifted. For instance, it may be possible to observe the spindle of the machine, but this spindle may be running at a low speed, though the gear to be shifted, one of the first gears in the system, may be running at a fairly high speed.

To overcome this difficulty devices such as the one shown in Fig. 151 are sometimes employed. In this device *A* is a cap fastened to the pulley, and *B* is a ring fastened to the sliding member which holds the floating ring that operates on the levers of the friction clutch. When this member is shifted to the left, it brings the friction clutch into action. When it is shifted to the right it releases the clutch and ring *B* does not yet touch cap *A*. By shifting it still further to the right, contact is made between *A* and *B*, and the friction between the two members will turn the machine over.

However, the pressure between the two members *A* and *B* is merely a direct pressure and not to be compared to the great pressure which holds the members of the friction clutch together when it is normally operated. The direct pressure is sufficient to turn the shafts of the machine, but not sufficient to overcome any great load or to cause accidents. This right-hand movement of member *B* may be the result of a movement of the shifter lever, or it may be operated separately by means of a treadle. As a rule, this latter construction is to be preferred, as it leaves the hands of the operator free for the manipulation of the gears.

First Progress Report on Gage Steel Investigation

The first laboratory work undertaken has been to determine the reliability of the Amsler wear test machine. This work is being conducted by Mr. Freeman and his assistants in the Metallurgical Division. Tests disks for this machine of SAE 1020 steel case-hardened and SAE 1090 steel hardened were made up by Pratt and Whitney Company. The case-hardened disks flaked in the machine and were consequently not suitable for determining its performance. As it is difficult to harden carbon tool steel uniformly, an oil-hardening steel, "Ketos," was made up into disks, hardened and used for preliminary tests of the machine. Difficulty was encountered in aligning the machine, but this has been corrected. However, sufficient data are not yet available to report definite results.

As the progress of the wear tests has been rather slow, arrangements have been made with Dr. Mathews, of the Crucible Steel Company, to get a supply of 1.10 carbon — 1.40 chromium-steel for hardening experiments and wear tests and of 0.45 carbon steel for testing the wear of hard disks against soft. As the chromium bearing steel is at present the most universally used gage steel, it is planned to make the most elaborate tests on it.

While waiting the receipt of appropriate steels for the study of hardening problems, some quenching experiments have been made to determine the characteristic curves, cooling power, and reproducibility of the common quenching media. This was accomplished by finding calorimetrically the average temperature of a standard nickel cylinder after different times of immersion in the quenching bath. Cooling curves were thus obtained for quenching in water at 30 deg. C. with and without motion of the cylinder, for quenching in oil at 30 deg. C. without motion and with slow and fast motion of the cylinder, for quenching in oil at 10 deg. C., 100 deg. C. and 200 deg. C. without motion of the cylinder, and for cooling in still air. The problems in heat treatment are being investigated by Mr. Scott assisted by S. S. Kingsbury of the Metallurgical Division.

Mr. French has varied the heat treatment of several steels in the form of 4-in. cylinders, similar to those recommended by the committee, with the principal object of determining the effect of rate of heating on the dimensional changes. Some of these cylinders showing large dimensional changes on hardening are being measured for time changes. The length measurements are being made under the immediate direction of Mr. Miller of the Gage Section. This section has also prepared an attachment to the millionth comparator to take 4 ± 0.003-in. blocks for measuring the changes on hardening and with time. The attachment includes an oil bath in which the specimens are partially immersed to secure temperature uniformity.

Encouraging Suggestions

By Frank V. Faulhaber

Machine shops that have tried to encourage their employees to send in suggestions have not always received the large number of ideas possible because some men will not bother to offer their suggestions on letters to be dropped into a box. As one executive explained: "Some employees will never think of suggesting some new improvement unless you absolutely ask them individually to do so. We find that many good ideas are not sent in to us as a consequence."

There is a good idea, however, available for machine shop executives who desire more suggestions and ideas from their employees. The example comes from a factory in another industry that has been bringing about good results with what is termed "report cards." The owner explained the system: "We distribute these cards every day, without exception, to all of our employees and our executives. Some men are timid and naturally hesitate to offer their opinions regarding a possible improvement. Then there are some individuals who have the thought that their ideas would not be used anyway and others, we have noticed, who must be prodded to get any ideas from them. The report cards have solved this problem."

As suggested, the cards are distributed daily and they are collected at the end of each day. Thus, each employee will want to do his share, for there are the cards to go by and they, naturally, furnish the necessary influence and encouragement.

Application of the Welding Torch to Railroad Repairs

Welding Torch Reduces Cost of Repairs—Locomotives Need Not Be Dismounted—Salvage of Many Small Parts Possible—Cutting Instead of Forging

SPECIAL CORRESPONDENCE

THE discovery of the possibilities inherent in the oxy-acetylene flame and the practical application thereof to industrial purposes through the medium of cutting and welding torches, may well be ranked among the most important and revolutionary steps in the progress of industrial art. This flame is to the mechanic what the scalpel is to the surgeon, inasmuch as it enables him to reach and if necessary reconstruct vital parts that were hitherto inaccessible.

FIG. 1.—WELDING BROKEN WALL IN STEAM PASSAGE

Though it may be a far cry from the disciple of Æsculapius to the wielder of the acetylene torch, the work of both is, nevertheless, along similar lines. The diseases of modern intricate machinery, like the diseases of men, are more than likely to be deep-seated and beyond the reach of superficial ministrations. In no class of machinery is this more true than in the locomotive, for in this ponderous piece of mechanism there are many vital parts concealed under its expressionless exterior that are subject to deterioration or destruction by reason of wear, corrosion, shock, vibration, exposure to extreme temperatures and many other causes, and it is the welder's duty to reach and restore these affected parts by cutting away the enclosing shell when necessary, and afterwards replacing it so that it may resume its normal functions.

As the life of the patient may depend upon the skill of the surgeon so may the lives of hundreds of perfectly healthy persons be dependent upon the skill of the welder, for should one of these mighty machines fail upon the road at a critical moment, not all the surgeons in the world could restore to order the havoc that would be wrought.

The New York, New Haven & Hartford Railroad has within the past three years adopted and put into extensive use this extraordinary means of locomotive repair and in this article will be shown a few of its applications to the salvage and reconstruction of machines that would without it demand complete rebuilding, or perhaps be continued in service with the true nature and serious aspect of their disabilities unsuspected until disaster resulted.

Though this road has applied the acetylene method of restoration to many locomotives, some of which have been in regular service for over two years since the repair was made, not once has a welded part failed in service; and, though welded parts are every day tested to destruction in their physical laboratories, it is always the sound metal and not the weld that yields.

An example of interior repair that is analogous to the work of the surgeon is shown in Fig. 1, where to reach the affected part it was necessary to cut away and afterwards restore the enclosing shell. The machine is one of the huge Pacific type of locomotives drawing the express trains in which you and I may any day be riding, unconscious of the delicate surgical operation that has enabled it to transport its valuable cargo in safety.

The cylinder, valve chamber, steam chest and one-half of the saddle are all comprised in a single casting with the ports and passages cored within it. One of the thin walls of cast iron that separates the live steam at 200 lb. pressure from the exhaust had become cracked or broken, probably by freezing, and allowed the steam to blow through, thus putting the engine out of business.

To repair the affected part it was necessary to cut out a panel, as at *A* in the outer shell, cut away the broken wall, weld in a new piece and then weld the panel back in place. The panel was cut out by drilling a series of holes in the form of a rectangle of sufficient size to enable the welder to reach the work upon the broken wall. The affected part was then cut away with a chisel along the line of the break and a new piece welded in. The white lines at *B* show the weld. The panel in the outer shell was then welded in as at *A*,

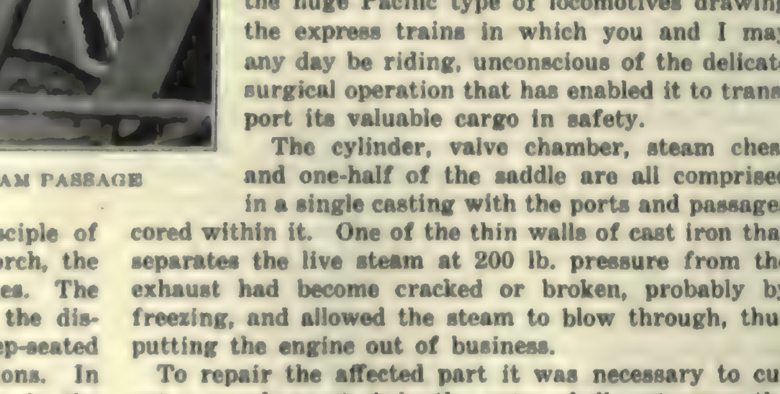


FIG. 2—A CRACKED CYLINDER RESTORED

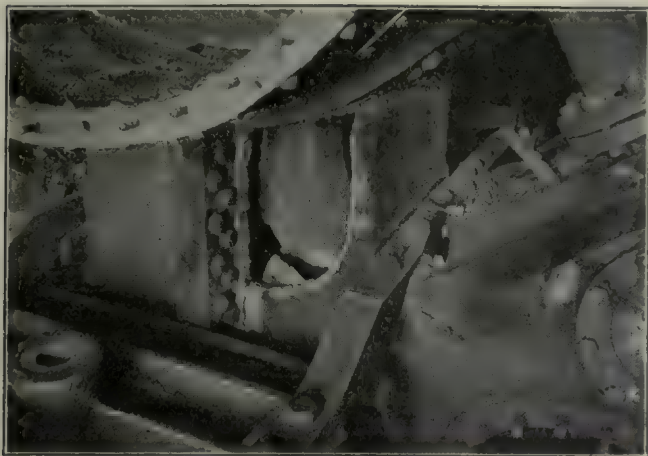


FIG. 3—A JOB OF "INSIDE WORK"

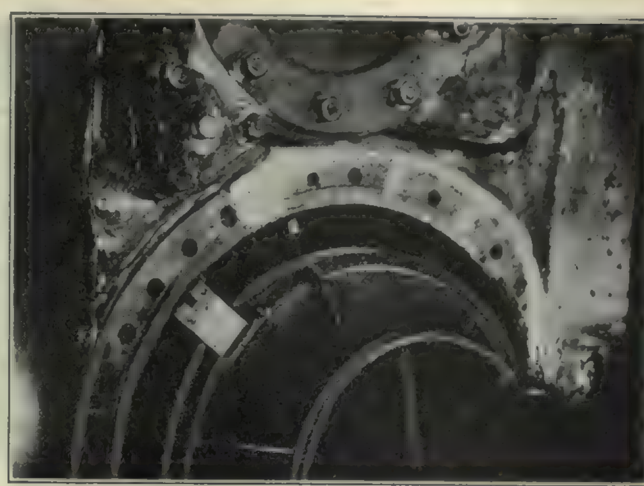


FIG. 5—REPAIRING CRACKED FLANGES OF CYLINDERS

this view showing the completed job. The small hole in the center of the panel was drilled and tapped for an eyebolt by means of which the loose piece could be handled. This hole was finally closed with a pipe plug.

In another engine of the same type one of the cylinders developed a crack throughout the entire length near the bottom. To make the repair and avoid the expense of a new casting, which, by the time it had been machined and assembled on the engine would have cost nearly two thousand dollars, the bushing was drawn out and with the aid of air hammer and chisel the cast iron wall was cut away along the inside of the cylinder in the shape of a wide V-groove, following the crack.

With the welding rod and torch this groove was then filled up, fusing the old metal with the new until the cylinder was restored practically to its original strength and contour. The portable boring outfit was then set up and a light cut taken through the cylinder, a new bushing fitted, and the engine was again ready for service with but little loss of time. Fig. 2 shows the completed weld before the cylinder was rebored.

An experiment that has been tried out successfully in joining the broken edges of important parts is shown in Fig. 3, where the joint had been but partly prepared for welding when the picture was made. Here again it was necessary to take out a panel to do some "inside work," though in this case the original break had gone far toward its removal by extending along two sides of the piece that had to be taken out.

This part, which when joined to its mate is known as the saddle and is called upon to bear the weight of the forward end of the boiler, is an integral part of the cylinder casting and to replace it would, of course, involve an entire new cylinder. The experiment referred to is the setting of small square or hexagon head tap bolts into the beveled edges that have been prepared for the weld, screwing them tightly into the iron. A double row of these small heads may be seen along the horizontal part of the break that extends back under the boiler.

In the welding process the heads are fused into the new metal and the bodies of the screws into the original casting, thus forming small anchors that are supposed to assist in holding the edges together.

In Fig. 4 may be seen a welding job that was done upon the cylinder of one of the large freight locomotives. A part of the casting had been broken off by impact, exposing the steam passage and rendering the cylinder useless. A casting was made to conform to the shape of the broken part and this was welded to place without difficulty. The cut shows the job before and after welding.

Minor cracks in the flanges, often caused by water getting into the cylinder while the engine is moving, are easily closed and the casting restored to its original strength and usefulness in a few hours, or in some cases minutes, thus saving the entire part from the

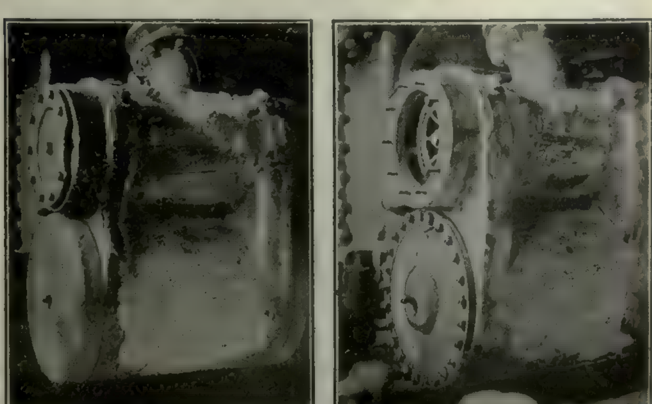


FIG. 4—BROKEN PART OF CYLINDER CASTING REPLACED

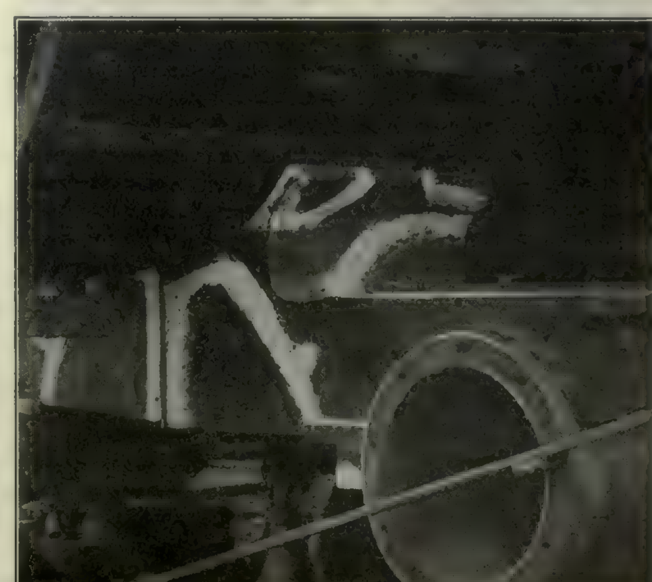


FIG. 6—AN EXTENSIVE REPAIR UPON A LOCOMOTIVE

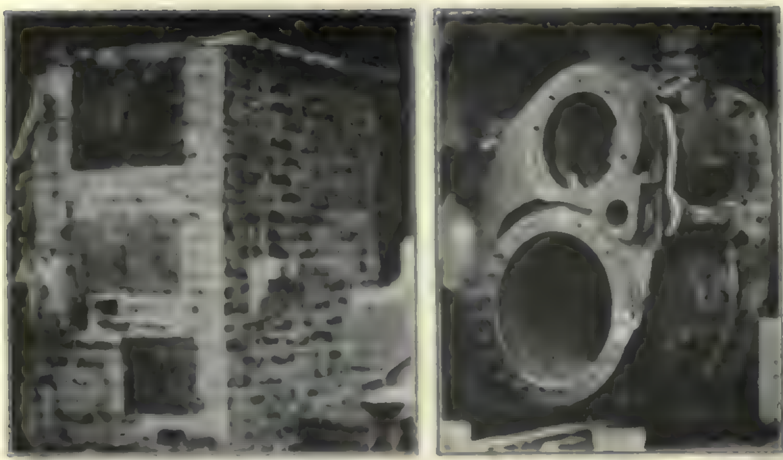


FIG. 7—A CAST-IRON WELD AND PREHEATING FURNACE

scrap heap and the engine from a long lay-over. Such a repair is shown in Fig. 5.

On another engine of a different type both parts of the saddle were broken in several places. Without the acetylene torch new castings would have been the only possible means of restoring the engine to service. The lines in Fig. 6 show the position and extent of the several breaks and indicate how the repair was made without dismounting the machine, and at a small fraction of the rebuilding cost. This is a freight engine and is now doing daily duty on the road.

The welding material used in all the foregoing operations is tobin bronze, and the art of handling this metal has been developed to a high state of perfection by the foreman in charge of welding operations for this road. Cast iron is also used as a welding material but the cost of such welds is usually much higher owing to the necessity for preheating the work, and the results are not equal in strength and dependability to welds made with bronze. In all the above described jobs there was no preheating and no prepartion other than chipping away the defective and corroded metal along the breaks.

The welds shown in Figs. 7 and 8 were made with cast iron and the elaborate preparations necessary are indicated by the presence of the furnaces shown in the illustrations. The cylinder castings were not removed from the engines, which stood upon the rails of the repair tracks, but the brick furnaces were built up in each case completely to enclose the cylinder, filled with charcoal and fired. Several hours were required to heat the job up to the requisite temperature, almost red hot, when the furnaces were torn away and the welds made. Besides the time and expense involved in preheating the work, the welder is handicapped by having to work in close proximity to the heated mass and cannot, therefore, work as efficiently as he might if the metal were comparatively cool.

Welds made with cast iron sometimes fail immediately—though the break is more likely to occur in the sound metal adjoining the weld than in the weld itself—because of shrinkage strains set up in cooling, and then the work has to be done all over again.

Locomotives are by no means the only things around a railroad shop that are repaired by welding. The foot plate of a derrick is shown in Figs. 9 and 10, broken in several places. This weld was made with tobin bronze, though the casting was preheated for the work. As it was an individual casting and required no dismantling it was taken to the welding shop and laid upon the "preheating box." Fig. 9 shows the casting on the box, where the welding was done. The combined length of the welds was 18 ft. and 100 lb. of bronze was used in the welding. The casting weighs approximately two tons and the operation of welding required 32 hr. In Fig. 10 the casting is shown suspended from a crane, where an idea of the extent of the welds may be obtained.

A badly broken cable drum is shown in Fig. 11. The rim was broken apart and four of the spokes were separated from the rim. Preheating was necessary in this case because of the shape of the casting, which would be likely to induce shrinkage strains that would again break the spokes as the work cooled.

In Fig. 12 may be seen a particularly exacting job of welding, not because of the difficulty of joining the parts but of the necessity for having the gear perform satisfactory service, after welding, without machining; otherwise there would have been nothing gained by having welded it. The gear was broken in four pieces, the breaks including a part of the rim. By means of clamps, trams and templets the broken pieces were fitted together and welded so perfectly that no machine work other than what could be done with a file was needed to restore it to usefulness. The gear is nearly 6 ft. in diameter and is a part of a wheel lathe used in the shops.

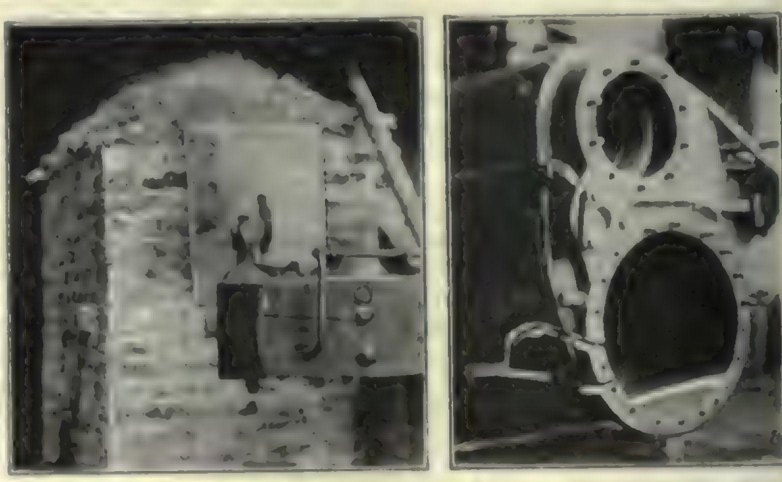


FIG. 8—PREPARING THE PREHEATING FURNACE

A larger job of similar nature is shown in Fig. 13. In this case there was no break in the rim but preheating of the latter was necessary to forestall shrinkage strains. The preheating was done with the gas

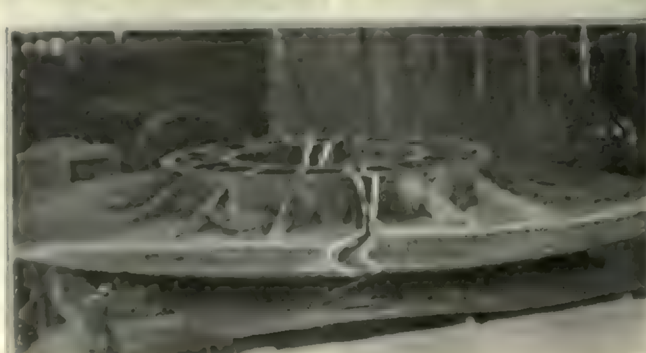


FIG. 9—FOOTPLATE FOR DERRICK ON PREHEATER BOX

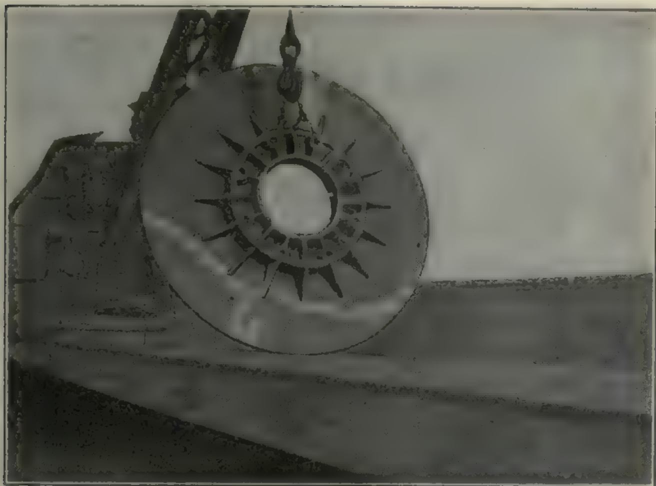


FIG. 10—THE COMPLETED JOB

ring that is used in the wheel shop for removing and resetting the tires of the driving wheels. It is shown in place in the cut.

Failures are rare, and when they do occur it is always during the cooling and consequent shrinking of the casting; never in service. The part shown in Fig. 14 is the foot plate of one of the road's wrecking derricks and is a very heavy casting. This weld was attempted with cast iron in the days before bronze was considered as a welding material and, though every precaution in the way of preheating was taken and repeated trials made, the ribs would pull away from the central hub in cooling. This job was, threfore, abandoned; but the foreman welder, under whose direction all the previously described work was done, is of the opinion that if this job should recur he would use bronze upon it with success.

Building up Worn Parts

Many of the smaller parts of locomotives, such as driving boxes, guide bars, pistons and piston rods, etc., that are subject to rapid wear are built up with bronze or soft steel and remachined ready for service, thus saving the expense of new forgings. On parts where little machine work is required a manganese bronze is used that resists wear much longer than the softer metal but does not lend itself readily to machine work.

FIG. 11—CABLE DRUM REPAIRED BY WELDING

FIG. 12—AN EXACTING JOB

Cracked bells for locomotives are reclaimed by bronze welding, and, though the welder will not guarantee the same note, the bells will ring as clear and true as before the break. Some of the bells that have thus been reclaimed may be seen in Fig. 15.

A part that wears out rapidly is the elevator screw of the automatic stoker used on some of the larger locomotives. These screws, Fig. 16, convey the coal from the tender to the firebox. They are three in num-

FIG. 13—A BROKEN GEAR RESTORED TO SERVICE

FIG. 14—A JOB THAT WAS ABANDONED

ber on each engine so equipped and as there is no machining upon them except grinding the journals they are made of very hard material. The constant passing of coal along the helix soon wears the edges sharp, in which condition they do not work satisfactorily and are liable to break. These edges are quickly restored to normal thickness by building them up with the torch, using manganese steel as a welding material.

The torch also plays an important part in the boiler shop. Plates may be cut out and new ones welded in, patches may be welded on, leaks stopped, refractory staybolts cut out, and many minor repairs made in a small fraction of the time that would be consumed by other methods. The use of welding is, however, somewhat restricted around a boiler shop by a law that demands riveted joints in certain places and the torch has not, therefore, completely banished the pneumatic hammer in this respect.

Cutting Torch Will Not Cut Cast Iron

In all the jobs here described only the *welding* torch has been considered. The cutting torch is of different construction and involves different principles. It is a peculiarity of the latter that may not be known to many whose experience does not bring them into contact with oxy-acetylene processes, that this torch will not cut cast iron. Therefore in preparing cast iron for welding, the cutting torch, with its slender finger of blue fire that cuts through the six-by-eight section of steel in a locomotive frame like a sharp knife through cheese, must be replaced by the pneumatic hammer and chisel.

That the torch will cut steel readily is evidenced

FIG. 15—CRACKED BELLS RECLAIMED BY WELDING

FIG. 16—EDGES OF CONVEYOR SCREWS BUILT UP WITH MANGANESE STEEL

by the side rod shown in Fig. 17 which was cut from the slab, including the round hole in one end, in forty

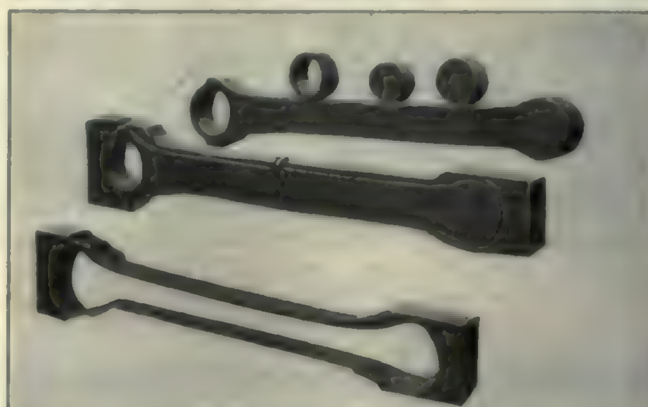


FIG. 17—AN EXAMPLE OF WHAT THE CUTTING TORCH WILL DO

minutes. The metal is 4 in. thick and so cleanly and squarely is the cut made that no machining of the cut surfaces is required for the finished part.

Retaining the Worker's Interest

By Robert Grimshaw

A temporary change of occupation may help to keep a man interested in his work if the set of operations he is doing proves too little monotonous.

"Too little monotonous" is what I said. The man who has a routine job calling for finger memory can let his thoughts wander fancy free, but the one who has to think of a dozen things is under a strain and should be given a monotonous job for a change.

FIG. 1. INSPECTING THE VALVES

FIG. 2. PISTON RING INSPECTION

A Few Marmon Inspection Methods

Showing Typical Inspection of a Few Parts of the Marmon Car Which Gives an Idea of the Care Used

SPECIAL CORRESPONDENCE

A FEW of the inspection operations in the Marmon plant are shown herewith. The valves are very carefully gaged as to size, straightness, angle of seat, etc., as shown in Fig. 1. The seat is tested for concentricity with the stem by the dial gage shown. The angle of the seat is inspected by the long gage with the side cut away, to be seen just above the micrometer. Each valve is carefully wrapped on passing inspection.

The inspection of piston rings is shown in Fig. 2. Here the thickness is inspected by such gages and the opening gaged when the rings are closed in on the form to be seen at the extreme left. The diameter of the rings before closing is indicated by the dial gage near the center. Valve spring tension receives careful attention as shown in Fig. 3, where the pressure exerted by each spring is weighed by a Toledo scale in connection with a special compressing device. The length is measured both before and after compression so as to determine the amount of the set.

The chassis springs also receive careful attention, every spring being tested by the pneumatic press shown in Fig. 4. The ends of the spring to be tested rest on a small car or truck so as to be free to move endwise as the spring lengthens under compression. Both the pressure required and the action of the spring are carefully noted.

FIG. 3. TESTING VALVE SPRINGS

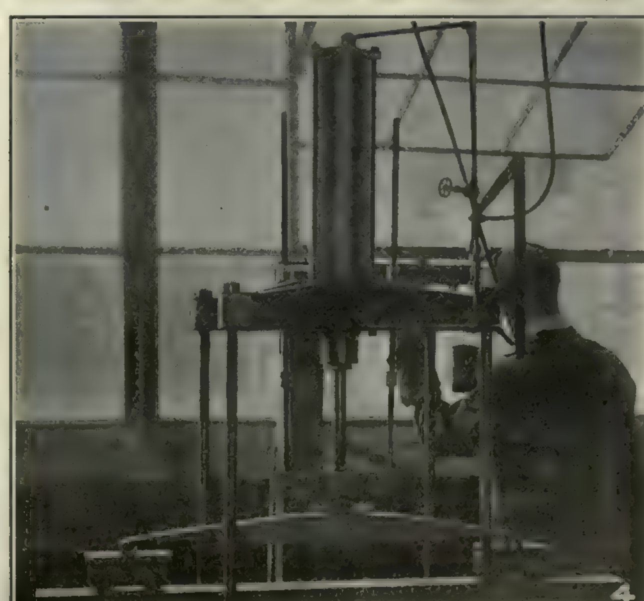


FIG. 4. PRESS FOR TESTING CHASSIS SPRINGS

Nickel and Its Alloys

The Second Article—Properties and Uses of Nickel-Silver and Monel Metal—How Monel Metal Should Be Melted, Cast and Forged

By PAUL D. MERICA
Director of Research, International Nickel Company

THE nickel-silver alloys are known in the trade under a variety of names such as german silver, white metal, arguzoid, electrum, new silver, platinoid and white copper. As shown in Table V, their composition is variable. They are produced chiefly in the form of sheet, wire and seamless tubes, but also in castings of a semi-ornamental nature, such as for automobile wheel hubs. Probably the chief use of nickel-silver is for table cutlery, such as spoons and fork stock to be silver plated. The metal is readily spun and drawn cold. For this reason and also because of its pleasing color and non-corrodibility, it is adapted to the production of numerous stampings and fittings.

The color and resistance to corrosion of these alloys improve as the nickel content varies from about 5 per cent in the cheapest ware to from 20 to 30 per cent in the best quality. Lead is added in stock such as key stock which is to be machined, in order to improve the machineability. The tensile properties and hardness vary, naturally, both with the composition and the temper of the metal. Table VI gives an idea of the properties of the typical nickel-silver alloys. During the cold working of these alloys by drawing or rolling, they may be softened by annealing, preferably in a muffle furnace with the exclusion of air at about 1,300 deg. Fahrenheit.

Commercial Forms of Monel Metal

The alloy known as monel metal is produced generally by direct smelting and refining of the copper-nickel bearing ores. It contains from 67 to 69 per cent nickel and from 28 to 29 per cent copper, together with about 2 per cent iron and from 0.5 to 2 per cent manganese and carbon, according to the use to which it is to be put. It is produced in the usual commercial forms as follows:

Hot-rolled rods contain about 2 per cent manganese and about 0.2 per cent carbon.

Cold-drawn rods are identical in composition.

Hot-rolled, bright annealed sheet contains about 0.25 per cent manganese and 0.10 per cent carbon.

Cold-drawn wire contains about 2 per cent manganese and about 0.15 per cent carbon.

Cold-drawn strip is similar to wire in composition.

Welded tubes are fabricated from the sheets.

Monel castings are similar in composition to the rods, but often contain some silicon.

TABLE V COMPOSITIONS OF NICKEL-SILVER IN COMMERCIAL USE

Material	Nickel Per Cent	Copper Per Cent	Zinc Per Cent	Lead Per Cent
Cutlery and knife stock	15 to 25	55 to 65	14 to 20	Fe. 0 5 to 1 5
Key stock	8 to 18	55 to 65	15 to 35	1 to 2
Jewelers' wire	5 to 25	53 to 63	25 to 32	
Brazing solder	8 to 20	35 to 40	40 to 55	
Watchcase metal	10 to 28	55 to 65	16 to 30	0 to 1
Spoon and fork stock	10 to 20	57 to 66	20 to 30	
Platers' bars and cores	5 to 25	56 to 70	18 to 24	

Besides these forms, monel metal is on the market in fabricated forms such as, screen and wire cloth, chain, wire rope, sash cord, rivets, screws, bolts and nuts, tacks, nails, balls, knives and forks.

Table VII describes some of the physical properties of monel metal. The principal useful properties are resistance to corrosion, a white color and a high polish which the metal will take and retain, mechanical strength and toughness which is retained even at high temperatures, and resistance to steam erosion. These properties are illustrated in the commercial applications of monel metal described later. In further illustration of the remarkable toughness of this metal, the results of the recent Bureau of Standards tests may be cited. It was found from the Izod and Charpy impact tests that a notched bar of hot-rolled monel metal required about 150 ft.-lb. of energy to break it, compared with the 50 to 100 ft.-lb. required to break the heat-treated alloy steels.

Remarkable Resistance to Corrosive Solutions

Monel rods and castings are used to a great extent in the construction of pickling tanks and crates for the pickling of steel. They resist for years the action of the 6 deg. Be. sulphuric acid used in pickling at about 150 deg. F., and in addition have the mechanical strength to carry the loads required.

Another large use of monel metal rods is for pump rods and liners, and for valves for handling mine and sea water and corrosive solutions generally. It has been found by test and experience that monel metal resists excellently the action of ammonia, ammonium hydroxide, fused and aqueous caustic alkalis, fatty and most other organic acids, sea water, solutions of neutral metallic salts such as alum, sulphates, chlorides, gasoline and mineral oils, phenol and cresols, photographic chemicals, urine, dry mercury, dyeing solutions and alcoholic beverages. It resists fairly well the action of sulphuric, weak phosphoric, hydrocyanic, hydrofluoric, acetic, and citric acids, ferrous sulphate and dry chlorine. It is not resistant to the action of hydrochloric, fused or aqueous chromic and nitric acids, molten zinc, potassium cyanide, sulphurous acid and ferric chloride.

Monel sheet has been used for roofing, as, for example, for the roof of the Pennsylvania Terminal in New York.

TABLE VI TENSILE PROPERTIES OF COPPER-NICKEL-ZINC ALLOYS

Strip	Tensile Strength Lb. Per Sq.In.	Elongation In 2 In. Per Cent	Composition Per Cent Nickel	Copper	Zinc
Hard	130,000	2	30	47	23
Annealed	73,000	32	30	47	23
Annealed	71,000	38	25	55	20
Hard	94,000	2.5	18	64	18
Annealed	58,000	33	18	64	18
Hard	107,000	2	18	55	27
Annealed	69,000	29	18	55	27
Hard	92,000	4	10	62	28
Annealed	63,000	48	10	62	28

TABLE VII. PHYSICAL PROPERTIES OF MONEL METAL

	Tensile Properties				Hardness	
	Yield Point 1,000 Lb. Per Sq.In.	Tensile Strength 1,000 Lb. Per Sq.In.	Elongation In 2 In. Per Cent	Reduction of Area Per Cent	Scleroscope Universal Hammer	Brinell 10 mm. Ball 3,000 Kg. Load
Sheet or strip						
Annealed	25 to 35	70 to 80	35 to 45	50 to 60	15 to 20	100 to 120
Cold-rolled	110 to 120	120 to 130	2 to 5	....	40 to 50	250 to 350
Wire						
Annealed	....	70 to 80	....	....	....	....
Cold-rolled	....	110 to 150	....	....	....	....
Rod						
Hot-rolled	35 to 60	80 to 100	30 to 45	50 to 65	20 to 30	145 to 170
Cold-drawn	60 to 80	80 to 100	30 to 40	50 to 65	....	180 to 200
Casting	25 to 40	65 to 75	25 to 40	....	....	....

Density: 552 lb. per cubic foot or nearly equal to that of copper.
Melting point: about 2,420 deg. F.
Coefficient of thermal expansion: 0.0000081 per degree F. (from 60 to 210 deg. F.), or just over that of steel.
Electrical resistance: 256 ohm per mil. ft. at 75 deg. F. or about 25 times that of copper.
Temperature coefficient of electrical resistance: 0.0011 per degree F.
Magnetic properties: weakly magnetic up to about 250 deg. F.
Optical reflection: 60 per cent compared with 95 per cent for polished silver and 55 per cent for polished steel.
Young's modulus of elasticity: 25,000,000 lb. per square inch.
Properties of hot-rolled rods depend on their size. Their proportional limit is about 80 per cent of the yield point and varies from 30,000 to 45,000 lbs. per square inch.

It is used largely in the construction of washing machines, dairy machinery and tanks, perforated mine screens and chutes, vat and tank linings for alkalis and acids, and for many household utensils.

The relative incorrodibility of monel metal, its resistance to the eroding effect of steam and its strength at high temperatures have made a unique place for it in the superheated steam field. Turbine blading and valve stems and seats for superheated steam are today largely made of this metal. For such purposes monel metal is well fitted because its thermal expansivity is nearly equal to that of steel, with which it is usually associated in valves for turbine construction. Fig. 4 shows a monel metal steam valve with a cast monel body and a monel trimmed rod.

Although monel metal is used for a great variety of additional purposes, the foregoing instances are typical of the general scope of its application in industry. The metal is not marked by an extreme resistance to corrosion (such as is platinum or gold, for instance), so much as it is by a relative incorrodibility together with valuable mechanical and other physical properties. To use an every-day term, it might aptly be called a "general utility" non-corrosive alloy.

Monel metal can be fabricated by essentially the same methods as are used in the fabrication of steel, but it differs from steel in some important particulars of its behavior.

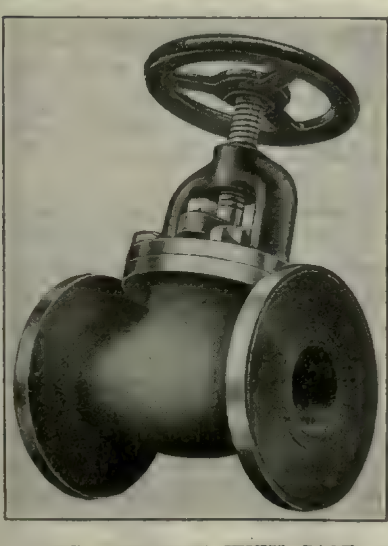


FIG. 4—VALVE WITH CAST MONEL BODY

Although monel metal is a nonferrous metal, the melting and casting of it conforms more closely to the steel foundry practice than to the casting of brasses and bronzes. This is evident from the fact that its melting point is about 2,500 deg. F. and that, depending upon the type of casting, it must be poured at from 200 to 400 deg. higher than that temperature.

The metal may be melted either in crucibles or in a reverberatory or electric arc furnace, and ingots or shot may be used together with foundry scrap. The usual precautions must be taken to prevent the metal from becoming over-oxidized. The most important feature in the melting operation is to finish it with the metal at the right "pitch," namely, with the proper carbon content. For casting, this carbon content should be not lower than about 0.10 per cent and not higher than about 0.35 per cent. It may be necessary to add flour carbon or charcoal with the charge in order to finish the melting with this amount of carbon. A good composition for casting contains about 2 per cent iron, 1 per cent manganese (added as ferro-manganese), 0.5 per cent silicon (added as ferro-silicon), 0.20 per cent carbon and the balance of nickel and copper.

Before pouring the castings, the metal should be deoxidized by the addition either in the ladle or in the crucible of 1½ oz. of metallic magnesium to every 100 lb. of metal. This magnesium is held with tongs and plunged to the bottom of the ladle, where it is held until the magnesium has dissolved. If the metal is at the

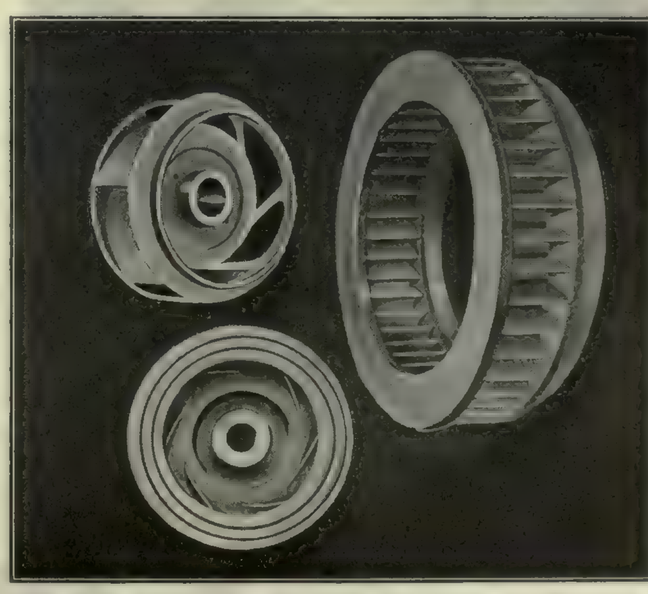


FIG. 5—IMPELLER CAST OF MONEL METAL

right pitch, this operation will proceed quietly and with no difficulty.

The molding and gating practice with monel metal is very similar to that used in the casting of steel. Molds should preferably be baked, but may merely be skin-dried. The shrinkage of monel metal is ¼ in. to the foot, so that heavy risers are necessary in order to feed the casting properly. Figs. 5 and 6 show turbine impellers and pump cylinder castings made of monel metal.

Except in a few important particulars, monel metal may be forged in the same manner as medium carbon steel. However, certain precautions are absolutely necessary in order that the forging may be successful. In the first place, the temperature at the beginning of the operation should be not over 2,050 deg. F. and not under 1,850 deg. F., and the work should not be continued beyond the time at which the temperature drops to about 1,400 deg. F., or when the metal becomes a dull orange color. If monel metal is heated above 2,100 deg. F., it is likely to become hot-short and to crumble readily under the hammer.

Not only must the forging work be carried out at the correct temperature, but the heating must be conducted in such a manner that the metal is not oxidized nor contaminated by sulphur from the fuel. The oxide or scale of monel metal adheres tightly to the metal and is not knocked off in the manner that steel scale is, but is worked into the surface of the forging. It is therefore necessary to prevent this scale formation by heating the metal in a neutral or slightly reducing atmosphere. Furthermore, even in a reducing atmosphere such as a smoky flame or in the blacksmith's forge, the metal will readily absorb sulphur from the fuel. This sulphur embrittles the surface of the billet in such a

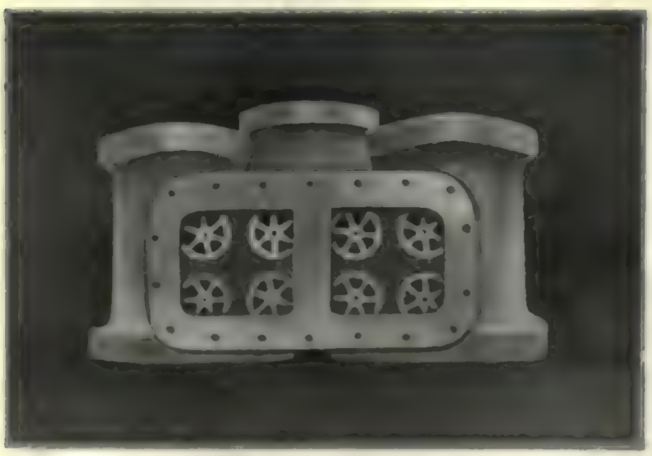


FIG. 6—MONEL PUMP CYLINDER CASTING

way that, in subsequent forging, the surface checks and cracks in a very characteristic manner.

In order to avoid oxidizing or sulphurizing, therefore, it is preferable to heat the metal in a muffle type of furnace if possible, and if not, in an oil- or gas-fired hearth furnace using fuel that is free from sulphur. In no case should the heating be carried out in a blacksmith's forge, as the metal will certainly be contaminated and cracked when the attempt is made to forge it.

Forging should be done with the hammer, as this means has been found much more successful than the use of any of the usual types of presses. This condition is possibly due to the fact that the metal retains its heat better under the hammer than under the press.

Monel metal is successfully drop forged with the use of tool-steel dies. The most important feature in drop forging this metal is the proper design of the dies. In

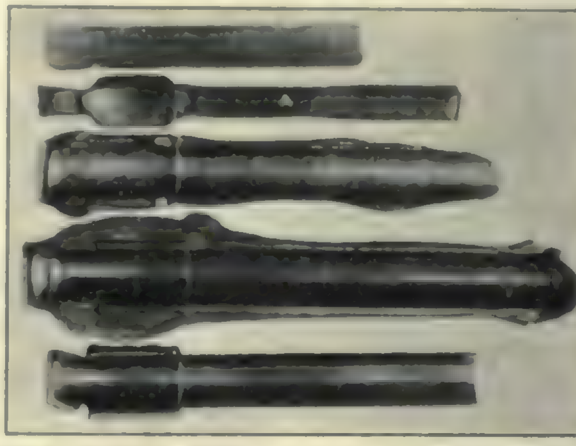


FIG. 7—DROP FORGING A TURBINE BLADE FROM A MONEL ROD

general, the dies should be cut in such a manner that the principal distortion in any operation will always occur in the thickest part of the forging, as this part retains its temperature the longest.

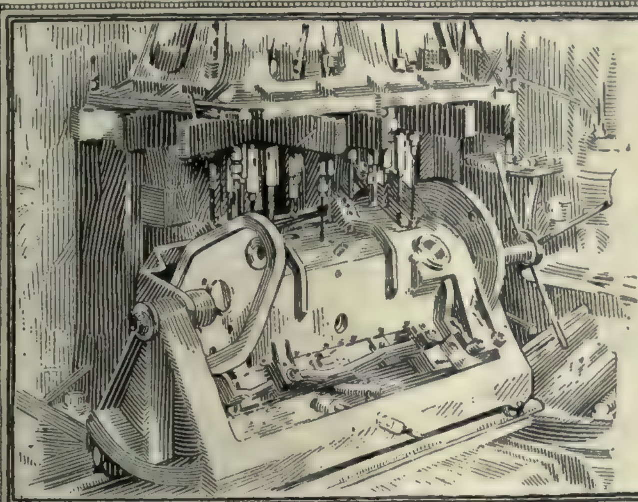
In Fig. 7 are shown the steps in the drop forging of a monel metal turbine blade from 1-in. square hot-rolled monel rod. In the first heat the rough forging *A* is produced. It is then reheated, finished and trimmed in one heat.

Oil Infection

By Gus Haessler

During the past year several articles have appeared in the *American Machinist* relative to oil systems used in manufacturing plants. Systems, more or less complete, were described and the effect of various oils in pure and impure states upon machine bearings and cutting tools were analyzed. Nevertheless there is one phase of the subject, namely, oil as a carrier of infection, that seems to have been mentioned only briefly and dismissed without the consideration to which the subject is entitled. Industrial medicine reports many cases of skin infection that may be traced directly to contaminated oil. As a means of protection the worker has the choice of painting the hands with iodine, wearing gloves or quitting the job, all of which imposes needless expense and inconvenience, aside from being objectionable.

The reports from the Peerless Motor Co. and others, page 127, Vol. 57, show results obtained by sterilization are sufficient evidence to justify the conclusion that the oil may become infectious. Moreover, the disappearance of the troubles of those affected, after the oil is sterilized, indicates the proper course to follow. The foregoing conclusions may be verified by any one in daily contact with tainted oil by changing to a no-oil job for a time. It is then possible to observe the effect of the contagion fade away and the reappearance of the trouble by simply returning to the oil job. Sterilization attacks the problem at its root and oil systems that do not include this process should be regarded as hardly in step with modern sanitary engineering practice.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Cutting and Shaping Dies Begun—Principles of Blanking Dies—Points of Design—Construction of Dies and Punches

SHEET metal is cut, pressed and formed into innumerable shapes by means of dies of various kinds. There are two general classes of dies, those which cut and those which shape. Cutting dies are used to punch or cut out sheet-metal blanks of the required form from a piece of stock fed through the punch press. The shaping dies are used to produce forms which require the material to be bent, twisted or drawn out so that it is changed from its original flat shape. Combinations of cutting and shaping dies are often made in which the blank is first cut out to the required outline and then shaped to the form desired.

These two classes of dies are sub-divided into several distinct types which we shall treat separately to avoid confusion.

Dies for sheet metal are used on punch presses of various kinds, the punches and dies being held, respectively, in the ram and on the bolster of the press. Suitable provision for locating is made, so that alignment of punch and die can be accomplished without great difficulty. Fig. 440 shows a capacity diagram for a punch press of standard make. The various dimensions on bolster and ram are given, together with machine capacities, in order that the designer may be able to determine whether or not the work which he has in mind can be used on a given machine.

Use of Capacity Diagram

The bolster shown at *B* is an integral part of the punch press itself. The bolster plate *A* is fastened to the bolster, and on it a die-holder is suitably mounted. The bolster plate is sufficiently thick so that die-holders of various sizes can be fastened to it in a substantial way. It would be possible to fasten the die-holder directly to the bolster; but this is not commonly done because a change may be necessary from time to time and a great number of holes might eventually be drilled in the bolster, which would be a disadvantage.

The punch may be held directly in the ram *C*, or it may be secured in a punch-holder which fastens on the ram. The shank of the punch-holder can be slipped into the hole *E*, clamped by means of the block *D* and prevented from turning out of its correct position by a setscrew in the hole *F*. The practice varies somewhat on these matters in different factories throughout the country.

The designer should be provided with capacity diagrams of all punch presses which are to be used on the work, and should design his dies in accordance therewith. It is generally advisable to select a press of a capacity somewhat greater than the work for which it is to be used, as it is much better to put work on a machine of ample size.

Principles of Blanking Dies

All dies which cut the metal to a specified form from the flat piece are called blanking dies, although there are several varieties of them and they are combined with other dies in many cases. In order to bring out the principles on which this kind of work is based, we shall discuss the matter, giving very elementary diagrams in order to make the different points as clear as possible. The material from which the work is made usually comes in a strip or sheet, but occasionally in a roll. Thin and narrow work is most frequently handled in a roll, using either hand or automatic feed. The material is passed across the face of the die and under the punch so that when the press operates, the punch passes down through the metal and shears the stock, which passes into the die. The principle of blanking dies is illustrated in Fig. 441. The punch shown at *A* is held in the ram of the press, while the die *B* is secured in the die-holder on the bolster plate of the machine. The hole *C* corresponds in shape to the punch, but is a trifle smaller. This variation between the punch and the die is determined by the thickness of the stock. The diagram *D* shows a punch *E* and a die *F*. The stock or work is indicated at *G*.

In order to make clear the action of the punch in connection with the work and the die, three diagrams are shown at *H*, *K* and *L*. In the first of these the punch *M* is just coming in contact with the work *N*. In the diagram *K* the punch *M* has passed partly through the work *N*, carrying with it the blank *O* as shown. In the diagram *L* the punch *M* has passed completely through the work *N* and has sheared the blank *O*, which then passes down into the die. The diagrams shown here

are purposely made in very simple form in order to bring out the principles used in blanking dies.

Before attempting the design of blanking dies, the tool engineer must consider carefully various matters which will affect the design. In order to bring out these points clearly, they are here itemized briefly and will be

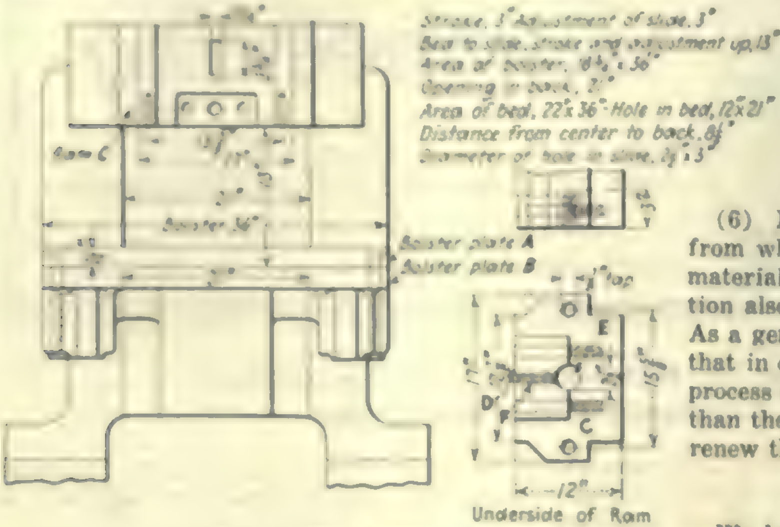


FIG. 440—CAPACITY DIAGRAM FOR A PUNCH PRESS

dealt with more specifically during the progress of the article.

(1) Shape of Blank: The form which is to be blanked affects the die in several ways. If the work is plain and of regular outline an extremely simple layout may be all that is required. If the work is irregular, there may be several ways of positioning it in the die, and that one must be used in which there will be as little waste of the material as possible. Work which is to be blanked and pierced requires a different arrangement from that which is only to be blanked. The method of laying out the form of the blank will be taken up later.

(2) Thickness of metal: The design of dies is affected by the thickness of the material from which the blank is to be cut. For thin work and soft metal, a comparatively shallow die of light construction may be sufficient. For thick metal, both punches and dies must be much heavier in order that they will stand the extra strains imposed upon them. The clearance between the punch and the die, and the angular relief of the die are also determined by the thickness of the metal.

(3) Quantity Required: This is an important point in design, as it affects the entire layout and general construction of punches and dies. For a small number of pieces a die can be made without much regard to the upkeep, while for high production work the regrinding of the die and keeping it to size for a long time are very important factors. These matters should always be considered at an early stage in the design. For a very large number of pieces, the die may be either sectional or solid, these points being dependent considerably upon the shape of the work and the difficulty of manufacture or upkeep.

(4) Machine Used: In the selection of a punch press for a given piece of work the thickness of the metal and general characteristics of the work to be done must all be considered. The capacity of the machine must be sufficient to handle the work to good advantage, and it is better to use a machine somewhat too large than to attempt to perform a piece of work on a machine which will be too light for the job. Machine data giving capacities and various dimensions which affect the design of dies should be conveniently available to the tool designer.

(5) Automatic or Hand Feed: The work may be fed by hand or automatically, according to its nature. If work is to be made from "ribbon" stock an automatic feed would naturally be used. Other automatic methods of feeding for sheet stock can also be provided, and they are often used on high production work. Naturally these matters affect the design of the die to some extent.

(6) Material for Dies: The kind of material from which dies are made is dependent on the kind of material which is to be blanked. The ultimate production also has an effect on the material used in the dies. As a general thing, the die is harder than the punch, so that in case of an accident or a displacement during the process of manufacture the punch will be injured rather than the die. The reason for this is that it is easier to renew the punch than to make a new die.

Construction of Dies and Punches

We have demonstrated the method by which a piece of work is produced in a die, and it is necessary now to take up a number of points in connection with both punches and dies. When the blank passes through a simple blanking die, it causes a certain amount of wear on the shearing edges of the die. After a while this wear causes imperfect work, but before this stage is reached it may be necessary to grind the face of the die and probably also of the punch. Provision is made to take care of this regrinding in the design of both the punch and die. As previously mentioned, it is customary to make the punch softer than the die, as it is much easier to replace in case of breakage by a lack of alignment or from other causes.

Dies are always relieved to give clearance for the blank to pass through. The angle varies from ½ to 2 deg. Some manufacturers have a rule for a clearance

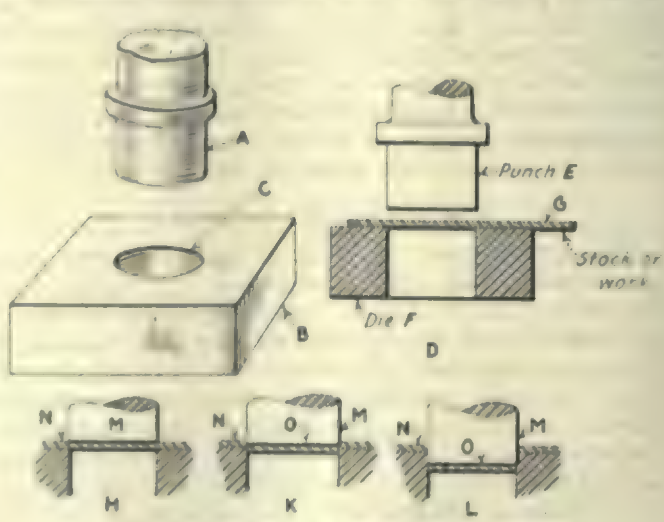


FIG. 441—PRINCIPLE OF BLANKING DIES

of ½ deg. for stock up to 0.125 in. thick, and 1 deg. for stock thicker than 0.125 in. When a small number of pieces is to be made the die is often relieved with a greater angle than this, sometimes as much as 4 to 5 deg., as it is easy to make in this way. Common prac-

tice has established a more or less flexible rule that dies should be made with a clearance angle from 1 to 1½ deg.

Two methods of relieving a die are shown in Fig. 442 at *A* and *B*. In the example *A* the clearance extends to the top face of the die, there being no "land." When the die becomes worn the upper face may be ground off, and although this changes the size slightly on account of the angular relief, the variation in the blank is often not sufficiently great to cause trouble. There are some manufacturers who use this method very largely, depending on final shaving dies to retain the sizes. Others use a die made like the example *B* in which the portion *C* has no relief, the remainder being relieved to an angle as shown. A land from $\frac{1}{32}$ to $\frac{1}{8}$ in. is used, depending largely on the material and the diemaker's practice. Dies for very thin metal like soft brass often have no land at all, and if made with a very shallow taper they can be reground a number of times without altering their size sufficiently to cause trouble.

Clearance Depends on Metal Thickness

In fitting the punch to the die a certain amount of clearance is necessary, depending on the thickness of the metal which is to be blanked. It is common practice to rough out the punch very closely to the size which has been scribed on the end of it from a templet produced in the die. After this has been done, the final size is produced by shearing the punch directly in the die. An additional amount is then taken off the punch to provide for clearance. In the example *D* a punch is shown at *E* directly above the die and ready to be sheared.

It is not customary to provide the punch with any back clearance or relief, although there may be cases where it might be made like the example shown at *F*. Generally speaking, no relief of this kind shoud be made on a punch. The example at *G* illustrates the clearance between the punch and die, as indicated at *H*. This clearance is entirely governed by the thickness of the metal in the blank and the nature of the material which is to be punched. Soft and thin materials require less clearance than do harder or thicker metals. Tables which specify the clearances necessary for different qualities of materials can be referred to as a guide in proportioning the punch.

In order to make sure that the material is in its proper position on the die, one or more guide plates are generally used. Stock from which the blanks are to be

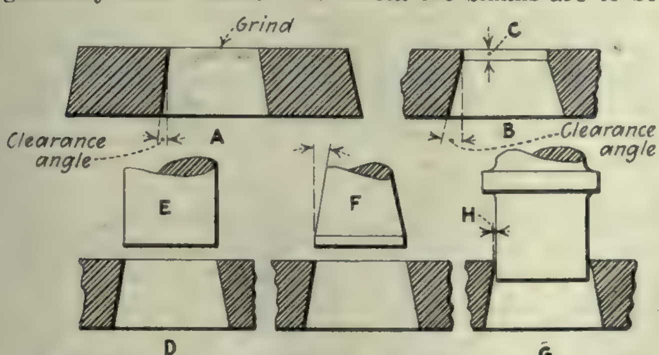


FIG. 442—CONSTRUCTION OF DIES AND PUNCHES, SHOWING STRAIGHT AND TAPER DESIGNS

made is fed through the press either by hand or by automatic feed. It may be in a sheet or in ribbon form, as previously mentioned. In order to illustrate the methods in common use, several diagrams are shown in Fig. 443. In the example *A* the die is shown at *B* and the punch at *C*. The guide plate *D* is at the rear of the die. The work *E* is held against the guide plate by the operator, and after each stroke of the press it is fed along the required distance and kept in position against

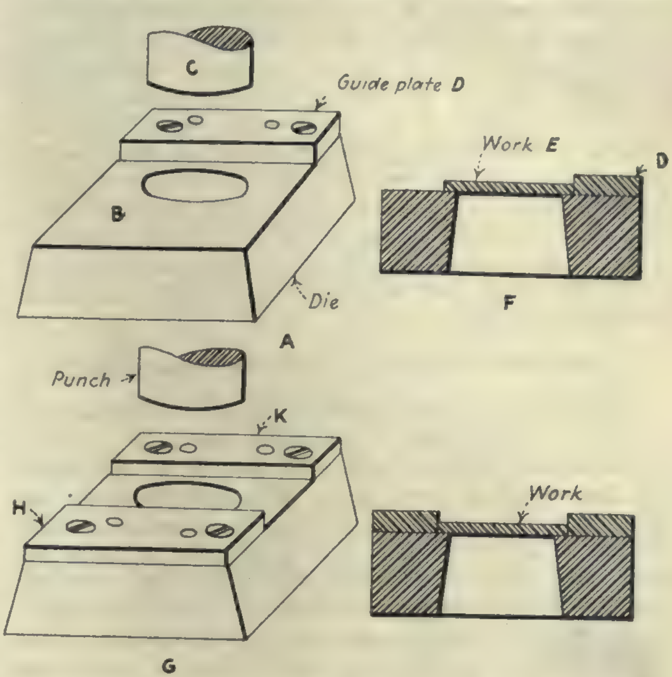


FIG. 443—GUIDE PLATES USED ON BLANKING DIES

the plate. The sectional view *F* illustrates these points very clearly.

In the example *G* two guide plates are used at *H* and *K*, and the stock is fed between them instead of being held against a single plate. There is always a certain amount of clearance necessary between the guide plates and the stock when two plates are used. The examples shown in the illustration on this page are intended simply to bring out the principle used in guiding the stock through the press.

Sources of Labor

By Robert Grimshaw

If it is desirable to know where one can buy asbestos, or phosphor bronze, sea island cotton or fireproof cement, it is equally desirable to know where to apply for labor in each of the various classes usually employed, and of those likely to be employed in an emergency or in a lively season. Thus, in a shipyard a number of "huskies" may be needed for only a few days, at a launching. Or one may want to know where to get a steeplejack or a flanger, a spot riveter or a number of carpenters.

The name of each applicant for a position of any kind, if he seems at all adaptable, should be entered on a card with a statement of all the details desirable in connection with his work, and, of course, with his house address and telephone number, if he has one. These cards should be arranged alphabetically in regard to family name. A duplicate set should be made by occupation and should contain the names in the first set, graded according to the supposed technical value, so that name after name under each occupation can be found in the first-named list.

The Men and Boys in Our Shops

By A. London

Being a constant reader of the pages of *American Machinist*, I was naturally attracted by the excellent contributions in vol. 56, pages 432 and 443 of *American Machinist* on "A Simple and Practical Apprenticeship System," and "Administration Methods." Having read those two articles with considerable interest, I asked myself as a foreman of considerable experience: (a) "What is the right education for the shop man?" (b) "What are the best incentives for the boys to improve themselves?" I am giving my personal views, and as I have lived in the shops as long as most men (some forty years) as fitter, erector, machinist and foreman, I hope that these views will help some along the road to success.

The Right Education for the Shop Man

It is my object to differentiate distinctly between the value to a shop man of technical education, on the one hand, and a logical and practical use of that which one has acquired from books and experience, on the other hand. It is an acknowledged commonplace that we cannot all be foremen and managers. It is at the same time emphatically true that every man who has a desire to excel, whether he be a fitter, erector, turner, plater or coppersmith, possesses a valuable ally if he makes a habit of acquiring various bits of knowledge and learns how to use them.

There is no finality in this profession of engineering. It is ever evolutionary and progressive, yet there are basic facts and fundamental principles connected with every phase of the mechanics' art which are unchangeable. These physical fundamentals are valuable assets for the shop man, and during more than forty years in the shops as apprentice, fitter, erector, machinist and foreman, I have proved their value.

Benefits of Home Study

There is not a class of the artisans mentioned who would not be directly benefitted by a home study of technical knowledge, accompanied by its practical application to the work done in shops. How many erectors of engines, boilers and heating systems know anything about the mechanical equivalent of heat, latent heat of steam, convection, point of saturation, relative volume, and superheat? And would not the erector of pumping systems benefit from a familiarity with the simple fundamentals of pneumatics, hydro-statics and hydraulics? All of these are interesting and absorbing subjects. Those whose work is to take charge of the erection of wood-drying plants and blast production would find their work doubly easy, if it were supported by the confidence arising from a knowledge of the laws of the exchange of heat.

Then come down to the shops. The fitter and liner-off in a large works is in a position to make or to mar the success of any machine-shop with which he may be closely connected. Unless he possesses a workable familiarity with geometry, angular measurements and trigonometry, his work, beside taking far too long and being of questionable accuracy, is usually a burden to himself. A knowledge of these things, even of an elementary nature, makes his job easier and his work less expensive and fully dependable.

In my experience as foreman, I have found that an apprentice who has acquired the knowledge referred to is more to be depended on for a difficult lining-out job than nine out of ten of the ordinary fitters around the shop. I have occasionally taken bright boys off the lathe, and they have been able to do a job of lining-off in about the time it would take the average shop man to get started. Shop managers quickly recognize the man who thinks mathematically, and we see the result in accurate work, saving of time, and lessened burden on the busy foreman.

To the coppersmith who has to take notes on outside work, a knowledge of drawing is of the greatest value. A case came under my personal notice a short time ago of a coppersmith who had been sent from Shiphams of Hull to take particulars for a set of piping for a steamship. He came provided with a bundle of ¼-in. diameter mild steel rods, with the aid of which a squared-paper sketch book and a rough protractor, he took notes and made rod templets for every pipe required, all in one day. When finished the templets were bundled together and sent to the works by train. I superintended the erection of those pipes, which varied from ¾ in. to 10 in. in diameter, and only one flange had to be reset. This man was a self-taught geometrician, as well as a practical and exceedingly expert coppersmith.

Value of Technical Knowledge

As to the value of technical acquirements to the shop-plater, the boilermaker and the sheet-iron worker, there can be no question. To attempt to do such work without technical knowledge is drudgery. I have employed men without such knowledge and have paid dearly for it.

One may see the burly plater who bungles through a job of a repair to the hull of a damaged ship and who succeeds with a process of "trial-and-error" and a lot of hand work in getting new plates to fit in the place of the damaged ones, but, at what a cost. I have given similar work out to young fellows skilled in the science which underlies good plating, and it mattered not whether the plates were plain or of awkward form, whether for shear, garboard or keel-strake, midship, counter or stem plates. They would take dimensions, make a few bar templets, sketch out the job, bend and drill the plates and deem it a disgrace to put one up in its place more than once for trial.

Brain Work in Boiler Repairing

Another man, a boilermaker and worthy of the name, was in charge of the replacement of the bottom half of each of a battery of Lancashire boilers. He was so sure of his methods that he visited the boilers only once to take measurements and returned to the works. He rolled and scarfed each and every plate to sketch, and drilled every hole before leaving the shop. This man had made a technical study of his trade as a boilermaker, and the result of the boiler repair was a healthy surprise to the board-of-trade inspector as well as to myself.

All of these simple facts go to prove that it is not altogether wise nor desirable to cram ourselves with a subject of what is generally known as the technical education of the schools. However, we do need to carefully and discreetly make the very best use of the time at our disposal in acquiring just as much of a particular science as is calculated to be of the greatest service in the work we have chosen.

The ultimate result of such a course would be that the majority of workmen would be thoroughly efficient

and would be able to do more work, and with less physical effort. Greater production at less cost would result and higher wages could well be paid.

Trade unions would not need to usurp managerial functions and would need only to fulfill their legitimate functions of looking after their members' best interests by co-operating with the employers for mutual benefit. This condition would lead to exclusion, as far as possible, of other than competent workmen for the highest rates of pay, and a distinct grading of others not so competent.

The foregoing are some of the beneficent results which would accure from a whole-hearted effort toward a higher status for the worker. The general effect would lead to a substantial elevation of the national character and secure the much desired benefit of a greater share of international trade.

"Service" in a Machine Tool Plant

WESTERN CORRESPONDENCE

Someone has said that this is an age of service. However true that may be, the Gardner Machine Co., Beloit, Wis., is one firm that has applied the idea in a practical way by creating a service department where any customer, or prospective customer, can see his work in process of grinding before he purchases a machine. It also gives him an opportunity to see what the finish will be, and gives him definite knowledge as to the amount of production obtainable.

The service department, shown in Fig. 1, contains one machine of each type built by the Gardner company, and upon these machines they grind, without charge or obligation, sample parts submitted by any prospective customer or present user who is having trouble in obtaining the desired quality or quantity. It is only incumbent upon the client to send enough parts so that a fair estimate can be made of the time required for the operation.

The service department is in charge of an expert demonstrator who designs whatever is necessary in the way of a fixture for holding the work, and when the report on the demonstration is made, all the necessary instructions for the manufacture of a similar fixture are included. If the client wishes, a sketch of the fixture is also submitted for his use. This has been a popular addition to the service.

TEST NO.

Form [illegible]

Service Department

Gardner Machine Company

"The Disc Grinding Authorities"

Beloit, Wis., ________________ 19___

Demonstration for ________________

Name or Symbol of Piece	No. of Pieces	Material	Approx. Area	Tolerance	Approx. Stock Removed
Clutch Collars.	25	Phosphor Bronze	10 Sq. in.	+ .001 - .001	1/8"

Condition of Samples	Requirements	Abrasive Disc Used
Good Castings	Grind two sides parallel	#163 G.I.A. for roughing. # 60 Adamite for finishing.

Machine Equipment Used #14 "plain" type with Wooden work holder.

Fixtures Used	Actual Grinding Time	Estimated Production per hour
Wooden work holder	Roughing 140 per hour. Finishing 200 per hour.	120 roughing cut. 180 Finishing cut.

Approximate Life of Disc on above work	Method of handling
G.I.A. Discs one week: Adamite Discs one day.	A simple wooden work holder was used to place work between wheels.

Remarks:

These pieces had about 1/8" excessive stock. We recommend that these patterns be cut down at least 3/16" as 1/32" on each side is plenty of stock to get finish.

We give you above an accurate and conservative report on Gardner Grinding samples of your work. This report can be duplicated in your own factory by using the equipment recommended. The services of this department are at your disposal free of charge and without obligation.

GARDNER MACHINE COMPANY

By WLT

FIG. 2—REPORT OF GRINDING DEMONSTRATION

The report, a replica of which is shown in Fig. 2, is returned to the client with his finished samples. As can be seen, both the actual production and the estimated production are given in the report, and this estimate is guaranteed. Recommendations as to the method of holding the work, the amount of stock to be allowed for finish, or anything else that would tend to help in increasing the amount of production are also included in the report.

The Gardner Machine Co. takes great pride in this large, well-equipped and efficiently - conducted department, and feels that it is in keeping with the spirit of the times. That it pays actual dividends has long since been satisfactorily proved, and the company would not under any circumstances consider abolishing it.

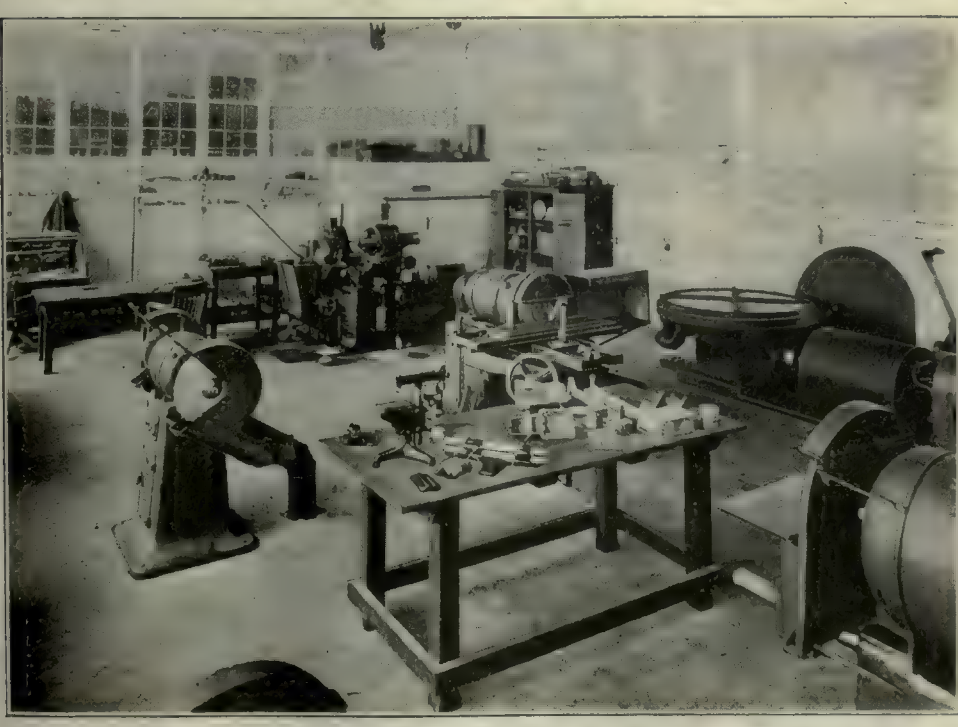


FIG. 1.—VIEW OF GARDNER SERVICE DEPARTMENT

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

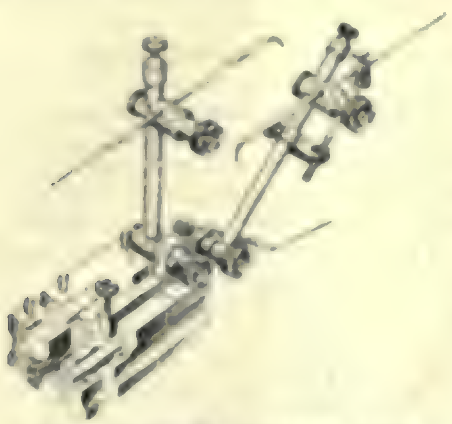
Three-in-One Surface Gage

By B. R. Wickes

The illustration shows a surface gage designed by the writer, that has an advantage over the common form of gage by reason of the three scribers, or locating points, which may be adjusted independently or in unison as desired.

The base is made in two parts, one of which is adjustable to and from the main base by means of a screw and graduated dial. Provision is made also for clamping a standard 2-in. scale in a slot in the base so that the movement may be read directly from the graduations. Two hardened steel rods driven in the main base support the sliding member, the range or adjustment of which is ½ inch.

Six hardened push pins, four in the main base and two in the sliding member, enable the tool to be used to



MULTI-PURPOSE SURFACE GAGE

obtain a setting parallel to a given surface, as the front of a milling machine table or the slots in a planer platen.

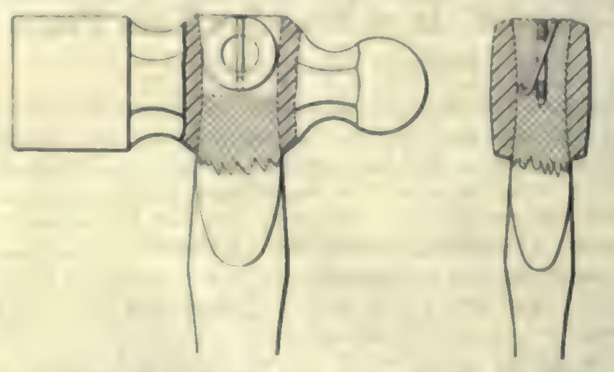
The two main spindles are mounted upon a rocker in the base that is adjustable by means of a finely pitched knurled head screw, working against the tension of a coil spring. Each scriber is so mounted upon its respective spindle as to be capable of independent adjustment. The bent scriber is to be used for scribing lines parallel and close to the base upon which the work is resting. It is adjusted by turning and is clamped in position when the adjustment is obtained by means of a knurled head setscrew.

The upper ends of the main spindles are so made that an additional scriber may be clamped in each for the purpose of locating centers or surfaces when a number of pieces of work are to be lined up for planing or milling, thus enabling the operator to do all the locating with one tool at one setting and do away with the necessity for the use of several other gages or the resetting of a single gage for each measurement.

Method of Holding the Handle in a Hammer

By Charles Kaufmann

The *American Machinist* has recently illustrated several ways to wedge a hammer handle so that the head will not come off. All these ways require the making or hunting up of something that is not usually at hand. Washers and wire nails should certainly be easy to



ANOTHER WAY TO HOLD A HANDLE IN A HAMMER

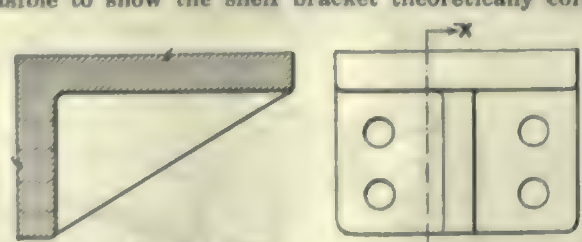
find in any shop and one of each is all that is needed to hold these two parts together under any sort of use or abuse. As shown in the sketch, drive a washer edgewise into the split end of the handle. Then take a wire nail, make a slight kink on the end so that it will not go straight, and then drive it cornerwise into the handle so that it will go through the washer and fetch up against the wall of the hole in the hammer head.

This will bend a sort of hook on the nail that will defy any reasonable tendency to work loose.

What Is the Best Way to Show Sections Through Ribs—Discussion

By Martin H. Ball

Having read with much interest the article on this subject by Aloysius Wilks on page 787, Vol. 56 of *American Machinist*, it seems to the writer that it is feasible to show the shelf bracket theoretically correct



METHOD OF SECTIONING RIB ON SHELF BRACKET

and still be practical by showing a section of the bracket at one side of its center on line *XX*, as indicated on the accompanying drawing, and by this slight change keep the draftsman's work down to the minimum.

An Adjustable Open-End Wrench

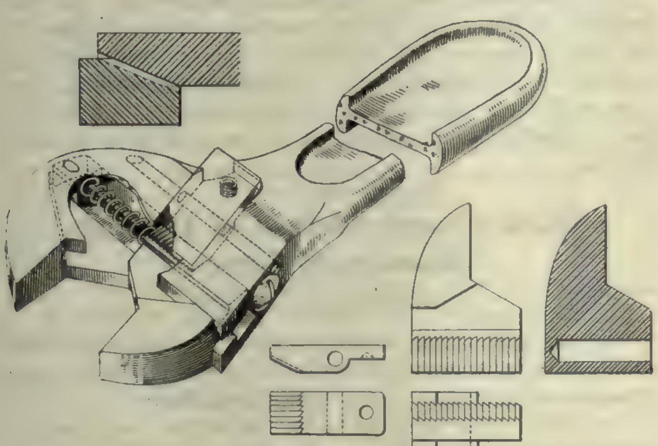
By R. W. Beckman

The quick-acting, adjustable, open-end whench shown in the accompanying illustration was designed by the writer primarily for use around the milling machine, but it soon demonstrated its adaptability and handiness to such an extent that it is now in general use throughout the shop.

In general shape and appearance it is not unlike many adjustable wrenches now on the market. Its advantage lies in the absence of screws or other adjusting mechanism that will inevitably work out of adjustment and cause endless annoyance.

The sliding jaw is made a nice, easy fit for the square hole that extends through the fixed jaw. As may be seen in the detail sketch, the bar of the sliding jaw is beveled to an angle and cut with suitable ratchet teeth. A "trigger," or latch, set into an opening made in the solid part of the tool, engages these teeth and holds the sliding jaw in whatever position it may be set.

A coil spring under the free end of the trigger holds the ratchet teeth in engagement. To use the wrench the operator's thumb is pressed upon the end of the trigger, releasing the sliding jaw which is then opened



ADJUSTABLE OPEN-END WRENCH

to its full extent. Setting the wrench upon the nut to be turned, with the fixed jaw against one of the flats, the sliding jaw is pressed forward into contact with the opposite flat where it will be held by the ratchet teeth.

Within its capacity the wrench is a very handy tool; almost instantaneous in adjusting and gripping any nut, bolt head, or rod that has two opposite parallel flats. Like all other tools, it can be abused, and should be handled with intelligent consideration of its limitations.

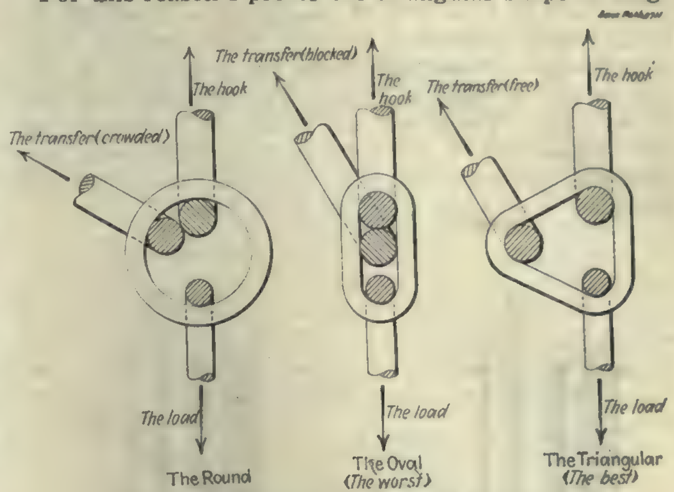
The Advantage of Triangular Rings for Sling Chains

By J. T. Towlson
London, England

In any erecting or other shop where heavy loads are handled by means of cranes or chain blocks, it is often necessary to transfer a load from one crane or block to another without lowering it.

When the sling chain, of the double hook type, for example, has a coupling ring of oval shape, it is a difficult matter to make the transfer safely because of the fact that one hook crowds or binds the other so that neither can be released easily. The round ring is some better in this respect, but is not so good as it should be.

For this reason I prefer the triangular shape of ring.



ROUND, OVAL AND TRIANGULAR RINGS FOR SLING CHAINS

With such a ring there can be no crowding of hooks, and there is always an inviting corner of the triangle in which to hang the second hook.

costs of service of a utility operating its own generating

Tap Drill Size Chart for Toolcrib

By R. L. Anderson

A device for displaying the size, pitch and diameter of drill for any standard size of tap, that eliminates the possibility of error on the part of unskilled men who may use it, is shown in the accompanying illustration.

The chart should first be prepared by typewriting the several notations in their respective places on a sheet of heavy paper and gluing the paper to the cir-

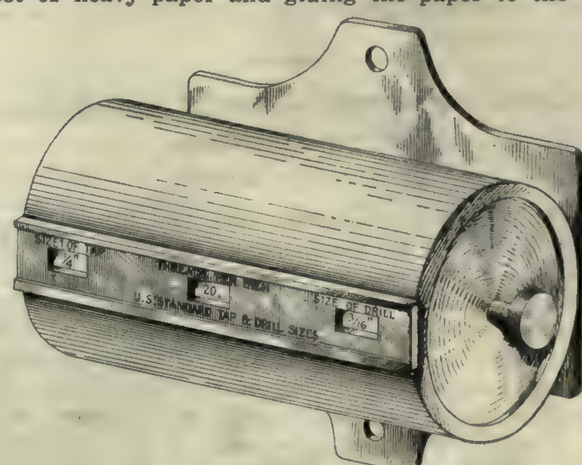


CHART FOR TAP AND DRILL SIZES

cumference of a wooden roller of suitable size. The rest of the device may be made of tin or galvanized iron. A strip of glass let into the top of the casing adds to the permanence of the figures.

The device can be fastened near the window of the toolroom so that when taps or drills are required the workman has but to turn the knob until the desired nominal size of tap appears in the opening, when the rest of the figures may be seen in their proper places.

A Troublesome Milling Job—Discussion

By P. Marsten

The article in *American Machinist* on page 352 by J. C. Adams interested me very much, because I had a somewhat similar experience not long ago. I, too, had to mill a narrow ledge. The material was steel in my case. There was no trouble with chatter, but the surface would not come square, which was very essential. At least two, and sometimes three, cuts were required to produce a fairly good result.

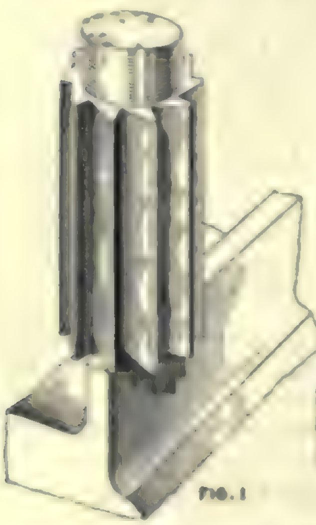


FIG. 1—CUTTER POSITION THAT PRODUCED CHATTER

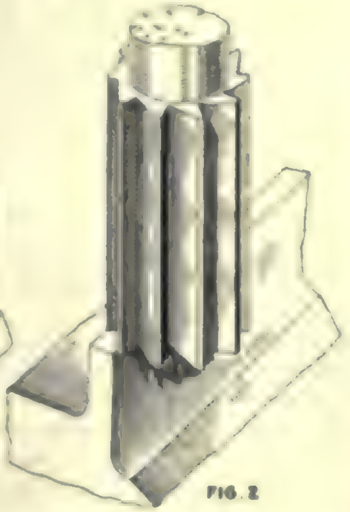


FIG. 1 — CUTTER POSITION CHATTER ELIMINATED

The job was done on a vertical milling machine and a 1¼-in. end mill was used as in Fig. 1. It took me quite some time before I tumbled to the fact that the pressure was at right angles to the work and bent the thin web; but once I realized this, it did not take me long to change the cutter to the position shown in Fig. 2. My trouble disappeared at once and I got a square job with one cut.

Cams for Brown & Sharpe Automatic Screw Machines

By Stephen McEvoy

In the design of cams, such as are used on Brown & Sharpe automatic screw machines, it is the practice of some designers to lay them out on what is known as a two to one layout. That is, for one cycle of the cam two sets of lobes are laid out and, with two sets of tools in the turret, two parts will be produced for each complete revolution of the cam shaft. The idea of this is that it is supposed to produce more work, but in reality it causes a decrease in the production, there being no provision for bringing the turret slide to a positive stop. Therefore, the accuracy of the lengths turned, drilled, etc., must depend on the accuracy of the lobes on the cam.

Where the work is not of accurate dimension, the above method is passable. But where the tolerance is small the method is far from being ideal. Even as to productive speed, it will be found that, by figuring for a single layout, any piece which takes more than three seconds can be done as fast theoretically and faster practically by the simple use of the correct gears necessary for the number of seconds to complete the part. The fastest gear furnished with the machine is three seconds and, if a piece can be made in less than that time, the two to one method is all right. The only parts, however, which can generally be made in that time are small pins.

My methods for laying out cams for Brown & Sharpe automatic screw machines is to adhere strictly to the single layout, requiring a simple set of cams for the toolmaker to make. This cuts down tool labor expense and makes a simple job for the operator to set up and keep going.

Another phase to be considered is wear on the machine and on jobs which call for three or less turret tools, I place an extra set of tools in the turret. I also remove three of the trip dogs for revolving the turret, consequently making one complete revolution of the turret to produce two parts. This method is, of course, only of advantage on fairly long run jobs but I am not claiming that I produce more parts per unit of time. I do save the wear on the machine by eliminating idle movements. When the work is such that only two tools are used, another dog can be taken off, leaving only two on the carrier and placing three sets of tools in the turret. This is done only on scale dimension work.

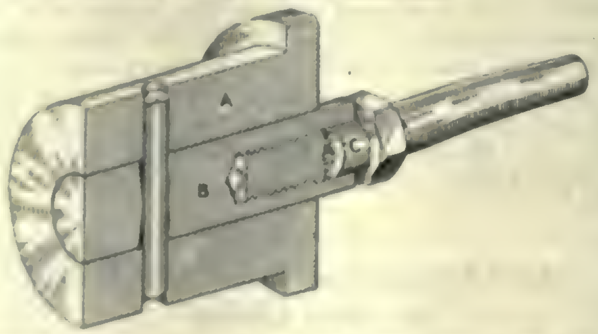
It is extremely hard to convince anyone who has not operated a Brown & Sharpe machine of the fallacy of the two to one layouts, especially if he be an executive responsible for production. Unbiased reasoning, however, will soon convince the most skeptical that he will learn something of advantage if he will only try my method.

Quick-Change Method of Holding Reamers in Turret

By Charles A. T. Kerr

The accompanying sketch shows a method of holding shell reamers in a turret lathe or screw machine when changes of size have to be made frequently.

The bushing *A* is made to fit the turret hole or toolholder. The block *B* is a float fit in the bushing, floating on the convex surface of the crosspin hole, which is tapered from both sides to the center, thus allowing movement in all directions to part *B*. Parts *A* and *B* remain always in the machine.



QUICK-CHANGE FLOAT HOLDER FOR SHELL REAMERS

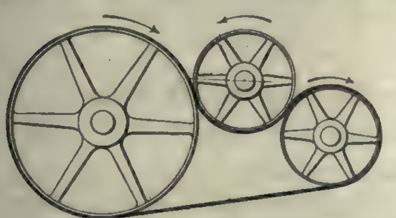
Part *C* is a hardened and ground reamer shank threaded to fit into *B* and secured by the lock nuts. For various sizes of shell reamers the only difference in the outfit is the size of the tapered shank.

By making part *B* with a smooth hole instead of a threaded one, other tools than shell reamers may be used by simply making the shanks interchangeable and cross-pinning them into part *B*.

Keeping a Belt Tight

By Robert Grimshaw

Under the above title on page 785, Vol. 56, of *American Machinist*, Mr. Towlson uses the word "intermediary" in reference to an unusual type of auxiliary belt pulley. It is a friction pulley between driver and driven, designed to neutralize the great pressure on bearings, due to excessive belt tightness in turn necessitated by two unfavorable conditions: Great difference in pulley diameters, and short distance between centers, the two resulting in insufficient arc of contact and surface of contact on the smaller pulley. This is a condition practically inseparable from circular-saw drive, where the necessity for utilizing practically the entire saw disk radius down to the clamping flanges, makes the use of an auxiliary of some sort an absolute requirement.


PROPOSED TYPE OF DRIVE

The tightener pulley is an abomination, straining the belt (or the lacings) and wearing journals and bearings, also consuming power in excess of that gained in transmitting force by its use. In other words, it is both dynamically and mechanically inefficient.

Dynamo and motor makers, where the belt-driven machine is practically on the same base as its driving or driven mate, replace the tightener by something more convenient but also more inefficient—a slide and adjusting screws to keep the belt good and taut, or at any rate, taut.

The idler pulley is an improvement over the tightener, as an intermediary, increasing as it does both the arc and surface of contact on the small pulley—if put in the proper place, which it seldom is—without greatly increasing the belt or lacing strain, or the pressure on journals and bearings.

Mr. Raworth's intermediary acts in a two-fold manner, to counteract excessive journal and bearing pressure and to act as a friction driving pulley.

Now why not combine the two systems, the idler that puts no strain on the bearings, which the tightener does, and the friction pulley between the driver and driven members? As the belt stretches, which will be less than if it is under high stress (the proper name of which is strain), it can be taken up, or an idler proper can be put on the other fold (below in the sketch) so that the "intermediary's" center is moved only to take up wear of journals and bearings of the members proper of the drive couple.

Two Kinks for the Toolmaker

By F. B. Shoemaker

Dry asbestos wicking, the kind sometimes used by plumbers and steam fitters for packing valve stems and similar joints, is much better material for packing small holes in intricate dies and pieces to be hardened than is fire clay. Containing no moisture, it will not "blow out" in quenching and it is more easily removed from the holes after it has served its purpose.

Plunging longitudinally in the quenching bath and moving around while cooling, has a tendency to prevent the warping of long slender pieces.

Two Ways of Making a Core

By P. W. Blake

Referring to an article by M. E. Duggan under the above heading which appeared on page 233, Vol. 57, of *American Machinist*, the core shown in the illustration is a stop-cock body core and not a core for a brass valve body as stated. Mr. Duggan doubts if there are many pattern makers sufficiently well informed on core-making practice to give a positive answer to the question: "Is this method practicable and economical?"

Any patternmaker trained in the manufacture of plumbers' brass goods knows that the practical method is to use core dryers on the smaller sizes because the dryers keep the cores from warping. As these cores are to be produced in large quantities, the proper method is to use gang cores boxes in which the cores are both made and dried.

Drilling Trunnion Holes in Wooden Rollers

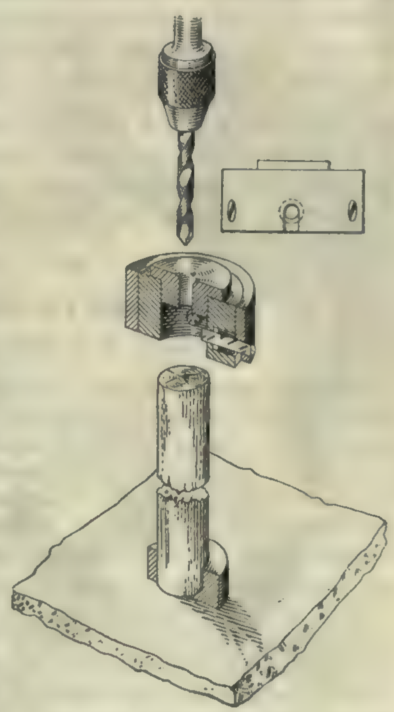
By Charles G. Spicer

Having occasion to drill holes in the ends of a large number of wooden rollers for the purpose of driving in steel pins to act as trunnions, and as the rollers were required to run fairly true without being turned, I devised the jig here shown to drill them. The rollers were about a foot long and ⅞ in. in diameter, with a ¼-in. hole in each end. With this jig I was able to drill, on both ends, from 400 to 450 rollers per hour.

I took an iron ring, or bushing, of a considerable thickness of wall, and drilled therein three radial holes, using two sizes of drill in order to leave a shoulder in each hole near the inner wall of the bushing. To these holes I fitted shouldered plungers and coil springs as shown in the sketch.

A drill bushing of hardened steel in the central hole of the main bushing completed the device. The hole in the main bushing fitted closely but not tightly over the rollers and the tension of the springs held it in place.

The drill was held in the chuck of a small drill press and a cup center on the table of the drill press served to locate and center the lower ends of the rollers.

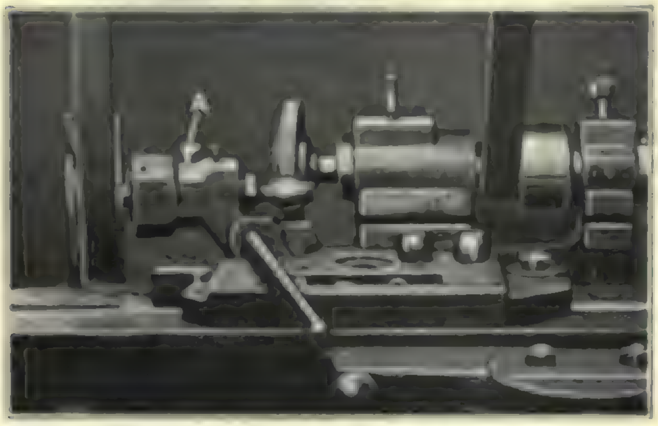

JIG FOR DRILLING END HOLES IN ROLLERS

Over the outside of the bushing, after the plungers and their springs were assembled, I drove a thinner steel shell having three holes to correspond to the small ends of the plungers. This shell thus acted as a backstop or retaining ring to keep the springs in their cells. The outer shell was fastened in place on the main bushing by means of screws.

Grinding Universal Joint Balls

By Henry M. Clary

Having an order to make up a lot of universal joint balls, to be made of steel, hardened and ground to 1½ in. in diameter, we were ultimately confronted with the problem of grinding the radius on the balls. Using an old die-plate for the base of the fixture, a block was cut to the shape shown at *A* in the illustration, then drilled and tapped in the bottom to receive a ½-in.



A SIMPLE RADIUS-GRINDING FIXTURE

pin which slipped into a hole in the die-plate, this pin acting as a swivel.

Then the block was bored for the spindle, which held the work on one end and the pulley on the other as shown. An adjusting collar in the end of the block next to the pulley allowed adjustment of the spindle for radius, the correct diameter being obtained by movement of the table. The ball was held on the end of the spindle by a nut. A short bar, threaded on the end and screwed into a tapped hole in the side of the block, served as a handle to swing the block.

The ball revolved at a speed of 344 r.p.m., and the grinding wheel speed was 1,800 r.p.m. The diameter of the ball was held within 0.002-in. limits, and an average production of 20 pieces per hour was obtained. This job was done at the Royal Machine Works, Detroit, Michigan.

Lubricants for the Shop

By H. R. Smith

Although much has been written about cutting lubricants, I have not noticed any mention of the lard-and-turpentine mixture. I have used this mixture many years with satisfaction, particularly for pipe threading. Lard oil seems so highly esteemed that the small user sometimes has difficulty in obtaining it pure or even getting it at all. But anyone can get common lard and common turpentine and mix them.

This is recommended only for squirt-can use and if it freezes or clogs the heat of a match will thaw it. If set aside in corked bottles in a warm place, and allowed to stand for some time, a clear fluid rises which is less affected by cold than the cloudy precipitate. The latter often needs to be warmed to make it flow.

Some years ago I read in the *American Machinist* of the use of beeswax as a lathe-center lubricant. Having faith in a number of other lubricants, such as flake graphite, oildag paste and mobiloil B, I tried to make up a shotgun prescription as a "cure all." I mixed these four ingredients in about equal amounts (melted the beeswax and added the others) making a black grease which is very effective for I have never had a center damaged while using it.

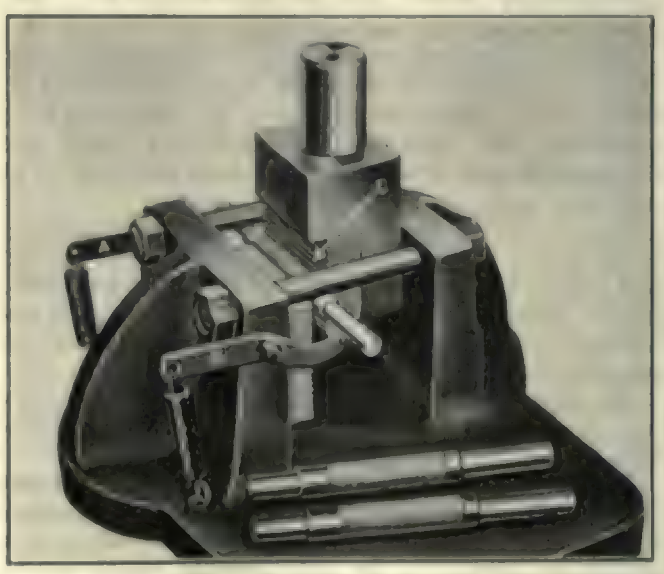
For the most severe work, if an oil be preferred, where effectiveness is more important than cost (as for instance to feed through a hollow lathe-center), I would suggest oildag paste with enough mobiloil B to make it liquid. The graphite in oildag is fine enough to pass through a filter, so there is no danger of it clogging any passages. Oildag paste is the concentrated form intended to be mixed with a large amount of oil, but of course is as harmless as any other graphite in any proportion.

Knurling Shafts in a Punch Press

By Frank C. Hudson

The American Radio & Research Corporation, Medford Hills, Mass., uses a large number of small armature shafts in special motors. These shafts are knurled in the central portion as shown in the illustration. Instead of knurling them in a lathe, as is usual, the device shown was made to handle the work in a punch press.

The die is tied together by two substantial bolts to prevent spreading when the punch rolls the shaft down.



PUNCH AND DIE FOR KNURLING SHAFTS

The shaft to be rolled is laid on the inner ends of the arms *A* and *B*, which tip down and release the shaft as it is rolled downward. The punch carries the corrugated steel block at *C* and there is a corresponding block in the die. A single cycle of the punch rolls the corrugations in the shaft, so that the production is very rapid.

How to Obtain Order

By Robert Grimshaw

The main things in obtaining order are:

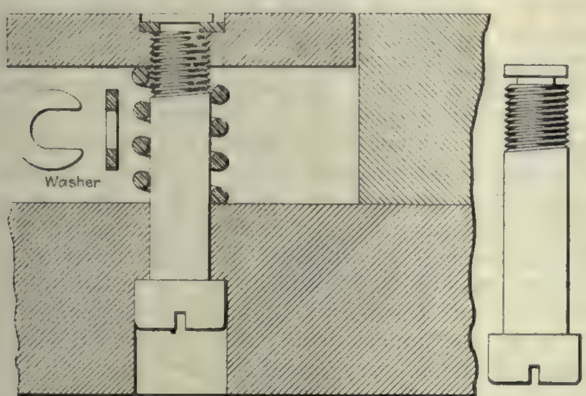
(1) An orderly mind
(2) The ability to impress on others the necessity for order
(3) A working force
    (a) capable of receiving that impression;
    (b) willing to co-operate in the necessary regulations to keep order.

Special Screw and Washer for Spring Strippers

By Edward H. Tingley

The accompanying sketch shows the style of screw and U-washer that is being used on all dies that have spring strippers in the plant of the Delco-Light Co., Dayton, Ohio. The trouble which was ever present with the usual type of shoulder screws for stripper plates caused this company to study the problem and design this special screw and washer.

The size of the screw and washer vary according to the size and strength of the stripper springs. The thickness of the washer has been standardized at $\frac{1}{16}$ in. and the width of the recess in the end of the screw is not over $\frac{1}{64}$ in. wider. The stripper plate is counterbored $\frac{1}{32}$ in. larger than the outside diameter of the washer.



HOLDING SCREWS IN SPRING STRIPPER

In assembling, the screws are screwed into the stripper plate until the recess shows above the face of the stripper, when the washer is slipped into place and the screws are backed off until the washer is clamped against the bottom of the counterbore.

It has been found in practice that this style of screw will not loosen, where the shoulder type will loosen and cause trouble. This style of screw and washer has been in constant use in many dies for four years with very satisfactory results.

Using a Multiple-Spindle Drilling Machine as a Station Machine

By Frank C. Hudson

An extremely interesting and unusual use of the multiple-spindle drilling machine on structural steel work is shown herewith, the illustration being from the shop of the Brown Hoisting Machinery Co., Cleveland, Ohio. The machine is fitted with a revolving and indexing table, which is controlled by the treadle *A*, in front of the loading station, where a piece of work is shown in place at *B*.

The work in this case is a sort of three-cornered brace, shown completed at *C*, the finished piece resting on a pile of blanks which have been sheared to the proper shape. The work is clamped by the two side straps shown at *D*, against the front angle iron *E* which squares it in position.

The drilling spindles are divided into three groups, the first operation being at the left. A large drilling plate or fixture *F* fitted with suitable bushings, is supported above the work by the arms shown at *G*.


USING A MULTIPLE-SPINDLE DRILLING MACHINE AS A STATION MACHINE

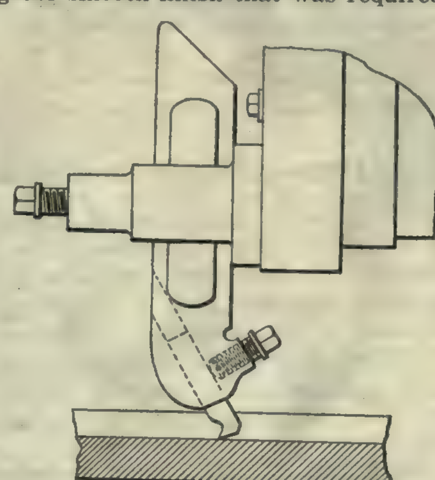
The first group of drills at the left drill eight holes, omitting only the center hole in the upper corner. It does not however, drill the two large holes to size, but makes a beginning with the two large drills at the outer edge. The next station drills the hole in the upper corner and enlarges the holes at each end. The last position finishes the large holes. This arrangement of drills divides up the work and gives a completed plate at each indexing of the table.

A large variety of guide plates or drilling fixtures enables many different pieces to be done on this machine. The plan opens up possibilities in many other lines and increases what has usually been considered as the field for the multiple-spindle drilling machine.

The Armstrong Holder as a Spring Tool

By William J. Thirkettle

The writer had occasion to cut a slot $\frac{1}{2}$ in. wide and $\frac{3}{8}$ in. deep by 8 in. long in a piece of steel, and had trouble in securing the smooth finish that was required at the bottom of the slot. The work was done with an Armstrong toolholder, used in a shaper. As the cut approached the bottom of the slot, accompanied by the usual chatter, I conceived the idea of reversing the holder and grinding the tool bit as shown in the sketch. This made a very excellent spring tool, as, owing to the angle at which the cutting edge was presented to the work, it was impossible for it to dig in, and a very satisfactory finish resulted. This method might be followed in similar cases, as it provides an effective remedy for a trouble frequently met.


REVERSING THE ARMSTRONG TOOL

Editorial

The Place Where Small Tools Should Not Be Made

OLD habits die hard. We may think that the time is past when every man made his own shoes, built his own house and raised his own food, but every so often the old habits crop out and we try to be what our forefathers were, 10,000 years ago; self-sufficient. Many manufacturers have failed because they had their pride of wanting to make everything that went into their product. They wanted to show the world that they were self contained. Cases of this kind are tragic and fortunately, they are not met every day. On the other hand there are innumerable cases of this self-sufficiency which are merely laughable. And yet, in the aggregate, they are of enough importance to be pointed out as a warning.

A common symptom of this disease is the making of small tools, either in the tool room or, quite often, in the manufacturing department of a shop. Perhaps with the exception of twist drills, every small tool in the shop is pounced upon by the amateur and appears as a home made product whenever there is any excuse for it at all.

As a rule, such home made tools cost more than those purchased. However, that is not the worst of it. We might let the man have the pleasure of fondling his own baby, even if it costs a few pennies, but it is at least a ten-to-one shot that the homemade product is made of a piece of steel that was handy even if it was not entirely suitable. It was probably not made correct as to angles and not properly hardened. However, the man who made it is not going to let his pet suffer and so he favors the tool and slights production. There are so many phases to this thing, and all of them bad ones, that it would take an old-fashioned sermon in three main parts to cover them all.

We think we save a penny, but we don't.

We believe we have a good tool, but we haven't.

And we forget all about the main thing: production.

Using Diamond Tools for Finishing Bearings

THE accurate production of holes for bearings is one of the great problems in the building of machinery. It has been very carefully studied by engineers and shop men in the automotive industries and much of the hand work of former years has been eliminated. The latest development seems to be in the use of diamond cutting tools for the final finishing, and some very interesting results have been secured in this way.

The article on this subject elsewhere in this issue gives data on the use of diamond tools which is startling in many ways. Continued accuracy which eliminates scraping and the use of a single tool in thousands of holes without resharpening, are points to be carefully considered by builders of any kind of machinery. Shop managers who are interested in quantity production of high-grade work should study this article carefully.

The Spread of Mechanical Skill

A NEW YORK newspaper quotes a Western merchant to the effect that the railroad shop strike was broken in the Central West by the sons of farmers. We are not concerned with the accuracy of the statement, but we see in it an indication of a national tendency that may well be noted by the machinery industry.

We often remark casually that we live in a mechanical age, although we usually fail to connect the remark with the thought that we are becoming a race of mechanics. With the advent of the automobile, the tractor, the electric farm-lighting plant and electrical and mechanical household appliances, people have been forced to take a greater interest in mechanical matters and, involuntarily perhaps, to become more or less skilled in the maintenance of mechanical contrivances.

What will be the meaning of our increasing familiarity with things mechanical? Will it be a larger appreciation of good machines and good workmanship? Will it be an increasing difficulty in the marketing of mechanical makeshifts? Will it be the relief of the community from the fear of domination by organized labor in the mechanical field? Will it prove the safeguarding of the country from military aggression by reason of the universal knowledge that, as a country, we are prepared to jump over night into the mechanical production of munitions necessary for modern warfare?

We are not prepared to answer all these questions, but aren't they worth thinking about?

"Tempering the Wind—"

A GERMAN student has managed to remain over three hours in the air in a motorless sailplane or glider. Perhaps, after all, the treaty provisions which forbade the construction of high-powered airplanes in Germany and which caused such a piteous outcry from the vanquished will react to their benefit.

Little is known, even yet, of the laws governing mechanical flight, but we seem to have progressed since the days of the war when the principal effort was to develop engines of higher and higher power. Designers knew then that the more power they could crowd into a plane the faster it would fly, and they had no time to devote to scientific research or to plane refinements. As a result we had single-seaters propelled by motors of 300 hp. and upwards, economic monstrosities.

Apparently we are about to go forward from the point where the Wright brothers left off. They were principally concerned with discovering means of control, and they were successful. The present-day gliding tests begin with a very fair knowledge of the control factor and aim at further advances in the knowledge of the laws of sustained flight. Germany is off to a good start.

It is not too much to say that we are on the threshold of a revolution in the science of flying. Perhaps before many months the dust column behind the flying automobile on country roads will be peopled by small boys in home-made gliders, even as their fathers "hitched on" behind the grocer's sleigh.

Where Arithmetic Is Needed

THE coal strike is at an end and it is time for some afterthought.

The anthracite miners originally refused to accept a reduction in wages of, practically speaking, 20 per cent. To show how much they were in earnest they struck on the first of April and did not resume work until the eleventh of September, a loss of 163 days or 23 weeks in which they might have earned money. At the end of this period they agreed to go back to work at the old wage, that is, without any reduction, and this agreement is to last until September first, 1923. Under the new agreement they will work 50 weeks. If they had stayed at work, with reduced wages, they would have worked 73 weeks between April 1, 1922, and September 1, 1923.

As far as their total earnings are concerned, we may say that they would have worked 73 weeks at 80 units of pay, whereas now they will work 50 weeks at 100 units of pay. In other words, their total earnings by the first of September, 1923, might have been 5,840, whereas it will be 5,000. In other words, they lost 14 per cent of their income even though they won the strike.

They had asked originally for an increase of 10 per cent and even if they had obtained all they demanded, their income would have been the income of 50 weeks at the rate of 110 or a total of 5,500. Had they obtained this increase, they would have lost 340 or approximately 6 per cent.

Let us put this in terms of dollars and cents: Suppose a man used to get $25 a week, then he asked for 10 per cent more, or $27.50 and was offered 20 per cent less or $20.

If he had accepted the offer he would have earned 73 times $20 or $1,460.

If, at the end of the strike he had obtained what he demanded he would have earned 50 times $27.50 or $1,375.

And as it stands now, he will earn 50 times $25, the sum of $1,250.

We used to consider that there were only two parties to an industrial controversy, employer and employee. Lately we have begun to realize that there is a third party, the public. It would seem that a fourth party should also be recognized—Arithmetic.

Cause or Effect

THE question of which was first, the hen or the egg, has never been satisfactorily settled, but nobody, in his right mind, denies that there is some relation between the two. We meet every so often a hen and an egg in disguise. Take, for instance, the fact that the automobile industry in this country has developed in an extraordinary manner and the parallel fact that, as a whole, automobile factories are wonderfully well equipped with machinery and tools. Aren't these two facts a hen and egg in modified form?

Of course, at the present the automobile industry is on such a large scale and on such solid footing that the factories can well afford to use the best there is in equipment. What is more, without the most up-to-date machinery, tools and methods, present day production and prices would be impossible. However, there was a time when the automobile had most of us guessing as to whether it had come to stay or come to go, when there was neither solid footing nor large production. And so we have once more the riddle of the hen and the egg before us.

Does the automobile industry have up-to-date equipment because it has such large proportions or, has it assumed these proprtions because the pioneers in the industry had the vision and the daring to spend their money for equipment which would insure large and cheap production. Whatever the answer may be, we cannot shut our eyes to the fact that here, as in so many other cases, wonderful growth and development have gone with modern equipment and methods.

Saving at the Spigot

ONE of the favored pastimes of some shop managers is to send circular letters from time to time to the department heads telling them that overhead must be reduced, *must* underscored. Thereupon, the obliging department head slashes the overhead and everybody is happy for the time being. One of the preferred ways of reducing the overhead charges is by cutting tool costs. Instead of buying expensive cutters and hobs, collapsing taps and what not, he makes them in his own department.

Most fair sized and all large shops have their tool room in which such work is supposed to be done, if it must be done at all. But our wise department head does not send his job to the tool room—not if he must cut overhead. The toolroom would probably charge him 50 per cent more than the price of a commercial product.

And so he has this work done by men who are mere amateurs at it and gets an inferior tool for a superior price. In addition, his production is bound to suffer and he must hide the cost of work done on the tool, something which is easy enough for a man who knows the ropes. But after all, the main object has been reached. Overhead has been reduced and the G. M. is happy.

There are other managers, lots of them, who know the ropes themselves and who do not insist on cutting overhead. They do try, however, to get reduced costs by reducing them where reduction is possible without raising the expense more at some other point.

Just Suppose

JUST suppose you had your money invested in a concern which did not pay enough in dividends to keep your family living in comfort, and suppose you spoke about it to the general manager and the directors and other high muck-a-mucks. Suppose they told you that they did all they could for their stockholders but that times were bad, that it was necessary to lay by a reserve fund, and that anyhow, you were getting as good dividends as anybody else in that business.

And now suppose that the directors vote $200,000 for a club house for the stockholders, to be entirely free, to have a swimming pool, a tennis court and a ladies' smoking room and all other high grade club house improvements. What would you say, and how would you say it? Would you add: "and bless the directors and the general manager," to your nightly prayers? Would you get enthusiastic about welfare work for the stockholders?

But why ask. Nobody would be fool enough to do anything of the kind. Nevertheless—

Just suppose.

Shop Equipment News

Diamond Pulley Grinding Machine

A machine for grinding the faces and edges of pulleys and similar parts has recently been placed on the market by the Diamond Machine Co., 9 Codding St., Providence, R. I. The machine is an evolution of the pulley grinding attachment furnished by this company for its regular heavy-duty face grinding machine, which attachment was described on page 435, Vol. 54 of *American Machinist*.

DIAMOND PULLEY GRINDING MACHINE

The machine carries a 14-in. diameter cylinder wheel, which is held in a steel chuck that insures against wheel breakage. The wheel spindle runs on ball bearings and is driven at a speed of approximately 1 500 r.p.m., this speed being varied to suit the nature of the work. A 10-hp. motor is attached to the machine frame.

The work carrier takes pulleys from 2 to 18 in. in diameter up to 6 in. face, the pulleys being held on a pintle positively driven through speed change gears. The work table has screw-operated movement in three planes, and an auxiliary rapid movement to and from the wheel actuated by a hand lever.

With this machine, pulleys may be ground with crown, flat, or even concaved faces, as desired, by positioning the work accordingly with relation to the wheel. The face in either case is a true ellipsoid curve instead of the usual two conical surfaces meeting at the middle The work is completed in one operation, leaving a semi-polished surface.

The machine is complete with pump, automatic valve, hose and water guards. By the use of water in grinding, greater production can be obtained at all times, we are told.

The attachment shown at the side of the machine in the accompanying illustration is provided for facing the edges of pulleys. The attachment may be very quickly mounted or even displaced. Its weight is announced at 50 pounds.

The machine occupies a floor space of 3 ft. 6 in. by 4 ft. 6 in., and the center of the wheel spindle is 44 in. from the floor. The weight of the machine is approximately 2,000 lb. Guards are furnished to enclose the wheel and work while in operation. The illustration shows the machine with these guards, as well as the wire belt guard, removed.

"Economy" Telescoping Tiering Machine

A portable tiering machine in which one frame member telescopes into another so that the machine has a lift nearly twice as high as its minimum height, is a recent product of the Economy Engineering Co., 2635 West Van Buren St., Chicago, Ill. The machine is made in both hand power and electric driven styles, the heavy-duty types of the latter style being operated from a power circuit, and the "Little Lifter" types, such as described on page 488, Vol. 55 of *American Machinist*, from a lighting circuit. The view on the left side of the accompanying illustration shows a tall tiering machine with the inner frame extended, while at the right is a smaller machine with the platform only partially elevated for tiering materials.

"ECONOMY" TELESCOPING TIERING MACHINE

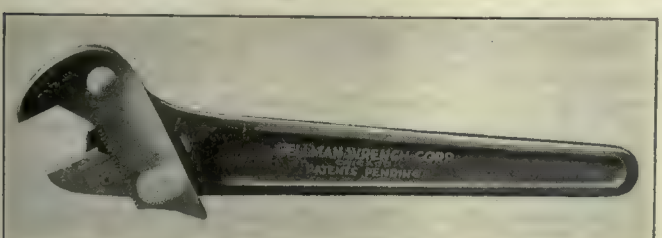
The machine is ordinarily mounted on three rollers, so that it can be easily moved about on the shop floor. When the machine has been positioned in the place desired for lifting, the steering roller is raised so that the legs rest on the floor and prevent the machine from moving. Outriggers that support the machine at the sides are provided for tall machines.

With the former models of tiering machine, the platform could not be raised any higher than the height to which the machine was built. The telescoping machine contains a set of uprights within the main uprights, this inner frame being capable of extension above the outer frame. When power is applied, either by hand or power, the platform rises to the extent of its travel with the inner frame lowered and the machine still at its minimum height, as with the usual ordinary tiering machine. The action, however, does not stop here, as both the platform and the inner frame continue to rise until the inner frame has gone to its upper limit of travel.

In descending, the inner frame comes down first to the bottom of the machine. The platform is automatically held in position at whatever point it is stopped. Devices are provided on the motor-driven machine for automatically stopping the machine at the top and bottom limits of the travel.

Gellman "Instant-Positive" Adjustable End Wrench

An end wrench that can be adjusted instantly and that stays adjusted until the nut is loosened or tightened has recently been placed on the market by the Gellman Wrench Corporation, Chamber of Commerce Bldg., 131 W. Washington St., Chicago, Ill. The wrench is drop forged and subjected to a carbonizing hardening process. The tool is very strong and rigidly constructed, and yet light in weight and thin enough to work in cramped places.



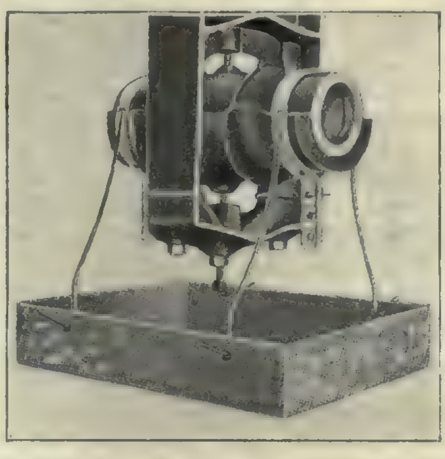
GELLMAN ADJUSTABLE END WRENCH

No screw is employed in the wrench, which construction eliminates bulkiness in the head. Referring to the accompanying illustration, it will be seen that the handle member forms the lower jaw and is notched at right angles to the gripping face, while the movable upper jaw is also notched and can be moved up or down when the notches are pulled out of engagement. Simply by pressing with the thumb of the hand holding the wrench, on the corrugated part of the movable jaw and thus disengaging the jaws, the upper jaw can be instantly moved up or down to the position desired. The wrench can be used to turn in either direction.

The tool is manufactured in sizes of 6, 9 and 12 in., weighing 4, 10 and 20 ounces, respectively. The 6-in. wrench is suited for light work, while the 9- and 12-in. wrenches are built for heavy duty, but at the same time are able to fit small nuts as well as large ones.

Acme Oil Drip Pan for Overhead Bearings

The Akron Sheet Metal Co., 103 North Main St., Akron, Ohio, has recently placed on the market a drip pan and hanger for catching oil that drops from bearing boxes. The device is especially intended for use on overhead lineshafts, as shown in the accompanying illustration, but it can be adapted to bearings secured to wall or post brackets. The pans and hangers are made in three sizes, each size being suitable for a range of shaft sizes. Shafts from $\frac{15}{16}$ to $2\frac{15}{16}$ in. in diameter can be fitted. All of the pans are 2 in. deep and the sizes are 6x8 in., 8x10 in. and 10x12 in. The hangers can be quickly installed on any style of bearing box. The pan may be easily removed for cleaning without disturbing the hangers. Since the pan is quite effective for catching oil that drips from bearing boxes, it prevents the soaking of floors and the damaging of goods that occurs when oil drops from the shafting.

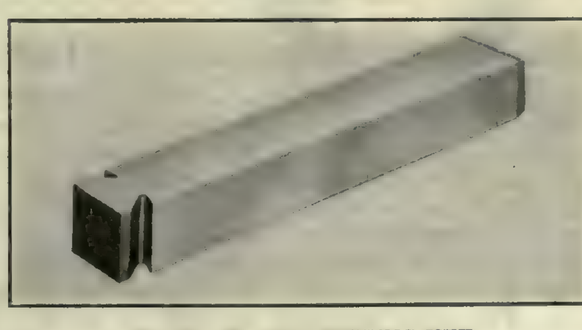

ACME OIL DRIP PAN AND HANGER

"Keytite" Self-Fitting Keys

A key that is capable of making its own fit in the keyway by shaving the sides of the keyway as it is put in place has recently been brought out by Smith & Serrell, Central Ave. at Halsey St., Newark, N. J.

It is the usual practice in the machinery industry to use keys to make the driving connection between shafts and couplings, gears, sprockets, and pulleys, and to mill or slot the keyway in the shaft and to slot the keyway in the external member. Since these two keyway sizes will vary slightly, to obtain the desired tightness between the key and keyways it is generally necessary to carefully fit the parts together. This is usually done by hand, either by filing the key to fit the keyways or by filing or scraping the keyways to fit the key, the work being expensive and time-consuming.

With the "Keytite" key, as the self-fitting key is called, no hand fitting is necessary. A tough chisel stock is used for the key, which is ground to a size very slightly larger than the nominal keyway width. A cutting edge and chip recess are provided near the front


"KEYTITE" SELF-FITTING KEY

end of the key. Ahead of these is a pilot slightly smaller than the nominal keyway width, so that it fits the keyway and guides the key.

To install the key the pilot is entered first with the cutting edge at the side, and then the key is driven home with a hammer or with a sledge, depending upon the size of the key. The cutting edge sizes the keyways to make a tight fit between the body of the key and the keyways.

In the larger sizes cutting edges are sometimes provided on both sides, as shown in the illustration herewith. When it is desired to fit on the top and bottom as well as on the sides, a cutting edge is also provided at the top. Gib keys and other modifications of keys can be furnished as required, all with the self-fitting feature. The keys can be furnished in a wide range of sizes, as to both width and length.

U. S. Electric Welder Co. Welding and Heating Transformer

The accompanying illustration shows an electric welding and heating transformer for use where hard service is encountered and high power is necessary. The device is a recent product of the U. S. Electric Welder Co., 327-8 Permanent Bldg., Cleveland, Ohio. Although the illustration shows a 15-kva. transformer for mounting in a butt welder or for heating purposes, the device is made in a variety of styles and sizes for mounting in other types of equipment.

U. S. WELDING TRANSFORMER

The supports for the primary and secondary coils and for the core are so placed as to prevent humming and shifting of any of the parts. The secondary is built up of heavy rolled copper bands spaced to provide ventilating ducts and well supported and insulated. The cooling surface provided is large enough to keep the temperature within safe limit during heavy overloads. The internal reactance automatically prevents the current from building up so that the temperature rises more than 50 deg. C. above the room temperature. The efficiency is stated to be high, reaching 93 per cent in the larger sizes.

Cincinnati Heavy-Duty Geared-Head Lathes

The Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio, has recently placed on the market a geared-head lathe made in sizes from 16 to 30 in., and adapted particularly to very heavy duty. The lathes, it is stated, are capable of transmitting double the horsepower ordinarily possible with lathes of the same size. This holds true for both the belt-driven and the motor-driven types, so that the machines are suitable for very severe service. The 16-in. lathe will transmit 9.2 hp. with a belt pull of 65 lb. per sq.in., although lathes of this size are usually run by 3-hp. motors and do not have the capacity for larger motors.

The direct-connected motor-driven lathes can be provided with either chain drive or belt drive using an idler pulley. The motor can be mounted on the headstock or in the rear of the cabinet leg. The belt drive is direct from the lineshaft to a constant-speed pulley. The control may be by means of a rod above the lathe, by a handle at the front of the head or by a lever on the apron.

A disk clutch fitted with a brake is incorporated in the drive so as to disconnect the spindle from all gearing when the machine is stopped. This removes the fly-wheel effect of large rotating gears attached to the spindle, and should be of use particularly when centering irregular work in a chuck or in machining small parts when the chucking time is a large factor in the operations.

Twelve spindle speeds can be obtained by the manipulation of three handles on the front of the head. On the 16-in. lathe the range of speeds is from 13.5 to 400 r.p.m. in geometric progression. This lathe can machine work at its maximum swing at a cut speed of 55½ ft. per min. and ½-in. work at a speed of 54 ft. per min., so that economical cut speeds are obtainable for the complete range of work. The full range of the changes can be made in 12 seconds, it is stated.

"Iron Salesman" To Sell Black & Decker Tools

To keep its products always before prospective customers, the Black & Decker Mfg. Co., has devised what it calls the "Iron Salesman." The company is convinced that the most important factor in the sale of its products is a demonstration, and the bureau of electric tools has evolved a new idea which provides a substantial work bench upon which the units may be actually demonstrated, a back piece which carries an assortment of machines on display and pockets for booklets.

These stands are elaborate, being made of oak with a waxed finish. The side and front panels of the bench consist of colored slides. The slides are easily removable and it is planned to supply new slides for the display stands periodically. This will make it possible to keep the display constantly bright and fresh, thus eliminating the monotony of permanent panels. The stands are loaned to jobbers who are required to agree to certain terms, one of which is to keep a requisite number of B & D machines on hand. The idea is good from a merchandizing and advertising viewpoint.

Precept and Example

By Robert Grimshaw

"Show me" has two meanings. One is "show me how," calling for instruction; the other, "show me why," implying "after you." No careless and slouchy foreman can succeed in breaking his men of careless and slouchy habits of either person or work. That is where the "show me" attitude of the men enters.

If he is a living example of clean living and conscientious work, if he can do what he asks his workers to do or show them how others have done it. If in an emergency he can take hold with promptness and vigor, he will have followers as energetic as he himself.

News Section

Cost Accountants to Hold Convention

With enormous shrinkages in inventory book values in corporate financial reports; with the great deflation which has been, and still is, in progress and with the adjustment of present-day costs of manufacturing on the basis of new wage scales and material prices as subjects of paramount importance to all industrial executives, the third international cost conference of the National Association of Cost Accountants to be held in Atlantic City, Sept. 23, 25, 26, 27 and 28, promises to attract widespread interest.

The convention will be held in the Hotel Ambassador in the seaside city and a program of exceptional interest has been arranged. Among the subjects to be discussed are the following:

1. Actual Costs as Compared with Replacement Costs.
2. Sales and Administrative Costs.
3. Standards as a Means of Reducing Costs.
4. Budgets—Their Construction and Use.
5. The Place of Costs in Business.

Drop Forging Institute's Annual Convention

The annual convention of the American Drop Forging Institute, to be held in Detroit on Oct. 3 to 6, concurrently with the convention and exposition of the American Society for Steel Treating, again emphasizes the imperative need of building up an organization commensurate with the magnitude of the drop forging industry in order that it may attain the prestige and standing in the industrial world to which its size and importance entitles it, says the Institute's Commissioners in a preliminary announcement of the forthcoming convention.

To this end, all producers of drop forgings are being invited to attend the Convention, and to participate in its proceedings on exactly the same basis as the present membership of the Institute. Misconception of the objects of the Institute, and the methods used to attain those objects, has retarded its growth and progress; and the opportunity afforded by the coming convention for all drop forgers to meet and to discuss their common interests, should do much toward correcting the situation.

The present officers of the institute are: president, J. H. Williams, president, J. H. Williams and Co., Brooklyn, N. Y.; vice-presidents, H. G. Stoddard, vice-pres. and treas., Wyman-Gordon Co., Worcester, Mass.; and O. F. Transue, pres. and gen. mgr., Transue and Williams Steel Forging Corporation, Alliance, Ohio; directors: C. E. Adams, president, The Cleveland Hardware Co., Cleveland, Ohio; F. C. Billings, president, The Billings and Spencer Co., Hartford, Conn.; C. A. Brauchler, president and gen. mgr., The Canton Drop Forging and Manufacturing Co., Canton, Ohio; Ferdinand Barnickol, president, Indianapolis Drop Forging Co., Indianapolis, Ind.; A. H. Chapin, president, Moore Drop Forging Co., Springfield, Mass.; J. F. Connelly, vice-president, The Champion Machine and Forging Co., Cleveland, Ohio.

Machine Tool Exports Show Decline in July

Metal-working machinery to the value of $1,074,371 was exported during July. This is a reduction of more than $300,000 as compared with exports in June. As compared with May, however, the July exports show an increase of approximately $180,000. Exports for July 1921 had a total value of $1,734,-495. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS METAL-WORKING MACHINERY

	June 1922	July 1922
Lathes	$84,198	$61,443
Boring and drilling machines	68,580	28,059
Planers, sharpers and slotters	52,280	33,881
Bending and power presses	31,531	7,351
Gear cutters	15,937	25,791
Milling machines	51,622	27,597
Sawing machines	6,678	1,013
Thread cutting and screw machines	17,290	16,756
Punching and shearing machines	20,685	9,581
Power hammers	3,162	8,973
Rolling machines	585	129,881
Wire-drawing machines	3,152	2,475
Polishing and burnishing machines	894	330
Sharpening and grinding machines	69,297	54,483
Chucks, centering, lathe, drill and other	13,605	17,519
Reamers, cutters, drills and other parts for machine tools	110,007	89,485
Pneumatic portable tools	30,687	41,980
Foundry and molding machinery	53,447	28,467
Other metal-working machinery and parts of	813,229	489,306
Total metal-working machinery	$1,446,866	$1,074,371
IMPORTS		
Machine tools	$26,549	$14,762

August Auto Output Gains Over July

Figures of carload shipments of automobiles reported to the National Automobile Chamber of Commerce here indicate business last month as the best on record for August. A total of 272,640 cars and trucks was manufactured by all the companies. This was an increase of 12 per cent over July and of 53 per cent over August of last year. The record production for one month is 289,120, established in June.

The report for August indicates a total of 1,671,418 cars and trucks for the first eight months of this year, compared with 1,668,550 for the entire year 1921.

Shipments out of Detroit over the Michigan Central in August were 8,557 cars. A total of 55,045 carloads was moved in the first eight months of this year as against 25,724 last year.

British Engineers Form Joint Council

Following the receipt of a message from M. Mowat of London, secretary of the British Institution of Mechanical Engineers, Charles F. Rand, chairman of the Engineering Foundation, announced that the leading engineering societies of England had formed the Engineering Joint Council, which will work with the engineers of the United States and Canada and of the other British possessions to bring about concerted action for world peace and the advancement of engineering ideals "for the good of mankind."

Mr. Rand described the organization of British engineering bodies into a single unit as a big step forward in the movement to form a world union of engineers, which already has gained great headway in France, Italy, and Czechoslovakia, direct contacts having been established by the engineering bodies of these countries with those of America.

Formation of the Briitish Engineering Joint Council, according to Mr. Rand, who with Col. Arthur S. Dwight of the A. I. M. E. was recently decorated by the French Government with the Cross of the Legion of Honor, was one of the results of the trip abroad of a mission of thirteen American engineers, headed by Ambrose Swasey of Cleveland, founder of the Engineering Foundation, to confer the John Fritz gold medal upon Sir Robert Hadfield of London and Eugene Schneider of Paris, head of the Creusot Works.

Organizations represented on the British Council, Mr. Rand said, comprise the oldest and most famous of British engineering societies, and include the Institution of Civil Engineers, Institution of Mechanical Engineers Institution of Naval Architects and the Institution of Electrical Engineers. One of the objects of the British engineers like the objects of the American engineers, is "to secure the better utilization of their services in the country's interests."

American Welding Society's Fall Meeting

The fall meeting of the American Welding Society will be held in Chicago, Oct. 2, 3, 4 and 5, according to an announcement from the society's president, C. A. McCune.

The morning and afternoon sessions and discussions will be held in the headquarters of the Western Society of Engineers, 1735 Monadnock Block. The joint session of the American Electric Railway Association and the American Welding Society will be held in the engineering room of Congress Hall.

An interesting program has been prepared and papers will be read on a number of subjects of great importance to the welding industry.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE

Editor, *Commerce and Finance*, New York

SINCE the first of this month there have been celebrated the four hundredth anniversay of the first voyage around the world made by Magellan, the centennial of Brazil's political independence and the eighth anniversary of the Battle of the Marne. They were all "epoch making" events, but they would have been forgotten if the calendar had not recalled them to us. Since each of them occurred the world has been "in the depths" and "on the heights" many times but if from history we can visualize its condition four hundred, one hundred, or even eight years ago, we will realize the fairly constant progress civilization has made despite greed and war and man's inhumanity to man.

These observations are prompted by the relaxation in energy and activity that seems to be noticeable now that the coal strike is settled and the railroad strike is being ended by the gradual return of the men to work. While these strikes lasted every one said and thought that when they were over things would boom.

But the boom has not come yet and the feeling is in fact somewhat reactionary as the cost of the strikers' idleness is counted and the high prices in prospect for coal are contemplated.

But this mood will pass. The country has been under a greater strain than it realized and some reaction as the tension is relieved was natural and inevitable. It is true that our coal will cost an average of probably a dollar a ton more than it did a year ago. On our winter's consumption of probably 400 million tons this means 400 million dollars, but that isn't much to a nation that spends 400 million dollars a year for soda water and chewing gum and over a billion and a half for automobiles and their upkeep.

The truth, as I have so often affirmed, is that business activity in this country is very largely dependent on the way people feel. The population of the United States is normally energetic and constructive. Nearly every one desires to better his condition and is willing to work to that end.

Readjustments made necessary by changed conditions are from time to time necessary, but it is almost a truism that business will be active if the credit to finance its activity is available. Look over the record since the war commenced on July 31, 1914, for confirmation of this. The successive shocks of the great struggle staggered us but we always recovered our poise and hopefulness promptly and the only prolonged depression was the one caused by the curtailment of bank credit during the deflation of 1920 and 1921.

Now we have plenty of credit. The frozen loans are nearly all thawed out. The reserves of the Federal Reserve System and its member banks are so high that those who are entitled to accommodation can borrow all they need. The bigger borrowers need not pay over 4 per cent.; well secured bonds are readily salable in quantity and Secretary Mellon has found it practicable to sell Treasury certificates at 3¾ per cent. A continuance of these conditions for at least six months seems assured and that is about as far ahead as it is wise to look now or at any time.

Labor disagreements in the railway, coal and textile fields seem now in a fair way to amicable settlement. A bountiful harvest is in prospect and a marked increase in industrial activity is being witnessed on every hand. With our own national economic household put in order, the time seems to have arrived to mold a definite foreign policy that production abroad may be stimulated, that international trade may be balanced and real—not inflated—prosperity may be enjoyed.

This is why most sagacious bankers and merchants are confident of better times ahead. They say that the people are getting down to work and they know that with work and credit to finance its products we shall make more, sell more and buy more. There are in fact many who predict inflation, though no two of them agree upon a definition of the term. When pressed for one they say that higher wages mean higher prices, followed logically by an expansion in the volume of credit and money used. This is comprehensible and reasonable, and is already exemplified in some industries.

The Steel Corporation advanced wages 20 per cent some weeks ago and now pig iron, steel rails and other steel products are up about $3.00 a ton. To get the help needed the cotton mills of New England have also raised wages and cotton textiles are noticeably firmer and higher.

It is quite possible that a general advance in all commodities may be recorded later on, but thus far it is chiefly the manufactured products that are higher. Wheat is stationary. So is cotton. In both markets buyers are waiting for the "autumnal dip" in prices that is usually due to the selling of the farmers. But in other directions where there is no great pressure to sell the markets are stiffening. Hides are firmer. So is copper. Jute and burlaps are again moving upward. Coffee is a little stronger despite the admitted selling of the Brazilian Government.

The slight decline in sugar seems to be ended. It was caused by the exaggerated emphasis put upon the inability of some small exporters of refined sugar to meet their engagements. The position of sugar is really very strong and it is attracting wider attention. As a medium of speculation it may in time rival cotton. Building material for immediate delivery is in eager demand as it is feared that railroad embargoes and freight blockades may cause a shortage. This is about the only thing that will check the building boom that enables plasterers and other workers to demand and obtain $18 or $20 a day. But it is unnecessary to elaborate. To use a musical metaphor a crescendo movement punctuated now and then by a minor "accidental" seems probable. It is the accidentals that we must be prepared for.

In the stock market it is the same story. Some speculators who held on during the strike are selling but there is no investment liquidation presently or in prospect and the indications are that for the balance of the year the market for stocks and bonds will logically reflect corporate earnings and the money market. It is impossible to particularize when hundreds of different issues are traded in each day but it seems reasonable to expect great activity and higher prices in the railway shares, for the traffic awaiting transportation is enormous and it seems certain that the roads will have more business than they can handle.

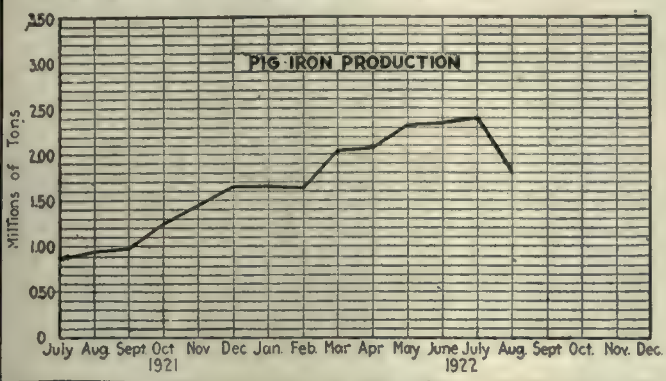
Of the political outlook in its relation to business but little need be said except that the Maine election and the primaries thus far held indicate the Administration will have a smaller and therefore a more manageable majority in the next Congress. This is reassuring.

The parturition of the tariff bill is still in progress but the community has become indurated and resigned to its absurdities. They will not be immediately felt, though they will certainly vex us later on.

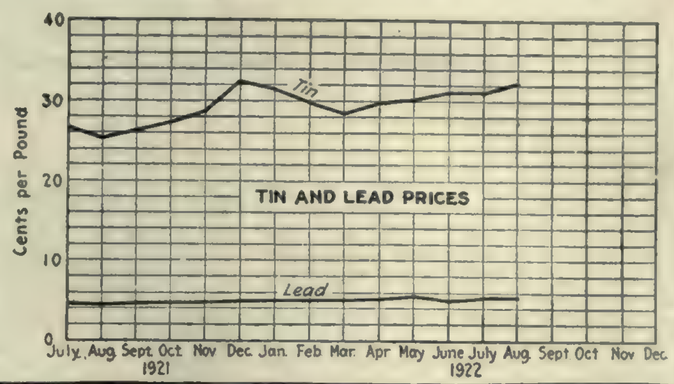
The economic morass through which Germany in particular and Europe in general is passing affords no footing for calculations in regard to future conditions abroad. By some it is asserted that the Continent is getting back to a more stable condition financially through the increased use of the dollar as currency.

It is reported that 251 billion German paper marks were outstanding on the 9th of September and on the basis of present values it is estimated that the foreigners who have bought paper marks speculatively have lost from 4 to 5 billion dollars. The American share of this loss is put at 2 billion dollars. These figures are, however, guesswork. The important fact is that Germany seems willing to print marks as long as they can be sold for more than the paper and printing cost.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Association.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



RAILROAD tonnage in the week ending September 2 approached the high peak reached in October, 1920, when, in one week a total of 1,010,000 cars of revenue freight were loaded. In the week ending on September 2, a total of 931,000 cars were loaded, this figure representing a gain of 41,000 cars in seven days. The striking feature of the loadings is the fact that the gain in general tonnage loaded is greater than in the loadings of coal.

Reserve ratio of the Federal Reserve System remained unchanged at 78.3 per cent on September 13 as compared with the week previous. The ratio of the New York member declined from 83.8 per cent to 83.7 per cent. Bill holdings in the entire system totaled $591 millions, a decline of $1,612,000 from the week previous. The reserve of the Bank of England reached 19.22 per cent as compared with 18.37 per cent last week. This approaches closely the highest point for the current year of 19.97 reached on June 22, and compares with the low of 8.83 per cent on January 7.

Crop values, as estimated by the Department of Agriculture, for the current year on six principal crops, will total in the neighborhood of $5¾ billions. Corn leads, the prospective yield being estimated as worth nearly $2 billions. The hay crop is second, valued at $1,160 millions, with cotton following closely in third place valued at $1,118 millions. Wheat is fourth, valued at $721 millions; potatoes fifth, valued at $502 millions and oats last, $404 millions. With these yields in sight the buying capacity of 6 million farmers this fall appears greater than at any time during the past two years.

Labor rates prevailing in the metal working industries, reported during the week, show that in Philadelphia tool makers are being paid from 55 to 80 cents, bench and lathe hands from 45 to 80 cents. Cleveland reports rates for tool makers ranging between 50 and 75 cents; bench hands, between 40 and 60 cents and lathe operators from 35 to 55 cents. Detroit reports 75 to 80 cents for tool makers; 50 to 55 cents for bench hands and 70 to 75 cents for lathe operators. In the New York district tool makers are being paid 75 to 80, while bench and lathe hands are receiving not less than 60 cents.

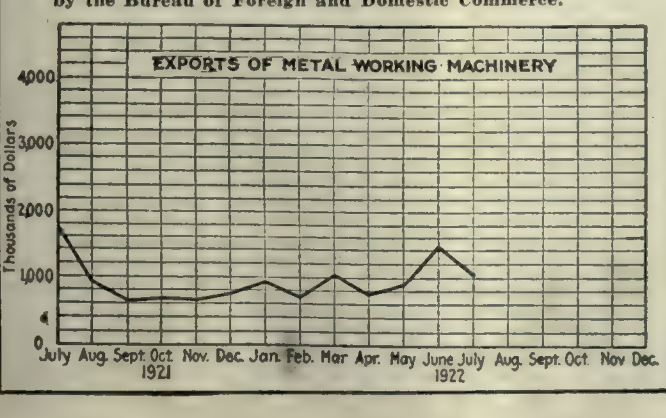
Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

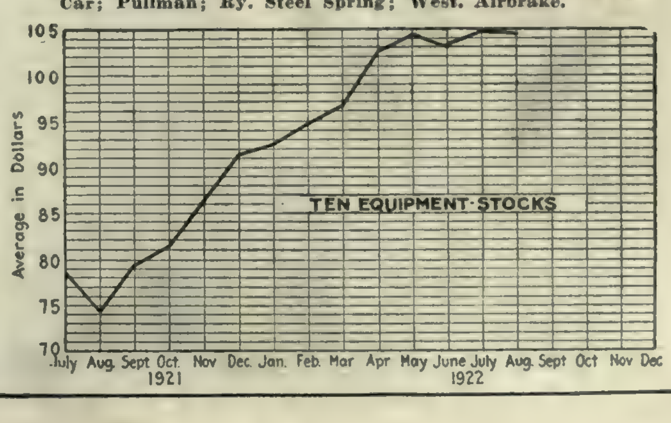
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0285	$0.0266	$0.0273
Cold finished shafting	per lb.	0.0373	0.0355	0.0396
Brass rods	per lb.	0.170	0.1650	0.1400
Solder (½ and ½)	per lb.	0.228	0.221	0.202
Cotton waste	per lb.	0.115	0.11	0.113
Washers, cast iron (½ in.)	per 100 lb.	4.00	4.00	4.66
Emergy, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	----------
Lard cutting oil	per gal.	0.575	0.575	----------
Machine oil	per gal.	0.36	0.36	----------
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

American foreign trade for the month of July, according to the foreign trade index figures just published by the Federal Reserve Board, eliminating the price factor, shows that our exports and imports for the month compare favorably with the pre-war volume. Based on an index figure of 100, as indicating the physical volume of our exports in July, 1913, the index figure representing the volume of exports for July, 1922, stands at 95.0. This compares with the index figure for the previous month of 107.4. Imports declined in volume also, the index for July being 187.7 as compared with 191 in June. Expressed in dollars and cents, on the other hand, exports for July were valued at $305 millions as compared with $325 millions in July, 1921. Imports in July were valued at $251 millions as compared with those of July, 1921, valued at $178 millions.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pr. Steel Car; Pullman; Ry. Steel Spring; West. Airbrake.



The British Machinery Industry

Demoralization as a War Aftermath—Economic Interdependence of Nations Becoming Apparent—Stimulation of Production Imperative

BY HENRY E. OBERMEYER AND ARTHUR L. GREENE

TWO clouds are hovering over the industrial horizon, and particularly the machine industry of England, today. Both are of equal importance and of equal seriousness as they affect a return to normal production. The first has to do with the unemployment situation and the second with the question of specialization.

The unemployment situation is undoubtedly one of the most serious and most portentous that the machine industries of England have had to face since the war. The number of machinists, or, as they are called here, engineers, out of work has decreased but slightly during the past six months. In not a few instances, the number is steadily increasing day by day. This demoralized state of affairs is primarily due of course to the chaotic condition of European finances which has decreased purchasing power to an alarming extent and brought even the staunchest of nations to the verge of bankruptcy. Until some outlet for the manufactured products of England is found, such as is hoped for when the Russian market reopens, both the Government and the individual employers themselves see little hope for a return to normal production and normal peace time employment.

MACHINISTS WAGES CUT SEVERELY

At the moment the machinists of the country are faced with the alternative of either taking another reduction in wages or of being thrown out of employment altogether. The wage of the average skilled mechanic averages some three pounds per week. The contemplated decrease which the employers have been forced to announce, will amount to 15s. 6d. per week, to take effect at the rate of 5s. 2d. per month for the next three months until the total reduction is in force. A vote among the employees is now in progress to determine whether or not the decrease will be accepted. From present indications, a compromise appears likely to be the result. This instance is cited merely to show in graphic detail the extremities to which the machine industry of England has been forced. No one, including the employes themselves, criticize the manufacturers in ordering the decrease. That it is a matter of necessity is too apparent. But just how the employee is to subsist on his two pound, ten a week or so is a question which is just as vital to the workman as is the question to the employer of how to maintain his working force intact in face of diminishing orders.

The phrase, "normal production" brings to mind a state of affairs which the English machine manufacturer has only lately begun to realize. It is, namely, that the manufacturer can never hope for a return of conditions anything like those obtaining before the war. And when more stable conditions are established, the normal, whatever it may be, it is said, will be entirely different from the pre-war normal. The English manufacturer has had brought home to him in vivid fashion the fact that the different parts of the world have grown more interdependent, that the world as a whole must be looked upon as one unit and not as a collection of different countries more or less separated from each other. No nation, it has come to be realized, can be definitely and permanently shut off by itself.

A case in point is that of the increasing competition felt by machine manufacturers in England from German sources. For several years after the war the opinion was held more or less generally in the British Isles that the Germans would be cut off from the other nations "behind a ringed fence, together with the lepers and wastrels of the world." No one realizes today better than does the English manufacturer the fallacy of such a belief. The sum and substance of the situation was ably expressed recently by a well-known English manufacturer: "If a nation is not exterminated it must be lived with and if it must be lived with it must be traded with. Not only must we sell to this nation, but we must in return take something from it. The only point to be decided is what goods or produce we are to take from any particular country and what goods we are to produce ourselves for export to that country, as well as for our own consumption."

Another fact but recently brought home to the English machine manufacturer, as a direct result of the existing stagnation in the industry, is that former customer countries are doing more and more of their own manufacturing, and on the other hand that competitor countries are developing and increasing their export trade. Today competitors in the United States, Japan, etc., are making a strong, and, in many instances a successful, bid for the trade of continental European countries where, in pre-war days, England had an undisputed monopoly.

UNEMPLOYMENT PROBLEM PERPLEXING

The difficulties confronting the machine industry of England are often likened to the scattered pieces of a jig-saw puzzle. English manufacturers are confronted with the necessity of slowly and laboriously piecing it together again. But even this comparison hardly gives a comprehensive idea or measures the difficulties looming in front of the manufacturing interests of England today. For, whereas, when the jig-saw puzzle is pieced together again the original picture appears upon its surface, when at last the world is more or less settled down and readjusted, an entirely different picture will be presented.

The daily press of the country is devoting columns of space to discussions of the present unemployment situation. The latest method suggested for its solution is that known as the scheme for trade within the Empire, which, to quote the words of its advocates, "is the most effective remedy for unemployment that can be devised." It is, in short, a system that would bring the industries of the dominions into closer unity and make the system of co-operation between them so essential to their own welfare that the Empire would be all-sufficing both for raw materials and manufactured articles. To quote but briefly Viscount Long, one of the leading proponents of the method:

"I have every reason to believe that the proposal that we should make the Empire one for purposes of trade is attracting a considerable measure of support both at home and in the various overseas dominions. I want to see the Empire devoting itself to such a provision of materials, in the parts of the Empire where they are wanted, as will enable trade and industry within the Empire to be carried on successfully and will demonstrate, what I believe is a fact, that the Empire can supply herself with everything she wants.

"That view is shared by the leading representatives of our dominions. We have adopted, as I think most wisely, a system of Imperial Preference under which we have also undertaken to give a similar preference in connection with any new duties that may be imposed from time to time.

SIDE LINE PRODUCTION ADVOCATED

"Having consolidated our own position and made the Empire one for the purposes of trade and commerce, we can then turn our attention to our Allies and by arrangement, give them a share in the products of the Empire. Our own needs—from no selfish motive, but purely from the point of view of self protection—must come first. All we want is that the Empire should be all sufficing, both for raw materials and manufactured articles but to leave the actual distribution and use of these products to the traders and business men of the Empire. This movement will tend to dissipate the unfortunate notion that for a man to move, say, from England to Canada or Australia is to cut himself adrift and make himself an exile from home."

This excerpt but goes to show that the industrial world of England today is coming around to the theory so long and so often advocated in America,—namely, home production for home consumption. Just what success will attend its introduction in England, remains to be seen.

For some years past, in fact dating from the time of the signing of the Armistice, English machine manufacturers have made a virtue of necessity and have turned their energies into a great diversity of side-line production. Fortunately for their own welfare at least, they have thus far been able to keep their factories at part time production and to keep the personnel of their factories intact by turning the facilities of their plants to different purposes. Other lines of industry have not, however, been so fortunate and in consequence have had to shut down their plants, and in not a few instances declare themselves bankrupt. The machine tool makers, however, early discovered that their plants were able to

turn out many of the smaller accessory parts needed in other industries and lost no time in grasping the opportunity laid at their door.

The motor industries in particular have been the salvation of many. Visit virtually any machine tool factory in England today and you will invariably find from fifty to seventy-five per cent of the output devoted to side-line production. Only a very small part of their plant will be found engaged in the production of machine tools and generally even this production will be found centered in experimental processes of new design and construction. It is no exaggeration to say that side-line production of many of the smaller parts which go into the making of automobile motors has kept the machine factories running at part or full time and is thereby enabling them to tide themselves over the industrial crisis. The situation, however, even at its best, is admittedly precarious and hardly better than a hand to mouth existence for the time being.

Specialization to Increase Activity

The many vital problems which have thus arisen as a result of this unemployment situation have brought in their train many innovations in the ways and means of manufacturing in England in an attempt to alleviate the situation. One of the earliest methods tried and still being utilized to a large extent, is that of specialization in manufacturing. Specialization here, in the true sense of the word, is by no means an innovation, but it is new in the sense that only within the past year has it been tried to a very great extent and been tried in practically all its phases.

The particular kind of specialization, around which so much controversy is being waged in the industrial world of England at present, is not that as generally applied to the workman but that as applied to a factory unit. It is the common belief among manufacturers of all kinds and grades, that specialization as practiced by Henry Ford in our country can never be successfully applied in England, either now or in the future. Their reason for making such an unqualified assertion is not based on the physical difficulties which would attend such an introduction as it is on the knowledge of the English workingman's temperament. As one factory manager explained: "The policy so common in an American factory of turning the human element or factor into a mere cog or adjunct of the machine he is operating is something to which the English factory hand would seriously object to. From our own standpoint even, we would find serious objections to this kind of specialization. We feel that with the introduction of such a system the workman loses that sense of responsibility which we always try to instill in the minds of our employees, from the lowest to the highest."

The foregoing opinion was found to be very generally concurred in. Group specialization by individual factories or units is quite a different matter, however, at least from the viewpoint of the English factory employer. The modern English exponent of this kind of specialization has proved to his own satisfaction at least the advantages of the system, but mention to him specialization by the individual and he will be found to be even more radical in his views than the out and out opponent of all and every kind of specialization.

To date it is almost impossible to judge of the success or failure which has attended the introduction of factory specialization in England. Perhaps the one positive reaction which has made itself apparent thus far has been the division of the machine industry of England in two camps, one in favor and one violently opposed to its introduction.

The objections to this method among English industrials lie principally in the recognition of the diversity of consumer needs as represented by the export trade. Before the war, the output of English machine tool factories was for the most part exported to the various Continental countries. While the amount exported to each country was of comparatively small volume, the total consumed by the entire nations of Europe was of considerable size.

It is easy to understand that the needs and types of tools demanded by the industry of each country should vary considerably. A machine tool demanded by a French silk manufacturer, for example, would necessarily be quite different from that demanded by the German steel manufacturer. As a result, the manufacturer,—and in this case the English tool manufacturer,—found himself unable to make any considerable number of standard tools, but had on the other hand to take a great number of small orders, each demanding a different type and size machine tool.

The situation today is hardly different in this respect from what it was in pre-war days. If anything, some machine tool manufacturers claim that the demand is not only for smaller quantity orders, but of even greater diversity as well. As Mr. John W. Earle, a well-recognized metal expert both in England and in America and head of the Earle-More Company, Ltd., manufacturers of non-ferrous metal castings, explained:

"The reason you in America can go in for mass production and specialization is for the simple reason that everyone takes in everybody else's washing. With us it is quite a different matter. We cater, and have of necessity to cater, to a dozen different nationalities, each demanding something entirely suited to its own particular needs. Under these circumstances what chance would Henry Ford have in this country?"

Machine Builders Co-operating

Judging from surface appearances only, following a visit to the industrial plants in the cities of Manchester, Birmingham and Leeds, it would appear that the exponents of specialization have undoubtedly the better of the argument for the time being at any rate. Their success has had its foundation based on the need for closer co-operation, a need which had its origin in the recognition of the dangers arising from ever growing foreign competition as exemplified in the increased facilities for communication. But while this latter factor has to some extent been disadvantageous to the trade of English machine tool manufacturers, it has also been of advantage to them. In other words, while increased facilities for communication have brought foreign competitors nearer to the English market, it has also worked to bring the foreign markets nearer to the English trades.

The factor of closer world interdependence was early recognized and utilized to their own advantage by the machine tool manufacturers of England. As early as 1916 an association known as the Associated British Machine Tool Makers was formed which included in its membership twelve of the largest manufacturers of machine tools in the country. Its purpose was not monopolistic in any sense of the word, inasmuch as it did not have for its object, either stated or implied, the purpose of excluding others engaged in the same line of industry. It was primarily formed for purposes of greater efficiency in manufacturing, the elimination of huge, unwieldly and expensive sales forces and of giving to each member of the association a particular field in machine tool making which the other eleven members would voluntarily agree to cease manufacturing. In short it made each member firm of the association but one department in the manufacturing of certain kinds of machine tools and thereby made of what had hitherto been twelve small unrelated manufacturers all engaged in competitive lines with each other, a unified whole, each department specializing in its own selected branch of machine tool manufacturing.

As an example, the H. W. Ward Co. agreed to specialize solely in capstan and turret lathes and to maintain through the association one sales manager in the central office of the association. Thus every order that came in, irrespective of which salesman received it, was to be put to the credit of whatever member firm of the organization made the particular tool called for.

The results attained have fully justified this organization. It has decreased in no small degree the sales expenses of the twelve member firms and what is no less important, it has, by eliminating some of the useless competition, enabled the tool manufacturers to devote considerable time toward making improvements in their special line of manufacturing. The Ward Co., in particular, has through its specialization introduced some features in capstan and turret lathes which have made their product unique.

To just what extent this form of factory specialization in England will grow in the future remains to be seen. The facts as developed so far, however, would seem to warrant a continuation of the method, and aside from the very reasonable objections raised by its opponents, it hardly seems an exaggeration to say that within the next few years specialization of this kind will become as great a factor in the industrial life of the country as was formerly the unrelated and competitive methods employed in pre-war days.

French Iron and Steel Trade Shows Gain

According to cable to the Department of Commerce from Acting Commercial Attache, John F. Butler at Paris, steady improvement in practically all lines of iron and steel is noted in France.

August rail sales were the best since the commencement of the year. Sales of foundry pig iron are on the increase.

Production of pig iron and steel during the seven months ending July was 2,689,000 and 2,413,000 metric tons, respectively.

Machinery Duties Under the Tariff Bill

WASHINGTON CORRESPONDENCE

Machine Tools. Machine tools and their parts are made dutiable at 30 per cent ad valorem in the tariff bill which has been agreed upon after conferences between representatives of the Senate and of the House of Representatives. In the House bill machine tools and their parts were made dutiable at 35 per cent to be based on American valuation. This was reduced in the Senate to 15 per cent ad valorem, based on foreign valuation. A compromise was effected whereby the rate was altered to 30 per cent ad valorem on the basis of foreign value.

Automobiles and Cycles. The bill passed by the House provides that if any country imposes a duty on automobiles or parts, when imported from the United States, in excess of the duty imposed by the United States on such articles, that the American duty shall be equal to that imposed by such a country, but in no case to exceed 50 per cent American value. The Senate struck out the House provision, but in conference it was restored, with the proviso that the maximum rate may not exceed 50 per cent on the foreign value. The same course was taken on paragraph covering motorcycles and bicycles.

Sewing Machines. The Senate amendment to the bill imposes a duty of 25 per cent, based on foreign value, on sewing machines and parts, when valued at not more than $75. A rate of 40 per cent, foreign value, was prescribed for sewing machines having a value greater than $75. The House had put sewing machines on the free list. In conference, however, the House agreed to strike sewing machines off the free list provided the duties were made 15 per cent and 30 per cent respectively, on the basis of foreign valuation.

Cash Registers. The House had put cash registers on the free list. The Senate imposed a duty of 25 per cent. In the conference the House representatives accepted the Senate rate.

Typewriters and Typesetting Machinery. Typewriters, typesetting machines, shoe machinery, sand blast machines, sludge machines and tar and oil spreading machines used in road construction and preservation, as well as their repair parts, were retained on the free list. Combined adding and typewriting machines were made dutiable at 30 per cent ad valorem in the conference bill, whereas the rate prescribed for the basket clause for machines and parts is 30 per cent ad valorem, a reduction of 5 per cent from the rate adopted by the Senate.

Knitting, Braiding and Insulating Machines. A duty of 40 per cent ad valorem, based on foreign value, was agreed to for knitting, braiding and insulating machines. The House bill imposed a duty of 35 per cent, American value, on embroidery machines, lace-making machines, and machines for making nets and nettings. The Senate lowered this rate to 30 per cent, based on foreign value. In conference the House rate was allowed to stand, with a change from American to foreign valuation.

Agricultural Implements. Agricultural implements, with the single exception of cream separators valued in excess of $50 each, remained undisturbed on the free list. These separators, as well as other centrifugal machines for the separation of liquids, were made dutiable at 25 per cent ad valorem.

Special Steel. The House conferees agreed to accept the Senate rates on steel containing molybdenum and tungsten. The additional duties which these steels therefore will pay are 65 cents per pound on the molybdenum content in excess of six-tenths of 1 per cent and 72 cents per pound on the tungsten content in excess of six-tenths of 1 per cent.

Small Tools. Pliers, pincers and nippers of all kinds, finished or unfinished are dutiable at 60 per cent ad valorem, regardless of length. The House bill had prescribed varying duties on these tools, according to their length. The rate on files, file blanks, rasps and floats was not considered in the conference as no changes were made in the rates prescribed by the House, which were: two and one-half inches in length and under, 25 cents per dozen; over two and one-half and not over four and one-half inches, 47½ cents per dozen; over four and one-half and under 7 inches in length, 62½ cents per dozen; seven inches in length and over, 77½ cents per dozen.

Elwood Steel Co. Buys Sharon Steel Plant

According to reports from Elwood City, Pa., the Elwood Steel Co. has purchased the plant of the Sharon Pressed Steel Co.

The plant acquired by the Elwood company adjoins the present realty holdings of that concern, and will be used in enlarging the present plant. During the war this plant was occupied by the Solid Drawn Forge Co., and some time ago the property was sold to J. A. Gelbach, J. J. Dunn, D. E. Moore.

When incorporation papers were taken out a few weeks ago, the capitalization of the company was increased to $250,000. With this additional working capital and the increased room for larger manufacturing facilities, officials in charge of the concern state they soon expect to be making 30,000 kegs of nails per month.

Officials of the company are: George E. Blyth, president; John J. Tyler, vice-president; August Miller, treasurer; Ira Bixler, secretary.

American Brake Shoe Forms New Subsidiary

According to reports recently made public, the directors of the American Brake Shoe and Foundry Co. have formally approved the plan for the formation of a new subsidiary to be known as the Ramapo Ajax Corporation to acquire properties of the Ramapo Iron Works with plants at Hillburn and Niagara Falls, N. Y., and Niagara Falls, Ont., and the Ajax Forge Co., with plants in Chicago and Superior, Wis. The plan provides for the sale of $2,250,000 first mortgage 20-year 6½ per cent bonds, which have already been underwritten.

Southern Iron Prices Advancing

The Southern Metal Trades Association advises that spot pig iron has continued to advance steadily in price at the Birmingham market, having reached as high as $28 per ton for No. 2 foundry iron, with some sales for shipment into northern markets at $27. Numerous inquiries are reported with furnaces operating steadily to keep up with demand. The only retarding feature at the time is the railroad strike, and the situation is improving steadily. While no sales for 1923 delivery of pig iron have been reported, inquiries are coming in. Unofficial reports indicate production in the Alabama district in August to have been well above July.

Post Office Plans Repair Depot for Aircraft in Chicago

Bids for an airplane repair and assembly depot and two hangars at the Speedway field, Chicago are being advertised by the Post Office Department.

The depot for mail planes which has been in operation for two years is on property surrendered by the Post Office Department. Permission has been granted to build on the Speedway park adjoining. The depot makes major repairs on damaged airplanes for all three divisions of the air mail service. Besides this an average of eight remade planes are being assembled every month for use in the service or for storage at reserve stations.

The depot, which will have 58,100 sq.ft. of floor space will contain a warehouse, garage, test stand room, factory and assembly room. The building will be two stories high. The two hangars will be 100 feet by 100 feet. The improvements will give the air mail service altogether 78,100 sq.ft. of floor space. It is estimated that this increase in facilities will accommodate present needs and allow some expansion in the future at the central field of the trans-continental air mail service.

Surplus Freight Cars Decrease

Reports furnished by the car service division of the American Railway Association from the rail carriers of the country showed that there were 70,455 surplus freight cars on Aug. 31. This was a decrease of 50,506 since Aug. 23. A surplus freight car is one which is in good repair but which is not needed to meet current freight requirements.

Surplus coal cars totaled 54,566 cars, a reduction since Aug. 23 of 41,839, while surplus box cars numbered 3,850, a decrease within the same period of 4,387 cars.

There was also a reduction in slightly more than a week of 926 in the number of surplus coke cars, the total being 1,982, while surplus stock cars totaled 3,091, which was 1,589 less than on Aug. 23. A reduction within the same time of 797 in the number of surplus railroad owned refrigerator cars was also reported.

Machine Tool Exhibit Creates Widespread Interest

Late reports reaching this issue of *American Machinist* indicate that the second annual machine tool exhibition, to be held in the Mason Laboratory of Yale University, New Haven, Conn., September 21, 22 and 23, has met with extraordinary support from the machinery builders. At this writing 110 firms have signified their intention to exhibit their products as follows:

Names of Exhibitors

Brown & Sharpe Co., Providence, R. I.
National Acme Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Pratt & Whitney, Hartford, Conn.
R. & J. Dick Co., Inc., New York City.
Elec. Alloy Steel Co., Youngstown, Ohio.
C. E. Johannson, Inc., Poughkeepsie, N. Y.
Rivett Lathe & Grinder Co., Boston, Mass.
Leland Gifford Co., Worcester, Mass.
Rhodes Mfg. Co., Hartford, Conn.
Kingsbury Machine Tool Co., Keene, N. H.
Abrasive Machine Tool Co., E. Providence, R. I.
The Haynes Stellite Co., New York City.
The Warner & Swasey Co., Cleveland, Ohio.
Joseph T. Ryerson Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Standard Shop Equipment Co., Philadelphia, Pa.
The Noble & Westbrook Mfg. Co., Hartford, Conn.
Cronin-Waddell Co., Boston, Mass.
Educational Exhibition Co., Providence, R. I.
Eastern Mach. Screw Co., New Haven, Conn.
Puriton & Smith, Hartford, Conn.
Standard Safety Mfg. Co., New Haven, Conn.
Manning Abrasive Co., Troy, New York.
Peerless Surfacing Mach., Co., Troy, N. Y.
Royal Waste Co., Rahway, N. J.
Alexander Brothers, Philadelphia, Pa.
Hoggson & Pettis, New Haven, Conn.
Standard Machinery Co., New Haven, Conn.
Martin Machine Co., Turners Falls, Mass.
American Society of Mechanical Engineers, New York City.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
B. C. Ames Co., Waltham, Mass.
Sidney Mach. Tool Co., Sidney, Ohio.
Walls Sales Corp., New York City.
Royersford Mach. Tool Co., Royersford, Pa.
Anderson Machine Co., Bridgeport, Conn.
Bickford-Switzer Co., Greenfield, Mass.
Cincinnati Elec. Tool Co., Cincinnati, Ohio.
Wisconsin Electric Co., Racine, Wis.
Detroit Twist Drill Co., Detroit, Mich.
J. D. Wallace Co., Boston, Mass.
Charles H. Besley Co., Chicago, Ill.
Grant Mfg. Co., Bridgeport, Conn.
American Milling Mach. Co., Cincinati, Ohio.
Sellew Mach. Tool Co., Pawtucket, R. I.
Hergi Mfg. Co., Bridgeport, Conn.
Bonner & Barnwall, New York City.
Athol Machine Co., Athol, Mass.
E. C. Atkins & Co., New York City.
Clinton E. Hobbs, Boston, Mass.
General Electric Co., Schenectady, N. Y.
Oven Equipment Co., New Haven, Conn.
Iron Age Publishing Co., New York City.
Jacobs Mfg. Co., Hartford, Conn.
Monarch Mach. & Tool Co., Sidney, Ohio.
Imperial Belting Co., Chicago, Ill.
American Machinist (Publishers), New York City.
Wright Mfg. Co., Lisbon, Ohio.
Skinner Chuck Co., New Britain, Conn.
New Haven Electric (Radio), New Haven, Conn.
Union Twist Drill Co., Athol, Mass.
Card Tap & Die Co., Mansfield, Mass.
The Carborundum Co., Niagara Falls, N. Y.
L. S. Starrett Co., Athol, Mass.
The Industrial Press Co. (Mach.), New York City.
Van Norman Mach. Co., Springfield, Mass.
Power, New York City.
Industrial Engineer, New York City.
S. K. F. Industries, Inc., Hartford, Conn.
Dodge Sales & Engineering Co., Mishawaka, Ind.
Johnson Belting Co., New York City.
J. T. Welch, New Haven, Conn.
H. G. Thompson & Sons Co., New Haven, Conn.
J. M. Ney Co., Hartford, Conn.
J. L. Lucas, Bridgeport, Conn.
Reed Prentice Co., Worcester, Mass.
Chamber of Commerce, New Haven, Conn.
Kilborn & Bishop, New Haven, Conn.
E. Horton & Son Co., Windsor Locks, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Universal Boring Mach. Co., Hudson, Mass.
Norwalk Iron Works, Norwalk, Conn.
Taylor and Fenn, Hartford, Conn.
Taft Peirce Co., Woonsocket, R. I.
Westcott & Mapes, Inc., New Haven, Conn.
J. T. Slocumb, Providence, R. I.
Madden & Morrison, Providence, R. I.
Hill Clark & Co., Boston, Mass. (F. M. Lord, Box 764—N. H.)
Hartford Mill Supply Co., Hartford, Conn.
Cochran & Bly, Rochester, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
A. F. Way Co., Hartford, Conn.
Page, Steel & Flagg, New Haven, Conn.
Builders Iron Foundry, Providence, R. I.
E. W. Bliss, Brooklyn, N. Y.
Eastern Sales Co., Boston, Mass.
Torrington Co., Torrington, Conn.
Standard Steel & Bearings, Inc., Plainville, Conn.
Detroit Belt Lacer Co., Detroit, Mich.
American Swiss File & Tool Co., Elizabeth, N. J. (26 John St., N. Y.)
Keller Mech. Engraving Co., Brooklyn, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Walworth Mfg. Co., Boston, Mass.
Vitrified Wheel Co., Westfield, Mass. (Page Steel & Flagg Co.)
Eastern Machinery Co., New Haven, Conn.
N. H. Gas Co., New Haven, Conn.
Gallophone Co. of N. Y., 151 Grand St., New York City.
Callophone Co. of N. Y., New York City.
Standard Steel & Bearings, Inc., Philadelphia, Pa.

Business Items

The Saco-Lowell Co., Lowell, Mass., one of the largest manufacturers of textile machinery in the country, will establish a branch plant at Charlotte, N. C., representing about a $150,000 investment. Work on the plant already is in progress.

The Powers Accounting Machine Corporation, St. Louis, Mo., has been incorporated with a capital stock of 1,000 shares of no par value. The company will do a general accounting and tabulating machine business. The incorporators are M. A. Bruce, C. H. Blaske and F. R. Bogart.

The Potosi Pipewrench Co., Potosi, Mo., has been incorporated with a capital stock of 500 shares of no par value. The company proposes to manufacture or sell state or county rights to manufacture or sell the company's pipewrench products. The incorporators are J. M. Cooper, S. M. Kathcart, W. H. Cooper.

The Stewart Warner Co. announces that all of the $2,000,000 of 8 per cent notes due March 1, 1925, have been retired. Practically the entire amount was converted into stock at the rate of 25 shares of stock for each $1,000 bond. Conversion, however, has not increased the outstanding capital stock, the company having purchased stock equal to the amount converted, in the open market.

The United States Steel Corporation has increased to $43 a gross ton the price of steel rails, effective October 1, and covering deliveries for the first half of next year. The present prices of $40 a ton, which was announced in October of last year, represents a reduction of $7 per ton from the level obtaining from March, 1919, until that time.

The Fulton Machine Tool Co., 1422 W. Randolph St., Chicago, Ill., has been reorganized and will be known as the Fulton Machine Co. The plant is being moved to larger quarters at 1525 Dayton St., where the firm will engage in contract manufacturing and the building of special machinery.

The Chicago, Rock Island and Pacific Railway Co. has been granted authority by the Interstate Commerce Commission to issue $1,000,000 of first and refunding mortgage gold bonds. The issue will be sold at not less than 83.50 per cent of par and the proceeds used for paying off indebtedness, including equipment trust obligations for additions and betterments, and for general corporate purposes.

The M. S. Little Manufacturing Co., Hartford, Conn., and the A. J. Beaton Manufacturing Co., New Britain, Conn., according to recent reports, are to be merged into a new organization to be known as the M. S. Little Manufacturing Co. The stockholders of the two companies are to meet in New Britain in the near future for the purpose of aproving of the plan.

The Chicago, Milwaukee and St. Paul Railway Co., in its report for June, shows operating revenues of $13,513,555, an increase of $1,160,554 and net operating income $1,215,104, an increase of $408,014. For six months ended June 30 operating revenues were $71,156,775, an increase of $3,387,195 and net operating income $1,617,155, an increase of $4,432,878.

The Vanadium Corporation of America, according to its chairman, J. Leonard Replogle, will show a net income for August in excess of $90,000 after deducting all charges.

The Casey Hedges Co., of Chattanooga, advises that it has lately acquired a site of about 50 acres on which will be constructed a new plant for the manufacture of boilers and plumbing supplies, to operate in conjunction with the present plant of the company.

The Louisville and Nashville Railroad Co. reports a net operating income for June of $2,619,409, bringing the total net operating income for the six months' period up to $9,839,446.

The Oilgear Co., Milwaukee, Wis., announces the appointment of the R. E. Ellis Engineering Co., 621 Washington Boulevard, Chicago, as its representative in the sale and distribution of Oilgear products in Chicago and the surrounding district.

The San Diego Iron Works, the successor to the California Iron Works, at San Diego, Cal., will manufacture the "California hydrant," for which it holds the patent. The new corporation is planning an extension of its business, specializing in structural iron, metal work and machinery.

The Canadian Pacific Railway Co.'s net operating revenue for June, amounting to $2,362,313, represents a decrease of $742,445. The half yearly period shows net revenue of $9,814,070, a decrease of $3,136,096.

Alfred Box and Co., Inc., Philadelphia, Pa., manufacturer of electric traveling cranes and hoists, announces the opening of a direct factory branch office at 30 Church Street, New York City. N. C. Failor will be in charge.

The Denver and Rio Grande Western Railroad Co. for June reports operating revenues of $2,737,227, an increase of $878,729 and net operating income $482,302, an increase of $1,120,360.

The Milne Foundry Corporation of Schenectady, N. Y., has been chartered recently at Albany, N. Y., with a capital of $100,000 for the manufacture of fuel saving devices, as well as engines, motors and machinery equipment used in connection therewith. The

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Attachment, Spotting and Routing, [illegible]

E. L. Krag & Co., 10 West Randolph St., Chicago, Ill.

"American Machinist," Oct. 6, 1921

The attachment is intended for the laying out and drilling of holes up to and including [illegible] in. in diameter in dies and work that require great accuracy. The method of performing the work is intended to replace that of locating holes by means of buttons. The device can be supplied for all standard makes of milling machines, being ordinarily attached to the No. 1, 1½ and 2 sizes. The spindle is fed by hand and a locking device is provided so that it can be securely fastened at any height. The spindle pulley and idlers are fitted with ball bearings. The work is moved under the attachment by the use of the feeds on the table of the milling machine.

Grinder, Floor, Electric, "Pioneer"

The Louisville Electric Manufacturing Co., Louisville, Ky.

"American Machinist," Oct. 6, 1921

The motor is ventilated, the air intake being so located that clean air is drawn through it. The machine is provided with ball bearings. Steel safety hoods are provided, with hinged side walls so that the wheels can be easily changed. The toolrests are adjustable. The starting switch for the motor is enclosed in the column, and a water pot can be attached. The grinder requires a 2-hp. motor, which can be furnished for either direct current or 60-cycle alternating current, the no-load speed being 1,800 r.p.m. for either type. The wheels used are 12 x 2 x 1 in. in size. Weight, 400 pounds.

Milling Machine, Bench, Hand, No. 3

Pratt & Whitney, Hartford, Conn.

"American Machinist," Oct. 6, 1921

The machine is only 21 in. high and occupies a bench space of 22 x [illegible] in. The spindle is of tool steel, as is also the double taper front bearing. The rear bearing is of bronze, and both bearings are adjustable to compensate for wear. Spindle speeds range from 132 to 1,510 r.p.m. A three-step cone is provided. The table has a working surface of 2¾ x 17¾ in. It has both screw and rack movement. The saddle has a crosswise movement of 2 7/16 in. and the knee may be adjusted vertically through a range of 6¾ in. Net weight, 185 lb.

Gage, Snap, Adjustable-Limit, Syracuse

Meldrum-Gabrielson Corporation, Syracuse, N. Y.

"American Machinist," Oct. 6, 1921

The chief feature of the gage is the locking device for the measuring pins, which are square in section. The shape of the pins prevent them from turning. The square pins in the Style A gage shown present a straight edge to the work. The pins of the Style B gage are equipped with rectangular anvils for use when measuring against shoulders. The Style G gage employs, instead of the usual "go" and "no-go" pins, three pairs of pins. The gage size is adjusted by turning a screw at the rear of each measuring pin. A small conical-headed screw is used to lock the pin in place. The tool is ordinarily made in twenty-four sizes to fit work up to 12 in. in thickness.

Clutch, Friction, Locking

Carlyle Johnson Machine Co., Manchester, Conn.

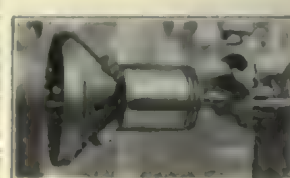
"American Machinist," Oct. 6, 1921

This friction clutch has been provided with a positive locking feature, so that slippage can be prevented after the clutch is completely engaged. When first thrown into engagement, the action of the device is the same as on the standard clutch. When the clutch has been completely engaged, and the speed of both parts is the same, pins on the outside shifter sleeve move up so as to engage those on the clutch itself, there being six pairs of pins spaced around the clutch. When disengaging the clutch, the pins are brought out of contact, and then the clutch can be slipped or disengaged entirely.

Attachment, Grinding, Automotive-Piston, No. 509

Norton Company, Worcester, Mass.

"American Machinist," Oct. 6, 1921

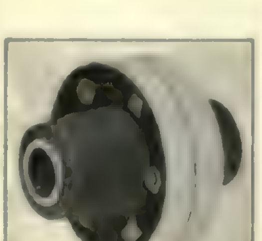


This piston-grinding attachment is for use on the autopart regrinding machine made by this concern. The attachment can be adapted to the holding of all styles and sizes of automotive pistons from 2¾ to 7½ in. in diameter. The fixture consists of a dead center, upon which revolves a cast-iron cone carrying thre tool-steel slidable jaws, the outer surfaces of which are ground conically. A transverse groove in each jaw permits the corner of the abrasive wheel to travel beyond the end of the piston. The cast-iron cone is driven by the regular drive pin and the piston itself by means of a spline on the side of one of the jaws.

Couplings, Shaft.

Hilliard Clutch and Machinery Co., Elmira, N. Y.

"American Machinist," Oct. 6, 1921



The illustration shows the keyless compression coupling. The coupling consists of two flanges bored tapered, and one slotted sleeve turned on the outside with tapers to match the flanges. When the flanges are drawn together by means of bolts, the shafts are gripped tightly so that slippage is prevented. The coupling is made in a range of sizes. A keyed flanged coupling is also made in a range of sizes. For connecting shafts of different sizes, reducing couplings can be furnished.

Locating Device, "Electrocator," Hansen

Bely Sales Co., 601 Washington St., Lynn, Mass.

"American Machinist," Oct. 6, 1921

The device is intended to facilitate the exact location of a given point with reference to the center line of the revolving spindle of the machine doing the work. It consists of a small electric transformer, an electric lamp, and a "ball wiggler." The wiggler, one end of which is insulated electrically from the other, is placed in a collet or attached to the spindle of the machine. Upon starting the spindle, the ball will describe a circle. It causes the lamp to flash at each revolution. As the table is raised, the center of rotation of the spindle is finally reached by the ball and the lamp burns steadily. A further raising of the table causes the ball to roll off the gage.

Clip, paste on 3 x 5-in. cards and file as desired

directors are William H. Milne and George C. Ratchford of Schenectady; J. Edward Lurie of Albany.

The Southern Pacific Co. reports a net operating income for the seven months amounting to $20,931,851 as against $16,812,873 a year ago.

The Shamboro Shuttle Co., Woonsocket, R. I. has purchased at public auction the property of the Saluda Manufacturing Co., near Greenville, S. C., and will install new machinery preparatory to commencing manufacturing operations within the next ninety days.

The Nashville, Chattanooga and St. Louis Railway Co. has made application to the Interstate Commerce Commission to issue $1,800,000 of certificates, the proceeds from the sale to be applied on the cost of eight locomotives, nine baggage cars, six coaches and 1,000 freight cars, estimated at $2,297,037.

The Cemele Machine Co., Salem, Ohio, was incorporated recently at Columbus with a capital of $30,000. The incorporators are C. P. Hepler, Amos Entricken, Hiram S. Hendrick, Fred Kremser and John Leeson.

The Gifford-Wood Co., Hudson, N. Y., manufacturers of coal handling and conveying machinery, according to an announcement by the Pittsburgh Chamber of Commerce has secured the property at Hulton, Pa., formerly occupied by the Crescent Forging Co. and will begin the work of remodeling the property at once preparatory to the commencement of manufacturing operations.

The Rebstock Co., St. Louis, Mo., has been incorporated and will manufacture and deal in machinery of all kinds including iron, steel, wood and sheet metal and will do a general manufacturing business in these lines.

The Birmingham Stove Works, Birmingham, Ala., B. H. HARTSFIELD, manager, advises that several thousand dollars will be invested enlarging the plant.

The Norwalk Iron Works Co., South Norwalk, Conn., announces that it has with it the Automatic Carbonic Machine Co., of Peoria, Ill., the plant and equipment of which is being moved to South Norwalk. Arrangements are now being made whereby the Norwalk Iron Works will be in position to supply a completely developed line of carbonic gas equipment for refrigeration and ice making in addition to its standard ammonia equipment.

The Dawson Variety Works, Dawson, Ga., announces its intention to start work immediately on the reconstruction of its machine shops, recently destroyed by fire.

The Walworth Realty Co., a subsidiary of the Walworth Manufacturing Co., Boston, manufacturers of the Stillson wrench, the Walmanco joint and other steam and gas fittings, tubes, etc., have awarded Dwight P. Robinson and Co., Inc., the contract for the design and construction of a warehouse, pipe shop and garage to be located on Jackson Avenue, Long Island City. The scope of the work includes the design and construction of a 3-story and basement concrete building designed to permit the addition of three floors later on, a garage to accommodate eight trucks, a pipe storage building and a pipe shop extension at the rear of the main building; also necessary retaining walls, platforms, paving and railroad siding. The main building will contain the offices, city sales department, shipping room and space for the storage of fittings and material. The pipe storage building is to be 60 x 214 ft. and will be served by a crane running out over the railroad siding. Construction has already begun.

The Carlson Brothers Tool and Machine Co., South Boston, Mass., is reported recently to have taken a long lease on the machine shop at 15 B St., that city.

The St. Croix Paper Co., Woodland Junction, Me., suffered a loss in its new lumber plant of $150,000 by fire a few weeks ago, much new machinery being destroyed.

The Butterfield and Co. Division, Union Twist Drill Co., Derby Line, Vt., manufacturer of taps, dies, reamers and screw plates, are occupying their new brick and concrete fire-proof buildings recently completed. The main factory building is 170 ft. long by 70 ft. wide, three stories and a basement, with annex one-story high, 170 ft. by 60 ft. and basement, and an ell to the main building 85 ft. by 70 ft., three stories, all of the latest approved construction. This move has necessitated the purchase of considerable new equipment and machinery, and when completed gives them practically double their previous capacity, this being necessary to take care of their rapidly growing business.

The New York Air Brake Co., according to a statement just made public by B. J. Minnier, general manager, has unfilled orders on its books at the present time, the volume of which is greater than in any previous period in the company's history. June shipments totaled $700,000.

The Pierce Arrow Motor Car Co. reports August sales and shipments for this year as being greater than those for the corresponding month in any year in the company's history.

The Florida East Coast Railway Co. has asked the Interstate Commerce Commission for permission to extend its line a distance of 125 miles, from Okeechobee to Miami, Fla.

The Diamond Chain and Manufacturing Co. announces the opening of an office at 340 Leader-News Building, Cleveland, Ohio. The office will be in charge of MR. H. I. MARKEY, who has been with the company five years as mechanical engineer in its engineering and sales departments.

The Youngstown Sheet and Tube Co. directors have declared a quarterly dividend of 75 cents per share on the common stock payable Oct. 1 to stockholders of record Sept. 20. The previous dividend rate has been 50 cents per share quarterly.

The United Brass Manufacturing Co., 3844 Hamilton Ave., Cleveland, Ohio, a co-partnership consisting of Benjamin F. Klein and William J. Schoenberger, has been dissolved by mutual consent. The United Brass Manufacturing Co. continues as heretofore in the manufacture of plumbing brass goods and water works brass goods at its present location, under the sole ownership of Benjamin F. Klein. William J. Schoenberger withdraws, and takes over the gas valve and stove cock department, which will be operated by The W. J. Schoenberger Co., located at Harvard Ave. at 103d St., Cleveland, Ohio, manufacturing brass gas valves, gas cocks and special fittings for gas appliances.

The Oilgear Co., Milwaukee, Wis., announces the appointment of the Cadillac Machinery Co., Lafayette and Beaubien Sts., Detroit, as its representative in the sale and distribution of Oilgear products in the state of Michigan.

The Modern Truck Manufacturing Co., recently formed in Mobile, Ala., with a capital of $50,000, G. M. BRYDE of Mobile, president, announces that machine shops for turning out truck parts will shortly be established in that city.

The Berger Manufacturing Co., Canton, Ohio, was incorporated recently, in Illinois, according to dispatches from Springfield, with a capital of $100,000. EDWARD A. LANGENBACH was named as president and CHARLES W. KRIEG as secretary.

The Oilgear Co., Milwaukee, Wis., has opened a New York office at 39 Cortlandt St., in order to be in direct touch with the entire eastern territory. Russell, Holbrook and Henderson, 30 Church St., New York have been appointed sales representatives of this company for the district in and near New York City.

The Lees Bradner Co., Cleveland, Ohio, has opened a sales office at 32 North Clinton St., Chicago, with FRANK ARTZ in charge.

The Fremont Metal Co., Fremont, Ohio, was chartered this week with a capital stock of $50,000. The incorporators are Frank Nagle, Lawrence Freehs, Carl D. Perkins, Marshal Bixler, and Elizabeth Bixler all of Fremont. The company has for some time been making metal bodies for auto trucks.

The Sullivan Machinery Co., following the completion of its new plant at Michigan City, Ind., will remove its Chicago works, utilizing the equipment and later disposing of its buildings. A tract of 125 acres has been acquired for the new plant, buildings to include foundry, machine shop, assembling plant, etc., and estimated to cost about $1,000,000. Office headquarters will be maintained in Chicago as heretofore. The new plant is expected to be completed early next year.

Personals

J. D. POWELL, formerly connected with the L. S. Starrett Co. has become associated with the Lufkin Rule Co. and will make his headquarters at Saginaw, Mich.

F. C. SCHREIBER, of late connected with the sales department of the Packard Co., has returned to the position which he formerly held with Stocker-Rumley-Wachs Co., Chicago, Ill.

IRVING S. KEMP has resigned his position as sales manager of the Vaughn &

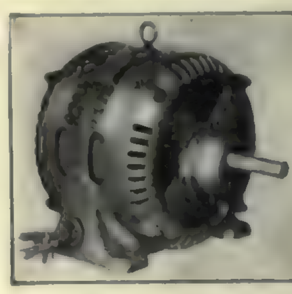
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Lathes, Buffing and Polishing, Ball Bearing, Nos. 5 and 6
Mitchell Engineering Co., Springfield, Ohio
"American Machinist," July 20, 1922

The No. 5 machine has two independent spindles, while the No. 6 model has a single spindle for carrying wheels at both ends. Its spindles can be controlled independently, and together with the bearings, can be removed by releasing the bearing-housing clamps. It can be furnished with motor drive and both machines can be driven either from overhead or underneath. No. 5 machine: Spindle length, 32 in.; spindle diameter in bearings, 2 in.; height to spindle center, 38 in.; floor base, 26 x 42 in.; net weight, [illegible] lb. No. 6 machine: spindle length, 44 in.; spindle diameter, 2 in.; height from floor to spindle center, 38 in.; floor base, 20 x 26 in.; net weight, [illegible] pounds.

Motors, Electric, Multi-Speed, A.C., Watson
Louis Allis Co., Milwaukee, Wis.
formerly Mechanical Appliance Co., Milwaukee, Wis.
"American Machinist," July 20, 1922

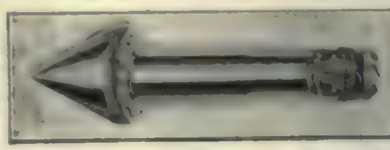


Motors can be furnished for constant horsepower, constant torque or any required combination of both in two, three or four speeds. The speeds are 600, 720, 990, 1,200 and 1,800 r.p.m., for circuits of either 60 cycles or other frequencies, and of either two or three phase. A control apparatus can be supplied which is suitable for both automatic and remote control.

Center, Anti-Expansion, Automatic
Snellex Manufacturing Co., Rochester, N. Y.
"American Machinist," July 20, 1922

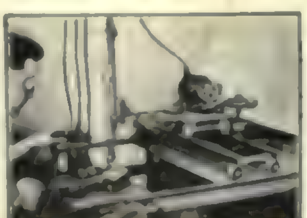
The center is used in lathe and grinding machine headstocks. The shank of the center proper is milled with a series of helical oil grooves and has longitudinal motion within the tapered case. This motion is opposed by a very stiff adjustable spring which allows the center to recede within the case to a limited extent when under great pressure, due to expansion of the work. Lubricant can be applied through a hole in the adjusting screw. Centers with Morse tapers from Nos. 1 to 6 are regularly carried in stock, but special tapers and centers can be furnished. Centers for grinding machines have heads of reduced diameter.

Center, Anti-Friction, Automatic
Snellex Manufacturing Co., Rochester, N. Y.
"American Machinist," July 20, 1922



The anti-friction center is used in lathe and grinding machine tailstocks either in conjunction with or separately from the anti-expansion center. The balls in the front race are larger than those in the former model. Centers with Morse tapers from Nos. 1 to 6 are regularly carried in stock, but special tapers and centers can be furnished. Centers for grinding machines have heads of reduced diameter, so that the wheel can pass over them in grinding small work.

Welding Machine, Automatic, "GEWE"
General Welding and Equipment Co., Boston, Mass.
"American Machinist," July 20, 1922



The welding rod passes through the center of the oxy-acetylene torch, and is fed downward by gravity. The torch is mounted on a connecting rod from which it receives a rotary motion. Motion at right-angles to the mean of that imparted to the connecting rod may be given to the whole machine, and the combined motion may be used in welding a seam. For heavy welds, an additional torch is supplied to preheat the metal. A friction wheel and disk, and a rheostat controlling the motor, give two speed adjustments. With the latter, finer adjustments and variations of speed can be made where the thickness of the metal varies.

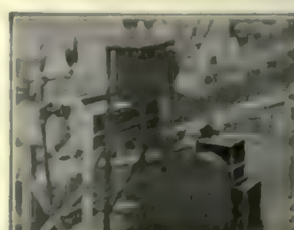
Micrometer, Inside, Height Gage
Reed Small Tool Works, Worcester, Mass.
"American Machinist," July 20, 1922

The micrometer range is lower than that of the other models and covers from 2 to 7 in. with the use of five rods. Five additional rods can be furnished for increasing the range to 32 in. The micrometer graduations read to 0.001 in. Converted into a height gage, the micrometer gives a range of 3 to 32 in. A clamping knurled nut holds the measuring rod in a perpendicular position. The V-shaped groove in the bottom of the base adapts the tool to measuring cylindrical work and distances between shafts. With a drill rod and a standard indicator, the tool can be used as a surface gage.

Vise, Combined Hand and Bench
Malleable Iron Fittings Co., Branford, Conn.
"American Machinist," July 20, 1922

The vise is for the use of toolmakers and patternmakers in manipulating small pieces of work in filing and other operations. The anvil clamp is attached to the edge of the work bench and has a tapered dovetail slot into which the vise proper is fitted. The pantograph arrangement holds the jaws parallel at any amount of opening within its range. The vise has a sliding pin handle similar to the handle of a regular bench vise and the offset end allows the pin to be moved from end to end without interfering with the projecting screw. Either plain or serrated jaws are furnished. Capacity, 1½ x 1½ inches.

Press, Horizontal, Hydraulic
Oilgear Co., 60 Twenty-seventh St., Milwaukee, Wis.
"American Machinist," July 20, 1922



Ram speeds can be instantly changed by the operation of a control handle located on top of the pump. The pump is driven by a constant-speed, 2-hp. electric motor and no accumulator or auxiliary pump is required. Suitable overload relief valves prevent injury in case the ram is driven against a stop. The cylinder is 9 in. in diameter and the full capacity pressure exerted on the ram piston is 800 lb. per square inch. The diameter of the ram is 5¼ in. and the length of the stroke is 20 in. Forcing capacity: 25 tons at speeds of from ½ to 6 in. per min. Maximum ram traversing speed: outward stroke, 37 in. per min.; return stroke, 56 in. per min. Distance between stop supports, 24 inches.

Clip, paste on 3 x 5-in. cards and file as desired

Bushnell Manufacturing Co., to become vice-president of the Evansville Tool Works, Evansville, Ind.

ALFRED J. LEWIS, formerly connected with the Babcock & Wilcox Co. and the American Steel Foundries Co., was recently appointed district representative with headquarters in the Foutain Building, Cleveland, Ohio, for the Pittsburgh Grinding Wheel Co., Rochester, Pa., manufacturer of grinding wheels and emery.

H. J. SWANSON, formerly associated with the Detroit Machine Tool Co. as sales manager, has been appointed manager of the Peerless Machine Co., Racine, Wis.

F. A. BALL, for many years associated with the L. S. Starrett Co., Athol, Mass., and more recently vice-president of the company, has been elected to the presidency to succeed the late L. S. Starrett.

JOHN J. CURRY, of Hartford, Conn., has recently been appointed mechanical superintendent of Plant D, of the New Departure Manufacturing Co., of Bristol, Conn., at Meriden, Conn. Mr. Curry has been in the Hartford plant of the company for some time, and is a master designer of tools, gages and fixtures used in the manufacture of the concern's products.

HARRY J. FOSS has been elected president of the Berkshire Mill Supply Co., of Pittsfield, Mass., to fill the vacancy caused by the recent death of CHARLES E. HIBBARD.

COL. C. L'H. RUGGLES, after a year spent as a student at the Army War College, has been returned to his old assignment as chief of the technical staff of the Ordnance Division of the War Department.

COL. J. W. JOYES, who has been serving as chief of the technical staff during the absence of Col. C. L'H. Ruggles, has been assigned to duty as ordnance officer for the Corps Area, having its headquarters at Governor's Island. Col. Samuel Hof, has resumed his regular duties as chief of the artillery division of the technical staff.

MILES W. O'BRIEN, president of the South Bend Lathe Works, South Bend, Ind., has been named a member of the board of lay trustees of Notre Dame University. He is the second South Bend man to be placed on the board, A. R. ERSKINE, president of the Studebaker Corporation, being the other.

W. G. NIMS has been elected vice-president of the L. S. Starrett Co., filling the vacancy created by F. A. Ball, who has just been elected president.

J. ERNEST G. YALDEN, for many years superintendent of the Baron de Hirsch Trade School, New York City, has resigned owing to poor health. ROBERT H. GREENE, who has been connected with the institution for several years, has been appointed to fill the vacancy.

FRED W. RAMSEY, who resigned as president of the Cleveland Metal Products Co., Cleveland, Ohio, some time ago to devote his attention to other activities, has been elected chairman of the board of the Cleveland Tractor Co. ROLLIN H. WHITE continues as president of the Tractor organization.

Obituary

CHARLES MILLER, a mechanical engineer in the employ of the New York Transit Commission, died in the Jewish Hospital, New York City, September 7, aged 58 years. He lived at 1,238 Bedford Avenue, Brooklyn, and was a member of the American Association of Engineers.

JOHN T. MCHUGH, 65, one of the leading steel men of the Shanango Valley, died September 9, following a short illness. Mr. McHugh was assistant superintendent of the Farrell plant of the American Steel and Wire Co. for the past several years, a member of the board of directors of the People's Bank and a former city councilman. In 1890 he worked in the same mill at Salem, O., where James A. Farrell, now president of the United States Steel Corporation, was a wire puller. He had been connected with the United States Steel Corporation for the past 35 years.

ALBERT PRYIBIL, president of the P. Pryibil Machine Co., Inc., New York City, manufacturer of spinning lathes, died at his home in that city, September 14, at the age of 51 years. Mr. Pryibil had been associated with the company for 35 years and had been president for the past twenty-five years. A widow and son, P. L. Pryibil, survive.

Book Reviews

Industrial Physics Mechanics. By L. Raymond Smith. Cloth; two hundred and eighteen, 5½ x 8 in. pages. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York, N. Y. Price $1.75.

This, the first of a series of three books on industrial physics, thoroughly covers every detail of mechanics. The author states his subject in a way the student can understand and illustrates the theories in terms of the student's every day interests. The book is a text on elementary practical mechanics for technical, industrial, vocational and evening schools. Many questions and problems are given at the end of each chapter.

The subjects taken up deal with: measurement and measuring instruments, elementary trigonometry, gravitation and gravity, forces, motion, composition of forces and velocities, resolution of forces and velocities, equilibrium of concurrent forces, equilibrium of parallel forces, equilibrium of non-concurrent forces, commercial and laboratory structures, elasticity, work, power, energy, friction, simple machines, practical study of machines, mechanical transmission of power, fluids, falling bodies; centrifugal force; the pendulum.

The author holds the position of Instructor in Industrial Physics at the Wm. L. Dickinson High School, Jersey City, N. J., and has tried out the material in his classes.

Knots, Splices and Rope Work, by A. Hyatt Verrill. The Norman W. Henley Publishing Co., 2 West 45th St., New York. Pocket size, bound in cloth, 104, 4½ x 6½ pages, 156 illustrations. Price, $1.

This little volume contains full directions for making most of the knots, splices, hitches and bends in use by seafaring men and riggers. It gives directions for making many of the ornamental knots used by those who "went down to the sea in ships" in the days when sailors were indeed sailors. The illustrations are vivid and the directions so complete as to be easily understood by the landlubber.

Everyone should know something of knots. As the author points out in his introduction, "a little knowledge of knots has saved many a life in storm and wreck and if everyone knew how to tie a knot quickly and securely, there would be fewer casualties in hotel and other fires.

Liquid Fuel. By Wm. H. Booth, Second Edition. Published by E. P. Dutton and Company, New York. Cloth, 6 x 9. 297 pages; 85 illustrations; 29 tables. Price $4.

A volume which contains much of the information included in the authors more elaborate work, LIQUID FUEL AND ITS COMBUSTION, issued in 1903, together with some more recent data on the burning of pertoleum fuel. The author deals, in the main, with English stationary and marine practice. He ignores the more advanced methods of burning oil as followed in America.

This would seem most unfortunate as the largest consumer of boiler oil is the United States and it is here that there is the greatest need of a thoroughly practical treasise on the subject as applying to American conditions. If the engineer wishes to obtain a general idea of the producton of crude oil, its chemical constitution and efficiency, as well as the precautions to be followed in burning oil, this volume will be found most desirable.

Pamphlets Received

Foreign Commerce Handbook. The Foreign Commerce Department, U. S. Chamber of Commerce, Washington, D. C. An exceptionally usable Foreign Commerce Handbook has just been issued by the Foreign Commerce Department of the Chamber of Commerce of the United States. Within the space of 31 pages this publication condenses a great deal of information as to sources of service in foreign trade. Its alphabetical arrangement makes it a handy reference work for the busy exporter or importer. The book contains also a list of the topics of national importance that are engaging the attention of the National Chamber's Foreign Commerce Department Committee under the chairmanship of Willis H. Booth of New York. As the first publication of its kind the handbook meets a distinct need in foreign trade circles.

Forthcoming Meetings

National Association of Cost Accountants. Third international conference to be held at Atlantic City, N. J. Sept. 23-28. Stuart McLeod, 130 West Forty-second St., New York, is secretary.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society of Mechanical Engineers, regional meeting, Sept. 25, 26 and 27, 1922, Hotel Kimball, Springfield, Mass. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

Second National Aero Congress and National Airplane Races, Detroit, Mich., October 7 to 14, 1922.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

National Founders Association, Nov. 22 and 23. Secretary, J M. Taylor, 29 South La Salle St., Chicago, Ill.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922. Grand Central Palace, New York City. Secretary, Calwin W. Rice, 29 West 39th Street, New York City.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Pig iron still scarce; No. 2 foundry, up 50c. in Birmingham, $1 in Philadelphia, $2 in Chicago and $3 in New York; basic advanced $2 in Philadelphia and $2.50 in Pittsburgh; bessemer, $1 higher per gross ton, in Pittsburgh. Structural shapes and soft steel bars, $2@$2.10 per 100 lb., f.o.b. Pittsburgh on ordinary business; $2.15@$2.25 for prompt shipments. Revival of buying by railroads, stimulating demand for plates; oil tank and ship plate buying also active. Leading interest quotes $2 on tank plates; independents, $2.10@$2.50 per 100 lb. Mill price of tin plates unchanged; steel rails, however, up $3 per ton, effective Oct. 1, the first change on rails in a year. Blue annealed steel sheets, in New York warehouses, up 16c.; black and galvanized, 30c. per 100 lb. New York also quotes advances of 15c. on hoops, 25c. on strips and cold-finished steel and 30c. on floor plates.

Zinc, 7½c. as against 7c.; Chinese antimony 7c. as compared with 5¾c.@6c. per lb., in New York warehouses. Lead demand active but prices stable; copper and tin also unchanged. Old metals, non-ferrous, up ¼c.@½c. per lb. in Cleveland.

Declines—Connellsville coke down 50c. per ton, prompt furnace and foundry; supply somewhat improved.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	34.64@35.64
Virginia No. 2	37.17
Basic	34.00
Grey Forge	33.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	32.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	32.50
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	8.0	5.25	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.[illegible]@2.60	4.19	3.50	4.00
No. 12	[illegible]@2.70	4.24	3.55	4.05
No. 14	2.70@2.80	4.29	3.60	4.10
No. 16	2.90@3.10	4.39	3.70	4.20
Black				
Nos. 17 and 21	3.20@3.35	4.70	4.05	4.70
Nos. 22 and 24	3.2[illegible]@3.[illegible]	4.75	4.10	4.70
Nos. 25 and 26	3.30@3.45	4.80	4.15	4.75
No. 28	3.[illegible]@3.[illegible]	4.90	4.25	4.85
Galvanized				
Nos. 10 and 11	3.35@3.50	4.90	4.25	4.85
Nos. 12 and 14	3.45@3.60	5.00	4.35	4.95
Nos. 17 and 21	3.75@3.90	5.30	4.65	....
Nos. 22 and 24	3.90@4.05	5.45	4.80	5.40
No. 26	5.05@4.20	5.60	4.95	5.55
No. 28	4.35@4.50	5.90	5.25	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	39½	24½
LAP WELD					
2	61	49½	2	34½	20½
2½ to 6	65	53½	2½ to 4	37½	24½
7 to 8	62	49½	4½ to 6	37½	24½
9 to 12	61	48½	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	39½	25½
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	35½	22½
2½ to 4	63	52½	2½ to 4	38½	26½
4½ to 6	62	51½	4½ to 6	37½	25½
7 to 8	58	45½	7 to 8	30½	18½
9 to 12	52	39½	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.29	3.50	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.06	5.50
Cold finished shafting or screw	3.90	3.60	3.70
Cold finished flats, squares	4.40	4.10	4.20
Structural shapes (base)	3.04	2.91	2.90
Soft steel bars (base)	2.94	2.81	2.80
Soft steel bar shapes (base)	2.94	2.81	2.80
Soft steel bands (base)	3.74	3.61	3.55
Tank plates (base)	3.04	2.91	2.90
Bar iron (2.45 at mill)	2.94	2.81	2.80
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{1}{16}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.50
Lead (up to carlots), St. Louis . 5.80; New York	6.60
Zinc (up to carlots), St. Louis . 6.50@6.55; New York	7.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	20.00
Antimony (Chinese), ton spot	7.00	7.75	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	15.75	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.25	20.50	18.75
Brass tubing (100-lb. lots)	22.50	23.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.75	18.50	15.75
Brass wire (carlots)	18.75	19.50	.....
Zinc sheets (casks)	9.25	9.25	.....
Solder (½ and ½), (caselots)	25.00	23.50	20.00
Babbitt metal (fair grade)	25.00	42.25	36.00
Babbitt metal (commercial)	15.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.25	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	4.50	4.75
Lead, tea	4.25	3.50	4.00
Brass, heavy	7.00	6.00	9.25
Brass, light	6.00	5.00	6.00
No. 1 yellow brass turnings	6.50	6.50	7.00
Zinc	3.00	3.50	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	5.80	7.25
IC,	14x20		7.25	6.05	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13¾, per lb.	.075	.06	.10
Wiping cloths, 13½x20½, per lb.	.08	.096	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville....per net ton		11.00@11.50	
Coke, prompt foundry, Connellsville...per net ton		12.50@13.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50-10%
1⅛ and 1¼x3 in. up to 12 in.	25%	50%	50-10-10%
With cold punched sq. nuts	30%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	20%	3.90 net	.....
Hex. head and hex. nut bolts	25%	....	65-5%
Lag screws, coach screws	45%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	....	55%
Tap bolts, hex. head, list plus	10%	....	.....
Semi-finished nuts ⅝ and larger	65%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$5.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.00	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	55%	60%	60%
Rivets, tinned	55%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	\$4.50	\$3.50	\$3.35
Cone heads, ditto (net)	4.60	3.60	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Calif., Los Angeles—J. Slater, 2626 South Hope St.—9 in. swing screw cutting machine, 3 ft. between centers, for machine shop.

Ill., Chicago—Emil J. Paslar Co., 1214 North Wells St., barber supplies, E. J. Paslar, Purch. Agt.—horizontal boring mill.

Ky., Louisville—Greathouse Bros., 654 ... power punch and shears for machine shop.

Md., Baltimore—A. Weiskittel & Son Co., 12th St.—one 60 in. x 60 in. x 12 ft. planer and 2 heavy engine lathes.

Mass., Jamaica Plain (Boston P. O.)—C. Carlson, 1 Boylston Pl.—small tools, drills and equipment for garage and machine shop.

Mich., Detroit—E. Gray, foot of Continental Ave.—machine shop equipment for proposed automobile service station.

Mich., Saginaw—A. F. Bartlett & Co., 910 South Linden St., A. M. Lemke, Pres.—one 16 in. or 18 in. heavy duty engine lathe with 10 ft. or 12 ft. bed, new or slightly used.

Mo., Kansas City—C. W. Berlett, 5729 Charlotte St.—power lathe and drill press for machine shop.

N. Y., Binghamton—Ornamental Iron & Welding Wks., A. Reynolds, Purch. Agt.—one shear, Henry Pels & Co., No. 13.

N. Y., Buffalo—L. Adler, 27 Walnut St.—machinery and equipment for garage and service station.

N. Y., Buffalo—R. H. Best, 236 Connecticut St.—equipment for garage and service station.

N. Y., Buffalo—Bronze Hardware Mfg. Corp., c/o W. H. Barlow, Pres., 108 College St.—machinery and equipment for the manufacture of automobile hardware and specialties.

N. Y., Buffalo—Earl Kinner, Inc., 91 Calvin St., A. G. Maddigan, Treas.—1,000 gal. gasoline tank with pump, and other equipment, for proposed gasoline and service station.

N. Y., Buffalo—A. J. Missert, 1477 Main St.—two 1,000 gal. tanks, two 5 gal. gasoline pumps and other equipment for gasoline and service station.

N. Y., Buffalo—J. Sattler, 1546 Delaware Ave.—machinery and equipment for proposed garage and repair shop on Auburn Ave.

N. Y., Buffalo—E. Waechter, 100 Ontario St.—machinery and tools for proposed garage and repair shop.

N. Y., Rochester — Jensen-McCollum, Inc.—machinery and equipment for garage and service station.

O., Columbus—Bingham Mfg. Co., manufacturers of tractors and truck wheels, H. S. Bingham, Pres.—two lathes, broaching machines, two grinders and other machinery.

O., Ironton—Ironton Boiler Wks., 511 North 2nd St., P. Meehan, Pres.—metal working machinery of various kinds.

O., Paulding—Paulding Wire & Iron Wks. Co., J. A. Nolte, Purch. Agt.—manufacturer of wire and iron products—metal working machinery.

O., Sandusky—Farrell-Cheek Steel Fdry. Co., foot of 1st St.—one 50 ton power press.

Pa., Canton—Canton Auto Sales Co.—machinery and tools for proposed garage and repair shop.

Pa., Canton—Keystone Garage Co.—machinery and tools for garage and service station, now being remodeled and enlarged.

Pa., Phila.—Ludwig Bros., 3226 Lee St.—one 6 ft. radial drill press, one 24 in. heavy duty shaper, one 42 or 48 in. planer, 12 to 14 ft. bed.

Tenn., Nashville—Standard Machine Co., 311 5th Ave.—machine shop equipment.

Va., Richmond—Pressed Metal Wks., Inc.—square shears, plating machinery and punch presses.

W. Va., Logan—Guyan Machine Shops—slitting shear and punch for 1 in. plate, also one 150 to 200 ton wheel press.

Wis., Appleton—Herman Motor Car Co., 680 College Ave.—automobile repair machinery for garage.

Wis., Appleton—Valley Motor Car Co., 726 College Ave.—machinery for proposed automobile repair shop.

Wis., Ashland—C. Walkusch—automobile repair machinery for proposed garage.

Wis., Mattoon—The Kratz Motor Co.—machinery for automobile repairing.

Wis., Milton—Burdick Cabinet Co., manufacturer of bath room cabinets and electrical medical apparatus—machine tools for proposed factory.

Wis., Milwaukee—Lynx Mfg. Co., 564 East Water St. (manufacturer of automobile accessories), L. P. Falconer, Purch. Agt.—punch press.

Wis., Oshkosh—Hathaway Buick Co., 25 Church St.—chain hoist and drills for proposed machine and repair shop.

Wis., Racine—Wisconsin Incubator Co., 1331 18th St.—sheet metal working machinery.

Wis., Sparta—Gross-Overland Co., M. Gross, Mgr.—machinery for auto repairing.

Ont., Chippewa—Davidson & Williams—complete equipment for garage and auto repair shop at Niagara Falls.

Ont., Port Elgin—W. S. Fenton—one engine lathe, with 12 ft. bed, back geared and compound rest.

Australia, New South Wales, Sydney—Benson Bros.—2 machines for making ½ in. washers.

Machinery Wanted

Cal., Owensmouth—G. W. Hector, (blacksmith) — shearing machinery and tire shrinker.

Conn., Norwich—Adams & Manning, 20 Thames St.—machine for crocheting cord or yarn around small rings.

Fla., Brooksville — Hernando County Dairy Co.—ice making and refrigerating machinery for proposed $65,000 dairy.

Fla., Miami—Biscayne Yacht & Machine Wks.—machinery for repairing and building yachts and other light water crafts.

Ga., Rome—Battery Mchy. Co., A. Butler, Purch. Agt.—one 10 x 12 Ingersoll Rand belt driven compressor, 100 lb. pressure, and one 50 hp. 3 phase, 60 cycle, 220 volt motor, with enough speed to drive compressor.

Ill., Chicago—Bauer & Black, 2500 South Dearborn St. (job printers)—Universal printing press, 14 x 22, with rollers.

Ill., Chicago—G. Mayer, 4238 Grand Blvd.—one crane, complete with clamshell.

Ill., Galesburg—C. A. Hall, 113-117 South Cherry St., manufacturer of candy—motor and candy maker.

Ind., Boonville—Enquirer—6 point linotype mats, remelting furnace, motor, belting and hangers.

Ia., Dubuque—The City, c/o O. E. Carr, City Hall—two 1,750 cu.ft. air compressors.

Kan., Wellsville—The Globe (newspaper)—three 10 x 15 ft. job presses for power attachment, also other printing equipment.

La., Oakdale—Oakdale American—power press.

Mass., Allston, (Boston P. O.)—Lincoln Laundry, 10 Wilton St., A. Lincoln, (owner)—machinery and equipment.

Mass., Brockton—Plymouth County Shoe Co., H. J. Feingold, Secy.—additional machinery for shoe plant.

Mass., Cambridge—Hingham Knitting Co., Charles River Parkway—"Banner" machine footers, 3 in. with 128 needles.

Mass., Haverhill—J. O. Ellison—air compressor with tank, drills, reamers and other small tools for garage, (used).

Mass., North Adams—Art Cloth Mills, Inc., H. D. Gagner, Pres.—several looms for small factory.

Mass., Waltham — Massasoit Knitting Co., Main St., T. E. Batey, Treas.—additional machinery for woolen mill.

Mich., Cadillac — Cadillac Lumber & Chemical Co., W. L. Saunders, Purch. Agt.—conveying and transfer machinery, power operated.

Mich., Detroit—Dodge Bros., 7900 Jos. Campau Ave.—complete equipment for proposed addition to automobile manufacturing plant.

Minn., Minneapolis—E. Walkup, 417 Hennepin Ave.—two linotypes.

Mo., Hartsburg—The Truth—newspaper press, paper cutter and other printing equipment.

N. Y., Buffalo—American Radiator Co., 603 Main St.—complete machinery and equipment for proposed $1,500,000 radiator factory at St. Paul, Minn.

N. Y., Buffalo—N. Bellanca, 350 Jefferson Ave.—shoe repairing machinery for proposed shop at 1389 Jefferson Ave.

N. Y., Buffalo—The Buffalo Bronze Die Casting Co., 90 Arthur St.—machinery and equipment for proposed addition.

N. Y., Buffalo—J. Economou, 2455 Seneca St.—machinery and equipment for proposed candy manufacturing plant.

N. Y., Buffalo—J. Mertz, 555 Sherman St.—equipment and tools for wagon repair shop at 12 Camp St.

N. Y., Buffalo—H. Mueller, Jr., 212 Forest Ave.—one cake machine, electrically driven, also other equipment for new bakery.

N. Y., Buffalo—Queen City House Wrecking Co., 68 Colorado St., W. G. Sweet, Dir.—machinery and equipment, electrically driven, for proposed saw mill.

N. Y., Buffalo—W. Sheehan, 52 East Utica St.—machinery and equipment for proposed broom factory.

N. Y., Buffalo—C. W. Siegel, 111 Eller Ave.—equipment for proposed bakery at 1175 Hertel Ave.

N. Y., Buffalo—Robertson-Cataract Electric Co., Mohawk and Elmwood Aves., manufacturer of switchboard equipment, J. D. Robertson, Pres.—machinery and equipment for proposed addition to factory.

N. Y., Canandaigua—Link Mfg. Co., 243 Gorham St.—machinery and equipment for enameling plant at Geneva.

N. Y., Cuba—Cuba Products Co., 26 West Main St., E. E. Moses, Dir.—machinery for food products plant.

N. Y., Gainesville—Gainesville Potato Assn., E. K. Lucas, Mgr.—machinery and equipment for handling and packing potatoes, for plant now under construction.

N. Y., New York—National Sponging Wks., 419 Lafayette St.—pile fabric brushing machine.

N. Y., New York—O. Sowers, 104 John St. (chemist)—machine for cutting small pinions.

N. Y., Orchard Park—Bd. Educ.—complete vocational equipment for high school, soon to be constructed.

N. Y., Rochester—Eastman Kodak Co.—machinery and equipment for proposed chemical factory in East Kodak Park.

N. Y., Rochester—I. Goldstein, 32 Oakman St.—several paper and lead cutting machines.

N. Y., Rochester—R. H. Gorsline, c/o New York State Sewer Pipe Supply Co., Union Trust Bldg.—special machinery and equipment for the manufacture of patented foto-tone, an apparatus for photographing sound waves.

N. Y., Tonawanda—King Electric Mfg. Co., 20 North Niagara St.—machinery and equipment for the manufacture of battery charging devices for automobiles.

N. C., Charlotte—Western Newspaper Union, 209 North Graham St.—ruling machine punch and perforator.

N. C., Hickory—Coast Line Overall Co. machinery and equipment for proposed branch factory at Monroe.

Okla., Dewar—United States Zinc Smelting Co.—new machinery and equipment for crushing and mixing departments, to replace that which was recently destroyed by fire.

Pa., Beaver Falls—Bd. Educ.—equipment for vocational department of new high school.

Pa., Canton—J. E. Roenitz—machinery, tools and equipment for plumbing shop now under construction, on Troy St.

Pa., Clarks Summit—Bd. Educ.—equipment for vocational department of proposed school.

Pa., Columbia — The Peerless Folding Box & Crate Co.—box and crate making machinery.

Pa., Lancaster—The Monitor Bi-Loop Radiator Co., Woolworth Bldg.—machinery and equipment for proposed addition.

Pa., Monaca—Bd. Educ.—equipment for manual training department of new high school.

Pa., Phila.—M. J. Hunts Sons Co., 251 Richmond St., (machinists) M. J. Hunt, Jr., Purch. Agt.—one complete cutting and welding outfit.

Pa., Phila.—D. I. Mann, Green St., contractor — portable log saw mill and engine.

Pa., Phila.—Robinson Iron & Steel Co., Parker & Umbria St.—stiff leg derrick, 40 ft. boom, about 3 ton capacity, complete.

Pa., Scranton—The Scranton Cap Co., 226 Penn Ave.—machinery and equipment for proposed addition to factory.

Pa., Scranton—Scranton Multigraphing Co., Rafter Bldg.—motor driven multigraphing machinery.

Pa., Wilkes-Barre — Lycoming Knitting Co., manufacturer of underwear and knit goods — machinery and equipment for branch factory at Dallas.

Pa., Williamsport—W. D. Crooks & Sons, Park St.—new machinery for proposed addition to factory for the manufacture of doors.

R. I., Providence—United Electric Ry. Co., Union Sta.—equipment for automobile repair shop.

S. C., Camden—Herfuth Engine & Mchy. Co.—one inclosed belt driven type ice making machine.

S. C., Florence—Florence Printing Co.—one power printing press.

Tenn., Copperhill—Copper City Printing Co.—one 9 x 12 job press for power equipment.

Tex., Austin—J. D. Miller—one 8 x 12 power job press, belting, hangers and supplies for job printing house.

Va., Ashland — Ashland Garage, V. Priddy, Purch. Agt.—burning in machine, battery torch, and oxygen air stand.

Va., Richmond—Eubank & Gaines, 1337 East Franklin St.—power cutting machine for printing plant.

Va., Richmond—Merchants Cold Storage & Ice Mfg. Co., 208 South 6th St.—compressors and one 120 ton ice making plant.

Va., Richmond—J. H. Rose Co., 16 North 13th St., (plumbing, roofing, cornice work) —10 ft. steel cornice brake.

Va., Richmond—Standard Electric Co., 1821 East Main St.—equipment for electrical repair and service works,(new).

Va., Richmond—Standard Printing Co., 1325 East Franklin St., A. L. Brockwell, Purch. Agt.—pony cylinder press.

Wis., Astico—Elba Condensing Co., J. W. Jones, Purch. Agt.—milk condensing machinery, power driven.

Wis., Athens—W. L. Erbach, woodworker —re-saw, motor driven.

Wis., Fredonia—Gilson Bros. Co.—equipment and motors for foundry.

Wis., Green Bay—Fairmont Creamery Co., 200 North Bway.—additional dairy machinery.

Wis., Jeffris—Larsen Lumber Co.—saw mill machinery, belting and shafting.

Wis., LaCrosse—J. F. and L. A. Keizer, 935 West Ave., S.—storage tanks, pumps, etc., for garage and filling station.

Wis., Milwaukee—Peerless Dye Wks., 3412 North Ave., F. W. Schmer, Purch. Agt.—dyeing and cleaning equipment.

Wis., Milwaukee—Rietbrock Land & Lumber Co., 700 Cedar St.—planer, rip saw, re-saw and cut-off saw, all equipped with individual motors, for proposed planing mill at Athens.

Wis., Sheboygan—Calumet Canning Co., c/o P. H. Peacock, 309 Michigan Ave.—machinery for pea and corn canning plant at Brillion.

Wis., Watertown—Perfection Table Slide Co., c/o W. C. Schultz, 603 Clyman St., manufacturers of tables and novelties—additional wood working machinery.

Wis., Wauwatosa—Milwaukee County Institutions, Bd. of Trustees, Watertown Plank Road, W. L. Coffey, Secy.—receiving bids until Sept. 25 for 2 automatic platform scales, 2 ton capacity.

Wis., West Bend—West Bend Construction Co., P. Berres, Purch. Agt.—sander (drum), planers, band saw and stickers.

Wis., Winneconne — Winneconne Cooperative Exchange, c/o J. Dreske—crushing, grinding, shelling and grain cleaning machinery for proposed grist mill.

Ont., New Toronto—Anaconda American Brass Co.—equipment for foundry at Port Credit.

Ont., Toronto—Glen Motors Ltd., Bank of Toronto Bldg.—machinery and equipment for proposed motor car plant to be erected along Niagara Frontier, possibly at Niagara Falls, Ont.

Que., Montreal—L. Bochom, 567 Delormier Ave.—anvil, forge and general equipment for blacksmith shop.

Que., Quebec—Price Bros. Co., 56 St. Pierre St.—machinery and equipment for the two proposed paper pulp mills at Kenogami.

Metal Working Shops

Calif., Atascadero—Doble Steam Motors Co., 714 Harrison St., San Francisco, will soon receive bids for the construction of a 1½ story, 100 x 500 ft. automobile factory, here. Estimated cost $100,000. Home Builders' Service Bureau (A. Roth), Atascadera, Archts.

Conn., Hartford—M. S. Little Mfg. Co., 151 Park Ave., manufacturer of plumbing goods, awarded the contract for the construction of a 1 story, 50 x 65 ft. addition to its factory. Estimated cost between $15,-000 and $20,000.

Del., Wilmington—Hilles & Jones Co. awarded the contract for the construction of a 2 story, 88 x 240 ft. foundry on 9th and Church Sts. Estimated cost $50,000.

Ill., Chicago—S. M. Earling, 140 South Dearborn St., is having plans prepared for the construction of a 1 story, 90 x 160 ft. garage, Montrose and Greenview Sts. Estimated cost $50,000. T. R. Bishop, 35 South Dearborn St., Archt.

Ill., Waukegan—Hewes Garage, 334 North Genesee St., is having plans prepared for the construction of a 2 story, 50 x 66 ft. addition to its garage. Estimated cost $40,000. National Constr. Co., 490 Virginia St., Milwaukee, Wis., Engrs.

Ind., Indianapolis—Olin Sales Co., 509 North Meridian St., awarded the contract for the construction of a 3 story, 51½ x 195 ft. automobile sales and service station, at 720-2 North Meridian St. Estimated cost $150,000. Noted Sept. 7.

Mass., Everett—Boston Elevated Ry. Co., 108 Massachusetts Ave., Boston, awarded the contract for the construction of substructures and foundations for two 160 x 300 ft. and two 53 x 56 ft. car repair shops and an 80 x 731 ft. transfer shop, here. Estimated cost, complete, $3,000,000. Noted Aug. 29.

Mass., West Springfield (Springfield P. O.)—Wico Electric Co., 132 Liberty St., awarded the contract for the construction of a 1 story, 90 x 400 ft. factory on West Rd. Estimated cost $100,000. Private plans. Noted Aug. 29.

Mass., Worcester — The Norton Co., Barbers Crossing, manufacturer of grinding wheels, awarded the contract for the construction of a 4 story, 50 x 125 ft. factory. Estimated cost $75,000.

Mass., Worcester — Wickwire-Spencer Steel Corp., 80 Webster St., awarded the contract for the construction of a 3 story, 33 x 100 ft. factory. Estimated cost $45,000.

Mich., Detroit—Dodge Bros., 7900 Jos. Campau Ave., are having plans prepared for the construction of an 8 story, 160 x 400 ft. addition to their automobile factory. Estimated cost $1,500,000. Private plans.

Mich., Detroit—E. Gray, foot of Continental Ave., is receiving bids and will open same about Sept. 23 for the construction of a 1 story, 34 x 260 ft. automobile service station, on Continental Ave. Estimated cost $40,000. Private plans.

Mich., Flint—The Fisher Body Ohio Co., East 140th St., and Coit Rd., awarded the contract for the construction of a 2 story, 202 x 401 ft. factory, for the manufacture of automobile bodies. Estimated cost $500,000.

N. J., Trenton — Mercer County Freeholders will receive bids until Sept. 26 for the construction of a 2 story, 55 x 75 ft. garage and warehouse on Brunswick Ave. Estimated cost $40,000. Noted Aug. 29.

N. Y., Buffalo—The Buffalo Bronze Die Casting Co., 90 Arthur St., plans to build an addition to its factory. Estimated cost $5,000. Private plans.

N. Y., Buffalo — The Cleveland Cold Drawn Steel Co., has been re-organized under name of Buffalo Cold Drawn Steel Co., Inc., and has purchased a 3¾ acre site here, and plans to construct a plant, 36,000 ton annual capacity. **F. R. Kew, Dir. and Production Mgr.**

N. Y., Buffalo—W. W. Grupp, 425 Humboldt Parkway, plans to build a 1 story garage, 50 ft. front, 64 ft. rear, 52 and 68 ft. sides, on Sycamore St. Cost will exceed $40,000.

N. Y., Buffalo—J. Sattler, 1546 Delaware Ave., plans to build a 50 x 272 ft. garage on Auburn Ave.

N. Y., Buffalo—E. Waechter, 100 Ontario St., plans to build a 2 story, 60 x 100 ft. garage on Ross Ave. and Ontario Sts. Cost to exceed $40,000.

N. Y., Hudson—The Holbrook Co., automobile body manufacturers, awarded the contract for the construction of a 100 x 260 ft. manufacturing building, also a 20 x 30 ft. service building, etc. Estimated cost $80,000.

N. Y., Long Island City — Walworth Realty Co., a subsidiary of Walworth Mfg. Co., 142 High St., Boston, manufacturer of Stillson wrenches, Walmanco joint and other steam and gas fittings, tubes, etc., awarded the contract for the construction of a 3 story, 76 x 132 ft. main building, a 1 story, 60 x 214 ft. storage building, a 1 story, 40 x 45 ft. garage and a 1 story, 45 x 116 ft. pipe shop, on Jackson Ave., here.

N. Y., Rochester—Jensen-MacCollum Co., 529 East Main St., awarded the contract for the construction of a 1 story, 100 x 155 ft. and 20 x 24 ft. auto sales building and service station, on Main St., E. Estimated cost $75,000.

O., Cleveland—F. Svoboda, 5377 Bway., is receiving bids and will open same about Sept. 22, for the construction of a 2 story, 45 x 139 ft. garage on Bway. and Mumford Sts. Estimated cost $60,000. Private plans.

Pa., Lancaster — The Monitor Bi-Loop Radiator Co., Woolworth Bldg., plans to build an addition to its factory, (25,000 sq.ft. floor space). Architect not announced.

Pa., Meadville—The Meadville Iron Co., Inc., Mill St., is receiving bids for the construction of a 1 story, 60 x 88 ft. factory addition, to be used as an annealing plant. O. Kohler, Pres., Shutts & Morrison, Marine Bank Bldg., Archts.

Pa., Monongahela—H. R. Downer and W. M. Rees, c/o Keystone Garage, are having plans prepared for the construction of a 2 story, 60 x 200 ft. garage. Estimated cost $40,000. Private plans.

Pa., Phila.—A. Box & Co., Inc., 813 North Front St., awarded the contract for the construction of a 1 story, 32 x 90 ft. and 30 x 110 ft. machine shop, on Ontario and Janney Sts. Estimated cost $6,000.

Pa., Pittsburgh—Graham Nut & Bolt Co., [illegible] West Carson St., awarded the contract for the construction of a 1 story manufacturing building. Estimated cost [illegible].

R. I., Pawtucket—H. & B. American Machine Co. awarded the contract for the construction of an additional story to its 3 story plant. Estimated cost $100,000.

R. I., Providence—Hope St. Garage Co., Inc., 535 Hope St., plans to build a 1 story garage and service station on 4th St., capacity [illegible] cars. Estimated cost $50,000. Architect to be announced later.

R. I., Providence—United Electric Ry. Co., Union Sta., awarded the contract for the construction of a 1 and 2 story, 85 x [illegible] ft. garage and repair shop on Melrose and [illegible] Sts. Estimated cost $100,000. Noted Sept. 14.

Wis., Appleton—Valley Motor Car Co. [illegible] College Ave., awarded the contract for the construction of a 2 story, 50 x 60 ft. garage and repair shop.

Wis., Ashland—C. Walkusch is receiving bids for the construction of a 2 story, [illegible] x 95 ft. garage. Estimated cost $40,000. Private plans.

Wis., Fredonia—Gilson Bros. Co. awarded the contract for the construction of a 1 story, 40 x 110 ft. foundry. Estimated cost [illegible]. Noted Aug. 10.

Wis., Jefferson—Probst Bros., c/o E. Probst, are preparing plans for the construction of a 1 story, 50 x 90 ft. garage. Estimated cost $40,000. Private plans.

Wis., La Crosse—J. F. and L. A. Kolzer, 925 West Ave., plans to build a 1 story, 50 x 60 ft. garage and filling station. Estimated cost $40,000. Architect not selected.

Wis., Milton—Federal Eng. Co., 444 Milwaukee St., Milwaukee, is receiving bids for the construction of a 1 story, 50 x 160 ft. factory here for the Burdick Cabinet Co., manufacturers of bath room cabinets and electrical medical apparatus. Estimated cost [illegible].

Wis., Neenah—Jaeger-Dowling Co., 214 South Commercial St., awarded the contract for the construction of a 2 story, 76 x 120 ft. garage and repair shop. Estimated cost [illegible]. Noted Aug. 29.

Wis., Oshkosh—Hathaway Buick Co., 25 [illegible] St., awarded the contract for the construction of a 1 story, 60 x 120 ft. machine and repair shop. Estimated cost [illegible].

Wis., Racine—W. J. Redden, Archt., [illegible] Arlington Ave., is receiving bids and will open same about Sept. 25 for the construction of a 1 story, 28 x 46 ft. addition to sheet metal department of the Wisconsin Incubator Co., 1331 18th St. Estimated cost [illegible].

Wis., Sheboygan—Kell Oil Co., c/o W. G. Kell, [illegible] North 9th St., awarded the contract for the construction of a 1 story, 40 x 90 ft. filling station and garage. Estimated cost $40,000. Noted July 6.

Wis., Sheboygan—Schnetzlewind & Zehm, [illegible] Indiana Ave., plan to build a 2 story, 50 x 100 ft. garage and repair shop. Estimated cost $45,000. Architect not selected.

Ont., Georgetown—J. N. O'Neil & Son have had plans prepared for the construction of a 2 story garage, automobile repair shop and blacksmith shop. Estimated cost [illegible].

Ont., Niagara Falls—Davidson & Williams, Chippewa, plan to build garage and auto repair shop, here. Estimated cost $50,000.

Que., Montreal—Quebec Liquor Comm., [illegible] plans to build a 2 story garage on [illegible] St. Estimated cost [illegible].

General Manufacturing

Calif., Berkeley—El Dorado Oil Co., University Ave. and 3rd St., awarded the contract for the construction of a 2 story addition to its factory. About $10,000.

Conn., Norwich—American Thermos Bottle Co., [illegible] Laurel Hill Ave., plans to build a large factory and warehouse.

Ill., Chicago—C. Hatzfeld, Archt., 7 South Dearborn St., is receiving bids for the construction of a 1 story, 47 x 105 ft. factory at 4317 Grand Ave., for the National Paint & Wall Paper Co., c/o architect. Estimated cost $20,000.

Mass., Fall River—Stevens Mfg. Co., Hartwell St., awarded the contract for the construction of four 1 story additions to its plant, for the manufacture of quilts, consisting of one 55 x 95 ft. addition to bleachery, one 45 x 55 ft. kierhouse, one 18 x 30 ft. caustic house and one 25 x 36 ft. filter house. Estimated cost $60,000.

Mo., Springfield—C. L. Rhodes Produce Co., 443 South Campbell St., will receive bids until Sept. 25, for the construction of a 2 story, 84 x 141 ft. plant. Estimated cost $50,000. Heckenlively & Mark, 642 Landers Bldg., Archts.

Mo., Springfield—Springfield Tannery Co., 314 Holland Bldg., is having plans prepared for the construction of a 1 story, 100 x 135 ft. factory, on Commercial St. Estimated cost $12,000. E. Hawkins & Co., 400 McDaniel Bldg., Archts.

N. H., Guild—Dorr Woolen Co. will build a 1 story, 45 x 50 ft. addition to its factory here.

N. J., Trenton—The Standard Inlaid Mfg. Co., East State St., manufacturer of linoleum, awarded the contract for the construction of a 2 story, 35 x 258 ft. factory. Estimated cost $50,000.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. Everything possible is done to insure authenticity and timeliness. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving. Your co-operation is invited.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

N. Y., Buffalo—Air Reduction Sales Co., 342 Madison Ave., New York, is having plans prepared for the construction of a plant here. Estimated cost $50,000. Francisco & Jacobus, 511 5th Ave., New York, Archts.

N. Y., Buffalo—W. Sheehan, 52 East Utica St., plans to build a 1 story, 32 x 42 ft. broom factory. Architect not announced.

N. Y., Geneva—Lisk Mfg. Co., 243 Gorham St., Canandaigua, plans to build an enameling plant, here. Estimated cost $1,000,000. Architect not announced.

N. Y., Long Island City—Perry Candy Co., 403 West Bway., New York City, will soon award the contract for the construction of a factory on Wilbur Ave., here. Estimated cost $75,000.

N. Y., Rochester—Eastman Kodak Co. plans to build a factory for the manufacture of chemicals, in East Kodak Park. Estimated cost $29,000.

O., Cleveland—A. Claus Mfg. Co., c/o A. H. Claus, Pres., 6701 Walworth Ave., manufacturer of store fixtures and cabinets, awarded the contract for the construction of a 1 story, 80 x 450 ft. factory and a 1 story, 80 x 240 ft. warehouse, on Brook Park Rd. Estimated cost $250,000.

O., Cleveland—W. E. Grimm, 3383 De Sota Ave., (manufacturer of candy), has had plans prepared for the construction of a 1 story, 40 x 100 ft. factory, at 3703 East 93rd St., here. Estimated cost $40,000. Private plans.

Pa., Columbia—The Peerless Folding Box & Crate Co., is having plans prepared for the construction of a 1 story, 60 x 200 ft. modern box and crate factory. Estimated cost $40,000. F. S. Sheeman, Swan Annex, Johnstown, Archt. Noted Aug. 17.

Pa., Glenshaw—Ball Chemical Co. awarded the contract for the construction of a 2 story, 64 x 113 ft. warehouse and manufacturing plant. Estimated cost $25,000. Noted Sept. 7.

Pa., Pittsburgh—Gulf Refining Co. is having plans prepared for the construction of a 144 x 175 ft. oil refinery plant on Mathilda and Gross Sts. Private plans.

Pa., Williamsport—W. D. Crooks & Sons, Park St., are having plans prepared for the construction of a 2 story, 125 x 160 ft. addition to its factory for the manufacture of doors. Estimated cost $75,000.

Va., Richmond—Ophuls & Hill, Inc., Engrs., 112-114 West 42nd St., New York City, will receive bids until Sept. 25 for remodeling plant here, install engines, compressors and a 120 ton ice making plant, etc., for the Merchants Cold Storage & Ice Mfg. Co., 208 South 8th St., Richmond. Estimated cost $250,000. N. Old, Jr., Mgr.

Wash., Brewster—The Standard Oil Co., Realty Bldg., Spokane, will receive bids until Oct. 1, for the construction of a 1 story, 40 x 60 ft. distributing station, including tanks, motor engines, etc., here. Estimated cost $20,000. G. E. McKay, Realty Bldg., Spokane, Engr.

Wash., Elk—The Standard Oil Co., Realty Bldg., Spokane, will receive bids until Oct. 1, for the construction of a 1 story, 40 x 60 ft. distributing station including, tanks, motor equipment, etc., here. Estimated cost $20,000. G. E. McKay, Realty Bldg., Spokane, Engr.

Wash., Elliot—The Standard Oil Co., Realty Bldg., Spokane, will receive bids until Oct. 1, for the construction of a 1 story, 40 x 60 ft. distributing station, here. Estimated cost $20,000.

Wash., Republic—The Standard Oil Co., Realty Bldg., Spokane, will receive bids until Oct. 1, for the construction of a 1 story, 40 x 60 ft. distributing station. Estimated cost $20,000.

Wash., Wilsoncreek—The Standard Oil Co., Realty Bldg., Spokane, will receive bids until Oct. 1, for the construction of a 1 story, 40 x 60 ft. distributing station including tanks, motor equipment, etc., here. Estimated cost $20,000. G. E. McKay, Realty Bldg., Spokane, Engr.

Wis., Antigo—The Faust Lumber Co. plans to build a 1 and 2 story, 75 x 190 ft. sawmill to replace the one which was destroyed by fire. Estimated cost $75,000. Architect not yet selected.

Wis., Antigo—Pacific Ice Cream Co. is receiving bids for the construction of a 2 story, 50 x 64 ft. ice cream factory. Estimated cost $50,000. H. Quackenbush, Mgr. Private plans.

Wis., Athens—Rietbrock Land & Lumber Co., 700 Cedar St., Milwaukee, will build a 2 story, 40 x 80 ft. planing mill, here, also a small blacksmith shop, etc. Private plans.

Wis., Green Bay—Fairmont Creamery Co., 200 North Bway., is having plans prepared for the construction of a 1 story, 40 x 60 ft. addition to its creamery. Foeller, Schober & Stephenson, Nicollet Bldg., Archts.

Wis., Milwaukee—Air Reduction Sales Co., 342 Madison Ave., New York, is having plans prepared for the construction of a 1 and 2 story, 30 x 80 ft. addition to its factory here on Buffum St. Estimated cost $30,000. Francisco & Jacobus, 511 5th Ave., New York, Archts.

Wis., Pardeeville—The Pardeeville Canning Co. plans to build a 2 story, 60 x 90 ft. factory. Estimated cost $40,000. Architect not selected.

Wis., Sheboygan—The Excelsior Wrapper Co., 1636 Erie Ave., awarded the contract for the construction of a 1 story, 142 x 148 ft. factory. Estimated cost $25,000. Private plans.

Wis., Winneconne—Winneconne Co-operative Exchange, c/o J. Dreske, plans to build a 2 story, 28 x 30 ft. grist mill. Estimated cost $10,000. Private plans.

B. C., Elko—Wigwam Pulp & Paper Co. awarded the contract for the construction of a 25,000 hp. power house, concrete dam, and also a sulphite paper making plant, 100 ton per day capacity. Estimated cost, first unit $3,500,000, total $10,000,000.

American Machinist

Volume 57 | NEW YORK, SEPTEMBER 28, 1922 | Number 13

Manufacturing Car and Locomotive Axles

Steel Specifications and Machining Operations—Inspection and Tests Forging Under Hydraulic Presses—Hollow Boring and Heat-Treating

BY NATHAN S. FROHMAN
Chief Inspector, Pollak Steel Co.

THOUGH railroad car and locomotive axles play a very important part in the transportation systems of the country, comparatively little is known of the "how and why" of the steps taken in their manufacture. That they are products requiring quality production, and that at the same time economy and efficiency in their manufacture are prime requisites, go almost without saying. The methods outlined in this article are those of the Pollak Steel Co. of Cincinnati, O., Marion, Ohio, and Chicago, Ill.

Steel used in the manufacture of standard car axles must be made by the open hearth process and must conform to the following requirements for chemical composition:

Carbon	0.38 to 0.52	per cent
Manganese	0.40 to 0.70	per cent
Phosphorus, not over	0.05	per cent
Sulphur, not over	0.05	per cent

Before forging, drillings are taken from each heat or melt of steel and an analysis is made to see that the steel conforms to these requirements.

The standard railroad car axles are forged from square billets. It is necessary that the billets be of sufficient size that proper reduction can be made in forging them down to axles, as the working down of the steel refines the grain and adds to its quality. Standard practice is to give a reduction of 2 to 1 in cross sectional area. Each heat of billets is maintained intact, properly identified and as a unit is conveyed into the forge shop, to furnaces in which the billets are to be heated. The waste heat from these furnaces is utilized to generate the steam which operates the forging hammers. After forging, the axles are placed on cooling racks, inspected for size and straightness, and, when cold, transferred to the machine shop.

The first machining operation is that of cutting the axles to length. Both ends are cut off at the same time in special machines, each of which is equipped with two toolposts and a centrally located driving chuck. They are then inspected for size and surface defects, the ends drilled for lathe centers in a two-spindle machine that centers both ends of the axles at the same time.

Rough Turning

The axles are then placed on a rack leading to the rough turning lathes, where the wheel seats and journals are rough turned. Practically all standard axles are rough turned only on the wheel seats and journals, though some are rough turned over the entire length. On axles rough turned only on wheel seats and journals that part between the wheel seats is smooth forged to size. One of the principal reasons for rough turning is to relieve the purchaser from performing this operation, thus keeping his lathes in first class condition to perform the finish turning operation. Rough turning also reduces the shipping weight, and at the same time reveals defects just under the surface which might otherwise remain unseen. The axles are turned on special "double-header" axle turning lathes, Fig. 1. A dog attached to the middle of the axle is driven by a centrally located driving gear. Tools mounted on carriages at each end of the lathe turn the journals and wheel seats at each end of the axle simultaneously.

Each heat of rough turned axles is laid on separate racks provided for the purpose, as shown in Fig. 2, and inspected for size and surface. The heat is then ready for the final inspection by the purchaser's inspector. The axles must conform to American Railway Association specifications. A test axle is selected from each heat or melt of steel and this axle must conform to the following drop-test requirements:

"The test axle shall be placed on supports (Fig. 3), three feet apart, so that the tup (weight) will strike it midway between the ends. It shall be turned over after the first and third blows. When tested in accordance with the following conditions, the axle shall stand the specified number of blows without fracture, and the maximum permanent set as the result of the first blow shall not exceed that specified in the table herewith:

STANDARD A.R.A. SPECIFICATIONS FOR STEEL AXLES

Size of Axle, Inches		Weight of Tup, 2,240 Lbs.		Supports 3 ft. apart
Journal.	Dia. at Center	Height of drop, feet	Number of blows	Maximum permanent set result of first blow, inches
$4\frac{1}{4}$ x 8	$4\frac{3}{4}$	$22\frac{1}{2}$	5	$7\frac{1}{2}$
5 x 9	$5\frac{3}{8}$	29	5	$6\frac{1}{4}$
$5\frac{1}{2}$ x10	$5\frac{7}{8}$	$34\frac{1}{2}$	5	$5\frac{1}{2}$
6 x11	$6\frac{7}{16}$	$41\frac{1}{2}$	5	$4\frac{3}{4}$

The deflection is the difference between the distance from a straight-edge to the middle point of the axle, measured before the first blow, and the distance measured in the same manner after the blow. The straight-edge shall rest only on the ends of the axle. The anvil of the drop-test machine on which the axle rests shall be supported on springs and shall be free to move in a vertical direction, and shall weigh 17,500 pounds.

If the test axle passes the drop test, drillings are taken for a check chemical analysis by the purchaser, so that he may know that the steel conforms to the required specifications. If the test axle passes both drop and chemical tests, all the axles in the heat or melt represented by that axle are accepted so far as these

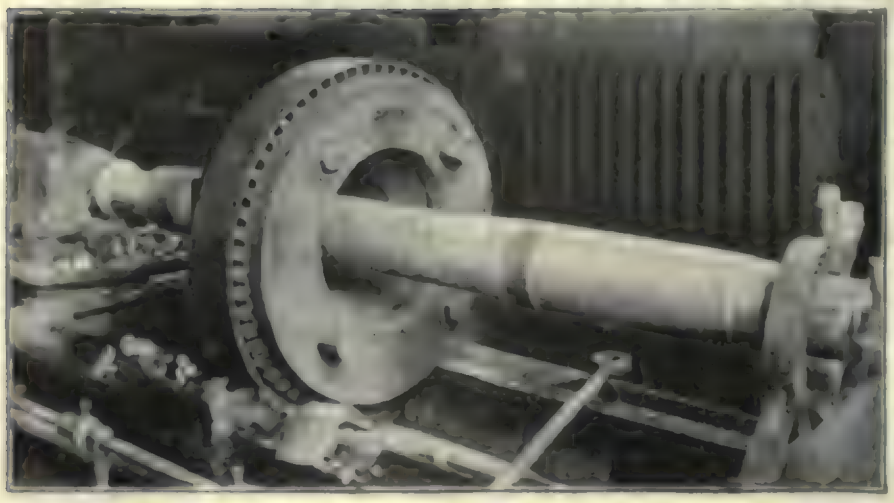


FIG. 1—ROUGH TURNING WHEEL SEATS AND JOURNALS

requirements are concerned. Each axle is then inspected for workmanship, size and defects.

For special axles for interurban, mine, narrow gage, and other cars, the forging and other manufacturing operations are the same as those for standard car axles, except that practically all interurban axles and some few other special axles are heat-treated and rough turned all over.

Locomotive Axles

There are three types of locomotive axles, namely truck, driving and trailing.

Truck axles are used in the small truck at the front end of the locomotive. They carry comparatively little of its weight. They are forged in the hammer shop, the forging operation being similar to that for car axles. Practically all truck axles are either annealed or heat-treated.

Driving axles are the heavy axles on which the large driving wheels are mounted, and the number under one locomotive varies from two to twelve. These axles bear practically all the weight of the locomotive, transmit the power to the driving wheels, and their importance to "safety in service" justies the greatest of care and attention in the processes of their manufacture.

Trailing axles are slightly smaller than driving axles, though considerably larger than truck axles. This difference in size is due to the fact that they carry the greater portion of the weight not carried by the driving axles. Some types of locomotives do not require the trailing axle. On locomotives requiring them they will be found back of the driving axles and just below the cab.

Due to the fact that locomotive driving and trailing axles carry great loads and are subject to great stresses, and therefore are comparatively large in diameter, particular care must be taken in the forging operation.

After years of experience the Pollak Steel Co. has determined that better locomotive axles are obtained by forging under hydraulic presses than under steam hammers. The size of the billets used for car axles is such that the working effected by the heavy blow of the hammer is sufficient to obtain the proper grain structure and produce a uniform product. However, in the case of the larger blooms used for locomotive axles the blow of the hammer affects merely the outer portion, or skin of the forging. In order to secure the proper working of the inner portion as well a heavier pressure is required, and this is obtained only under a hydraulic press. The higher quality of the finished product justifies the increased cost. A 1,000-ton hydraulic press is shown in Fig. 4. The heating furnaces are shown at the left.

The locomotive axles are forged from large blooms, which are of such size as to insure the necessary reduction to refine the grain structure of the steel. Here again, the standard practice is a reduction of two to one.

One of the most important factors in the forging operation is proper and accurate regulation of temperatures at which the steel is worked. Much of the life of a piece of steel may be destroyed by excessive heating or by forging at too low a temperature. Therefore, at all times it is necessary to have the steel at just the proper temperature.

After forging, the axles are allowed to cool on a cinder bed, in order that the cooling may proceed slowly and the steel may have all the time necessary to make the desired changes in physical structure while passing through the critical ranges of temperature.

The driving and trailing axles come from the press in multiple lengths, each bloom making four to six axles, depending upon the weight of the original bloom and the weights of the axles forged therefrom. These long multiple axle shafts are taken to a saw adjoining the press shop, and the axles are sawed to approximate length.

Hollow Boring

The next operation depends upon the specifications. If they call for hollow boring and heat treating the axles are first hollow bored in special boring machines, Fig. 5, and then conveyed to the heat-treating department. If the specifications call for heat-treatment only, the axles are sent direct from the saw to the heat-treating

FIG. 2—SIZE AND SURFACE INSPECTION JUST PREVIOUS TO SHIPPING

FIG. 3—DROP-TESTING MACHINE

department. Usually, however, when axles are heat-treated they are also hollow bored. The practice of hollow boring and heat-treating locomotive axles is rapidly becoming a universal custom. Hollow boring is nothing more nor less than boring a hole through the center, the entire length of the axle.

Axles are hollow bored for a number of reasons. First, it increases the heating and cooling surface, thus permitting a more uniform heating and cooling in the heat-treating processes, as the heating and cooling of the axle may then proceed from the inner wall as well as from the outer surface. This uniform cooling is especially important for quenched forgings, where the change in temperature is very rapid, for if the material is not cooled uniformly very large internal stresses are set up.

Second, no matter how careful the steel manufacturer may be in giving a big discard from his ingot and though there is very close inspection, there is still a chance for ingots and blooms to contain piping and segregations which cannot be detected from the outside. This piping and segregation cause internal defects which gradually grow, due to vibration in service, until they become so large that the axle breaks. Hollow boring removes segregation. Should there be any piping it is discovered by careful inspection of the interior of the axle through the bored hole, and the axle is scrapped. A pipe in a driving axle discovered by hollow boring is shown in Fig. 6.

Third, locomotive axles are hollow bored with 2-, 3- or 4-in. holes. As the strength of the axle is proportional to the cube of its diameter, removing the central core reduces the strength but little. This is especially true because the core of the axle generally contains a poorer grade of steel than the rest of the axle. While the strength of the axle is proportional to the cube of the diameter, the weight is proportional to the square of the diameter. In these days of high speeds and heavy loads, it is advantageous to have stronger axles without increased weight. It can readily be seen that by adding to the outside diameter of the axle and by hollow boring to keep down the weight, the axle can still retain its original weight and be much stronger.

Heat-Treating

Axles are either annealed or heat-treated. Annealed axles are heated in the heat-treating furnace and are then either air cooled or furnace cooled. Heat-treated axles are heated, quenched in oil, reheated to drawing temperature and then either air cooled or furnace cooled. Annealing refines the grain size of the steel and removes forging strains, thus increasing the ductility and toughness of the steel.

Locomotive axles are heat-treated in order to refine the grain of the steel, thereby increasing its strength, toughness and wearing qualities, as evidenced by the increase in ultimate strength and elastic limit, as well as the elongation and reduction of area. Heat-treatment relieves forging strains, increases the toughness and ductility of the steel and adds to its tenacity and strength. The effect is shown in Fig. 7 by the reproduc-

FIG. 4—1,000-TON HYDRAULIC AXLE FORGING PRESS

FIG. 5—HOLLOW BORING A LOCOMOTIVE AXLE

tion of microphotographs of the grain structure of an axle as forged, after annealing and after heat-treating.

The furnaces used for the heat-treatment of axles, shown in Figs. 8 and 9, are 22 ft. long and 12 ft. wide. They are oil burning and are designed to heat uniformly throughout. The bottom of the furnace is removable and is of the car type. It rests on wheels that move over a double track. The car is moved into and out of the furnace by the use of cables and an electric motor. The door of the furnace is of the vertically lifting type and is operated by compressed air.

The two most important factors in the heat-treatment of steel are heat control and heat measurement. The necessity for great accuracy in these two facts can be readily understood when it is known that a variation of 15 deg. F. in the temperature of a furnace can radically change the desired grain structure of the steel, and consequently the quality and character of the finished product.

FIG. 6—DRIVING AXLE, SHOWING PIPE FOUND BY HOLLOW BORING

Accordingly, each furnace is equipped with six thermo-couples to accurately measure the heat. These thermo-couples are arranged so that there is one at each end and one in the center of each side of the furnace. They are tested each week by checking them against a standard pyrometer. In addition to the thermo-couples, recording instruments give a graphic record of the temperatures maintained throughout the treatment of each furnace load of axles. A contral station is shown in Fig. 10. The temperature of any furnace connected thereto is shown at all times. The oil burners for the heat-treating furnaces permit a very close regulation and the temperature of the furnace can be controlled to within a variation of 5 deg. Fahrenheit.

When the axles have been heated to the temperature necessary to obtain the desired results, they are removed from the furnaces and dipped in a quenching

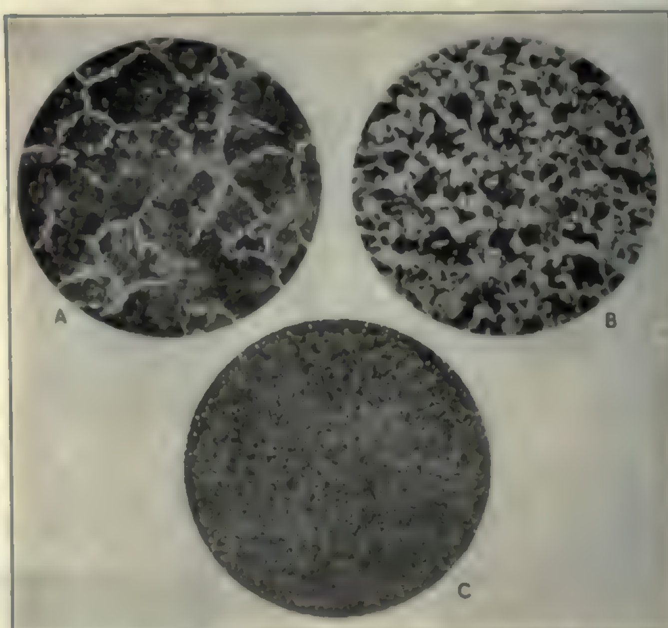


FIG. 7—MICROPHOTOGRAPHS SHOWING THE GRAIN STRUCTURE OF AN AXLE. (*A*) AS FORGED. (*B*) AFTER ANNEALING AND (*C*) AFTER HEAT-TREATING

tank, Fig. 11. The tank is located at a distance of 10 feet from the heat-treating furnaces. It is 12 feet in diameter and 22 feet deep. Oil, which is the only quenching fluid used, is pumped through a series of coils located under water in a 150,000 gal. reservoir, after which it is returned to the quenching tank. The circulation maintains the quenching fluid at a uniform temperature. In addition, while passing through the tank the fluid is agitated by compressed air in order to assure thorough circulation.

The door of a heat-treating furnace can be raised, the car removed and a charge lifted from it and dipped in the quenching tank in nineteen seconds. This speed of operation is made possible by the furnace design and equipment and the close proximity to the quenching tank.

After-heat treatment, all locomotive axles are tested for their physical properties. Tests are taken from a certain percentage of axles from each heat of steel in a furnace load. A test piece, 1 in. in diameter by 4 to 6 in. long is cored from a prolongation on the end of

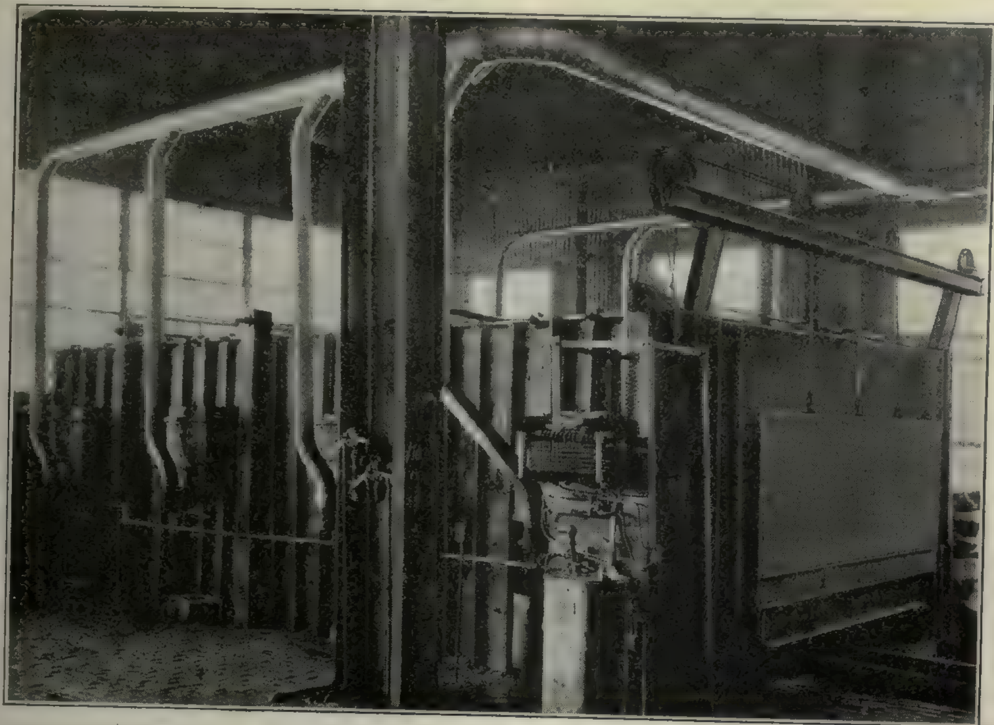


FIG. 8—CAR AND LOCOMOTIVE AXLE ANNEALING FURNACE

the axle, being taken from a point midway between the center and the outside surface. After testing, these prolongations are cut off. The middle section of the test piece is turned to ½ in. in diameter by 2 in. long. The ends are used for grips in the testing machine. The piece is then tested and its physical properties ascertained. If a bend test is required, a second test piece is cored from the test prolongation on the same axle. This piece is then planed to a ½ in. square cross section and tested in a bending machine. It must give a bend of 180 deg. without fracture.

All axles that have been quenched and drawn are subjected to a proof or shock test. Each axle is supported near the ends and a weight of 2,240 lb. is dropped on it from a specified height, depending on the diameter of the axle. The weight is dropped on the axle twice, the axle being turned through an angle of 90 deg. between the two shocks. If the axle has internal flaws which can be detected in no other way, they will usually be discovered by this proof test, and the axle will break where the flaws are located.

After having met the physical test specified, the axles are moved to the machine shop adjoining the heat-treating department. There they are rough turned on "double header" lathes. Locomotive axles are rough turned all over.

After the rough turning operation is completed, the axles are inspected for size, workmanship and surface appearance. Throughout the manufacture there is a thorough surface inspection of all material after each operation. Thus any defects which develop cause the axle to be scrapped at once, and no further time or labor is wasted upon it.

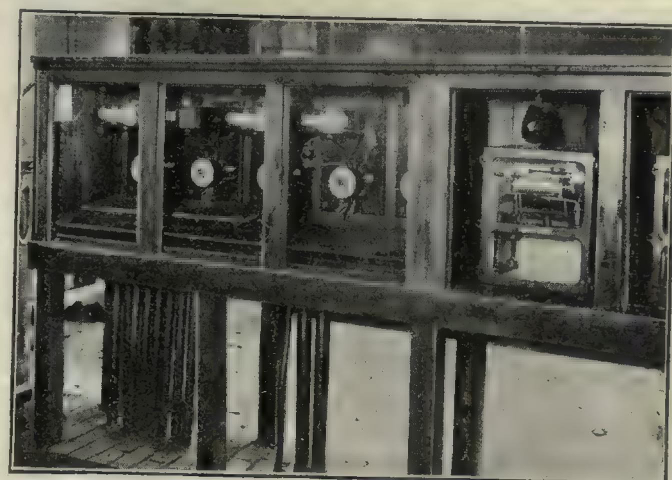


FIG. 10—A CONTROL STATION IN THE HEAT-TREATING DEPARTMENT

FIG. 9—LOCOMOTIVE AXLES READY TO BE ANNEALED.

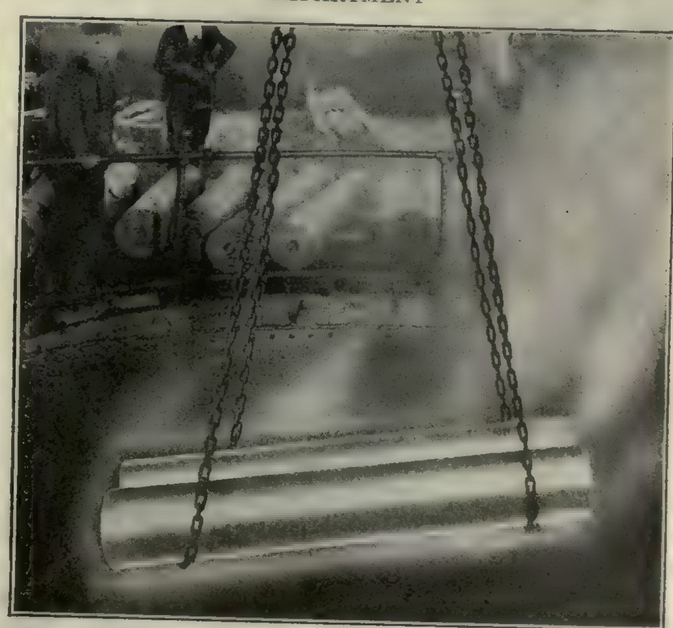


FIG. 11—QUENCHING HOLLOW-BORED LOCOMOTIVE AXLES

Getting a Profit Out of Low Prices

Dangers of Baseless Business Optimism—Rising Prices Not Essential to Business Success—Importance of Accurate Cost Information in Dull Times

By WILLIAM R. BASSET
Of Miller, Franklin, Basset & Company

ONE rarely attends a public luncheon or dinner, in these days, without being assured by some speaker, hired or lured into being present because of his rare knowledge of business conditions, that the worst is over and that sometime in the near future, usually about three months hence, business will have "returned to normal." Invoking prosperity has become something of a cult with us and a poor speaker is one who hangs crape all over the hall. A good speaker, on the other hand, arouses his audience to cheers with the promise of nice, fresh money coming in, unaided and by the barrel. Prosperity speakers have been in demand for two years past as have been prosperity slogans. What might better be in demand, is calm common sense with which to think out and tackle the real problems of business in the present and near future. Business today is a real problem and one not to be solved by those with the notion that, if only they sit tight long enough, business will come to them of its own accord and that, therefore, the use of brains will not be necessary.

All this talk of the coming of prosperity is, from one viewpoint, quite harmless and amusing. It helps those who are deep in sorrow because men in business, in spite of the legend of the hardhearted business man, are essentially emotional. They are dejected when prices go down, for the reason that they have been trained to believe that good business is always accompanied by rising prices. It is true that more men make money in a rising than in a falling market and that the amount of skill required to do business is in inverse ratio to the rate at which prices are rising. When they are going up very quickly it requires the minimum skill to make money. It takes skill to avoid making money. And, since the science of business is so little known, the number of men who can adjust themselves to make money, more or less regardless of prices, is so small as not to affect the opinion of the majority.

Prices Cannot Always Go Up

Most concerns are managed on a basis which is essentially emotional. The harmful part of making prophecies regarding prosperity, however, is that the prognosticators talk in terms of rising prices while they tend to block a necessary revision of prices and methods of manufacturing and selling. People are led to believe that the fight to keep up prices may be made effective and that business is prosperous as it prices—not as it serves.

Just as the less enlightened labor unions put restrictions on production, so also do the less enlightened manufacturers and distributors put restrictions on prices. The union, by limiting a worker's output and closely circumscribing his duties so that five men are required to do the work of one, seeks to create an artificial labor famine. The manufacturer and the distributor, by curtailing supplies, try to create an artificial goods famine. Neither recognizes that a fight against cheapness is a fight against plenty and actually a danger to industrial health and real business stability. Conditions are not, to use the language of the market reports, "improved" when a price stops falling or even rebounds a bit. Indeed, that may be only a sign of blocking the way to sound prosperity.

High prices are a boon to poor manufacturing. They provide a margin for the man who does not know what he is doing. The man who does know what he is doing looks at a high price as a physical culturist looks at a fat man, something that has to be sweated down. The wholly remarkable success of Henry Ford has not been the result of magic. He has simply employed the utmost of science in working out his designs, his methods of manufacturing, and his methods of distribution. The result is that his business volume has steadily increased and others have stood still or gone backward.

We are passing into a period where price for quality will control. That sort of business has to be planned because it cannot be opportunist. Low price and high quality can be given only as a result of carefully planned operations and manufacturing on a narrow margin of profit cannot be carried on long if any controllable factors are left uncontrolled. Small slips in a business with a high margin of profit may mean failure if it happens in a high volume establishment where fractions of pennies have to be reckoned with.

The World's Burden of Debt

There is no reason to believe that for a very long period to come prices can be other than low. This country, and every other large manufacturing country of the world, is burdened with debt. A certain number of hours out of every man's week, whether he knows it or not, have to go to paying for war and its wastes. We have each of us assumed a portion of the war debt, a portion more or less adjusted to our means. We cannot, therefore, whether we are employers or employed, reasonably expect to have an adequate surplus unless each dollar that we spend is well spent. Inflation, as through the bonus, may disturb prices but the relations will eventually be on the basis of small return in goods for large effort.

There used to be a notion that, if only the advertising were forceful enough, the price did not matter. Everyone remembers the top-lofty, "I do not manufacture for price—I manufacture for quality, I cater only to the 'quality market.'" That idea never got over in any country but the United States. It is true that English goods were sold the world over at higher prices than German goods, but they were sold on service. They were sold as being cheaper in the end than other goods of which the first cost was less. That principle will never alter. Neither will the principle that an article which is almost a work of art can make its own price. Art or any extraordinary quality which approaches art is non-competitive. But how much "quality" is really quality? How much is backed by service? And how much is just bunk?

The European nations always have been close buyers. Their people shop around, and disagreeable, time-wast-

ing bargaining prevails. It is a fact that no American product has ever held successfully in a European market unless it gave a better dollar's worth than any other product. The same rule will determine success in the American market and it cannot be otherwise. People must buy carefully. What was termed the "buyers' strike," it is beginning to be learned, was the starting of a new and permanent buying attitude.

The man who expects to sell now or in the future has got to get his prices down to where people can buy. He can get his prices down by selling below cost and can then more or less painlessly retire from business. With that process I am not concerned. I am concerned with the exemplification of how to make prices so low and quality so high that good business will be assured. Good business is business paying adequate wages and earning adequate profits.

Ascertaining Sales Expense

The first step toward attaining this desirable end is the ascertaining of costs. It seems extraordinary that there could be any question as to the value of cost finding and cost keeping. Perhaps there is no question as to its value, for most manufacturers and distributors think that they know costs. The majority will not even go to the trouble of making certain that they know costs. A delusive cost system is much worse than none at all. Most home-made systems are delusive. They do not take enough factors into consideration.

For instance, the common method of getting at sales expense is to divide the total of merchandise by the total of sales expense. The figure thus obtained is supposed to be the percentage cost per dollar of sales. It may or it may not be. If all the goods are exactly alike, priced exactly alike, and sold under exactly the same conditions, the figure will be accurate. But that condition practically never exists. What really results from this method of calculating is the loading of high-priced articles with such a volume of sales expense as to make their movement difficult and to relieve low-priced articles of so much sales expense that actually they are often sold at a loss. I know one wholesale booksellling corporation, doing a large business, principally through the mails, that believes costs can be found by this simple process of division. They believe that their sales expense is twenty per cent. They get an average discount from the publishers of between forty and fifty per cent and they allow a discount to their customers of from ten to twenty per cent. They make money selling a five-dollar book. They lose money selling a single one-dollar book. And, therefore, although their business is a very large one, their total profits, at the end of the year, are inordinately small considering the volume and the credit risk taken. If they knew their costs, they could arrange combinations of orders that would offer substantial advantages to buyers and, at the same time, assume more profit to themselves.

Units of Sale

The subject of units of sale is one which deserves a great deal of attention from business men. It is enough to point out that the unit is to be determined by the costs and when that unit is once determined, then variations from it have to be sold at prices dictated by the costs. If, say, twelve dozen articles constitute a case, eleven dozen cannot be shipped at the same price per dozen as a full case. The breaking of a case and the repacking involve an additional cost. It is not feasible, because it goes against buying habits, to quote a price for case lots and a higher price for broken lots. It is better business to quote a price per dozen with a substantial discount for case lots.

Sales costs are rarely accurate, and manufacturing costs are in but little better condition. One of the many fallacious ways of estimating a manufacturing cost is to compare the labor and overhead with the cost of the material. This method can almost never give a figure that means anything because the value of the material is only a factor entering into the cost of the finished product. The value of the material in no way determines the amount of work that has to be put upon it or the space that it occupies. There is no single method, no system of cost accounting that will give exact results through even a single factory or store, much less through all factories and stores, and it is for this reason that expert assistance must usually be had. I think that this is generally recognized but the recognition is accompanied by the fear that an expert will install a complex system which will be difficult to operate.

I admit that many such installations have been made and also that there are some problems in cost accounting that do not permit a simple solution. But there is a degree of refinement beyond which it is not necessary to go. Simplicity is the keynote of modern cost accounting. There was once a belief that absolutely accurate figures should always be obtained but common sense has taught that beyond a point, the expense of collating with absolute accuracy is a waste of time and money. In such cases it is usually possible to set standards which can be revised from time to time.

Accurate Costs in a Fiber Manufacturing Plant

In the manufacture of vulcanized fiber, the paper has to be immersed in a chemical solution for a length of time depending upon the thickness of the paper. It was very difficult to obtain costs on this operation and quite out of the question to treat each lot as a separate unit for cost determination. Instead of attempting any such impossible program, experiments were undertaken by which correct costs were achieved at considerable expense for each kind of article. Then these costs were accepted as standard. They are revised from time to time, according to the price of the materials used, but since there has been no change in the general process, the basic cost relation has remained unchanged and several checks put upon it have demonstrated it to be essentially accurate.

No, a cost system, to be accurate enough for all ordinary business purposes, does not also have to be elaborate. But its simplifications have to be scientific. It is one thing to get at absolutely exact costs and then devise a simpler method for everyday use and quite another thing to dispense with the scientific preliminary investigation and adopt a method whose only merit is simplicity. We must first have all of the facts or there can be no accurate shortcutting. For instance, the fiber company that I have just mentioned had, before its present management came into authority, something which it called a cost system and which was simplicity itself. But the figures had not been based upon scientific analysis. The analysis showed that in some cases the costs were too high and in others the costs were too low. In fact, taking the old costs as an average they varied from the standard by fully forty per cent. That company turned itself from a losing

into a paying venture simply by the new and improved operations that were pointed out by the cost figures.

Cost figures are not mere historical exhibitions. They are guides to future progress. Unless they are in such form that they can be used as guides, there is some doubt in my mind as to whether it is worth bothering with them. On the other hand, they can always be used as guides if they have been properly assembled. They will show more than the eye can see. Take the matter of idle equipment. Rule of thumb costing does not show the cost of idle equipment. Good costing does. I recall a pottery superintendent who had an aversion to filling kilns to capacity. The owners gave him his way. They did not think it much mattered. I put in a new cost system, which demonstrated that this little idiosyncracy of the superintendent cost nearly seventy-five thousand dollars a year when the pottery was operating at capacity!

Many little habits or odd ideas creep into shops and no one thinks anything of them. The right sort of cost system shows that sometimes these whims are most expensive. Costs, when arranged and presented in monthly tabulations, so that comparisons may be made, give to the executive exactly the same sort of information that a doctor learns from a nurse's chart. The patient's pulse, respiration, and temperature are not important of themselves but they are evidences of condition. They are starting points for investigations. Costs of themselves are important, for without them prices can only be guessed at, but, if costs are used only for pricing, only a small portion of their usefulness is being realized. In their full usefulness, they guide what products should be made and how they should be made, what products should be sold, and when and how they should be sold. They advise the physician. The starting point of manufacturing and selling is the record of the cost accountant.

The development of cost accounting has caused its scope constantly to widen, to assume more and more the rôle of guiding counsellor, and has especially advised in times when orders are difficult to obtain. If a plant is running at capacity, it is fairly easy to get at the costs. But, if a plant is running at only half capacity and is scratching for orders, we find the costs in a new function. The fixed charges remain fairly constant and, if we apply the same overhead to half capacity production as to capacity production, we discover, if we are faithful to our costs, that the decreased business ought to be priced higher than the capacity business. Then we should advance our prices. Advancing prices when business is hard to get is quite the surest way of getting none. It is then that costs will point out how to cut prices without loss, how best to adjust the factory to the market.

We shall get good times when business men use cost figures as a guide in reducing costs, when they make the lower cost the excuse for lower prices. It will make selling easier; it will bring into the market those buyers who went on strike; and it will turn up buyers who never before could afford to buy our products.

Methods of Machine Tool Design

Beginning Chapter Seven on Feed Mechanisms—General Basic Conditions Affecting Design Continuous Feed Arrangements—Lead Screws for Lathes

By A. L. De LEEUW
Consulting Editor, American Machinist

It WAS pointed out before that the designer meets the greatest difficulty in the development of a feed mechanism, because there are so few cases where he knows with certainty the load for which he has to provide. It is, however, fairly safe to say that in lathes and milling machines the feed pressure may be figured to be equal to the pressure on the tool or against the cutter. In a drill press the feed pressure depends on two items, both of which are rather undetermined at the present time. Using a twist drill, we find two elements requiring feed pressure: One is the penetration of the lip into the material, the other is the penetration of the bridge or web between the lips. This latter item is entirely undetermined and may be very great. The first item resembles to a certain extent the pressure required to feed a lathe tool into the work. There is, however, one important difference which causes the feed pressure required for the lip of a drill to be greater proportionately than that required for the feed of a lathe tool.

In Fig. 152 a piece of lathe work is represented bearing with a pressure P on the tool. This pressure can be determined when the cutting speed and the required horsepower are known. If, for instance, we know that the cutting speed is 60 ft. and that the hp. required is 5, then we know also that the pressure on the tool must be $\frac{5 \times 33{,}000}{60} = 2{,}750$. This figure is not exactly correct because part of the power has been consumed by friction, and furthermore, the law that the pressure required for feed is equal to the tooth pressure is merely an approximation. Nevertheless, the value obtained in this manner is a fairly good indication of the magnitude of the feed pressure, and enables the designer to lay out his feed mechanism by simply allowing an ample factor of safety.

A lip of a twist drill as it removes metal is shown in Fig. 153. The various points of this lip travel with different velocities, so that if the outside of the drill travels at a speed of 60 ft., the average speed of the drill lip will be only 30 ft.; and if again the horsepower required should be 5, we would find that the average pressure against the lip is 5,500 lb., which would be the amount of the feed pressure, or at least approximately so. In addition there would be the pressure required for the penetration of the central web or bridge.

In machines of the planer type, such as shapers, slotters and planers, there is no feed pressure required beyond that necessary for the moving of certain machine parts. As a rule these parts move with a low speed and for a very short distance only, so that the power required for the feed is very small. In all cases, such as on lathes, drill presses, milling machines and planers, we must consider the power required for the movements of slides, and the like. This power may or may not be an important item. When we say "power" we use an expression which is wrong, though commonly employed. The amount of power required for the feed is always very small, because the speed of the moving parts is low. It is the feed pressure with which we are concerned, and the torque on a lead screw or the pressure on the teeth of a feed pinion may be very much increased beyond that required for the cut by the resistance of the moving parts, due either to their weight or to the friction caused by gibbing, or by both.

Classification of Feeds

Feeds of machine tools may be classified under two headings: *intermittent* or *continuous.* Intermittent feeds are found on planers, slotters, shapers and certain types of car-wheel and driving-wheel lathes, facing heads and the like. According to the source of power, intermittent feeds may be divided further into *mechanical, electrical, hydraulic* and *pneumatic* feeds. Continuous feeds also might be divided according to the source of their power; but in this class of feed the original power source is not of so much importance to a designer as it is in the other class, and it is better to classify the continuous feed according to the part which delivers the feed pressure to the machine member which has to be advanced. We will therefore classify the continuous feeds as follows: *screw, rack, cam, hydraulic,* and *pneumatic* feeds. We will first analyze the continuous feeds starting with the last member of the mechanism.

The following elements must be carefully considered in the design of a screw for feeding purposes: (a) The amount of pressure in an axial direction; (b) the nature of thrust bearing; (c) whether screw is in tension or compression; (d) the effect of expansion on long screws.

Rule for Feed Screw Lead

Feed screws may be used merely for the purpose of advancing some machine member or they may be arranged for cutting threads. In this latter case, a definite relation must be maintained between the screw and a spindle or other rotating member. Cutting of scrolls, spacing of racks and similar elements, all require such definite relation. In these cases it is not permissible to have anything but positive connections between spindle and screw. Belts, friction clutches, etc., cannot be used.

When a screw is used as a lead screw, the designer will find that he is more or less limited in his choice of the lead. If, for instance, large leads must be produced by the machine, it becomes very necessary to use a large lead in the screw also. If, on the other hand, very small leads must be produced, he is limited in the selection of lead for his screw by the fact that the thread must have a sufficient wearing surface, so that he must still maintain a fairly large lead.

Generally speaking, the following rule may be applied in the selection of lead for a feed screw: *Select the lead as large as possible, using if necessary multiple threads to obtain it, but do not make the angle of the helix with the normal plane more than 20 degrees.*

To show the effect of a large lead on the amount of power required for feed, we shall select a numerical example and carry the calculation out in a rough fashion only.

Load, 10,000 lb.
Diameter of screw, 3 in.
Lead and pitch, ¼ in.
Outside diameter of thrust bearing, 5 in.
Bore of thrust washer, 2 in.
Coefficient of friction between screw and nut, estimated, 15 per cent.
Coefficient of friction at thrust washers, estimated, 8 per cent.

One revolution of the screw advances the load in an axial direction ¼ in., so that the useful work done per revolution is $\frac{1}{4} \times 10{,}000$ in.-lb. = 2,500 in.-lb. Assuming that we use an Acme thread, the pitch diameter of the screw is 2¾ in. and the pitch circumference 8.643 in. When the screw makes one revolution it performs work for friction equal to

$$10{,}000 \times 8.643 \times 0.15 = 12{,}964 \text{ in.-lb.}$$

The average diameter of the thrust washer equals $(5 + 2) \div 2 = 3\frac{1}{2}$, so that the average circumference

FIG. 152

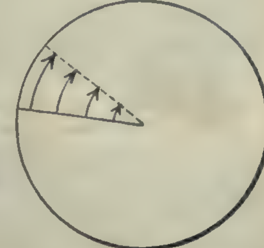


FIG. 153

FIGS. 152 AND 153—ACTION OF METAL CUTTING TOOLS

is 11 in. Work of friction done by the screw on account of thrust for one revolution is, therefore, $10{,}000 \times 11 \times 0.08 = 8{,}800$, so that the total work done for one revolution of the screw equals $2{,}500 + 12{,}964 + 8{,}800 = 24{,}264$ in.-lb.

If we had made this screw with 1-in. lead and ½-in. pitch, its pitch diameter would have been 2½ in., its pitch circumference 7.857, and the work done on the various items enumerated above would have been:
Moving load ¼ in. in axial direction, 2,500 in.-lb.
Overcoming friction in nut for one-fourth of a revolution, $\frac{1}{4} \times 10{,}000 \times 7.857 \times 15 = 2{,}964$ in.-lb.

Overcoming friction in thrust washers for one-fourth of a revolution, $\frac{1}{4} \times 10{,}000 \times 11 \times 8 = 2{,}200$ in.-lb.
Thus the total work done in this case would have been $2{,}500 + 2{,}946 + 2{,}200 = 7{,}646$ in.-lb., which is less than one-third of the work done in the previous case.

The calculations here are of a rough and preliminary nature, but sufficiently accurate to indicate the very great effect an increase of lead has on the efficiency of a lead screw. We have reduced the amount of work to be done by the difference between 24,264 and 7,646 in.-lb., or 16,618 in.-lb. If we had changed the thrust bearing to a ball bearing, and if we should neglect the very small amount of work which must be done to overcome the resistance of such a ball bearing, we would have saved 8,800 in.-lb., or not much more than half of what we have gained by changing the lead. Of course we can go a step further and substitute a ball bearing for the

thrust washers in addition to the increase in lead, in which case we would have gained another 2,200 in.-lb. In that case, the total amount of work to be done for ¼ in. advance would have been 5,446 inch-pounds.

The amount of power required for the feed is, as a rule, quite small, and it might seem at a first glance that trying to reduce this small amount is hardly worth while. However, it is not reduction of power we are after. The torque required to turn the screw is only slightly more for the increased lead and thrust washers than the torque required for the original screw, and it is even less when ball bearings are used; while at the same time the screw turns at one-fourth of the speed, so that all of the mechanism between the first drive and the feed screw can be reduced to much smaller dimensions on account of the much greater reduction in speed. As a rule, it is very desirable to confine a mechanism of a machine tool to the smallest possible dimensions, so that anything which permits of using small gears, shafts, clutches, etc., is worth while going after. Comparing again the amount of power required to move the load ¼ in., we find that in one case 24,264 in.-lb. are required, in another case 7,646 in.-lb., and with still another modification (ball bearings instead of thrust washers) 5,446 in.-lb., or not much more than one-fifth of the original amount. Furthermore, the efficiency of the screw could be still further increased by giving it more lead. Even without doing this, the mechanism required for driving the lead screw has been made very much lighter, as the power to be transmitted is only slightly more than one-fifth of the original amount.

Diameter of Lead Screw

The next important element of the lead screw to consider is its diameter. As in all engineering problems, we are confronted here with a dilemma. We wish to make the screw as large as possible so as to reduce its deflection to a minimum and to give it the greatest possibe resistance against rupture, and we also wish to make it as small as possibe in order to increase its mechanical efficiency. As the true function of the engineer is to effect a compromise between conflicting conditions, we must weigh the importance of the two requirements against each other, and we see at once that there is a difference depending on whether the screw is used as a feed screw only, as a lead screw only, or as a combination of the two.

If the screw is used as feed screw only, no harm can result from the fact that there is a certain amount of torsional deflection, provided the screw is not loaded beyond its safe limits. In order to meet the conditions we would make the core of the screw as small as the load would permit, we would make the depth of the thread, and therefore the pitch, as small as possible, and we would provide the necessary bearing surface between screw and nut by making this nut very long. We would further give the screw a multiple thread so as to have the greatest possible lead. Such a construction of the feed screw might actually be carried out in some special machine when we have complete knowledge of all the elements, but if the screw is part of a general utility machine where the load may change for different jobs and from moment to moment, it would not be safe to construct a lead screw in this manner.

If, for instance, this screw were used as a feed screw for a lathe on which a piece is turned up requiring an intermittent cut, there would be a constant change of torsion in the screw causing the tool to jerk into and out of the work, which would be detrimental to the machine as well as to the tool. As such a condition may arise in any lathe, we shall have to make the diameter of the core larger and the pitch coarser than the ideal requirements call for. Furthermore, as it is exceedingly difficult to get a good fit between a screw and a very long nut, we shall have to confine ourselves to a shorter nut and make the pitch of the screw larger than we first intended in order to get sufficient bearing surface between screw and nut.

Actual Conditions in a Lathe

Attention should be called here to the fact that, though the amount of power required to move the load ¼ in. has been reduced, the amount of power required to turn the screw one complete turn has actually increased by increasing the lead. We found that 24,264 in-lb. are required for one revolution of the screw when the lead is ¼ in., and that four times 7,646 in.-lb. are required for one revolution of the screw when the lead is 1 in., so that the core needs to be larger. If we had substituted ball bearings for the thrust washers, we would have required four times 5,446 in.-lb. per revolution of the screw, which is less than that required for the original design, so that in that case we can actually reduce the core of the screw by a small extent.

The torsion of a lead screw causes more serious trouble when threads must be cut, because the twist in the screw shortens the lead. This is of importance especially when long screws are cut. It is true that the shortening of the lead remains the same per thread whether the screw is long or short; in other words, the percentage of shortening is not affected by the length of screw to be cut, so that if a certain machine can cut a screw to an accuracy of, say, 0.002 in. per foot, it will produce this degree of accuracy whether a screw of 10 in. or 10 ft. length is cut.

Effect of Roughing on Finishing Cut

On the other hand, a screw is not chased with one single cut. A number of cuts are taken and some of these are roughing and others are finishing cuts. More metal is removed on the roughing cuts than on the last finishing cut, and therefore the torsion and the consequent shortening of the lead is greater when roughing than when finishing. Suppose the error caused by this shortening of the lead were 0.0005 in. per ft. when roughing, and suppose the length of the screw were 40 ft. Then the total length of the threaded part would be 0.020 in. short. This is the condition of the screw when the roughing cuts have been taken. If now we take the finishing cut we will have considerably less torsion and therefore less shortening of the lead. As a result, it may well be that the total shortening of the lead is only 0.002 or 0.003 in. instead of 0.020 in. for the entire length of the screw; which would mean that we cannot take an even cut along the entire length of the screw, but that at one end the cut will be 0.017 or 0.018 in. more than at the other end. This would mean either that we have to take several finishing cuts, or else that we get a screw of lesser finish and accuracy. In order, then, to overcome this uncertain action of the lead screw, we must make this member heavier when it is used as a lead screw than when it is used as a feed screw; this is so as to keep the torsion and the deflection dependent upon it down to a minimum.

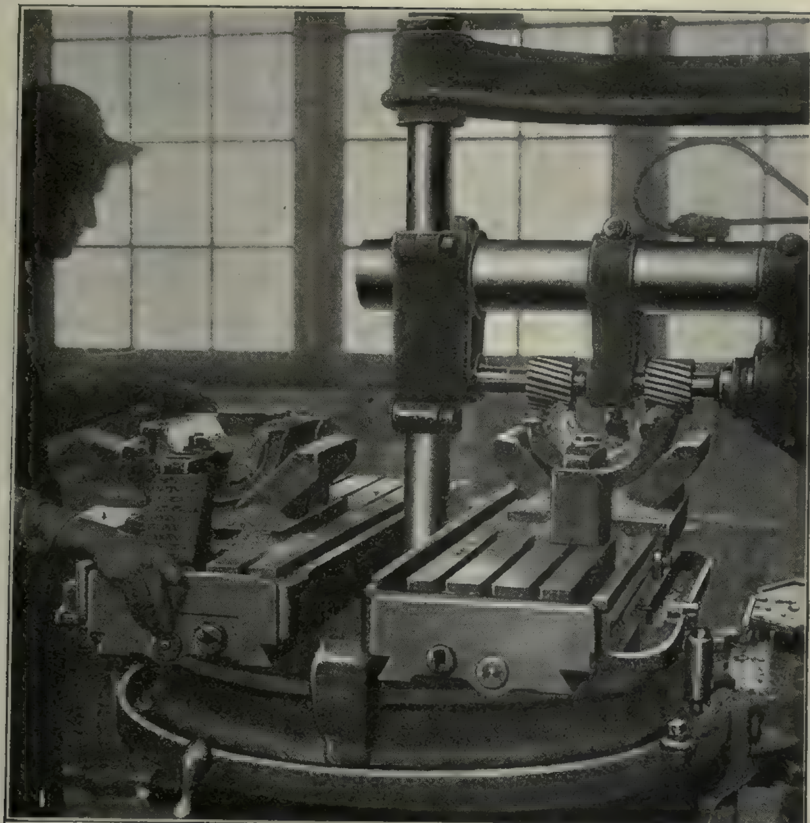


FIG. 1—MILLING DIESEL ENGINE BEARINGS. FIG. 2—TURNING THE OUTSIDE

Diesel Engine Work in a California Shop

By Herbert Crawford

Two rather interesting machining operations in making bearings for large Diesel engines are shown in Figs. 1 and 2. In the bearings shown in Fig. 1, the babbitt has already been poured in the bronze shells which are now being milled on a Potter and Johnston continuous milling machine. As may be seen this machine is provided with two tables, mounted on a turntable, arranged for indexing so that work can be loaded in the fixture on one table while the cutters are operating on work so mounted on the other table. The fixtures used in this operation are large V-blocks in which the bearings are held by straps in the usual manner.

After the faces have been milled the two halves are placed together on a mandrel, as shown in Fig. 2, and in detail in Fig. 3. The body of the mandrel *A* fits the inside of the bearing. The arms *B* form abutments for the outer ends of the straps *C*, which clamp the bearings by the flange and leave room for facing the inside shoulders, as well as for turning the outside of the bearing itself. Here the work is being done on a Steinle lathe, the flange of the mandrel being bolted to the chuck by T-headed bolts. A substantial center is bolted to one face of the turret. Piston rings are made from cast pots such as shown in Fig. 4. The pot has feet at the bottom, providing a convenient means for fastening it to the machine table. The boring, turning and facing are done by tools held in toolholders mounted in the turret on the crossrail. The multiple cutting off tool is held in the side carriage of the Bullard vertical turret lathe as shown and arranged to cut off the rings progressively, the top ring being cut off slightly before the next one and so on down the line. The machines illustrated are a part of the modern machine tools in use at the shops of the Skandia Engine Co., Oakland, Cal., and give some idea of how well the shop is equipped for the rapid handling of comparatively heavy work.

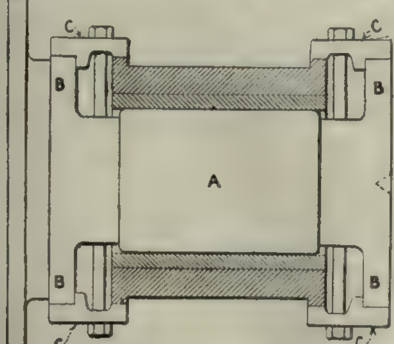


FIG. 3—DETAILS OF BEARING MANDREL

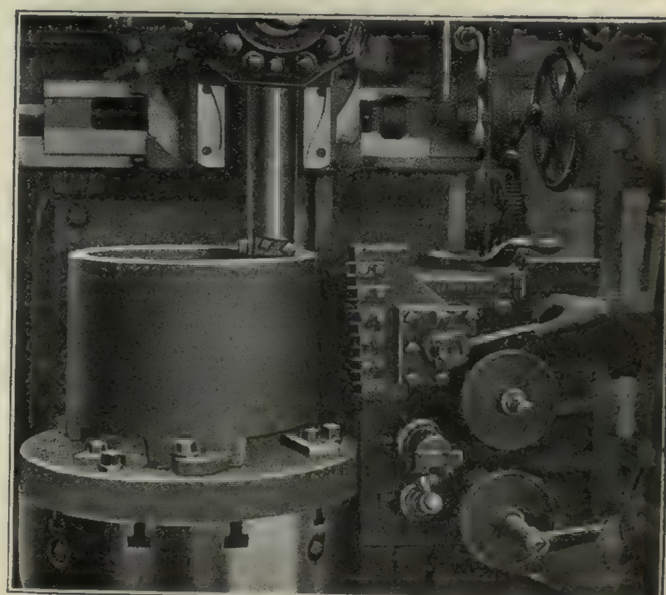


FIG. 4—CUTTING OFF 12 PISTON RINGS

Nickel and Its Alloys

The Third Article—Special Tools for Cutting Monel Metal—How It Should Be Worked and Finished—Alloys for Electrical and Heat-Resisting Uses

BY PAUL D. MERICA
Director of Research, International Nickel Company.

Monel metal is readily machined, threaded, tapped, drilled and milled, but like other metals such as steel, aluminum and brass, it is most readily machined when the machining conditions are adjusted to its individual characteristics. On account of the toughness of the metal, cutting tools should be made from a first-class grade of high-speed steel, and should be ground with sharp cutting angles.

These necessary sharp cutting angles for lathe work are best obtained without weakening the cutting edge, by grinding the tools with either a large top rake or a combined top rake and side slope. Two cutting tools have been developed that permit the use of higher cutting speeds with a minimum of regrinding. The first is ground with a 13-deg. clearance angle and a 20-deg. top rake or back slope. The nose is tapered gradually at an angle of 9 deg. from a plane parallel to the side of the tool, and the cutting edge is rounded with a $\frac{3}{16}$-in. radius.

The second cutting tool is ground with a 6-deg. clearance angle and a combined 8-deg. top rake and a 14-deg. side slope. Both tools cut cleanly and easily rid themselves of the long tough chip characteristic of monel

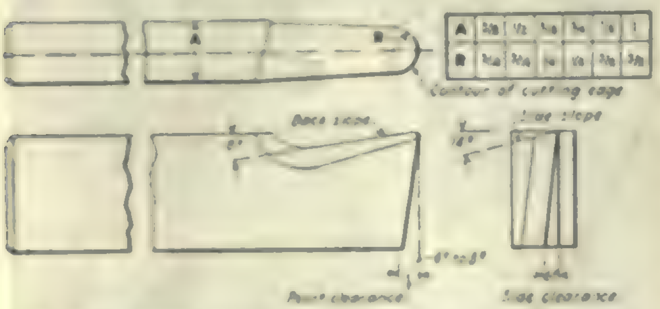


FIG. 8—RECOMMENDED SHAPE FOR ROUGHING TOOL FOR LATHE WORK ON MONEL METAL

metal. Fig. 8 shows an efficient type of roughing tool for lathe work. The cutting edge of the tool should be set slightly higher than the center of the work to obtain the greatest shearing effect. This height will differ with work of varying diameters. For small work, tools dressed with the nose offset should be used.

Design and Treatment of Monel Threading Tool

The threading tool, on acount of its pointed cutting edge, has a greater tendency to crumble. For that reason, the tool is ground with a smaller top rake and a clearance of 9 deg. and 12 deg., respectively. The sides on the nose of the tool are ground in a gentle slope from top to bottom. The point of the tool may be ground for any standard thread desired.

For the $\frac{3}{8}$- and $\frac{5}{8}$-in. tool bits, the clearance angle depends upon the position of the tool held in the toolholder, and should be made just large enough to preclude any possibility of rubbing the flank of the tool against the work. As most toolholders in themselves furnish sufficient top rake for the tool, no top rake is necessary for the $\frac{3}{8}$-in. tool bits. With the $\frac{5}{8}$-in. tool bits, a 4-deg. side slope is an advantage.

Among the several high-speed steels that have given satisfaction in cutting monel metal, are Rex AA (Crucible Steel Co. of America) and Maximum 000L (Peter A. Frasse & Co.). Directions for heat-treating these steels are furnished by the manufacturers and should be carefully followed.

It has been discovered that properly tempering the tool after the initial hardening increases the life of the cutting edges which machine monel metal. Tempering the tool relieves the strain in the metal and gives it a tough rather than a hard cutting surface. This has been found to be beneficial, as monel metal is a tough rather than a hard metal. For shops with the facilities at hand for heat-treating high-speed tool steels, the following procedure has produced good tools for machining monel metal:

Raise the temperature slowly to 1,800 deg. F. (yellow heat), and then quickly to from 2,200 to 2,300 deg. F. (white heat), and cool the tool by plunging it into fish oil. Draw the temper at 1,000 deg. F. and allow the tool to cool slowly in a closed box. This process is used for high tungsten steels.

Monel Castings Require Stronger Tools

Cast monel metal, like most sand castings, has a particularly tough outer skin, which subjects the cutting edge of the tools to a fairly severe strain. For machining monel metal castings, therefore, the cutting edges of the tools may be made more blunt than those previously described, with beneficial results. A tool of this description has less tendency to cut cleanly, but it is stronger and withstands better the hard knocks encountered in cutting the skin of the casting. After the skin has been roughed off, no trouble is encountered in cutting the more uniform metal underneath. Slightly slower cutting speeds are also necessary for cast monel metal. Rolled or drawn monel metal, due to its more homogeneous structure, is somewhat easier to machine than cast monel metal. The chip is longer and tougher, and higher cutting speeds may be adopted with good results.

The cuts, feeds and speeds in Table VIII are based on the experience of a number of firms in machining monel metal, and are given to determine in a general way the proper speed with a given cut and feed. It will be noticed in this table that a good average speed of 60 ft. per minute with a $\frac{1}{4}$-in. cut and $\frac{1}{32}$-in. feed should be used for cast monel metal. Likewise, a good average speed of 70 ft. per minute with a $\frac{1}{4}$-in. cut and $\frac{1}{32}$-in. feed should be used for rolled monel metal. For a better finished surface, lighter cuts at higher speeds may be taken.

Monel metal may be drilled at any reasonable speed and feed. No advantage is gained by departing from the standard twist drill cutting and clearance angles as furnished by the majority of the large drill manufac-

Much of the information in this article has been obtained through the extended investigations of A. J. Hanlon in co-operation with various users of monel metal and with manufacturers of tools such as the Greenfield Tap and Die Corporation, The Union Twist Drill Co., Goddard and Goddard, Pratt and Whitney Co. and the Crucible Steel Company of America.

urers. A clearance angle of 12 deg. and a cutting angle of 59 deg. with relation to the center of the drill are being accepted as the best for the majority of work. At low speeds on monel metal, carbon steel drills work fully as well as high-speed drills. From tests made on monel metal at the Union Twist Drill Co., it was found that drills would stand up longer and drill more holes at a cutting speed of 20 ft. per minute with 0.005 in. per revolution feed; ordinarily 30 to 35 ft. per minute is used.

TABLE VIII. FEEDS AND SPEEDS FOR TURNING MONEL METAL.

Cut, Inches	Feed, Inches	Cast Cutting Speed, Ft. Per Minute	Rolled Cutting Speed, Ft. Per Minute
1/64	1/64	150	170
	1/32	120	140
1/32	1/64	100	115
	1/32	90	100
	1/16	75	85
1/16	1/64	85	95
	1/32	70	80
	1/16	50	55
1/8	1/64	75	85
	1/32	60	70
	1/16	45	50
	1/8	40	45
1/4	1/32	50	55
	1/16	40	45
	1/8	30	35

The same principle of designing sharp cutting angles for machining monel metal is equally applicable to milling cutters. Cutters should always be made from high-speed steel. The tooth spacing should vary according to the diameter and the kind of cutter; but, as a general rule, it has been found best to have as many teeth on the cutter as possible so that each tooth may take a small cut with the least amount of strain.

For plain milling cutters, the teeth should be ground at a slight taper, widest at the cutting edge to prevent binding and possible tearing of the metal. A slight undercut on the teeth of the milling cutters, of approximately 10 deg. has proved to be beneficial in milling monel metal.

The amount of the cut and the surface speed depend a great deal upon the strength of the milling machine. A good average speed for general practice in milling monel metal, is from 70 to 80 ft. per minute with a 1/8-in. cut and a 0.005 to 0.01-in. feed per revolution.

Allowance for Chips in Taps and Dies

One of the chief difficulties in tapping monel metal is the tendency of the tough chip of the metal to stick in the flutes of the tap and wedge. For that reason, it is advisable to design taps with two or three lands and shallow flutes, so as to obtain additional strength. A lip should be ground back of the cutting edges in order that the chip may better curl through the flutes and clear itself. When the metal is to be tapped completely through, it is good practice to grind the cutting edge of the tap at an angle of from 10 to 15 deg. to the axis of the tap, with a plugging or chamfer of four or five threads.

The best all-around cutting speed for tapping monel metal lies between 15 and 20 ft. per minute. Taps should be watched carefully to avoid overheating. They may be made either from high-speed or carbon tool steel.

Threading monel metal requires considerable power, and for that reason low speeds are advisable. A good average speed of from 15 to 20 ft. per minute has been found suitable for threading monel metal. This practically corresponds to the specified speeds for threading tool steel. Solid dies should be ground with a chamfer of one or two threads and a 1/64-in. backing off or clearance.

Disposal of the chips plays an important part in the successful threading of monel metal, and for that reason the flutes on the round split dies should be made sufficiently large. When threading with a hand screw machine, the operator should be careful to feed the die gently until he feels it just taking hold of the work, after which it takes its own course. Small pieces of monel metal sometimes become embedded in the flat between the threads of the die and spoil the crest of the threads on the work. For that reason the die should be carefully examined as often as possible. Cold-drawn monel metal rods are the best for threading purposes, as their tolerances are closer than those of the hot-rolled monel metal rods. The oxidized surface of the hot-rolled rods is fairly hard and is apt to dull the cutting edges.

The selection of the proper lubricant is very important when machining monel metal. Among those on the market that have given excellent results are:

Cutting	Houghton's Soluble Oil, a gallon to 10 gallons of water. E. F. Houghton & Co.
	Equinox No. 1, Lindsay McMillan Co.
Threading	Cresol No. 1 Soluble Oil, emulsion of 15 parts water to 1 part Cresol No. 1. Lindsay McMillan Co.
Milling	Oakite, Oakley Chemical Co.
Cutting and Threading	Top Cutting Oil, Frontier Manufacturing Co.
General	Machine Oil.

Precautions to Be Observed in Welding

Monel metal may be readily welded by the oxy-acetylene torch, by the spot or resistance welding process and by the metallic arc-welding method. It cannot be smith-welded, due to its tendency to become covered at a welding heat with a layer of oxide which prevents welding. The resistance welding of monel is exactly similar to that of steel or other metals, and in fact it may be thus welded to them.

In oxy-acetylene welding, the principal precautions to be observed are:

Maintain a neutral or slightly reducing flame which is still amply hot enough to melt the metal.

Exclude air from the weld as much as possible by avoiding drafts and by keeping the torch flame well spread over the weld.

Build up the weld completely in one place before proceeding, or, in other words, do not weld in built-up layers.

Build all monel welds well up above the surface in order that any dirt and scum may be floated well out of the body of the weld.

Generally, it is not wise to use any flux except when welding thin sheets, and here the regular borax flux will be found useful. A low-carbon welding wire of monel has been found to give the best results.

The same general precautions that are observed with the similar forms of steel should be taken in welding sheet, rods or castings. Rods should be V-welded;

TABLE IX. ALLOYS FOR ELECTRICAL PURPOSES

Type	Commercial Names	Composition: Nickel Per Cent	Composition: Copper Per Cent	Composition: Iron Per Cent	Composition: Chromium Per Cent	Composition:	Electrical Properties: Resistivity Ohms. Per Mil.-Ft.	Electrical Properties: Temp. Coeffic. Per Deg. F.	Recommended Max. Working Temp., Deg. F.	Tensile Strength: Cold-Drawn, 1,000 Lb. Per Sq.In.	Tensile Strength: Annealed 1,000 Lb. Per Sq.In
Nickel-chromium	Nichrome, Chromel, Calido, Ravo, Nicrelox	60 to 85	....	0 to 25	10 to 22	....	550 to 650	0.00006 to 0.0001	2,000	160	80
Ferro-nickel	Climax, Comet, Phenix	25 to 30	....	Balance	2 to 3	....	500 to 520	0.0005	1,100	140	70
Nickel-copper	Advance, Ideal, Constantan	40 to 50	Balance			....	280 to 300	Nil	1,000	115	60
Nickel-silver	Platinoid	10 to 30	45 to 60	....	....	Bal. Zinc	100 to 250	0.0002	600	100 to 120	60 to 70
Monel metal	....	68	27	....	....	....	250	0.001	1,400	120	65
Manganese-nickel		95				Bal. Mang.	120	0.001	1,800	120	60

sheets over 3/16 in. in thickness should be bevelled; and castings should be pre-heated.

The arc welding of monel metal by the metallic arc method follows essentially that of steel. The best results are obtained by the use of a monel electrode coated with a powdered deoxidizer having a content such as the following: Magnesium, 14 to 16 per cent, manganese, 27 to 36 per cent and silicon, 45 to 50 per cent. This composition can be obtained from the Electro Metallurgical Corporation. The welding rod should be made positive.

The practice of welding by this method is described in an article by Merica and Schoener (The Use of Metallic Deoxidizer in Arc Welding with Monel Metal, Journal of the American Welding Society, May, 1922).

Oxy-acetylene or arc welds in monel metal will give tensile strengths between 45,000 and 55,000 lb. per square inch with a moderate ductility.

Soldering, Brazing and Annealing Monel

Monel metal may be soldered as readily as copper and by exactly the same methods. The only precaution that is necessary is to see that the piece to be soldered has a bright, clean surface and is not covered with an oxide scale as, for example, a hot-rolled rod.

The brazing of monel metal is carried out in the same manner as the brazing of copper, and the ordinary brazing spelter is used with borax as a flux.

Whenever it is necessary, monel metal should be annealed in a reducing atmosphere, in order that it may retain a bright metallic surface and not become covered with its characteristic adherent scale. The best practice is to box-anneal it. A seal of fire clay, sand or iron filings, should be used and sufficient charcoal should be placed in the box to maintain a reducing atmosphere, but not necessarily so that it comes in contact with the articles themselves. The metal should not be placed in direct contact with the sides or bottom of the box, but should be rested on supports of monel.

A temperature of from 1,500 to 1,650 deg. F. should be maintained actually within the box for at least an hour in order to secure a uniform annealing. The actual time required for this operation will, of course, depend upon the size of the box and the type of the furnace. Until it is below about 500 deg. F., the material should not be removed from the boxes.

Annealing should always reduce the hardness of any type of monel to approximately the values shown in the table for the annealed metal, and a hardness test may well serve as a measure of the thoroughness of the process.

Because of its toughness and strength, monel metal is somewhat more difficult to spin than copper, brass, steel or silver. However, with the proper tools and sufficient annealing, it is possible to spin monel into articles of almost any type or shape. It is necessary to have more power available in the machine used for spinning monel metal, and the operator is also called upon to exert more power. In addition, the work must be annealed more frequently, and in all cases before the ductility of the metal becomes exhausted.

Tools and Dies for Spinning and Drawing

The proper tools are made of bronze or similar soft metal or wood. Steel or cast-iron tools are not adapted to this operation, as they have a tendency to seize and drag the metal. In spinning monel a slightly slower speed may be profitably adopted than in spinning other metals, the usual speed being about 600 linear ft. per minute. Ordinary tallow may be used as a lubricant.

Essentially, monel metal requires the same methods for drawing as those employed for steel, although it should be recalled always that monel metal is hardened more rapidly by cold-working than is steel, and that therefore the annealing must be more frequent. It also requires more power than steel and a slow stroke has therefore been found the best in practice.

Due to the "stickiness" of the metal, the design and the material of the die should be such as to allow for the greatest ease of flow with a minimum amount of friction. Dies of cast iron have been found to offer the least resistance to the flow of the metal. The radius of the corners of the dies should be increased to approximately twice that commonly used for steel, for monel

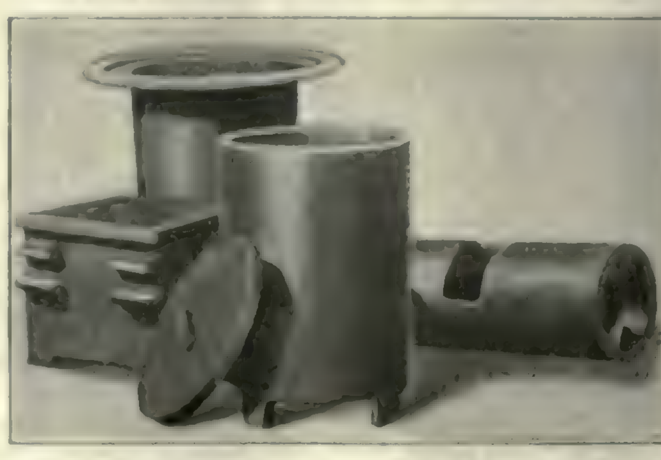


FIG. 9—CARBONIZING AND ANNEALING POTS AND BOXES MADE OF CAST NICHOME

has a tendency to shear when drawn over sharp edges.

The amount of clearance of the dies is an important feature. A clearance of 0.004 in. has been found satisfactory in drawing the lighter gages of monel metal sheet. This metal has also less tendency to wrinkle than has steel, and in consequence it is often possible to use less pressure in holding the blank and thus to reduce the power required to draw and to increase the depth of the draw.

Electrical and Heat Resisting Alloys

In the construction of rheostats and other electric controlling devices, as well as of electrical heating units such as the household electrical toaster or the electric annealing furnace, alloys are required which have a high electrical resistance, a low temperature coefficient and an unusual resistance to oxidation at higher temperatures up to from 1,800 to 2,000 deg. F. Nickel, in combination with copper, iron and chromium, enters into the composition of all the commercial alloys used for this purpose. Table IX gives the properties and composition of alloys for this use.

After the discovery that such alloys do not oxidize readily at high temperatures when heated by an electric current, many of these alloys were used commercially for general purposes apart from the electrical ones, in which the so-called "heat-resistance" is a principal factor. Thus has come the increasing use of nickel alloys for carbonizing boxes and pots and for annealing boxes. Fig. 9 shows a group of cast nickel-chromium or nichrome boxes and pots for carbonizing and tempering steel. In spite of the higher cost of these alloy castings, in the maintenance cost they have in many cases proved superior to cast iron or steel, due to their longer life. These alloys are produced commercially in the form of wire, strip and castings.

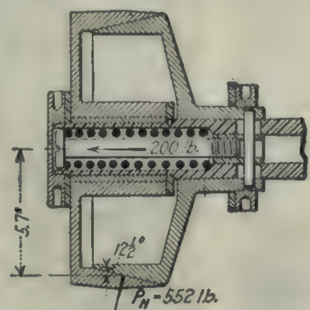
Comparison of Cone and Multiple-Disk Clutches

By Arthur F. Bennett

The comparison presented itself in the form of a problem in selecting a friction clutch to work in conjunction with the speed-changing mechanism of a geared-head lathe. The clutch was required to operate simultaneously with the sliding gears in order to reduce the destructive clashing of the latter. A further requirement was that it should operate with a minimum of effort, as otherwise its continued operation would fatigue the operator, probably resulting in failure to change to the proper cutting speeds as the work progressed, and thus tending to inefficient operation of the tool.

In any kind of friction clutch some force is required to create the friction between the driving and the driven members. The important factor in this case was to select a clutch in which this force would not exceed 50 lb. for the transmission of 5 hp. The cone clutch being the simplest, it was used on the first machine, as it was not foreseen that the operating effort could be greatly reduced by using a multiple-disk clutch that would occupy no more space and would transmit the same or greater horsepower.

The two types of clutches are shown in section in Figs. 1 and 2, and the appended formulas show clearly the advantage to be obtained from the use of the multiple-disk type. In our case the greater cost of the multiple-disk clutch was more than offset by the increase in efficiency of operation. The work of the operator was greatly lightened by the disk clutch.



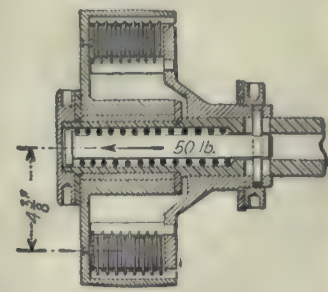


FIG. 1—SECTION OF CONE CLUTCH. FIG. 2—SECTION OF MULTIPLE-DISK CLUTCH

Calculations for pressure required and power transmitted by cone clutch: Material of friction surfaces cast iron, slightly lubricated.

Mean radius of cone $R = 5.7$ in.
Spring pressure $P = 200$ lb.
Cone angle $A = 12\frac{1}{2}$ deg.
Speed of clutch $N = 500$ r.p.m.
Coefficient of friction $f = 0.15$

Formula for normal pressure between friction surfaces P_N:

$$P_N = \frac{P}{\operatorname{Sin} A + f \cos A} = \frac{200}{0.216 + 0.15 \times 0.976} = 552\ lb.$$

Formula for horsepower:

$$Hp. = \frac{P_N f R N}{63{,}025} = \frac{552 \times 0.15 \times 5.7 \times 500}{63{,}025} = 3.7\ hp.$$

Calculations for power transmitted by multiple-disk clutch.

Material of friction surfaces Raybestos (molded) and steel, not lubricated.

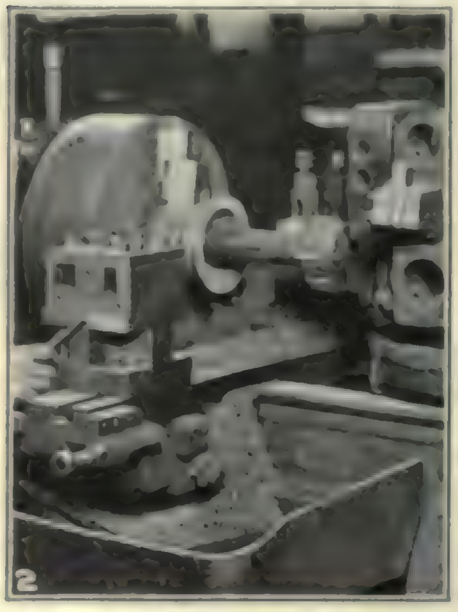
Mean radius of friction surfaces $R = 4$ in.
Spring pressure $P = 50$ lb.
Speed of clutch $N = 500$ r.p.m.
Coefficient of friction $f = 0.18$ for operating temperature of 600 deg. F.
Number of friction surfaces $S = 17$

$$Hp. = \frac{PfRNS}{63{,}025} = \frac{50 \times 0.18 \times 4.375 \times 500 \times 17}{63{,}025} = 5.3\ hp.$$

Standardizing Electrical Apparatus

In the work now being done along standardization lines, we should not make the mistake of failing to become acquainted with what has already been accomplished. The Electric Power Club, an association of manufacturers of electric power apparatus and control apparatus, was organized for the standardization, improved production and increased distribution of their product. Back in 1919 this club adopted specific pulley sizes for use with each size and speed of motor.

A hand book of over 350 pages, distributed by the club, contains many other recommendations for standards and should be carefully considered in any standardization work which affects electrical machinery. Real standardization must not overlook any important industry and, as electrical apparatus is so closely allied with machinery of various kinds, the work of this club should be carefully studied in connection with the work now going on toward the standardization of all lines.



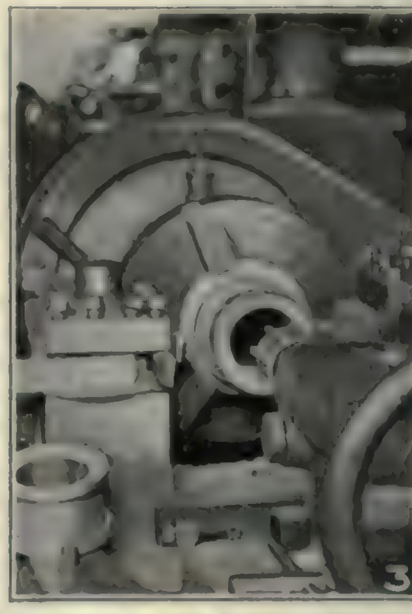


FIG. 1. ROUGH-BORING AND TURNING IN SPECIAL JAWED CHUCK. FIGS. 2 AND 3. MORE LATHE OPERATIONS ON BOTH ENDS OF BEARING

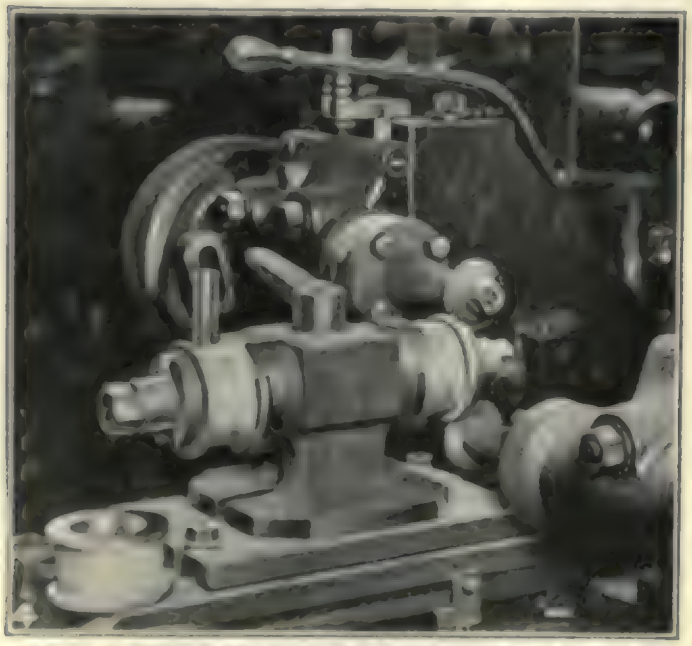


FIG. 4. SLITTING BEARING ON BOTH SIDES IN DOUBLE ENDED, INDEXING FIXTURE

Making Marmon Bearings

SPECIAL CORRESPONDENCE

The life of any motor depends very largely on its bearings. The more carefully they are made (of the right material) and fitted, the better will the results be, both as to smooth running and long life. The making of bearings for the Marmon motor is very largely told in the pictures on these pages. The different steps in shaping and finishing the bearings can be seen so well in the illustrations that but little explanation of the processes is necessary.

The shell has a flange cast on one end for gripping in the special chuck jaws shown in Fig. 1, where the shell is being rough-bored and faced. This end is cut off after later operations, two of these being shown in Figs. 2 and 3.

The bearings are then sawed on a double-headed milling machine, as in Fig. 4, but the slot does not go deep enough to quite separate the halves. The sawed shell is then clamped on a balanced faceplate, Fig. 5, so that the clamp rests on both halves and the shell.

FIG. 5. THE FINAL BORING WITH SINGLE POINT TOOL IN SPECIAL BALANCED CHUCK. FIG. 6. MILLING THE MATING SURFACES OF BEARING SHELL

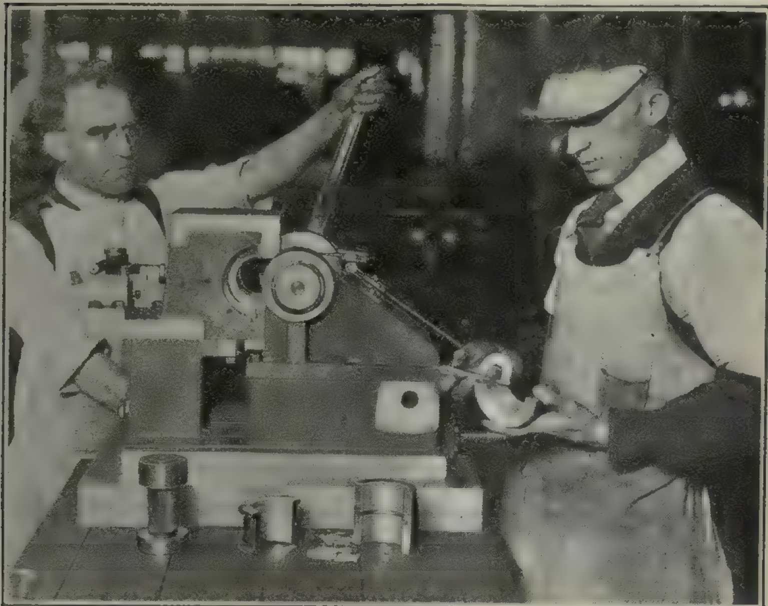


FIG. 7. FINISHING THE BEARING SURFACE IN A SPECIAL SHAVING MACHINE. FIG. 8. ANOTHER VIEW OF THE SHAVING MACHINE

The shell is then finish bored, separating the two halves, these being next milled true and flat as in Fig. 6.

Shaving or scraping the bearing is done on the special machine shown in Figs. 7 and 8. The half bearing is held in a rigid chuck which is moved to the proper position toward the cutter bar. When the bearing is in position the cutter is swung a half revolution by the handle shown and takes a scraping cut the full width of the bearing. This method has been found to give a very satisfactory bearing surface, and is a very rapid way of doing the job.

The two half bearings are then mounted on a mandrel, being held between collars, and the outside finished by grinding as in Fig. 9. The final touching up of the ends for clearance is shown in Fig. 10, the surface plate being used to test the flatness.

The Marmon plant utilizes lapping plates quite extensively, one of these being shown in Fig. 11. The plate is of cast-iron, grooved into small squares on a planer and charged with the desired abrasive. It is large enough for several men to use at once and has been found of great assistance in securing just the fits desired in work of this kind that requires real care.

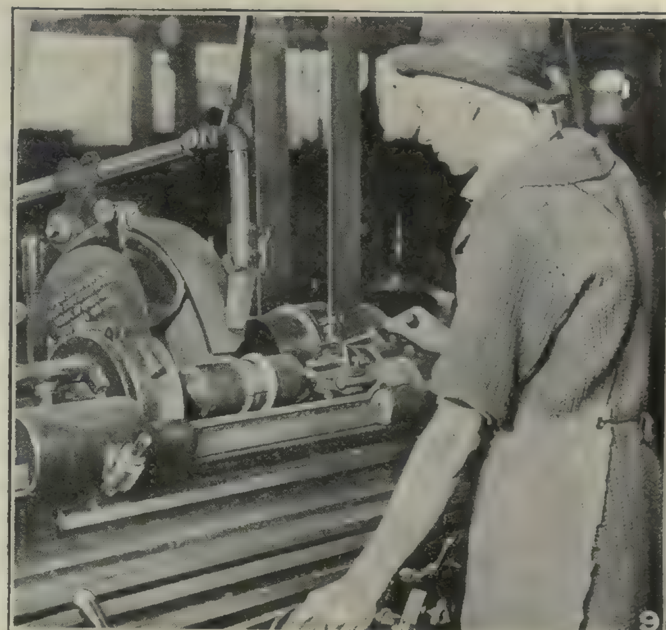
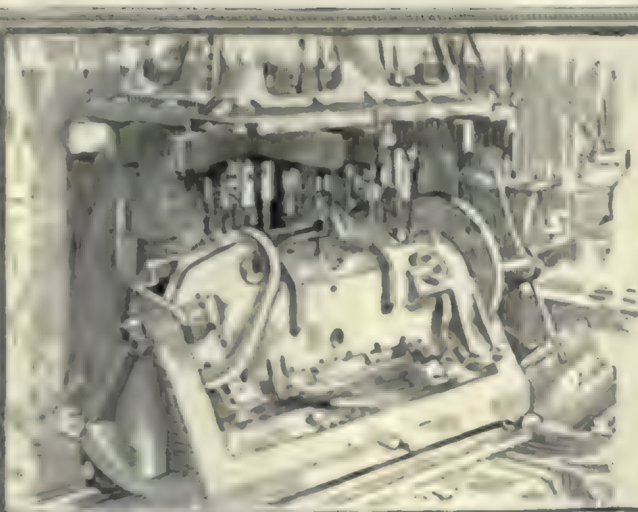


FIG. 9. GRINDING OUTSIDE OF BEARING SHELL, USING SPECIAL MANDREL

FIG. 10. SCRAPING THE END TO FIT SURFACE PLATE SHOWN. FIG. 11. USING LARGE LAPPING TABLE TO GET A BEARING ON BEARING CAPS



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Blanking Dies Continued — Guide Plates, Stripper Plates, Die-Blocks and Punch Holders — Sectional or Built-Up Dies

WHEN a die has become slightly worn and requires regrinding, it is obviously necessary to remove the guide plates in order that the surface may be free from anything which would prevent its being ground readily. It is therefore quite necessary to fasten the guides in place so that they can be replaced in the same position without difficulty. Fig. 444 shows several applications of stock guides and the method of fastening them in place. In the example *A* the stop is shown at *B* and the guide plate at *C*. Screws are placed at *D* and *E* to hold the plate in position. The dowel *F* is located on the center line with the screw, while the other dowel *G* is off center an amount as indicated at *H*. This arrangement makes it impossible to replace the plate except in the position shown, as any attempt to turn it around into any other position would immediately show that the dowel holes would not line up. A method of this sort can be used in the location of all plates. The two guides shown at *K* and *L* are also arranged so that the dowels are placed in different positions, in order that there may be no chance of error in replacing them.

While speaking of the use of guide plates and showing their application to various dies, it is well to mention the fact that where two guide plates are used, the amount of clearance between them must be somewhat greater than the width of the stock itself. This fact is illustrated in the example at *M*, in which the strip has a circular hole in it at *N*. When punching this hole the stock is likely to be bulged out a trifle, as indicated at *O*. Unless clearance is provided between the guide plates, as shown at *P*, the operator might find great difficulty in feeding the stock after it is punched.

Another method which is sometimes used in connection with two guide plates is shown at *Q*. The work *R* is held against the plate *S* by means of a spring *T*, which is suitably placed on a plate *U* opposite to it. This spring should be of sufficient strength to hold the stock over against the guide plate *S* when feeding it through the press. Other methods are in use for obtaining the same result, but as the requirements are very simple the designer can be governed by his own inclination in regard to the method used. Another point which should be brought up in regard to the use of the two guide plates is the fact that the stock used is likely to vary in width more or less; therefore, it is well to make a sufficient allowance between the plates to take care of such a condition.

After the punch goes through the stock and the die, on its return stroke it pulls the stock up with it, so that some provision must be made on the die to strip the stock from the punch. Various methods are used for this purpose but the principles are much the same in all cases, the object being simply to make sure that the stock is not drawn up with the punch.

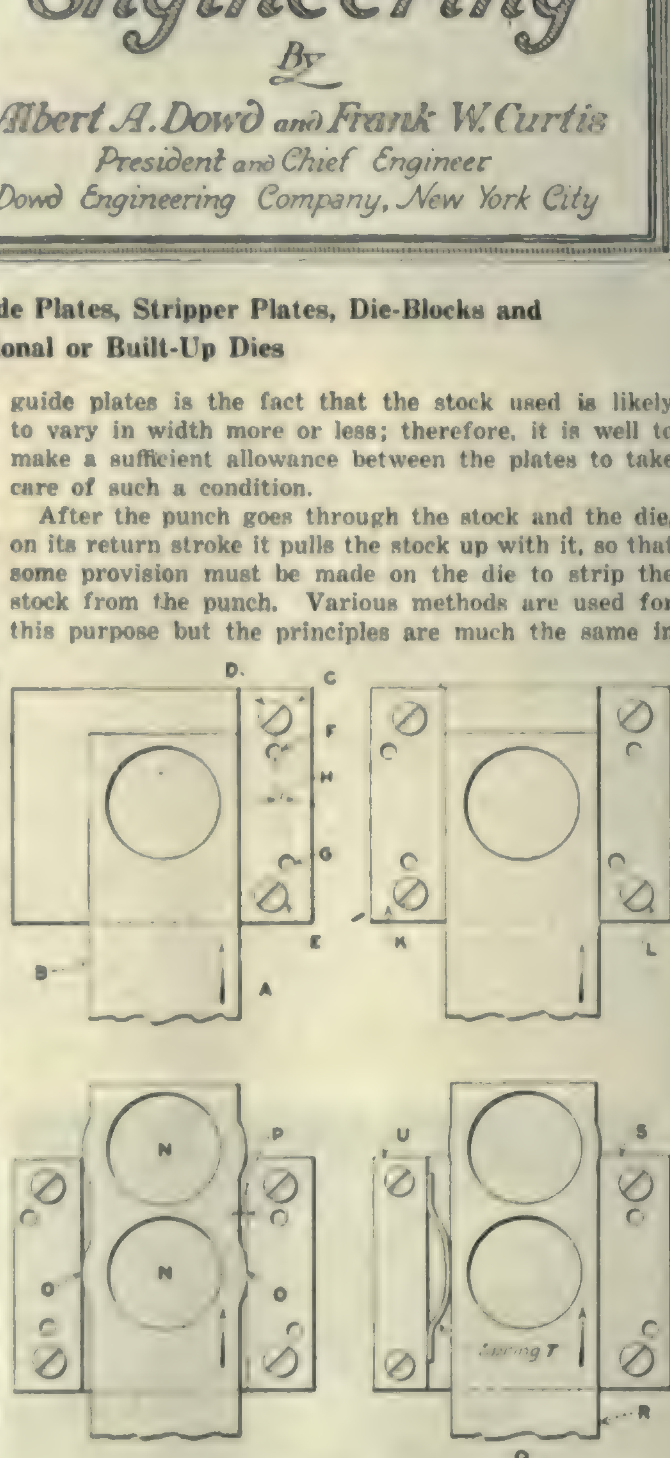


FIG. 444—APPLICATION OF STOCK GUIDES

In the example *A* shown in Fig. 445, the die *B* is provided with a stripper plate *C*. The work passes through the opening between the guides, as shown at

D; and when the punch rises and takes the position shown at *E* the stock *F* is pulled off from the punch by the plate *C*, so that it drops down and takes the position indicated in the sectional view. There is a single guide plate *G* in this case to which the stripper is fastened at the rear, while at the front a spacing collar *H* is used to keep the plate in its correct position.

Another form of stripper is shown at *K*, which is a combination stripper and guide made of one piece, as indicated at *L*. The work *M* passes through it as shown, and the action of the punch and stripper is illustrated in the example *N*. The punch shown at *O* has just passed down through the stock *P* and the blank has been cut out. On its return stroke it pulls up the work as shown at *Q*, and when the stock strikes the stripper it remains in the position shown until the punch has left the stock, after which it drops down on top of the die. The clearance in the stripper plate should be sufficiently great to allow for contingencies. Other forms of strippers are occasionally used, but the matter is really so simple that it does not require a lengthy description.

In factories where a great many dies are used, it is advisable to standardize the die blanks as far as possible. The material from which dies are made should be of such a nature that it does not shrink or change greatly during the process of hardening. Factories usually specify certain kinds of steel for dies, and it is usually advisable to follow the practice in use in the particular factory where dies are to be employed.

A great deal can be done to simplify the work of the diemaker by standardizing the die blanks as shown in Fig. 446. A table like this can be easily worked out to cover a considerable variety of sizes. The tabulated dimensions permit the blanks to be made up and drawn from stock when a new die is required. The matter of standardization is an important one and should not be neglected. Dies are usually dovetailed to an angle, as shown in the illustration, and these die blanks fit a die-holder which is placed on the bolster plate of the

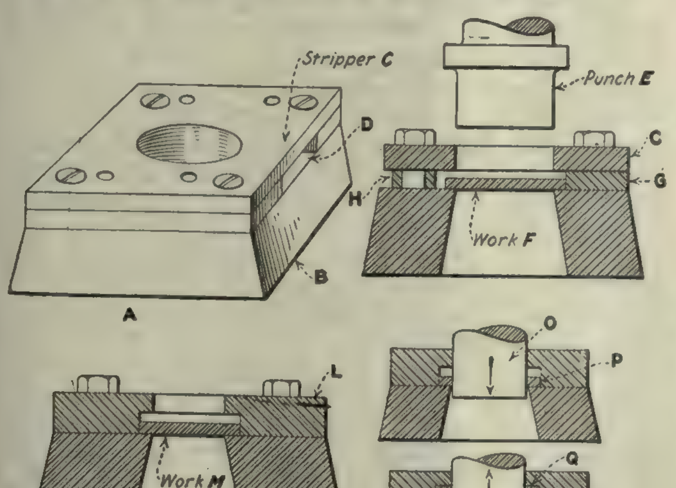
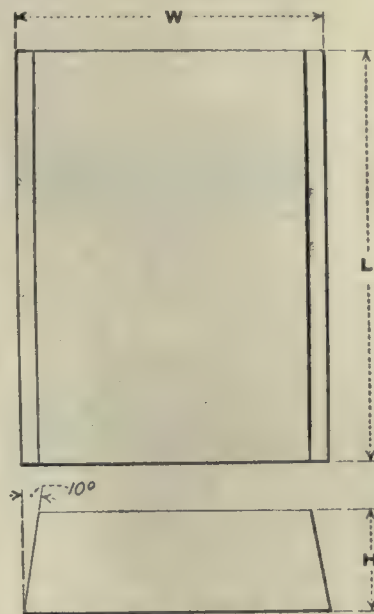


FIG. 445—STRIPPER PLATES USED ON BLANKING DIES

punch press. A common form of holder consists of a block which is dovetailed so that the die blanks fit it and can be clamped securely in position on it.

Punches are held in the ram of the punch press in different ways. Several methods are shown in Fig. 447. In the example *A* the holder *B* is so made that the stem is of such a size that it fits the ram of the press. The punch itself, shown at *C*, is inserted in a hole in the holder as indicated. This is a very simple type of holder, yet it is often used for simple punches and where



No	H	W	L	STOCK LENGTH
A	1¼	4	[illegible]	36
B	1¼	4	6	36
C	1¼	5	7	36
D	1½	4	5	30
E	1½	4	8	24
F	1½	5	6	30
G	1½	5	8	24
H	1½	6	6	30
J	1½	7	9	30
K	1¾	7	10	32
L	1¾	9	12	36

FIG. 446—METHOD OF STANDARDIZING DIE BLANKS

only one or two punches are required. Another holder is shown at *D*, this example having a stem *E* which fits the ram of the punch press, and being dovetailed to receive a supplementary block *F* in which the punch *G* is held. The block is suitably dovetailed so that it will fit the holder, and a clamping gib is provided at *H* which can be set up by means of setscrews shown at *K*. This method is a very good one and it lends itself very readily to accurate alignment.

In another example, shown at *L*, the holder is similar to that illustrated at *A*, the shank *M* being fitted to the ram of the press. The supplementary holder *N* contains the punches shown at *O* and *P*, and it is fastened to the holder by means of the screws shown and suitable dowels. These are not shown in the drawing. Another type of holder is shown at *Q*, this type being dovetailed at *R* and the punches *S* and *T* being located in a block *U*, which is positioned in a slot in the holder and fastened in place by means of screws.

When work is short, the punch or die does not ordinarily require a shearing action, but when the work is long this shearing action produces the blank much easier and with less strain on the press. A diagram to bring out these points is given in Fig. 448. It may be mentioned that the amount of shear is usually proportional to the thickness of the stock. In other words for stock 0.250 in. thick the shear, or height of the triangle between the faces of the punch and die, would be about this amount.

In the example shown at *A* the work *B* extends through the die as indicated, and it is somewhat long in its general shape. If both punch *C* and die *D* were to be made straight, as shown, and if no shear were to be provided on either punch or die, considerable pressure would be required and a heavier press needed for the work. If the punch, on the other hand, were made straight as shown at *E* and the die ground to an angle *F* proportional to the thickness of the stock to be

punched, the pressure would be greatly relieved and the action on the press would not be so severe.

For work which has a number of sharp corners and also where the die would be difficult to machine on account of its general shape, a sectional die or one

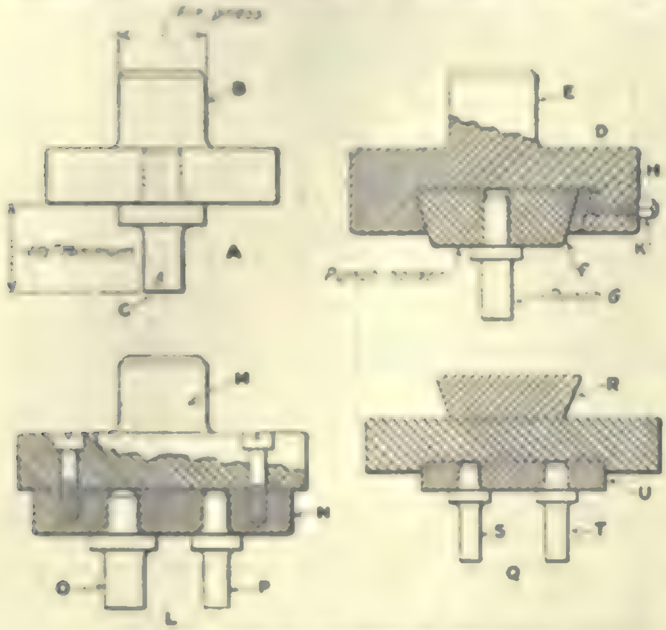


FIG. 447—STYLES OF PUNCH HOLDERS

which is built up of a number of different pieces is often required. The advantages of such a die are obvious, as not only is the manufacturing considerably simplified, but replacements are much easier in case of wear or breakage. In very high production work of irregular pieces sectional dies are frequently used.

In Fig. 449 is shown an example of a die of this sort in which the holder *A* is made of cast iron and suitably fastened to the bolster plate. The die itself is composed of separate pieces *B*, *C*, *D*, *E*, *F* and *G*, all of these pieces being made up separately and carefully fitted and doweled in place. The sharp corners and irregularities in the parts can be readily machined when made

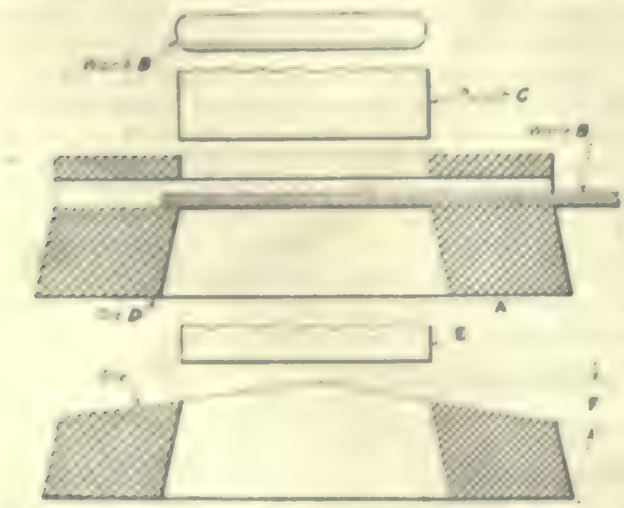


FIG. 448—SHEAR ON PUNCHES AND DIES

up in this manner, so that when they are assembled they form a complete unit ready for producing the work. No attempt has been made in this drawing to do more than illustrate the principles of this type of die. A suitable stripper plate would obviously be necessary.

In general it may be stated that the type of die selected for a given piece of work is dependent on a number of factors, some of which have been mentioned in this article, while other will later be specifically treated with diagrams to illustrate the points of importance. It should be noted that one

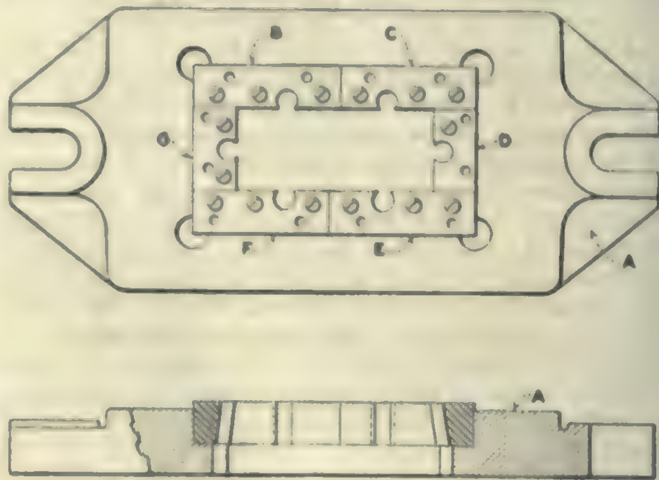


FIG. 449—SECTIONAL OR BUILT-UP DIE

man's idea in regard to the best manner to make a die may be somewhat different from another man's; and yet dies made by both, although slightly different in their construction, may produce the work equally well.

Forced and Shrink Fits

By John J. Serrell

I wonder if there is not a serious error in the figures given on page 210 of *American Machinist* in the article by W. S. Standiford on "Forced and Shrink Fits in Machine Construction and Repair." In his example he gives an allowance of 0.008 in. for a 4-in. shaft and estimates that the pressure in tons will be about 48 tons.

Referring back to Vol. 39, page 941 of *American Machinist*, C. F. MacGill gives over 200 records of pressed fits. Considering record Nos. 6 to 26 inclusive, he shows that it took from 33 to 50 tons pressure with a total allowance of only 0.003 or 0.004 inch.

Again, Mr. Standiford suggests a greater allowance for shrink fits; that is, 0.004 in. for each inch of diameter of the fit, which would give 0.012 in. allowance on a 4 in. in diameter shaft.

For an ordinary turned steel shaft and reasonably smooth bore, I believe that either 0.008 or 0.012 in. allowance for a bore approximately 4 in. in diameter would most certainly burst a cast-iron hub, and such an allowance would set up stresses in a steel hub which would not allow a reasonable factor of safety.

I believe it would be better practice to use a total allowance of from 0.0015 to 0.0025 in., depending upon the shaft size. This is the total allowance and not the allowance per inch of diameter. Tests are said to show that a shrink fit will hold about three times as well as a pressure fit, other conditions being equal. Where a well fitting key is used, it should not be necessary to use sufficient allowance so as to endanger the breakage of the external member which is pressed or shrunk on the shaft. In fact, we have furnished many thousands of flanges for flexible couplings using the total allowance of 0.0015 to 0.003 in., and we have never heard of one of these flanges coming loose on the shaft.

Peace and Wages

Artificial Prosperity Can Never Be Permanent—Government Controlled Prices and Wages a Fallacy—Competition with Foreign Countries and Cheap Labor a Necessity

BY ENTROPY

AT THE time of the armistice many employers looked for a prompt return to a before-the-war basis. They saw the necessity of some reduction in the cost of living, even though it might not drop all the distance it had risen. They attempted to stem the tide of rising wages but without success. People seemed to feel that there could be no end to prosperity and few realized how artificial it was. Prices and wages continued to move upward with nothing to support them except inflation of money and credit and employers found themselves unable to alter the course of affairs. They were forced to follow the public. Men and women had accustomed themselves to spend nearly their full incomes. When first deprived of the overtime pay, which had often exceeded the regular wage, they took out their savings and cashed their Liberty bonds. The stories of their money madness are somewhat exaggerated but still based on facts. Men in considerable numbers are today tramping the streets, penniless but wearing silk shirts and expensive shoes and hose. Their houses are filled with costly furniture, phonographs and the most expensive records.

The so-called "buyers' strike" was hardly a strike in the ordinary sense of the word. It represented an attempt to reduce the cost of living because of necessity, not through voluntary thrift. People could not have bought more than they did no matter what price reductions were offered. This reversed the vicious circle of war times, and instead of prices going up because the supply could not be kept up, prices began to go down because the demand was gone. This made necessary reductions in shop forces, and that again cut the purchasing power of a public that had already spent everything that it could seemingly raise.

Wage and Price Fixing

Unfortunately there are many people who believe that the Government can, if it will, fix rates of wages and at the same time set prices, which must not be exceeded, at which the product of this same labor shall be sold, and that no matter how these rates are set, manufacturers can find an adequate profit somewhere between. The extent and sincerity of this belief would be unbelievable if we had not had the example of our Government doing that very thing during the war. What does not appear to the public, is that the deficit was made up by borrowing and that those borrowings must be returned unless we are to have wholesale bankruptcy. The enormity of our national debt is almost beyond the imagination. The amount of personal and corporate debt is beyond even that. If only each head of a family might realize that all national, state and municipal debts are personal to him, and if he would compute his share of them before he votes for people who will get him deeper in debt, we might soon have a settlement of all debts. Each head of a family of five averages to owe, on behalf of the Federal Government, of which he is a part, approximately a thousand dollars. This is costing him fifty dollars each year that it is not paid, and in order to pay it he will probably have to pay another fifty dollars each year until it is wiped out. This entirely outside the cost of maintaining government institutions of all kinds which will cost at least as much more. If he is prosperous and averaging a better wage than his neighbor he must expect to carry a larger part of the burden. If then he is to be taxed in order that business may be run at a loss, he finds that he must pay his share of the loss. It may be concealed from him, but he may be sure that he will pay in some way or another.

Luxuries Predominate

Just now we are in the awkward position of having more luxuries than we have necessities. It is as if a farmer decided to raise only asparagus and brussels sprouts. At market rates with business good and others raising the beans and potatoes he might make a good profit, but if everyone raises only these luxuries we will soon starve. Warehouses and stores are full of useless things. The supply of necessaries appears to be hardly more than is needed week by week. This condition cannot be changed until workmen begin to make necessities. They cannot go to work until manufacturers and banks are convinced that there will be a sale for the goods at a profit when they are made. They cannot be expected to be convinced until people have once more begun to buy necessities. And that they cannot do until they have turned the last of their luxuries, their toys, into whatever cash they will bring. It seems rather a pity that the labor which has been put into musical instruments, carpets, laces and fine clothes should be wiped out, but that is the fate of all such things in the end, so what difference does it make whether they are scrapped, and placed on the second-hand market now or a year from now.

In ordinary times if a man makes toys for his children he makes them only in the long winter evenings and not during the summer when he can work long hours on things which he needs for his support and comfort. We find however the majority of workmen have spent the money which they earned during flush times on things which are virtually toys, things which they did not need and which they cannot eat nor make any other good use of now. The fur coats which they bought do not keep them any warmer than red flannel underwear; their automobiles keep them from walking or other needful exercise, and they try to maintain health on doctors' prescriptions. Their player-pianos make it unnecessary that they learn music, and the natural deterioration in taste has come. In their mistaken notions of the value of money they have imitated a few other people who are conspicuous spenders to the injury of health, both mental and physical. If they could only realize that wealth is as dangerous as dynamite to one who does not know how to use it, they might have been more willing to have invested their money in something that would tide them over the rainy day that always follow times of inflation.

American workmen must realize that they sooner or later must face competition with countries where the scale of living is not nearly as high as it was in this

country previous to 1914. So long as this country could not produce enough for its own needs a high protective tariff kept us in an artificial state of high wages and high cost of living. Now, in order that all may be kept busy, it is necessary that we export, not merely raw materials but finished products. Our workmen must inevitably compete with those of other countries or only work short time with the reduced standard of living which that implies. This is further made necessary by the fact that the rest of the world owes us money which can only be paid by sending us goods of other kinds than those which we can make here to advantage, which virtually means that by the time our account with the world is squared we must have made a profit of some ten billions or more, over and above the profit which the other countries have made.

In face of this the only way that American workmen can maintain a high standard of living is to maintain a high rate of production. This can be done in two ways, one which is largely in the hands of their employers, further labor saving machinery and specialization; the other which is largely in their own hands, efficient work.

The first is the method which was followed after the close of the Civil War. It has seemed to many that it has already been carried quite as far as was wise. There is no doubt but that further labor saving devices can be invented, but they can only be profitably used by very large concerns which can so control their markets that special machinery can be used for many years before changes and improvement in the product made will make necessary its scrapping.

The second method is more likely to bear fruit, if only the workmen themselves can see their possibilities. They can become more efficient and by accomplishing more have more. This does not mean that they shall work to exhaustion. Out of all the work of manufacture, mining and agriculture there is no longer much necessity for exhausting physical exertion. There is already sufficient machinery on the market for handling heavy loads so that if industry is grouped in large enough units to permit of its purchase, there need be but little heavy manual labor performed. It does mean greater concentration on the work in hand, greater interest in the work and a determination to accomplish results. It also requires greater intelligence regarding the work to be done.

Unfortunately, we have to admit that this country already has a great body of citizens whose intelligence is not of a high order. Our gates have been open as a refuge to peoples whom the other nations have been glad to spare. The selection has been by poverty rather than adaptability. That the results are no worse we may be thankful.

Effect of German Standardization on Exports—Discussion

By R. Poliakoff

On page 373, Vol. 57, of *American Machinist* there was published an article by Oscar R. Wikander under the above title, and from it I quote:

"To give a concrete illustration of this point, I may mention that at the time of my visit, a syndicate of nineteen German manufacturers and one Swedish manufacturer were executing an order for seven hundred locomotives for Russia, all of the same design, and every part in every one of them was being made interchangeable with the corresponding part in all the others, all parts having been manufactured to the same fits and tolerances. This feature will have the great advantage of permitting the Russian railroads to use any disabled locomotive as a store of spare parts for all the others. In one case a locomotive was assembled from parts machined in twenty different shops, with no more difficulty than a locomotive which was built complete in one shop. In case of future orders, the Russians will no doubt specify that all new locomotives of this class be built not only of the same design as above, but so that every part is interchangeable with the above."

Mr. Wikander refers evidently to the order of the Russian Soviet Government for 700 locomotives to be made in Germany. The contract of the purchaser with the manufacturer *does* specify in paragraph 5 that the parts are to be interchangeable, no matter at which of the works they are made, but the same contract also has a clause in the same paragraph 5 stating that it is permissible to make these interchangeable parts fit one another by applying hand operations (filing, scraping, etc.). It can be readily seen that this latter clause not only kills entirely the preceding one, but the whole idea of interchangeability.

The foregoing remarks are, of course, in no way a criticism of the interchangeability idea in itself.

Safe Loads for Two-Part Chain Slings

The accompanying data is from a blue print used in the plant of the Marion Steam Shovel Co., Marion, Ohio. This table contains such a lot of useful information for users of chains for hoisting, as to be well worth laying aside for future reference. It will be noted that the strength of single chain is given, and a substantial deduction for safety when using in different positions is made. Safe loads for using two chains with a straight pull are shown under the column marked 90 deg., while the other columns give angles of 60, 45, 30, 20, 15, 10 and 5 deg., respectively. The difference in permissible load is very marked.

SAFE LOAD FOR TWO PART SLING

Strength of Single Chain in Lbs.	Size of Chain	90°	60	45	30	20	15	10	5
75,000	2"	130,250	112,790	92,125	65,125	44,540	33,700	22,615	11,350
61,630	1¾"	107,850	93,400	76,260	53,925	36,860	27,920	18,725	9,400
46,660	1½"	81,650	70,710	57,740	40,825	27,930	21,130	14,175	7,120
32,000	1¼"	56,000	48,500	39,600	28,000	19,150	14,500	9,725	4,880
20,830	1"	36,450	31,570	25,775	18,225	12,465	8,800	6,330	3,250
16,330	⅞"	28,570	24,740	20,200	14,280	9,770	7,400	4,960	2,500
12,000	¾"	21,000	18,190	14,850	10,500	7,180	5,485	3,645	1,830
8,330	⅝"	14,570	12,620	10,300	7,285	4,985	3,770	2,530	1,270
5,330	½"	9,320	8,070	6,590	4,660	3,190	2,410	1,620	810
3,000	⅜"	5,250	4,550	3,715	2,625	1,800	1,360	910	460
1,330	¼"	2,320	2,010	1,640	1,160	800	600	400	200

DON'T [illegible]
DON'T [illegible]
DON'T [illegible]
DON'T [illegible]
DON'T [illegible]
DON'T [illegible]
DON'T [illegible]
DON'T [illegible]
DON'T [illegible]

TABLE OF SAFE LOADS FOR SLING CHAINS

In addition to the table there are several pertinent as well as important pointers concerning the use of chains, given beneath the figures. These figures represent the daily usage of a large concern handling much heavy material, and are thoroughly practical.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Gashing the Teeth of Bevel Pinions

By Milton Wright

A simple and effective device for gashing the teeth of bevel pinions, that has a productive capacity far beyond what its appearance would indicate, is partly shown by the accompanying illustration. From its location in proximity to other machines and a blank wall it was impossible to secure a comprehensive photograph.

Eight gashing cutters are mounted upon the arbor of a Lincoln type milling machine, built by the Hendey Machine Co., and the sole duty of the machine is to rotate the cutters and pump lubricant to them. None of the remaining movements of the machine are utilized except that the table is run back by hand for unloading and reloading, and again run forward to a stop before throwing the device into action.

All the other movements of the cycle are within the device itself and are entirely automatic, being operated by the worm *A*, Fig. 1, which receives its movement through a universal joint from the shaft that would ordinarily operate the regular table movements of the machine, and therefore having all the advantages in the way of feed regulation to be derived from the speed-change gear box with which the machine is provided.

Within the frame of the device are four sectors having a swinging movement of perhaps 30 deg. of arc (the center of gyration cannot be seen in the picture) operated by short connecting rods, the ends of which appear at *B*, *C*, *D* and *E*, and which derive their reciprocating movement from a four-throw crankshaft driven from the worm wheel in mesh with the worm *A*.

Each sector carries two spindles, the outer ends of all of which are plainly visible in the picture. Upon the inner ends of these same spindles are mounted the blanks to be cut. Each spindle has keyed to it a spur pinion, also visible in the picture, and both pinions of each pair are in mesh with a single spur gear of slightly larger diameter which turns freely upon a stud. All of this mechanism is mounted upon the outer face of each sector and swings with it.

In addition to their function as spur gears in turning their mating pinions, each gear has cut across its back the requisite number of radial slots (the same in number as the spur teeth of the gear) forming projections that may be likened to the teeth of a crown gear except that the tooth spaces have parallel sides, thus making an index plate of each gear.

The arms *F*, *G*, *H* and *I* are stationary at all times, though adjustable. Upon the inner face of each of these arms is a spline that fits the parallel tooth spaces of the "crown gear" and thus acts as the locking pin. To a crosshole through the inner ends of each of the brackets *J* and *K* a round pin of hardened steel about $\frac{3}{8}$ in. in diameter is fitted to slide freely, though without shake, in a direction parallel to the main supporting bar *L*. Brackets *J* and *K* are stationary and this pin is so located in each that its end is in position to contact with one of the teeth of the spur gear, as the latter swings upward, at a point about midway between the vertical and horizontal planes. This is the indexing mechanism, and the outline, Fig. 2, shows the relative position of its parts.

The sectors are so suspended that when their inner ends swing upward, carrying two blanks simultaneously to their respective cutters, the outer ends swing downward, carrying with them the two pinions and their single operating gear and index plate combined. At the same time the adjacent sector is swinging in the opposite direction, withdrawing its two cut blanks from the the cutters and also its index plate from the spline.

As this sector (let us say the second one from the left, as it occupies about the position to be described) moves upward the tooth space of the "crown gear" or

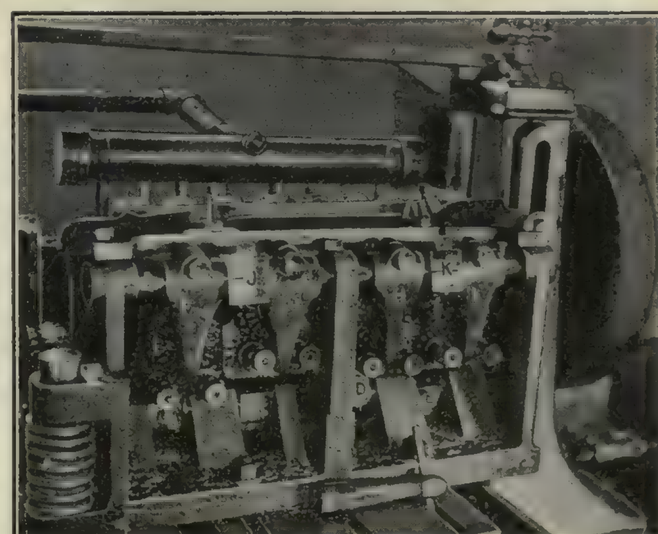


FIG. 1—DEVICE FOR GASHING BEVEL PINION TEETH

index plate, passes out of mesh with the spline on the inner face of the arm *G*, leaving the gear free to turn. At the same time one of the spur teeth of the same gear contacts with the end of the sliding pin, which at this time projects to the right of the bracket *J*. As the upward movement of the gear continues, though the pin in contact with one of its teeth would oppose such movement, the result is that the gear is rotated slightly (a distance equal to one tooth and space) on its stud in a counter-clockwise direction. This turning movement causes the tooth above the one in contact with the pin to push the pin endwise to the left so that it now projects to the left of the bracket *J*.

The two blanks upon the inner ends of this pair of spindles have now been turned one space forward in a direction opposite to that of the gear, bringing them

into position for the next cut. The sector (still the second) now swings downward at the gear end and upward at the work end, bringing the next space of the crown gear into mesh with the spline on arm G and locking the spindles against further turning.

At the same time the first sector, swinging the gear end upward, withdraws its crown gear from mesh with its respective spline on arm F, brings a spur tooth in contact with the sliding pin now projecting to the left of the bracket J, and goes through the same cycle of indexing, except that the direction of rotation is to the right, or clockwise.

That is all there is to it. Two sliding pins, with no springs, latches, pawls or screws to limit, retard or promote their movement in either direction; four spur gears with "crown" teeth upon their backs; and eight pinions with their respective spindles—yet this device gashes twelve 7-pitch teeth in eight bevel pinion blanks of mild steel in 90 seconds.

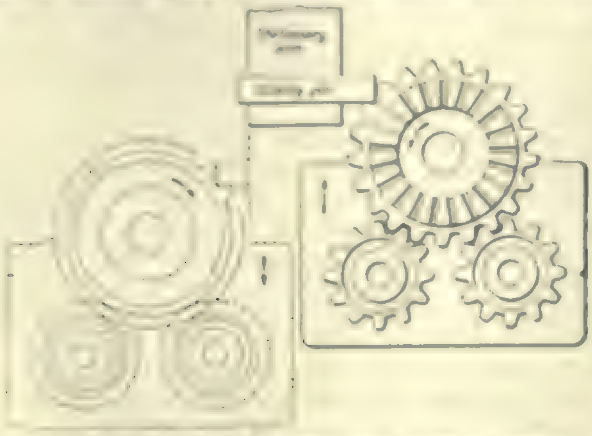


FIG. 2—OUTLINE OF INDEXING MECHANISM

The reloading time is about two minutes, thus enabling one operator to handle two machines to advantage. A possible productive capacity is about 480 pinions per hour. It is but fair to state that this pace would be too strenuous and that the devisor is well satisfied with a sustained rate of 140 pieces per hour per machine.

The object of the device is, of course, to releve the Gleason generators on which the pinions are finished of the preparatory work of "roughing out." As the only movement of the device is the swinging or rocking motion of the sectors there can be no relative traverse of the cutters, and an approximate tooth form could only be expected. The pinions are advanced to the cutters in a direction almost at right angles to the bevel surface, sinking the cutters to the full space depth at a point toward the large end of the tooth and allowing the space to round out as it approaches the small end in correspondence to the radius of the cutter.

With cutters 4 in. in diameter sufficient stock is removed from the blank to enable the generators to finish a gear in one cycle, which is all that could be expected of any roughing operation. Because of the rapid production, one machine will keep many generators busy.

The device is the conception of Philip Norton, formerly superintendent for the Turner Machine Co., Danbury, Conn., and is now at work in that factory. It was built without drawings; patterns being made as the work progressed and the parts gotten out either by Mr. Norton or under his immediate supervision, so that a few free-hand sketches constitute the only remaining record of its construction.

Chucking Hardened Gears for Grinding Hole

By Charles A. T. Kerr

An efficient and accurate method of holding hardened gears or sprockets in a chuck when grinding the hole is shown in the accompanying illustration.

HOLDING HARDENED GEARS IN CHUCK

The chuck jaws should first be ground true. If sprockets are to be held, the diameter of the roller should be made the same as that of the roller of the chain that is to run with the sprocket. If the work is upon gears, the roller must be of a diameter that will allow it to contact with the gear teeth at the pitch line.

The groove at the middle of the roller is made so as to allow the rubber band, which is used to hold the roller in place on the chuck jaws, to pass around and hold the roller without coming in contact with the work.

Combination Dies

By C. E. Stevens

In producing the part shown in Fig. 1 it was necessary to hold the round hole and slot to size and in the correct relation to the bend. To attain the required accuracy a shaving operation was necessary. The round hole had to be countersunk on both sides and this operation was done in combination with the blanking and shaving operations which are shown in the accompanying illustrations.

As the pieces were produced in large quantities, it was deemed advisable to build dies of the pillar type to give proper alignment and quick set-up.

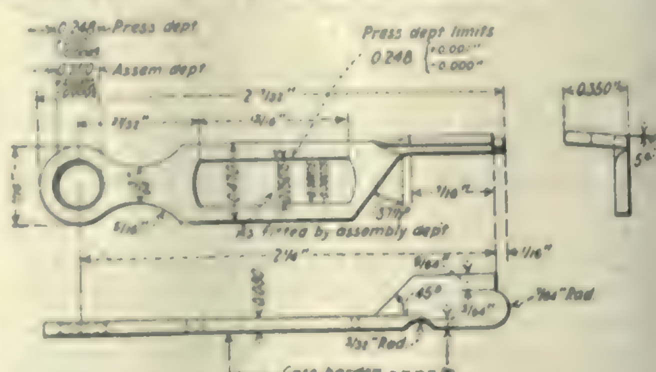


FIG. 1—PIECE TO BE MADE IN COMBINATION DIE

The die for the first operation is shown in Fig 2, and the general construction can be readily understood from the illustration.

The die shoe A and punch holder B are of cast iron, fitted with pillars C which are tool steel hardened and ground. The die block D is of tool steel and bushed for the round piercing holes. The stripper E is cold-

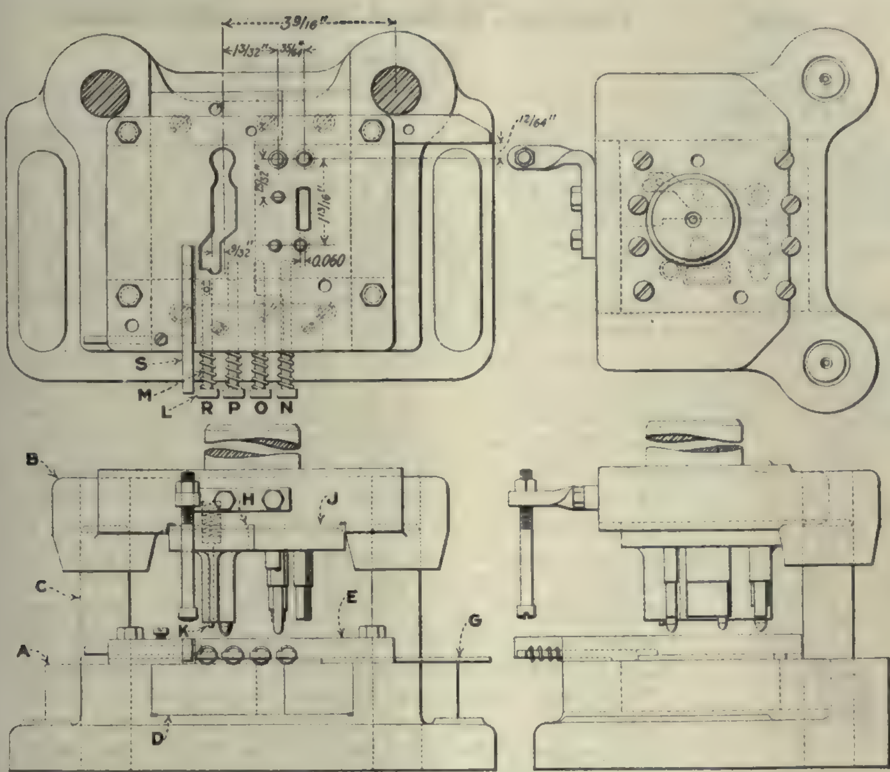


FIG. 2—DIE FOR FIRST OPERATION

rolled steel held in place with four $\frac{5}{16}$-in. hex head screws and two dowels, the two rear screws also holding the back guide *G*, which is cold-rolled steel cyanided and which extends 2 in. from the edge of the stripper to aid in starting the stock straight.

The blanking punch *H* is made with a shoulder and is screwed to punch holder *B*, while the smaller punches are set in punch pad *J*.

The spring kicker *K* is set in punch *H* to prevent the blank from following the punch on the up stroke should the die wear a little large, which is the case many times in blanking small parts.

In operating dies of the progressive type it is often necessary for the operator to guess or measure the spacings when starting a new strip of stock. The inaccuracy of this method is overcome by stop fingers *L* of which there are four, held out by coil springs *M*.

The stock is fed into stop *N* held in by operator, the first stroke of the press piercing two round holes and an elongated slot. The stock is fed to stop *O* on the second stroke of the press when the round hole is shaved and also countersunk on one side. The stock is then fed to stop *P* which is an idle operation for the first row of holes. This space was necessary to give ample wall for the blanking and piercing operations in the die. The stock is next fed to stop *R* and blanked, and from then on it is fed by automatic finger *S*, allowing the operator to run the press without stopping for the balance of a 6-ft. strip, the press running at 112 strokes per minute.

The second operation is to bend the lip. This is done in an ordinary clamp forming die, which is found in most press rooms and needs no explanation.

The third operation is to countersink the opposite side of the round hole and shave the slot. The die for this operation is shown in Fig. 3, and is of the same general construction as the die used for the first operation.

The part to be shaved is placed in nests *A* and *B*, which are screwed and doweled to die block *C*.

The countersinking and shaving punches *D* and *E* are set in the machine steel pad *G* mounted on holder *H*.

The stripper *J* is of the spring type and acts as a presser pad against the work while it is being shaved, and also strips the work from the punches on the up stroke.

The piece is put in the die by the operator, the press is equipped with compressed air, and to the air pipe is attached a push valve which operates with the up stroke of the press and blows the finished part together with any shavings from the die. By using air in this manner, the die is kept free from shavings and the operating time is reduced to a minimum.

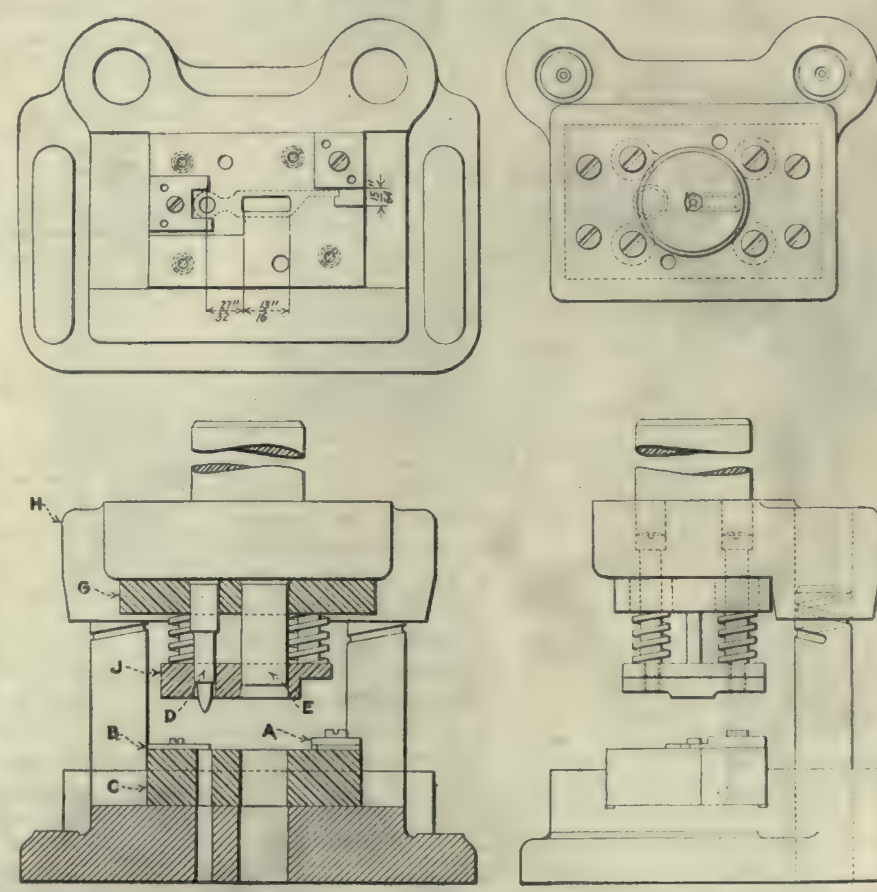


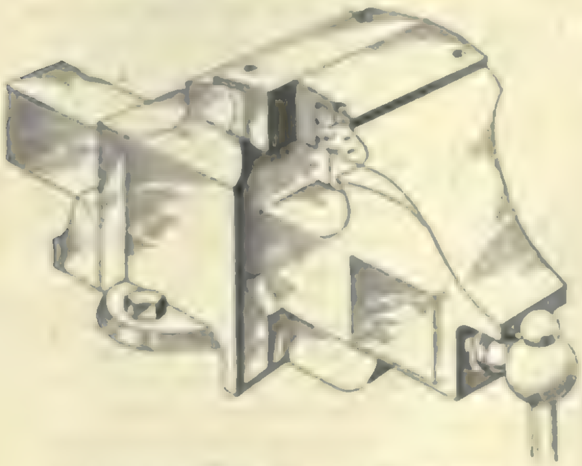
FIG. 3—DIE FOR THIRD OPERATION

Fixing Soft Metal Faces to Vise Jaws

By S. E. Frew

To prevent the annoyance of having the soft metal faces drop out of the jaws of the vise just when you have both hands full and are trying to close the vise sufficiently with your knee to get a temporary grip, the simple method shown in the sketch herewith will soon demonstrate its value in the average repair or job shop.

Drill two shallow holes, about $\frac{1}{4}$ or $\frac{3}{8}$ in. in diameter,



FIXING SOFT JAW FACES TO THE VISE

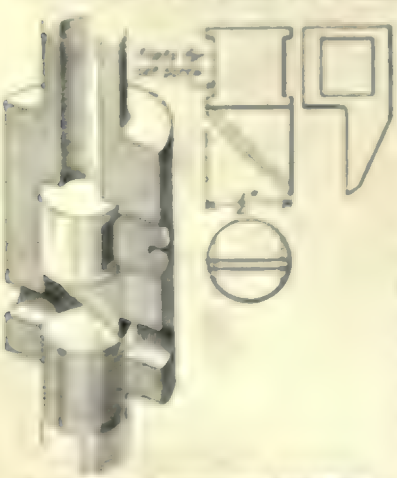
just back of the hardened part of the regular jaws and, with the soft jaws in place, put a round end punch as nearly over these holes as can be determined, and drive the soft metal into them. If the punch is located anywhere near over the hole to begin with it will drift toward it as the pounding continues and form a sort of dowel that will effectually prevent the soft jaw from being accidentally displaced.

Tool for Pointing Screws

By Charles G. Spicer

The writer had occasion to put a 45-deg. point on a quantity of $\frac{1}{2}$-in. malleable iron screws and made the tool shown in the illustration to be used in a drill press. It is obvious that the same tool could be used to equal advantage in the turret lathe if occasion required.

The cutter was made of a small piece of high-speed steel and was held in place by setscrews. A hole through the shank of the tool provided a way to drive out the cutter, when necessary to resharpen, by means of a knockout rod.



TOOL FOR POINTING SCREWS

A quick-acting vise was used on the table of the drill press to hold the screws and the work of pointing was handled very rapidly.

Cutting Diamond Screws—Discussion

By J. T. Towlson
London, England

In an article by Joseph Hewes under the above title and published on page 971, Vol. 56 of *American Machinist*, will be found a description of a method of cutting diamond screws—i.e., right- and left-hand threads crossing each other on the same part of a bar. The present writer commends the method as good, yet perhaps the following method adopted by him in cutting a number of diamond screws will be of interest.

A master diamond screw, having a diameter of about four times that of the screws required, was cut and then casehardened and ground to a fine finish. The screw to be cut was held in the lathe chuck and the master screw socketed to it and fastened by a setscrew.

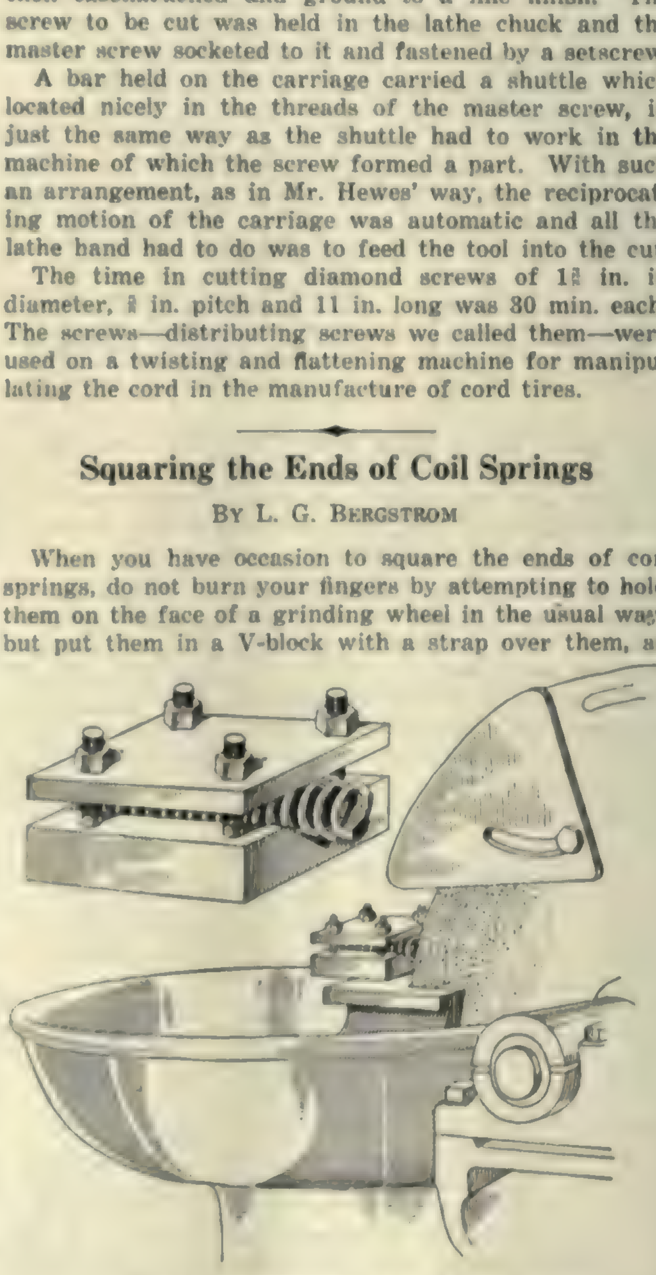
A bar held on the carriage carried a shuttle which located nicely in the threads of the master screw, in just the same way as the shuttle had to work in the machine of which the screw formed a part. With such an arrangement, as in Mr. Hewes' way, the reciprocating motion of the carriage was automatic and all the lathe hand had to do was to feed the tool into the cut.

The time in cutting diamond screws of 1$\frac{3}{4}$ in. in diameter, $\frac{3}{8}$ in. pitch and 11 in. long was 30 min. each. The screws—distributing screws we called them—were used on a twisting and flattening machine for manipulating the cord in the manufacture of cord tires.

Squaring the Ends of Coil Springs

By L. G. Bergstrom

When you have occasion to square the ends of coil springs, do not burn your fingers by attempting to hold them on the face of a grinding wheel in the usual way, but put them in a V-block with a strap over them, as



SQUARING SPRINGS IN A V-BLOCK

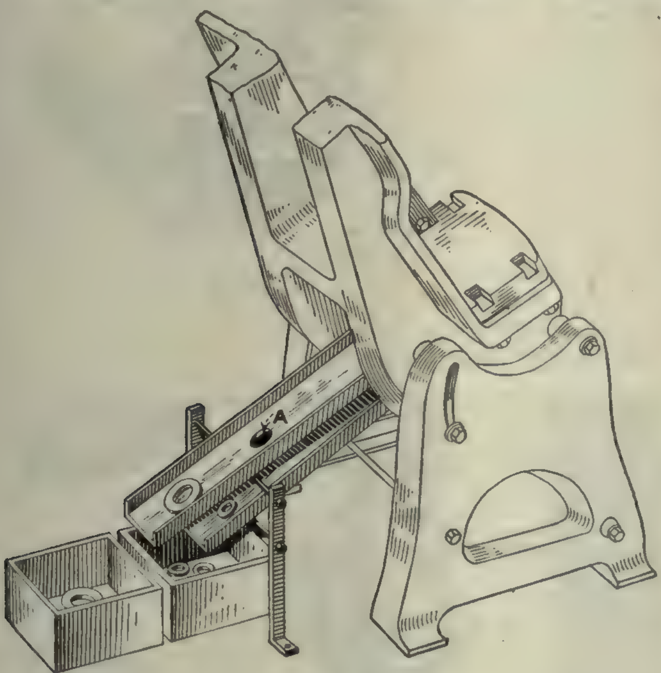
shown in the sketch, and set the device on the toolrest of the grinding-wheel stand. In this way you can get a good square end on the spring. You need not draw the temper of the spring nor lose your own, and when the job is done the spring will still be in the V-block instead of under the bench.

Sorting Punchings Automatically

By Herbert Crawford

In going through the plant of the Hoover Suction Sweeper Co. the other day I saw a clever device for sorting two sizes of punchings as they come from the punch press. They were punchings for the field and armature of the motor, the armature being cut from the center of the field so as to save material.

Two inclined metal chutes lead away from the back



CHUTES WHICH SEPARATE PUNCHINGS

of the punch press, both the field and armature punchings sliding out of the die and on the upper chute. This chute has a hole at *A*, as shown in the accompanying illustration, just small enough to prevent the field punchings from dropping through. As the pieces come from the press they slide over the hole, which permits the smaller, or armature punchings, to drop through to the lower chute. In this way the two punchings are automatically separated, each going to its own box on the floor at the ends of the chutes.

Pneumatic Drills in a Car Shop

By Fred S. Harger

The series of articles by Howard Campbell upon the manufacture of pneumatic drills, recently appearing in *American Machinist*, have been of especial interest to me for the reason that I am employed in a shop that uses a large number of these tools. In one department devoted to the assembly of the small cars used in coal mines there are 70 or more of these drills—Little Giant, Thor, Little David, etc.—and the manner in which they are applied may be of interest to other readers.

The bodies of the cars are made of wood and bound with iron straps. The bolt holes in the straps are pierced upon a Read punching machine before coming to the assembly floor. In applying them they are first fastened to place with heavy wooden clamps and then the wood frame beneath them is drilled for the bolts by means of the air drills. These drills are suspended from ropes that pass through sheaves attached to the overhead timbers and counterbalanced by a weight at the other end of the rope, so that they will remain at whatever height they may be placed.

When a strap is firmly clamped to a car frame the workman has but to reach up for a drill, pull it down to position, drill such holes as may be necessary and push the drill back out of the way again. The holes already punched in the strap serve to guide the drill, and the work is done very rapidly.

As fast as the holes are drilled a helper sets in the bolts and runs the nuts on with his fingers as far as he can conveniently do, so that when the workman has finished drilling a set of holes and pushed the drill up out of the way he pulls down another that is fitted with a socket wrench and sets up the nuts to the limit of the power of the drill.

Spare parts for all drills in use are kept in the tool crib; also complete machines ready for service. When anything happens to the drill he is using, the workman immediately returns it to the crib tender and receives another to replace it, while the defective drill goes to the repair shop. In this way there is no time lost in waiting for repairs or adjustments. There is a sufficient number of spare drills to make certain that all those on the assembly floor are ready for instant service.

Shop Boxes Built from Scrap Lumber

By Wallace C. Mills

Scrap pieces of hard maple can be used to build up shop boxes as shown in the illustration. The pieces are cut to size, planed and glued together. A box so constructed has a good appearance and will stand a great deal of hard usage. By putting permanent skids on the bottom these boxes can be used to advantage in connection with elevating platform trucks.

Similar boxes may be built up from the shallow crates used for shipping sheet tin plates. After the

SHOP BOX BUILT OF SCRAP LUMBER

tops and bottoms of the crates have been removed the frames are cleaned and the corners drilled in a jig so that any number may be fastened together by means of long wires or rods. The rods should be headed at one end like a large wire nail and, after cutting to the length required by the box, they are set in place and clinched on the under side.

This method of fastening is used in preference to nailing because of the difficulty of driving nails in the hard wood.

Understanding Shop Terms

By F. Butt-Gow

Under the above heading there was published on page 916, Vol. 55 of *American Machinist* a short article by Robert Grimshaw. I know that Mr. Grimshaw has had a world wide experience but I beg to differ with what he says about the meaning of a shim. My American experience taught me that what is called a liner in England and Scotland is called a shim in the United States. Neither of them is wedge shaped, but are generally made in various thicknesses, the thinnest of brass foil and the thicker ones of heavy gage tinplate or brass. They are used most frequently in marine practice, many engineers connected with land installations preferring to have bearings brass to brass. This may be accounted for by the fact that an engine working at a factory or power and light plant runs under regular conditions and usually shuts down when repairs are made.

In regard to a "monkey wrench" I do not think Mr. Grimshaw will find the word "universal spanner" in use. The type of wrench, of which "Coes" is about the best known, used to be called a coach wrench when made with a wooden handle, as it was first made for use on carriage and wagon work. The usual term for any spanner or wrench capable of adjustment is shifting spanner and one of the best known of these is the "Clyburn." If space permitted I could give many more examples of different names for the same thing.

Supporting a Motor While Overhauling

By G. A. Luers

While fitting crankshaft, camshaft or main bearings in a motor block, the block is in an inverted position, so that the projecting piston heads and valves usually interfere with the block being seated squarely on the bench. These parts are also apt to be damaged while moving the engine on the bench. To avoid this and still be able to place the block in the inverted position, a simple method of supporting it is to use four cylinder head bolts, one in each corner of the casting. The bolts are spaced sufficiently far apart to provide a stable base, and the block can be brought to an even seat on the bench by screwing one or more of the bolts further in or out. This method not only protects the parts but saves time in handling.

USING CYLINDER HEAD BOLTS TO SUPPORT MOTOR

Drill Press Used as a Threading Machine

By Allen P. Child

In cutting threads on electrical outlet boxes a manufacturer equipped a high-speed tapping device with an adjustable diehead and made a threading machine out of a drill press. The tapping device may be used on the live spindle in either a horizontal or a vertical position. If the work is to be hollow milled or some other operation performed upon it, slip collets may be used in connection with the tapping device and a hole drilled, reamed, counterbored and tapped without moving the work or stopping the machine.

FIG. 1—OUTSIDE THREAD CUT ON DRILL PRESS

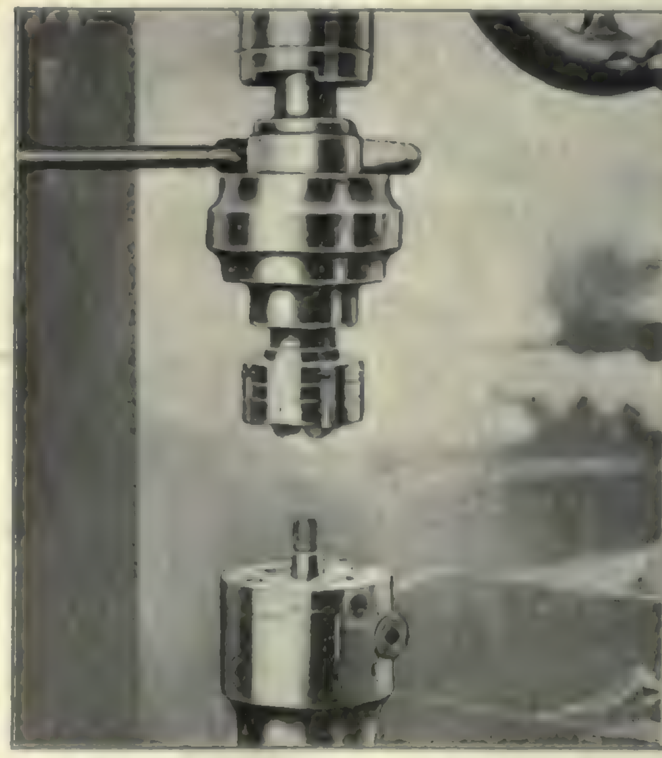


FIG. 2—DRILL PRESS SET UP FOR THREADING STUDS

The threading job mentioned above is shown in Fig. 1, while in Fig. 2 may be seen the machine and device arranged for threading studs.

Soliloquies of Old Mac

By R. McHenry

The easiest way to adjust the center rest on a large lathe to receive a heavy piece of work is to slide the tailstock of the lathe up to the place where the point of the tail center is in the same plane as the jaws of the rest, then measure with a scale from the point of the center to the face of the jaws, the distance being the radius of the work. The rest is now ready to receive the work without further juggling.

Editorial

Makeshifts

MAKESHIFTS are, as a rule, indications of poor management. Once in a while we may have to use them because of an accident and sometimes because circumstances, not to be foreseen by human beings, make their use unavoidable. On the whole, however, a makeshift indicates lack of foresight and frequently stupidity or misconception of economical values.

One reason why we find so many makeshifts is that the men who make them are generally proud of their product. What is worse, they have a right to be, at least in a large percentage of cases.

As a rule, a makeshift is the product of someone's ingenuity applied to conditions which have no right to exist. Somebody is obliged to make a nice fitting plug for a hole which has been drilled in the wrong place. The man has the right to be proud of the plug but not of plug and hole together. Plain penuriousness, or inability to estimate things at their proper value, may be the reason or excuse for many makeshifts.

We hire a man at fifty cents an hour to shovel snow from our side walk but we give him no snow shovel. Instead we furnish a piece of board and an old broom handle with a piece of twine and have him spend fifty cents worth of time making some monstrosity with which to shovel twenty-five cents worth of snow for every dollar he gets. We feel that we have saved the price of a snow shovel and are proud of it. Perhaps we even show it to our neighbors and describe it in the *American Machinist*. Worst of all, we keep it for use again next year.

Innumerable makeshifts have been described which are laughable or pathetic, sometimes both. And yet, those who made the contrivances did a good job and showed ingenuity, initiative and resourcefulness. They are to be congratulated but at the same time, they should never have been compelled to make the things. Any number of contrivances used in the shop are the result of poor management which fails to realize that proper tools must be provided to insure proper production.

Anyone doubting that such management exists, need only go through a number of railroad repair shops. Some of these are veritable museums of makeshifts, telling the story of how clever the men are and how poor the equipment with which they have to work.

Railroad shops are not the only one which indulge in the making of home-made contrivances and tools. As a class, however, they outshine all other large machine shops. The reason may possibly be found in the fact that, to the management of a railroad, the repair shop is a necessary evil because it earns no money. Records show how much money was earned by each freight car and records are even made that show what was earned by each locomotive. Yet, in reality, the locomotive has no more earned money to its credit than the repair shop. The freight car earns something because freight is transported in it, but it cannot earn this money if there is no locomotive to pull it. Moreover, the locomotive could not pull the freight car unless there were a repair shop to make the locomotive fit for duty.

Service or Graft?

A CERTAIN company, which we shall call *A*, purchased a few machine tools from another company *B*. This company *A* (which, by the way, does a jobbing business) employs an engineer—outside talent—for the purpose of getting the most out of the equipment. This gentleman requested company *B* to give full information as to feeds, speeds, capacity, etc., of the machines bought. So far so good. But he also wanted complete diagrams of machines and their gear trains, and this information was to be given on sheets and in a form as standardized by him.

This would involve an amount of labor costing easily $500, besides depriving the machine tool manufacturer of the services of one of his engineers for a considerable time. Company *B* dares not refuse or even charge for this work for the reason that this engineer, like several others, is a pupil or follower of a well known efficiency engineer who is in the habit of making such demands. The company is afraid that it would not be able to do business in the future with a concern with which any of these engineers may be temporarily connected. This fear may be unfounded but it controls company *B* and companies *X*, *Y*, *Z* likewise.

This thing makes us wonder about two things. In the first place, where the engineer got the nerve to make such a demand. Does he think it legitimate service; does he demand it because he thinks he has the power to; or does he think that the answers to his questions are really worth all of $500 and that he would pay that much if he did not get it for nothing?

In the second place, what is the matter with the backbone of the seller? Why doesn't he bluntly refuse, or better yet state in a business-like manner that he will furnish all necessary information gratis, but that he will charge so-and-so much for all other information or for data in a form different from the one ordinarily furnished? Reasonable service should be free, all other should be paid for. We may not be able to furnish a formula by which to calculate if a thing is reasonable, but it is not likely that two normal men would quarrel about it.

This "service" idea has been much overworked and mis-applied. Some advertise it who have no intention of delivering the goods, and some demand almost any kind of graft under its name.

Just Suppose

JUST suppose you were working out in a shop drilling holes in a funny shaped piece of steel. And you asked the boss what it was and what it did, and he told you that your business was to drill holes and not ask questions.

Or suppose again you had a new boss who not only told you what the piece was, but showed you where it went, and why it had to be drilled just right. For which boss would you do the best work, or take the most interest in your job? Of course you don't work in the shop, but—

Just suppose.

Shop Equipment News

Niles-Bement-Pond Plate Planer

The accompanying illustration shows a plate planer that has recently been placed on the market by the Niles-Bement-Pond Co., 111 Broadway, New York, N. Y. Among the principal features of the machine are the design of the bed and the method of attaching the carriage to the bed. The construction prevents chips from getting on the bearing surfaces of the carriage and screw, so as to add to the life of these parts.

The tool carriage is attached to the front vertical side of the bed, and is guided by square shears. It is secured at both top and bottom by removable bearing supports, which will permit the carriage to be taken from the bed at any position on the length of the bed. The bearing surfaces are provided with taper gibs for taking up wear.

The carriage is reversed automatically at any desired position by contact with stops adjustable on the shifter rod. The operator with very little effort can start, stop, or reverse the carriage by manipulating this shifter rod by hand. The drive screw is supported in a trough with an oil channel of sufficient depth to cover the full depth of the thread with oil. Roller bearings are provided to take the end thrust of the screw.

Two relieving toolholder slides are mounted on a standard and have simultaneous vertical adjustment by means of a screw and handwheel. Horizontal adjustment of the standard is made by means of another screw and handwheel. Both tool slides can be swiveled for planing bevels.

The pneumatic jacks are of the two-way type and enable rapid clamping. Air is admitted in the tops of them by clamping the plate, and in the bottoms for unclamping.

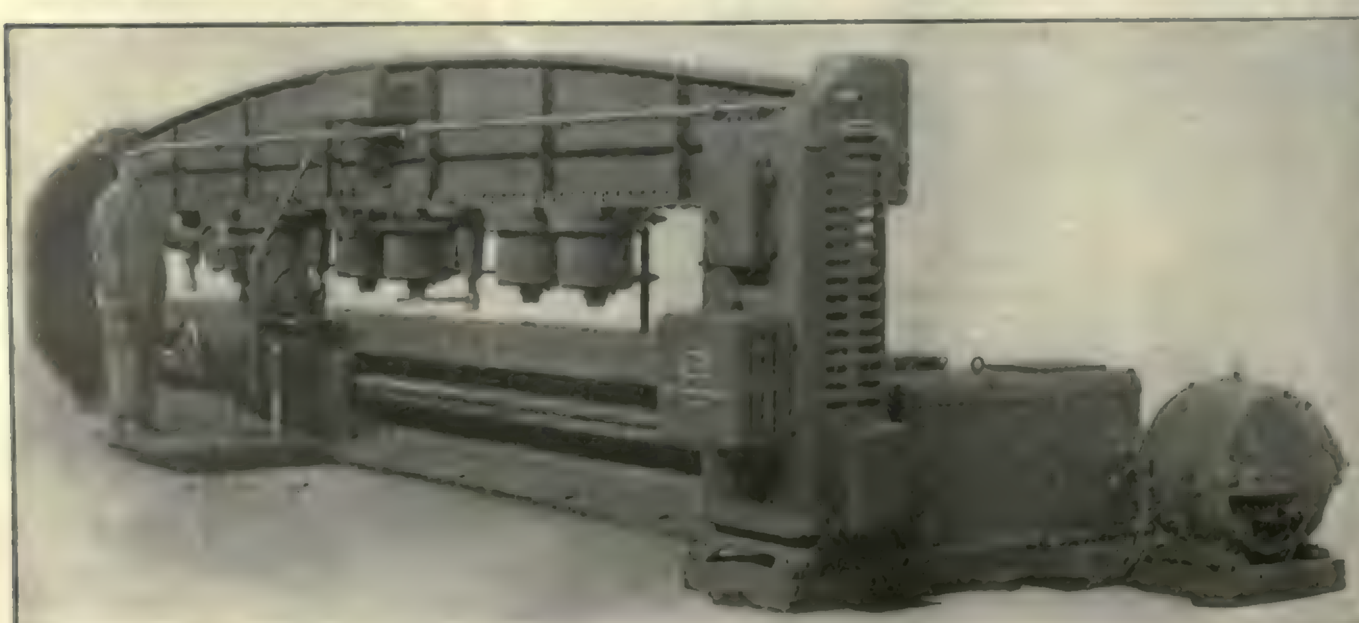
The direct-connected driving motor is controlled by means of a master switch attached to the shifter rod, and an enclosed panel having forward, reverse, accelerating, and dynamic brake contacts. A push button is mounted on the right-hand housing, so that the machine may be started and stopped without manipulating the shifter rod. The main driving gears are enclosed in a box, and dip in oil.

Harris No. 10 Semi-Automatic Hob and Form Cutter Grinding Machine

A semi-automatic hob and form cutter grinding machine, shown in the accompanying illustration, has recently been placed on the market by the Harris Engineering Co., Bridgeport, Conn. The machine is intended especially for use in shops where the number of hobs and cutters to be ground does not warrant the use of the more expensive full-automatic hob grinding machine made by the same concern and described on uage 1,262, Vol. 52 and on page 190, Vol. 56 of *American Machinist*. The machine, designated as the No. 10, has a capacity for work up to 8 in. in diameter and 10 in. long.

The hob or cutter to be sharpened is carried on an arbor having a taper shank and fitting into the work-carrying spindle. The outer end of the work is supported by a center carried in an adjustable tailstock. The height of the center of the work is 41½ inches.

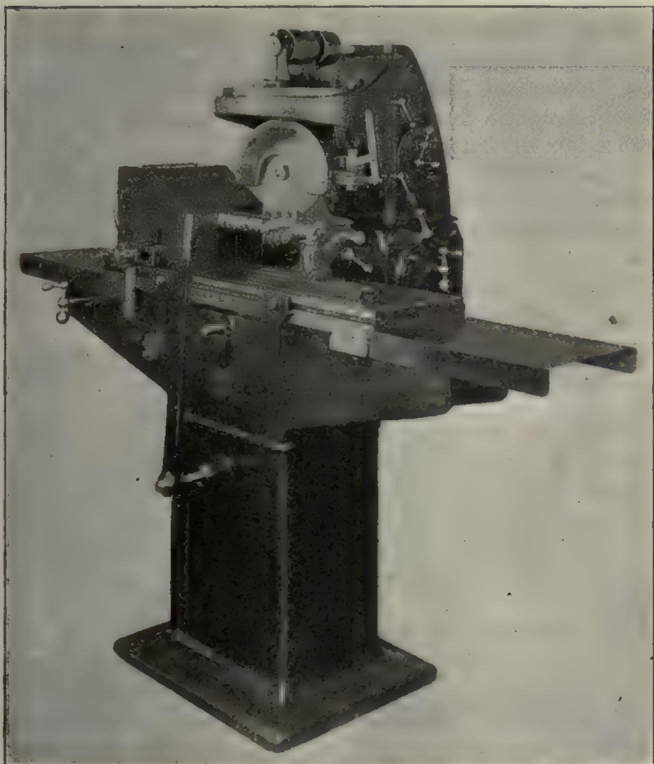
The work-holding members are mounted on a long table that can be operated by the hand lever at the front of the machine, so as to move the table back and forth on the base and pass the work across the wheel. This table is carried on ball roller bearings. It is stated that its movement is so easy and sensitive that the operator can judge from the feel of the handle whether



NILES-BEMENT-POND MOTOR-DRIVEN PLATE PLANER

the grinding is too heavy or too light. Stops are provided to limit the stroke to the length of the hob, the maximum travel being 15 in. All of the working parts are covered to protect them from grit and dust.

Hobs having helical flutes are rotated during the travel of the table by a sine bar, which can be quickly adjusted to suit different angles and which actuates



HARRIS NO. 10 SEMI-AUTOMATIC HOB AND FORM CUTTER GRINDING MACHINE

a cross slide that carries a rack meshing with a gear on the work spindle. The maximum helix angle obtainable with a hob 8 in. in diameter is 47 degrees.

The indexing is arranged to care for any number of flutes from 4 to 26. The indexing plates used are interchangeable with those of the full automatic grinding machine, and they have two sets of notches, one set for indexing and the other set for the escapement. The index plate must have the same number of notches as there are gashes or flutes in the hob to be ground. The indexing mechanism is semi-automatic, and can only operate at the end of the return strike. At this point, the operator with his left hand pulls the hand wheel as far toward him as it will go, and the hob is then indexed to the next flute.

The grinding wheel spindle is driven by a belt without any turns or idler pulleys. The speed is ordinarily 2,700 r.p.m., and a special wheel 8x1 in. in size is provided. The entire wheel head is of heavy construction and provides all the necessary adjustments and graduations for angularity, for wear and for setting. The wheel has a horizontal adjustment each side of the center of 1½ in. The wheel spindle is carried in dust-proof bronze bearings provided with lubrication from an oil well and with means of taking up wear.

One of the most important features of the machine is the diamond truing device used for dressing the wheel. The device is built into the head, is always in position, and may be used when the machine is in operation without disturbing the position of the work. The device may be set so as to true the wheel to grind the faces of the teeth radial, or by shifting the traverse adjustment of the head the grinding may be such as to give top rake to the faces of the teeth. This undercutting the front faces gives an improved cutting action for many types of hobs. The hob is fed against the grinding wheel by means of a hand wheel which the operator turns with his left hand, so as to rotate the hob slightly after each complete revolution.

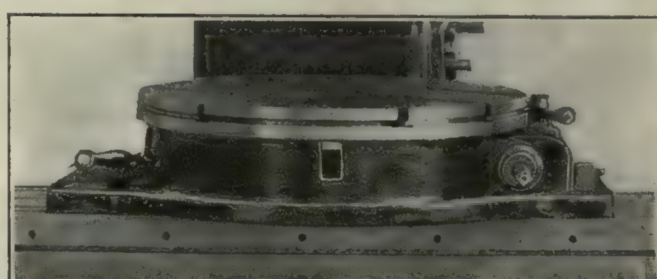
The machine can be furnished either with countershaft drive or with individual motor drive, the motor being mounted on the top of the machine and driving directly to the spindle in the latter arrangement. All necessary equipment for flood lubrication of the cut can be provided. The machine occupies a floor space of 50x90 in., and weighs about 1,760 pounds.

Toledo Rotary Milling-Machine Table

A rotary table that is controlled by the regular feed levers of the machine, including the traverse, has been developed by the Toledo Milling Machine Co., Toledo, Ohio. The table, front and side views of which are shown in Figs. 1 and 2, is driven from the feed drive shaft through a telescopic shaft and two pairs of steel bevel gears that drive a 2½-in. steel worm meshing with a 20-in. worm wheel.

The sixteen regular feeds of the machine are applicable to the rotary table, and the feeds are controlled by the same lever that controls the regular feeds of the table. The design of the mechanism makes it impossible to engage more than one power feed at a time. The quick return is also applicable to the rotary table in either direction. These controls are especially advantageous in continuous milling operations.

The diameter of the table is 24 in., but work of larger diameter can be accommodated. The table is graduated throughout the entire 360 deg.; and by using a dial on the worm-shaft, division to minutes can be obtained.



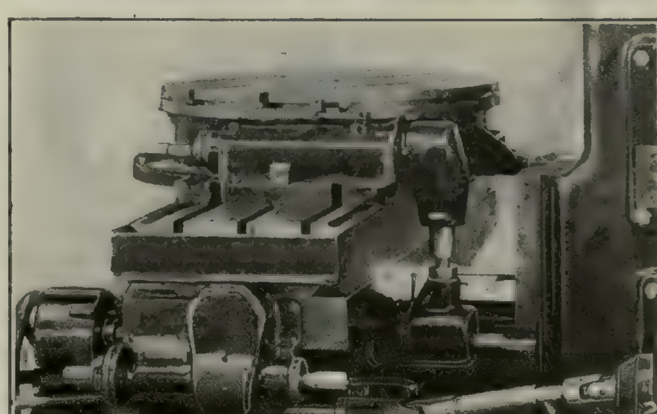
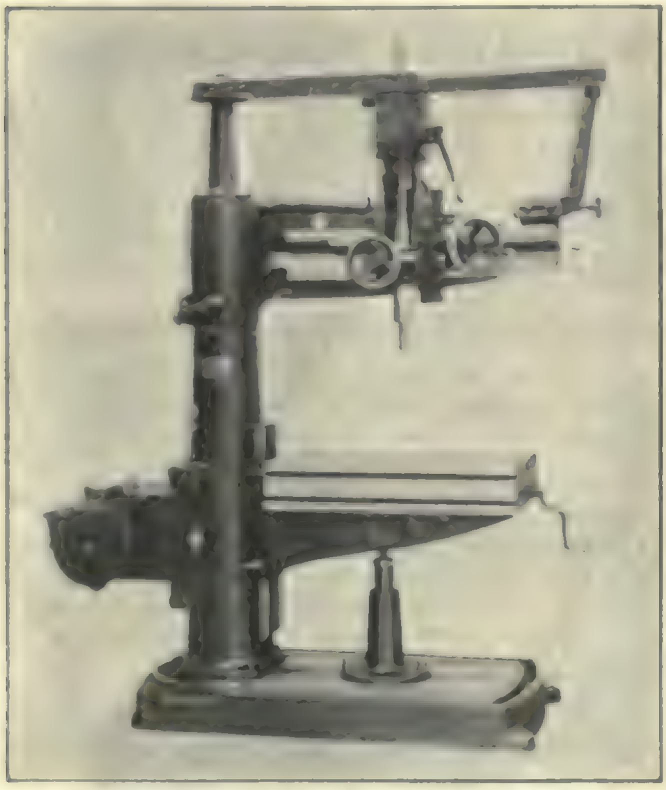


FIG. 1—TOLEDO ROTARY MILLING-MACHINE TABLE FRONT VIEW. FIG. 2—SIDE VIEW OF TABLE

Fosdick High-Speed Sensitive Radial Drilling Machine

The accompanying illustration shows a radial drilling and tapping machine recently developed by the Fosdick Machine Tool Co., Cincinnati, Ohio. The purpose of this machine is to drill and tap work of too large an area for a high-speed sensitive upright drilling machine, yet also to drill and tap small holes which require much greater speed than can be attained on the heavy-duty type of radial drilling machine. The rapidity of positioning the drill, together with the ease of operation, minimize the time required "between holes," while high speeds and excess power reduce the actual drilling time.

The table is readily removable, thus allowing 49½ in. between the spindle and base, which has a working surface of 28 x 36 in. and is provided with T-slots. The vertical movement of the table is 16 in., actuated by means of a ball-bearing telescopic screw. Its working surface is 20 x 33 in., with 31 in. maximum distance from the spindle. The arm is sensitive in its movement and may be swung completely around the column. It is supported on both annular and thrust ball bearings on the column, which extends through to the top.



FOSDICK SENSITIVE RADIAL DRILLING MACHINE

The spindle, as well as other revolving members, is equipped with ball-bearing journals. It has a No. 2 Morse taper, and a vertical traverse of 8 in. The horizontal movement of 28½ in. along the arm is operated through a rack and helical gear by means of the handwheel at the right. This position of the handwheel enables the operator to swing the arm and move the head simultaneously with the right hand, while the left hand is free to raise and lower the spindle and clamp the arm.

The sensitive feed and quick return are operated by the lever at the right, or the handwheel at the left. Friction back gears permit instantaneous shifting from high drilling speeds to slow speeds for tapping or drilling larger holes, the ratio being 4½ to 1. The tapping attachment frictions, like those of the back gears, are easily adjustable with an ordinary screwdriver.

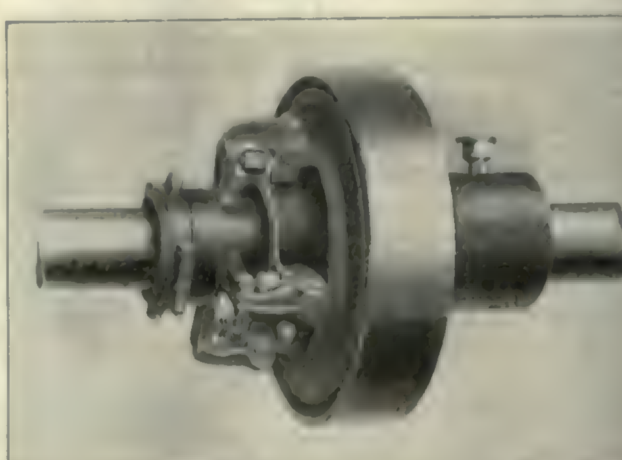
The drive is regularly through tight and loose pulleys on the machine, giving both a high and low speed forward and reverse. The pulley guard and belt shifter are adjustable to meet the belt from any angle. The belt maintains a uniform tension at every position of the head. Motor-driven machines require a 1-hp. motor, either constant or variable speed.

A reservoir for coolant is cast in the base, and a pump with a nozzle to the drill point may be supplied. Separate box or universal tables can be furnished as extras, in place of the regular elevating rectangular table. The machines are built with either 3 or 3½ ft. arms; the dimensions just mentioned are for the 3-ft. size, which weighs 2,650 pounds.

Wood's "Universal Giant" Heavy-Duty Friction Clutch

The "Universal Giant" friction disk clutch made by the T. B. Wood's Sons Co., Chambersburg, Pa., has recently been improved to adapt it to particularly severe service, such as encountered when frequent starting and stopping of large machines or groups of machines is required. The former model and the one still employed for lighter duty is equipped on the disks with hard maple blocks that contact with the friction disks when the clutch is engaged. For heavy-duty work, however, "Non-Burn" friction lining made by Johns-Manville, Inc., New York, N. Y., is employed instead of the blocks. This lining is stated to be capable of standing very severe service regarding both the load and the starting conditions; it will not burn out due to heating and its resistance to wear gives it a long life.

The clutch is made in sizes having rated capacities from 5½ to 480 hp. at a speed of 100 r.p.m. It is of the floating disk type and may be furnished with either one, two or three disks. It may be employed on lineshafts, directly on machines, or mounted in the bores of large pulleys and gears.



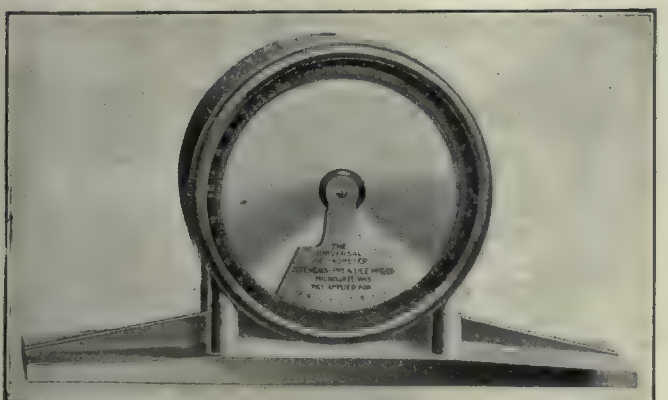
WOOD'S "UNIVERSAL GIANT" FRICTION CLUTCH

A No. 36 double-disk clutch with "Non-Burn" lining has been applied in a drive requiring 500 hp. at 200 r.p.m. Although the starting load varies from 700 to 800 hp., the clutch is successfully slipped, it is stated, to gradually start the shafting and bring it up to speed.

Stevens-Prentice Universal Inclinometer

A device known as an inclinometer and intended for use in reading and checking angles has just been placed on the market by the Stevens-Prentice Manufacturing Co., 377 National Ave., Milwaukee, Wis. The inclinometer consists essentially of an aluminum housing carrying a graduated dial and mounted on a semi-steel base. A vernier pendulum is pivoted in the center of the dial. A small brake can be employed to stop the oscillation of the pendulum and hold it stationary while reading is being done. The tool can be used when checking and reading bevels, angles and levels. It is adapted to use in the toolroom and checking department, and for structural and other work.

The use of the inclinometer obviates the necessity for mathematical calculations when determining or laying out angles. A reading for every 5 min. of arc is given, although the device can be furnished to read to minutes. When the line marked 0 on the vernier pen-



STEVENS-PRENTICE UNIVERSAL INCLINOMETER

dulum coincides with the line marked 0 or 90 on the scale of the dial, the instrument is plumb. The vernier is read in the same manner as the ordinary vernier caliper, and very close and accurate results can be obtained. The tool may be held in any position when making a reading, as the dial is graduated throughout its full circumference.

The base has a ribbed bottom and can be fitted directly to the work that is to be measured. It can be furnished in lengths of either 7, 18 or 24 in. The rapidity of action of the device is the chief feature, as the angle can be ascertained at a glance. It is stated that on the same operation the same reading will be obtained repeatedly even by different operators, as the pendulum always responds to the action of gravity.

Newton Model C-76 Four-Spindle Knee-Type Milling Machine

The machine shown in Fig. 1 is a four-spindle knee-type milling machine recently placed on the market by the Newton Machine Tool Works, Inc., Philadelphia, Pa., one of the plants of the Consolidated Machine Tool Corporation of America, 17 East 42nd St., New York, N. Y. This machine is intended for facing and slotting connecting rods in one operation and at high speed.

The drive is by belt and is transmitted directly to the spindles by worms and wormwheels. The four spindles have tapered ends, are mounted in substantial housings and have individual adjustment that allows for the variation in the distance between the spindle centers.

The vertical feed to the table is operated through

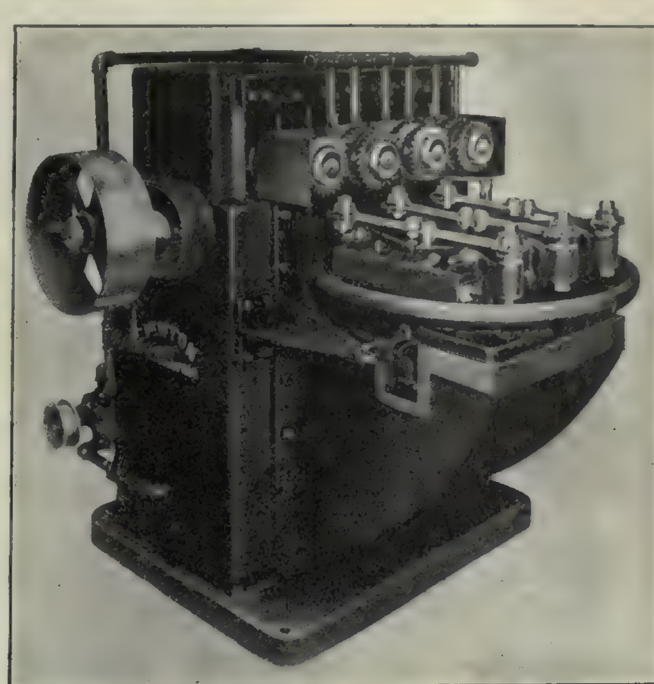


FIG. 1—NEWTON C-76 FOUR-SPINDLE KNEE-TYPE MILLING MACHINE

change gears and is transmitted by a worm and large diameter wormwheel to a cam. The latter gives a quick upward movement to the knee, changes to a slow feed for the cut and then to a quick downward movement, after which the feed automatically stops, allowing the table to be indexed. To again start the machine, the feed is engaged by means of a hand-operated lever conveniently located on the right-hand side of the machine.

Loading of one set of fixtures is accomplished while the cut is being taken on the work in the other. Consequently no time is lost between cuts other than that required for indexing the table. The set of fixtures illustrated in Fig. 2 will accommodate six rods at one time. It should be noted that each fixture has an individual adjustment, allowing a variation in distance between the rods.

The machine is geared to give one cycle of feed in 0.76 min. Allowing two seconds for indexing, the production would be 225 rods per hour, or 1,620 rods in a day of 8 hr. at 90 per cent efficiency. Attention is called to the compactness of the machine, as the floor space required is only 60 in. square.

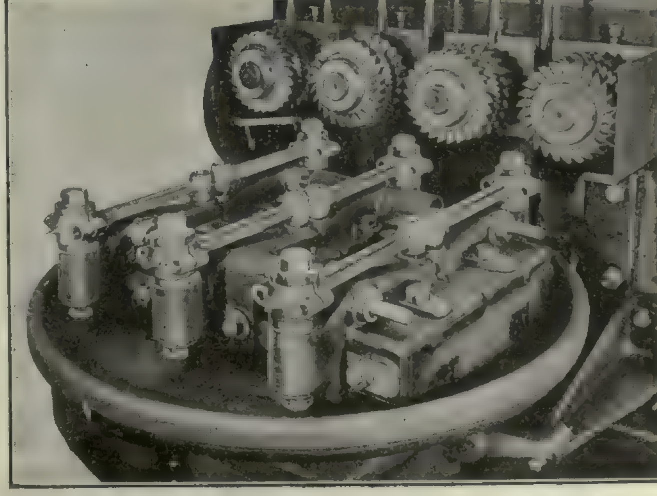


FIG. 2—FIXTURES FOR CONNECTING RODS

Van Norman "Valvo" Valve Grinding Machine

The Van Norman Machine Tool Co., Springfield, Mass., has recently brought out under the trade name of "Valvo" a small self-contained machine designed especially for service stations and truck fleet owners for grinding poppet valves of automotive engines.

In the design of the machine, which is shown in the accompanying illustration, the use of belts is eliminated; both the work head and wheel head have individual motors for power, and the parts are mounted on a substantial base. The grinding wheel is mounted directly on the shaft of a $\frac{1}{4}$-hp. ball-bearing motor revolving at 3,450 r.p.m., this motor being rigidly attached to the base of the machine. The work head spindle is driven by gearing from a $\frac{1}{15}$-hp. motor, the whole work

VAN NORMAN "VALVO" GRINDING MACHINE

head being carried on a movable slide operated by a handle at the left.

The valve is held by the stem in a split draw-in collet having a capacity up to $\frac{7}{8}$ in. in diameter. After the valve has been tightened in the draw-in collet and the work head, which has graduations up to 80 deg., has been set at the proper angle, the grinding is done by passing the valve across the face of the wheel by means of a back-and-forth movement of the handle at the left, while the work is fed to the abrasive wheel by the hand feed wheel at the right. The face of the valve is thus ground true to the stem. It is stated that the average valve can be reground within 1 min., and that 2 min. is ample time in which to perfectly refinish the worst valve that is encountered in actual practice.

The reamer for the valve seat can be ground at the same setting, thus insuring a proper and correct seating of the valve in the motor block. In addition to grinding valves the machine is well adapted for other operations about the service station, such as grinding ignition contact points, tappet screws, and a variety of short pieces and small parts.

The main slide and cross slide of the machine are planed and scraped. The work head has a ground taper spindle with provision for taking up wear. An adjustable stop screw is provided for control when grinding on the face of the wheel. A push button is so located as to lock the spindle in place to permit tightening the draw-in collet. The intermediate gear between the work-head motor and spindle is made from fiber to give smooth running.

The small amount of power required makes it possible to attach the machine to a lighting circuit. The regular equipment includes one split chuck, a diamond with holder for truing the wheel, reseating reamer, one wheel, and a finger and holder for sharpening reseating reamers. The overall dimensions are: Length, 20 in.; width, 15 in. and height, 16 in. The size of the wheel is 6x2 in. Weight, 110 pounds.

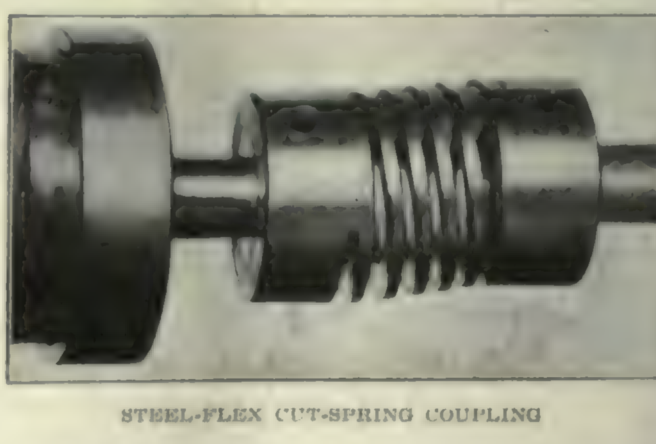
Steel-Flex Cut-Spring Flexible Shaft Coupling

A flexible coupling of the type illustrated herewith has recently been brought out by the Steel-Flex Coupling Corporation, 1712 First National Bank Bldg., Detroit, Mich. It is an all-steel coupling, has a machine-cut spring and is for shafts up to 1 in. in diameter. The body of the coupling is formed from a cylindrical tube of a quality of steel suitable for power transmission on account of its toughness and high elastic qualities. Hollow-head safety setscrews are employed for securing the coupling to the shafts.

The couplings are intended for direct connecting light-duty motors to small drilling machines, blowers, fans, pumps and the like, where shafts are slightly out of line and where it is desired that the coupling should reduce the friction in shaft bearings and act as a shock absorber on sudden starts.

By bending in the spring, the coupling allows for both angular and parallel misalignment, although it is always desirable that the shafts be as nearly in line as possible. Cushioning of the starting load and of shocks in the drive is accomplished by torsional deflection of the spring.

The company also manufactures a standard line of coil-spring flexible couplings for shafts from 1 to 12 in.



STEEL-FLEX CUT-SPRING COUPLING

in diameter. The helical driving coils of these couplings are formed of rectangular chrome-vanadium steel bars tempered to provide high elasticity. These coils, one within the other, are mounted on machine steel plugs. On the ends of the coils are shrunk steel headers, binding the parts into a continuous flexible unit. Flanges are attached by means of safety cap screws. These heavy-duty flange-type couplings are for use on lineshafts, as well as for direct connecting motors and turbines to auxiliaries.

Titan Portable Electric Drill

A portable electric drill, of which light weight and simplicity of design and operation are the outstanding features, has recently been developed by the Titan Manufacturing Co., 140 South Dearborn St., Chicago, Ill. The accompanying illustration shows the arrangement of the parts of the tool.

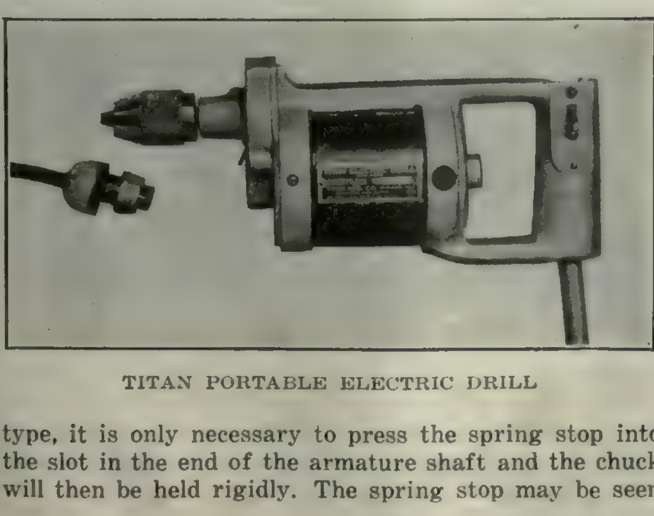
The frame of the drill is of aluminum. The motor was designed by the Westinghouse Electric & Manufacturing Co. especially for this drill. Under test it is stated to have developed more than $\frac{1}{8}$ hp. It is of the universal type and will operate on either alternating or direct current. It runs at high speed on light loads and slows down on the heavier loads, providing the proper change in speed for different sizes of drills. When a $\frac{5}{16}$-drill is being used in soft steel, the drill rotates at about 850 r.p.m., which is approximately the correct speed for a drill of this size. With small drills, the speed is approximately twice as much, and when running free the speed of the spindle is about 2,000 r.p.m.

A feature of the tool is that the windings are coated with a special compound and baked 90 hours, resulting in a solid coil with no possibility of the wires becoming loose. This coating adds greatly to the insulating properties and makes the armature practically indestructable from accidental mechanical abrasion. The armature is not injured by immersion in either oils or water except as they might rust the metal parts on which the coils are mounted.

Ventilation is provided by a vent in both the upper and lower branches of the handle, assuring that the handle grip will always remain cool and that the incoming air will be distributed to all parts of the motor. The motor field is held away from the housing by rivets which permit the air to circulate. The air is discharged in front of the housing, tending to blow away from the drill any dirt which might be raised by the drilling operation.

The gears are packed in grease, the pinion being of steel cut directly on the armature shaft, and the gear of bronze. The teeth are of the helical type. The gear ratio is $7\frac{5}{12}$ to 1, which odd number is intended to prevent the same pair of teeth on gear and pinion always meeting, thus distributing the wear. The thrust is taken on a ball bearing, working between two hardened and ground tool-steel surfaces.

To hold the armature from turning when opening or closing the chuck, which is of the Goodell-Pratt keyless



TITAN PORTABLE ELECTRIC DRILL

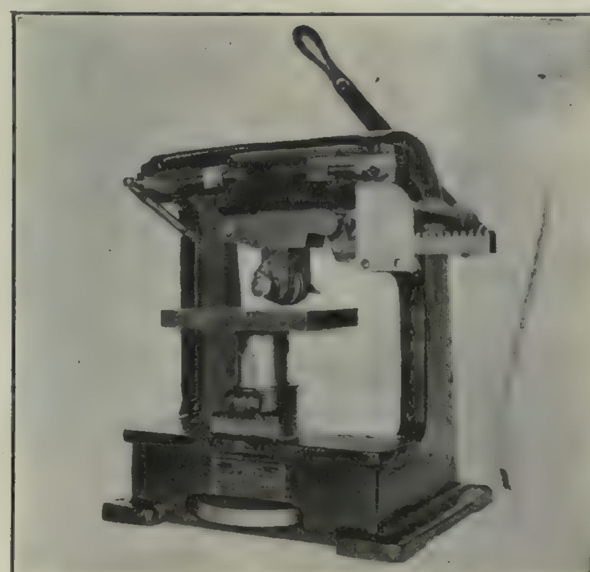
type, it is only necessary to press the spring stop into the slot in the end of the armature shaft and the chuck will then be held rigidly. The spring stop may be seen in the illustration, just below the spindle. The armature and spindle bearings are made of bronze and are equipped with spring oilers.

The switch is located in the handle of the drill in such a position that it can be operated by the thumb while holding the drill in the natural position. The pressure on it can be released without effort. The switch is of the quick-break type that is either absolutely closed or open, and was developed for this drill by the Cutler-Hammer Co., of Milwaukee.

The plug which is supplied on the cable is steel armored, non-breakable and all parts are riveted together, eliminating the danger of the contacts becoming loosened or the plug becoming broken by hard use.

Noble & Westbrook No. 13 Bench-Type Marking Machine

The bench-type marking machine herewith illustrated has just been placed on the market by the Noble & Westbrook Manufacturing Co., Hartford, Conn. The machine is designated as the No. 13, is small and inexpensive, and capable of marking four lines of $\frac{1}{16}$-in. lettering on flat or cylindrical articles up to 2 in. in diam-



NOBLE & WESTBROOK NO. 13 MARKING MACHINE

eter. The maximum distance of the marking is 2 in. The marking is done by means of cylindrical steel marking dies. On flat articles the die rolls over the work, and on cylindrical articles both the die and the work roll together.

The design of the machine is similar to that of the Noble & Westbrook marking machines now on the market, except that the pressure is applied from the top by a cam movement worked through a rack and pinion, and not upward through the table as in the larger models. The slide is fitted with roller bearings, and the table can be raised by a hand wheel by steps of thousandths of an inch, and locked in the proper position, thus permitting control of the depth of the marking.

Small drills, reamers, knives, chisels or similar parts can be marked at the rate of about 700 an hour, it is stated. The machine occupies a bench space of 10 x 12 in. and weighs 60 lb. It is furnished with one die holder of suitable design for either flat or cylindrical parts.

K-N Laying Out and Drilling Machine

A machine especially for the toolroom, known as the K-N laying out and drilling machine, has just been placed on the market by E. L. Krag & Co., 50 West Randolph St., Chicago, Ill. The machine is intended for use in conjunction with the Johansson compound slide and blocks, making a complete laying out and drilling machine for the spacing of holes in such work as dies, jigs, templates and master plates. With this machine the system of locating holes with buttons is entirely eliminated on such work as the machine will accommodate. A front view is shown in Fig. 1, while Fig. 2 shows a side view.

One of the principal features of the machine is the rigid arm extending below the point of the drill in such

FIG. 1—K-N LAYING OUT AND DRILLING MACHINE.
FIG. 2—SIDE VIEW OF MACHINE

a position that a bushing of the correct size for the drill can be located just above the surface of the work to prevent the drill from springing. A set of small drill bushings is supplied with the machine and extra bushings of any size desired can be procured from the manufacturer. The table of the machine is adjustable for height, making it possible to bring any thickness or diameter of work up to the bushing.

The head of the machine swings a full 360 deg., allowing drilling to be done at any degree. The spindle housing and the bracket holding the guide bushings are cast in one piece, assuring perfect alignment at all times. The guide bushings are made of tool steel, the hole is lapped to size, and the bushing is ground concentric with the hole. The spindle pulley and idlers, as well as the end thrusts for the spindle, run on chrome-nickel balls, all bearings being ground after hardening. The spindle is driven by means of a round belt, which is always kept at a uniform tension by a compensating spring idler, mounted in such a manner that the belt is always in alignment.

Six changes of speeds are provided from 400 to 4,300 r.p.m., furnishing the proper speeds for all drills up to ¼ in. in diameter. As a routing or milling machine, the tool can be operated with a single-lip cutter. A locking screw is provided for locking the spindle in a fixed position. The spring idler keeps the belt at the proper tension at all times, allowing the belt to slip if too great pressure is exerted on the cutter and thereby saving the cutter from breaking.

The head of the machine, which is similar to the K-N spotting and routing attachment described on page 572, Vol. 55 of *American Machinist*, is so constructed that it may be removed from the column and mounted on a milling machine in five minutes. It may then be used for laying out and drilling directly from the milling machine screw, or for greater accuracy, in connection with the Johansson compound slide and blocks. The spindle speed, which is seven times the milling machine speed, makes it possible to use a very small cutter. In drilling small holes in jig or tool work, any number of holes may be drilled with an accuracy of dimensions between holes practically equal to the accuracy of the Johansson blocks.

Pratt & Whitney Wheel Dresser for Vertical Surface Grinding Machine

The accompanying illustration shows a device that has recently been developed by the Pratt & Whitney Co., 111 Broadway, New York, N. Y., for dressing the wheels of vertical surface grinding machines without danger of injury to the operator. The advantages of hand dressing can, however, be obtained with the dressing attachment.

The device consists of a bracket bolted or riveted to the wheel guard and supporting the stem on which the dresser proper is pivoted. The dressing wheels are held in one end of a bent bar, so that they come to position on the face of the wheel. The other end of the bar forms a handle, so that the wheels can be easily moved into position. The dressing wheels can be moved on the face of the grinding wheel in the same manner as though a hand dresser were employed.

No change in the set-up of the work or of the wheel

P. & W. WHEEL DRESSER FOR VERTICAL SURFACE GRINDING MACHINE

is necessary when the dressing is done, and the action of the device is very rapid. The dresser may be easily applied to grinding machines now in use, and it is furnished as regular equipment on new machines.

Wallace Electric-Driven Portable Sifter and Strainer

An electrically operated device for rapidly sifting and straining has recently been placed on the market by J. D. Wallace & Co., 1401 West Jackson Blvd., Chicago, Ill. In Fig. 1 the device is shown as employed for sifting sand in a foundry. It is stated that the device can sift a ton of moist molding sand through a No. 2 riddle in four minutes, delivering the sand perfectly cleaned and thoroughly mixed, and that two men shoveling at top speed cannot keep the sifter running at full capacity.

The device can be hung from any convenient support, being either moved to the sand pile or sifted directly over the core trays or flasks. Since the extreme motion of the riddle is only $\frac{1}{16}$ in. from its central position, the workman has no difficulty in locating the sifter when placing a shovelful of sand in it.

The principal feature of the machine is in the motor, which is connected directly to the riddle. The armature and the shaft of the motor remain stationary and the field and housing revolve at high speed. This housing is weighted on one side, so that when it revolves it gives an eccentric or circular vibrating motion to the riddle. No gearing is employed, and the motor is equipped with self-oiling ball bearings.

The motor parts are inclosed in a dust-proof casing, and cooling air is circulated around the motor by its own motion. The air is drawn in at the top of one arm of the supporting frame tubing, and after circulating around the motor is expelled at the top of another arm. A valve trap at the air intake prevents dust and dirt from entering. The machine is ordinarily equipped with an 18-in. riddle having a No. 2 screen, although the screen can be quickly changed and removed by simply loosening the riddle clamps.

When it is desired to strain or mix liquids, such as clay-milk, oils, paints, varnishes, enamels and chemicals, the apparatus appears as shown in Fig. 2. The straining attachment has considerable capacity both above and below the screen. The spout for delivering the strained fluid connects to the bottom receptacle, so that

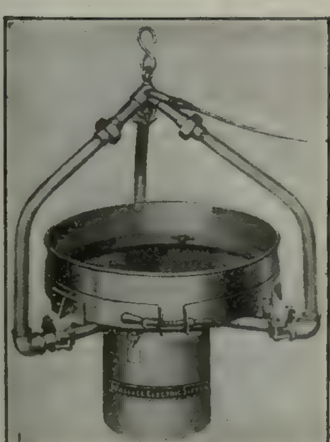


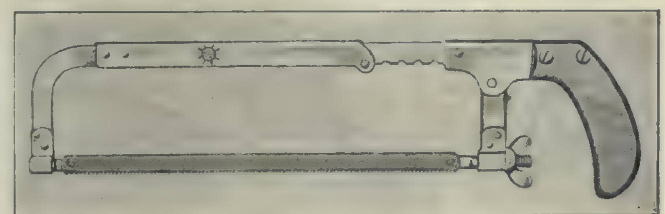
FIG. 1—WALLACE ELECTRIC SIFTER. FIG. 2—DEVICE FITTED WITH STRAINING ATTACHMENT

the liquid can be drained off into a tank underneath the strainer. Phosphor bronze screens of any mesh can be inserted in the strainer attachment by simply loosening the side wing bolts.

The top is partially closed, leaving an opening large enough to admit the substance to be strained, and yet preventing the liquid from splashing over. The screw cap at one side of this top enables the screen to be cleaned without taking the riddle apart. It is stated that the circular vibratory motion of the device enables very rapid screening and thorough mixing. The motion of the riddle breaks up lumps, and particles of grit and dirt are not forced through the screen. The device requires very little head room.

Consolidated Tool Works "Easy Grip" Hack Saw Frame

The hacksaw frame shown in the accompanying illustration is designated as the No. 40 "Easy Grip" frame, and has recently been placed on the market by the Consolidated Tool Works, Inc., 296 Broadway, New York,



CONSOLIDATED "EASY GRIP" HACK SAW FRAME

N. Y. The handle is so positioned that it affords a comfortable grip for the operator, does not cramp his hand and enables him to obtain a powerful stroke with as little fatigue as possible.

The frame is made entirely of nickel-plated steel, with the exception of the wooden handle. The wing nut for tightening the blade is located at the rear or handle end of the tool, where it is out of the way. The blade may be turned to face in any of four directions.

Bonus for Attendance

By Robert Grimshaw

It is aggravating to have a man who is expected to tend a machine come in late when it is eating its head off with the usual expenses for "interest, taxes, maintenance and depreciation, etc.," especially when the same machine is the most profitable investment in the whole establishment, except, of course, the money paid for your services. It is even more aggravating to have the storekeeper fifteen minutes behind hand or to find that the engine runner has overslept himself. The crowning injury, however, is when the fireman, who could on a pinch "start her up," if the operating engineer was not on hand, has a head or a stomach as the result of yesterday's lobster and ice cream at "Coney" and fails to materialize on time. An entire day's absence is of course the pinnacle of loss.

Yet these things happen and about the only way to stop them is to offer a bonus for full and prompt attendance in stretches of a month each. The bonus for a month's full attendance can be more than four times as much as that for a week, and is worth it. Just how much it is worth is for the manager to determine, in consultation with the foreman and the cost accountant. No firm can afford to have even piece-work operatives lose time. The bonus offered would certainly amount to less than the loss due to curtailed production.

News Section

S. I. E. Convention Opens October 18

"Economics of Industry—the Fundamentals Necessary to Maintain Maximum Production with a Minimum Effort, Waste, and Cost" is to be the main subject of the ninth national convention of the Society of Industrial Engineers at the Hotel McAlpin, New York, Oct. 18, 19 and 20, 1922.

The opening session will begin Wednesday, Oct. 18, at which time Joseph W. Roe, president of the Society, will speak on "The Relation of Economics to Industry."

"The Economic Background Necessary for a Business Executive" is a topic that will receive special consideration at a general meeting of the Educational Group on the first day of the convention. At another meeting Ernest F. DuBrul, general manager, National Machine Tool Builders' Association, will present a paper on "The Economic Aspect of Production." Arthur J. Todd, director of labor, B. Kuppenheimer & Co., will deliver a paper on "The Industrial Age." A. J. Lutterback, Comptroller, Palmolive Co., will speak on "The Budget and the Financial Forecast."

At the banquet, three other speakers of note will address the convention. They are F. H. Sisson, vice-president, Guaranty Trust Co., D. R. Dewey, Massachusetts Institute of Technology, and Royal R. Keely. Mr. Keely has recently returned from two years of engineering work in Russia. He is an industrial engineer and is eminently qualified to speak on "The Industrial Situation in Russia."

Special interest will center on the Friday evening session which is to be devoted to "The Application of Material Handling for the Purpose of Reducing Costs and Increasing Production." There will be an interesting exhibit of material handling equipment as well as other factory and office equipment.

The Society welcomes all who are interested in better management to attend the convention and to participate in the discussions and inspection trips. Copies of the complete program may be obtained from the Business Manager, S.I.E., 327 South LaSalle Street, Chicago, Illinois.

Engineering Secretary on National Tour

On a nationwide tour ending in San Francisco early in October, when the national meeting of the American Society of Civil Engineers will be held, L. W. Wallace of Washington, executive secretary of the American Engineering Council of the Federated American Engineering Societies, will address the engineers of Los Angeles at noon on Thursday, Sept. 28. A luncheon has been arranged for that day by the Joint Technical Societies of Los Angeles.

Mr. Wallace is interpreting the mission of the Federation, organized with Herbert Hoover as first president, to the engineers of the West, where a large growth in the Federation's membership and influence is looked for during the next year. One of the principal topics of Mr. Wallace's Los Angeles address will be the report of the American Engineering Council's Committee on Work-Periods in Continuous Industry on "The Twelve-Hour Shift in American Industry."

Increase in Exports of Motor Boats and Airplanes

The Automotive Division of the Department of Commerce reports a decrease in every classification of automotive exports in July, except motorboats and airplanes. There was, however, an increase in the unit values in all cases. Passenger car exports during July decreased 28.4 per cent in number and 24.4 per cent in value as compared with exports during June, 5,600 having been exported at a value of $4,395,541. The unit value of $784 was an increase of $42. The lowest decrease was shown in exports of cars valued between $800 and $2,000. Motor trucks decreased 26.7 per cent in number and 6.9 per cent in value, exports having totaled 822 valued at $734,148 and the unit value having increased $192, the average value of trucks exported being $893.

Belgium was the leading truck market, having taken 170 trucks valued at $38,031 during June and 340 valued at $84,405 in July. Canada occupied second place with 117 trucks valued at $225,697 as compared with 156 valued at $250,626. Mexico was third with 105 valued at $45,880 against 135 valued at $65,546.

Swiss Machinery Imports Show Decline

During the second quarter of the present year Switzerland imported 51,000 metric quintals of foreign machinery not including electric apparatus, as against 97,000 quintals during the same period of the preceding year. For the first three months of 1922 the machinery imports amounted to 60,549 quintals as compared with 102,000 quintals during the first three months of 1921.

The value of the machinery exported from Switzerland was 40,800,000 francs for the second, and 30,900,000 francs for the first quarter of 1922 as against 65,900,000 francs and 65,950,000 francs during the same two periods of 1921.

According to reports from all parts of the country the situation on the Swiss machinery market leaves still very much to be desired. In some measure only the large electric machinery establishments are busy, which have booked considerable orders for locomotives, turbines, dynamos, etc.

Engineers Elected to Eye Sight Council Board

Election of several engineers and educators to the Board of Councillors of the Eye Sight Conservation Council of America is announced from the headquarters of the Council in New York by Guy A. Henry, general director. Engineers chosen include Prof. Joseph E. Roe, head of the Department of Industrial Engineering in New York University, and Dr. F. C. Caldwell, professor of Electrical Engineering in Ohio State University.

Prof. Roe is a member of the Executive Board of the American Engineering Council of the Federated American Engineering Societies, and president of the Society of Industrial Engineers. Prof. Caldwell is chairman of the Committee on Education of the Illuminating Engineering Society. L. W. Wallace, executive secretary of the Federated American Engineering Societies, is president of the Eye Sight Conservation Council.

Prof. Roe described eye conservation, which is to be intensively carried on in the classrooms and workshops of the nation, as an important public service made possible largely through the disclosures by the Hoover Committee on the Elimination of Waste in Industry. Enormous losses, Prof. Roe said, were being sustained by the nation through defective eye sight. Surveys in industrial centers and in city and rural schools are showing that economic and physical damage is being caused simply through failure of parents, teachers and factory managers to correct faults which can be remedied.

Army Ordnance Association Annual Meeting

More than one thousand engineers are expected to attend the fourth annual meeting of the Army Ordnance Association, which will be held at the Aberdeen Proving Ground on October 6. A program of test firings and demonstration of the more recent developments in ordnance material and ammunition has been arranged. A year ago a similar demonstration was attended by 800 engineers. So much of value to the members of a number of classes of engineering developed on that occasion that it is believed a much larger gathering will be had at this year's demonstration. While the invitation is limited to members of the Army Ordnance Association, the American Society of Mechanical Engineers, and the Society of Automotive Engineers, it is pointed out that there will be many features of the program of interest to chemists, electrical, and civil engineers that a large representation from these branches of engineering probably will be present. The requirements for an invitation can be met by anyone who is not a member of any one of the three societies mentioned by taking out membership in the association.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

DURING the week the speculative markets followed tradition in their response to the cables received from Europe about the situation in the near East. When the news suggested war stocks and cotton went down while wheat went up. When the reports were less ominous the movement of prices was reversed.

But with their repetition people have gradually become less sensitive to the alarmist rumors and even if the worst should happen and England became involved in a war with Turkey it is now doubtful whether business in the United States would be much shocked or disturbed.

There are but few men in Europe and fewer in America whose opinion with regard to the Turko-European problem is worth much. It has vexed statesmen for centuries and will probably continue to trouble them for a long time to come. Most Americans doubt the likelihood of war because they believe that the world is utterly tired of bloodshed and will adjust its quarrels by compromise, at least until another generation has come to the fighting age.

Accepting this generalization as we turn to the business record of the week one is struck by the unanimity with which firmness in the commodity markets is reported. Here are some of the headings that appear over the various market reports published in the New York *Journal of Commerce* of Sept. 21:

"Lead firm," "Tin firm," "Heavy copper exports," "Scrap iron soaring upward," "Ferro silicon advances," "Pipe in special demand,' "Iron at $28 a ton in Birmingham," "Grain strong," "Mill feed higher," "Fruits higher," "Sugar steadier," "Raisins excited," "Canned tomatoes strong," "Kerosene higher," "Demand for silk growing," "Cotton yarns firm," "Worsted yarns tending up," "Wide sheeting trade grows broader," "Hemp advances," "Burlaps advanced sharply," "New carpets higher."

In each case special reasons are given for the upward tendency, but what many regard as its underlying basis is revealed in the sub-heads printed over the report of the dry goods market. They read as follows:

"High protectionists look for era of prosperity," and "Many merchants say it is impossible now to avoid evil effects of inflation."

These two statements explain the confidence in higher prices to which I have previously alluded as so general in the East. It is due to the expectation of what is vaguely called inflation and is in fact a reflection of the high wages now being paid and the high import duties imposed in the tariff bill just passed. Opinions differ as to whether the country will be benefited by having its cost of living again increased, but there is no doubt that rising prices create a feeling of prosperity which stimulates activity and speculation for a time; even though it be illusory. It is with this feeling that business men must now reckon, for he who bases his calculations entirely on facts and takes no account of feeling is likely to go as far astray as those who ignore the facts and shape their course entirely with reference to the prevailing sentiment.

> **There is no doubt that rising prices create a feeling of prosperity which stimulates activity and speculation for a time, even though it be illusory. It is with this feeling that business men must now reckon. Calculations based on facts without taking feeling into account, are as likely to be erroneous as calculations which ignore facts and use prevailing sentiment only as their foundation.**

But it is certain that the farmers do not as yet share in the illusion of prosperity, present or prospective, to which the rest of the country seems to be surrendering itself. If it is to become nation-wide better markets for their products, especially wheat and cotton, must develop or be provided. Should these staples become permanently worth substantially more than they are now selling for there is but little doubt that the optimism of the industrial districts would become general, but for the present the people of the agricultural regions feel that they have been overlooked in the plans made for reviving business and no great increase in their purchasing power is to be expected.

Their predicament is our most serious domestic problem and some radical efforts to solve it may be tried. One of them is suggested by the story of a Texas farmer who abandoned his crop because he could make more than it would net by taking the job of a railway shopman who had struck.

If everyone who is dissatisfied could thus apply the lesson of "Put yourself in his place" it might be a good thing for the country as a whole.

There are, however, only two commodities that are substantially cheap. One is sugar, which is nearly a cent below the price at which it was selling ten weeks ago, and more than twenty cents a pound under the war top. The recent decline is charged to the high duty imposed in the McCumber tariff bill, but with prices nearing the cost of production refineries and distributors are expected to buy more freely soon. At under three cents cost and freight for Cuban raws, sugar is very near the cost of production.

Rubber shows a little more resiliency on fresh rumors that the English and Dutch producers will get together to limit production. This time the movement is being led by three Americans, David M. Figart, Walter B. Mahony and Edgar B. Davis, who propose the organization of an International Plantation Rubber Co. with a capital of fifty million pounds sterling.

Aside from the "ups and downs" attributable to the news from Europe there have been few developments in the security markets that call for comment. The general feeling is that if the expected business boom comes there will be less money with which to carry stocks and bonds. Many good judges are therefore disposed to believe that bonds are high enough and that a further advance in stocks is not to be expected except as increased earnings may justify it in the case of particular corporations.

As many railroads are now handling more traffic than ever before in their history the railroad stocks as a class have been well bought.

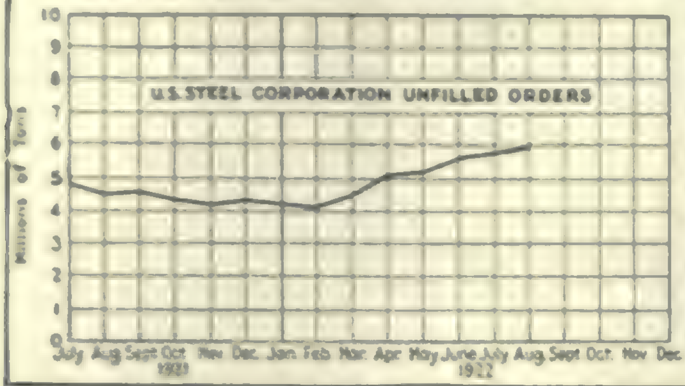
President Harding's veto of the bonus bill and his admirable statement of his reasons for disapproving it have given much satisfaction. Following the Senate's refusal to override the veto there was an improvement in the price of Liberty Bonds and it is reported that Secretary Mellon will shortly undertake some extensive refunding operations involving a large issue of ten year bonds on a 4 per cent basis.

The foreign complications have taken the speculative "tang" out of the atmosphere but it may return when the political temperature and humidity in Europe are reduced. Certainly the week has proved that prices are not easily depressed even by news that would be acutely depressing if there were any commercial or financial distension.

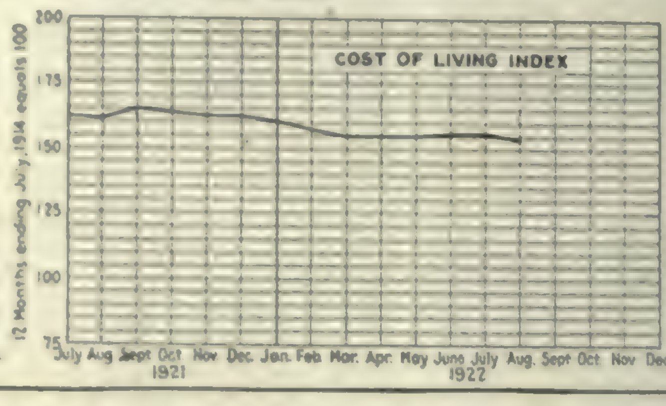
In Germany money is said to be tight despite the infinite quantity of paper marks outstanding. The Reichsbank has therefore announced that for the present seven billions marks a day will be printed and issued. The prospect defies the imagination and it is strange that marks continue to be salable at even 6 cents a hundred in New York. The other foreign exchanges have been surprisingly steady and their steadiness has engendered some cynicism as to the reported disaffection between France and England.

The Federal Reserve statement shows a reserve ratio unchanged at 78.3 per cent, and a decrease of $6,000,000 in the gold held. This decrease is doubtless due to the persistent effort that is being made to force gold, in the shape of gold certificates, into circulation, the purpose being to avert inflation by reducing the gold held by the banks.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



RAILROAD EQUIPMENT EXPENDITURES on the railroads of the United States during July, totaled $78,715,628, according to compilations of the Interstate Commerce Commission. A year ago, in the same month, the expenditure amounted to $95,277,725, while in July 1920, a total of $138,580,346 was expended.

Foreign exchanges were unsettled during the week, chiefly owing to the situation in the Near East. French francs dropped 9 points on September 21 to 7.56, and Italian exchange declined 3½ points to 4.19. Sterling was quoted at $4.42½, a loss of 1 cent. Marks sold at $0.00071.

Reserve ratio of the Federal Reserve System remained stationary at 78.3 per cent, the banking situation continuing its showing of great strength. Bills on hand totaled $644 millions, an increase of $5.5 millions over the previous week. The reserve of the Bank of England again stepped up from 19.22 per cent to 19.61 per cent. This figure closely approaches the highest point for the current year of 19.97 per cent reached on June 22 and shows the rise which has taken place since January 7, on which date the reserve stood at 8.83 per cent. French note circulation decreased.

Wheat crop of the United States now being harvested, is estimated by the Department of Agriculture at 805 millions of bushels, or 26.6 per cent of the world's total. Canada's harvest is estimated at 321 millions or 10.7 per cent. That of British India is expected to total 366 millions or 12.2 per cent. The world yield is estimated at 3,018 millions as compared with the 1921 yield of 3,059 millions. Pre-war yield was about 2,800 millions yearly.

Comparative Prices of Shop Supplies

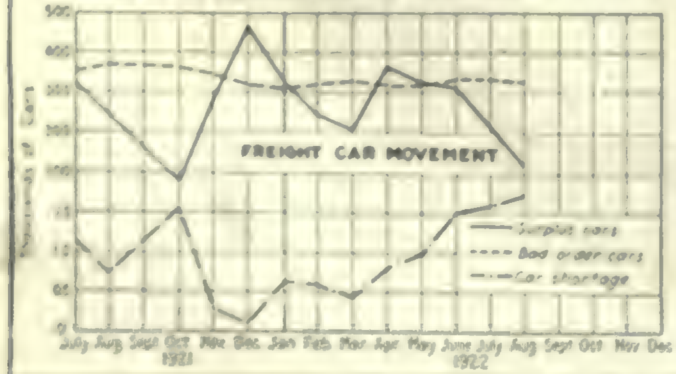
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.......	$0.0285	$0.0273	$0.0273
Cold finished shafting......	per lb.......	0.0373	0.0360	0.0396
Brass rods	per lb.......	0.170	0.1650	0.1400
Solder (½ and ½)	per lb.......	0.228	0.221	0.202
Cotton waste..	per lb.......	0.115	0.11	0.113
Washers, cast iron (½ in.)...	per 100 lb.	4.30	4.00	4.66
Emery, disks, cloth, No. 1, 6 in. dia	per 100.....	3.11	3.11	....
Lard cutting oil	per gal......	0.575	0.575	....
Machine oil ..	per gal......	0.36	0.36	....
Belting, leather, medium.......	off list.......	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list.......	55% @60%	50%@ 65–10%	50%@ 60–10%

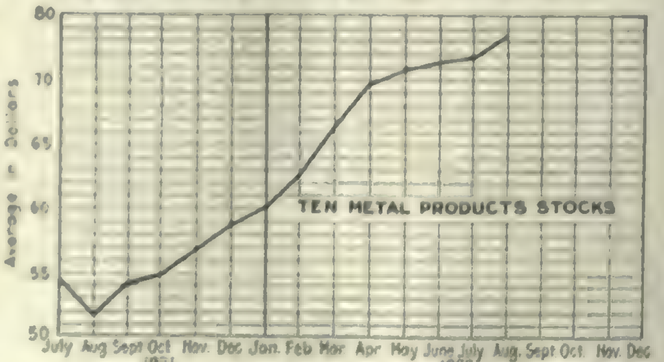
Conditions in Germany according to last Thursday's cables, are reflected in the advance of the discount rate by the Reichsbank during the past week to 8 per cent, thus marking the highest rate established by any of the great European banks either before or since the war, and higher than at any previous time in the Reichsbank's history. Vast issues of paper marks have depreciated Germany's currency to a point where it is nearly worthless. It is not difficult to see that the cost of doing business has reached a point entirely out of keeping with the capital with which business is conducted.

American foreign trade for August, in the light of the pros and cons of the tariff controversy, has several points of interest. Imports had a total value of $271 millions while exports were valued at $302 millions, the excess of exports or our "favorable" trade balance amounting to $31 millions. This is the smallest surplus appearing in American foreign trade since September 1914. It is even $19 millions less than the surplus of August, 1913. While our exports for August of this year exceed those of July by less than $1,000,000, our imports on the other hand, increased nearly $20 millions. Increased buying in anticipation of the new tariff together with coal imports valued at $5,000,000 seem to account for the increase over July.

Monthly average of car shortage, surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



Business Conditions in England

War Debt Settlement Retarding Recovery—Unemployment Situation Reflects Loss of Markets—Machinery Industry Stagnant

BY OUR LONDON CORRESPONDENT

THE storm that has been threatening over the European continent for two years or so developed recently so rapidly that a deluge was anticipated almost momentarily. But at the worst it has been postponed and we breathe again. With the causes we are not here concerned; they go back certainly to the making of the peace, if no further, and it is hoped that those who are called in to avert wreckage will proceed less on the war-time idea of doing things for immediate effect. Short views are right enough for men engaged in business, but statesmen try to take rather longer views.

Great Britain, of course, depends largely, even mainly, on overseas trading. For some time she has been finding her markets restricted, partly as an entirely natural result of the war, and partly also as a result of the war in a narrowness of mental outlook which takes form in the erection of tariff walls merely to keep out the goods of the foreigner. It is difficult to find a country that has not thus effectively prevented or minimised imports and at the same time has not attempted to export.

Reparations Settlement Imperative

That trade is barter is clearly seen in the reparations problem. For a number of years the allies were doing their best to send shell and other metallurgical products into what was for the time being a part of Germany. Victory having been won and the military war terminated, they have endeavored to get payment by way of reparation. Exactly how Germany is to pay if she cannot send goods has never been understood. The allies, or certain of them, have resisted payment by way of services and full payment in gold is of course impracticable. Also to enable the allies to carry on the war they themselves had to obtain credits and to import material from any country having the power to supply, and the same difficulties as regards payment are experienced.

If we take your own case, the British marine transport is finding increasing difficulty in rendering even its pre-war service. The articles we have to supply naturally take the form of manufactured goods, the export of which to America has seldom been easy and is certainly not being eased, while as regards gold, even if it were available, it is understood here that American bankers have all they need by way of reserves and would by no means be glad to increase the amount amassed, even if additions took the form of annual war debt payments. How we are to pay is a puzzle much discussed both in public and privately.

The loss of markets to Great Britain has shown itself in the employment field, and figures given in these columns from time to time have indicated the extent of this problem. Unemployment as officially known at the exchanges reached its worst condition at the middle of last year when we had more than 2,000,000 men, women, boys and girls out of work, with rather fewer than 1,000,000 on short time. In the course of the intervening year short-time workpeople have been almost eliminated, being reduced to somewhere about 70,000, and the totally unemployed people have declined markedly in numbers, so that they amount to say one and one-third millions. Not everyone unemployed is embraced here; for example, agricultural laborers are not included. For purposes of comparison the figures are eloquent of improvement. Yet the burden of unemployment is still excessive and Great Britain is looking forward to another winter of discontent, the Minister of Labor, himself an optimist, having estimated that the unemployed will not drop much below one and one-fifth millions during the current year.

> "If the broken nations of Europe are not repaired, even the states still solvent will slip, one by one, into the general ruin," says the Right Hon. Reginald McKenna, former chancellor of the British Exchequer. The situation in Europe today, more especially in England is deserving of serious thought and study from everyone with a real interest in foreign trade. The United Kingdom has ranked first among our twenty best customers. She has taken nearly 28 per cent of our total exports. If we are to recover this position, the imperative necessity for an adjustment of war debts, a settlement of the reparations problem and the establishment of a broad-visioned foreign policy becomes apparent.

Unemployment Effect Far-reaching

Various efforts have been made and are being continued to alleviate the distress which naturally follows. During the period of difficulty something like £50,000,000 has been spent by the local authorities and the government on relief work, and it is announced that another ten millions will probably be available during the winter and that the municipal authorities have been invited to suggest further schemes of public utility. In fact some 2,600 proposed schemes are under consideration. Then the guardians of the poor have found in indoor and outdoor relief some £60,000,000, while through the Unemployment Insurance Act benefit to the tune of 90 millions has been paid, with, the Minister of Labor has stated, if necessary, another 50 millions available up to the middle of next year.

Three-quarters of the sum paid in unemployment benefit, he is careful to point out, has been obtained pretty equally, from employers and employed. Then, under the export credits scheme, credits to the extent of £16½ millions have been agreed to and, further, loans up to £17 millions have been guaranteed in respect of capital for carrying out schemes, providing work at once, that will ultimately lead to the material welfare of the country. It is possible that loans in respect of capital up to 50 millions may became available.

The effect of unemployment is now showing itself on retail trading, and the Glasgow Co-operative Wholesale Society reported for the first half of this year a decline in trading turnover of more than £3¼ millions, or just under 28 per cent. as compared with the turnover of the same period of last year. Conversely, this year, for the period under notice a net profit of £142,300 is reported as against last year a debit balance of more than £221,650. The decline is due to falls both in prices and volumes.

The amusement world has at last taken its place in the slump and, the state of the theatres having for some time been parlous, the music halls are now experiencing bad times. One large London hall, which not so long ago paid 20 per cent, reports a debit balance of more than £23,000 during the last period in review. Another company with an interest in a number of places of amusement shows a profit of rather less than £86,500 as compared with £221,500, while another syndicate of music halls has been unable to pay an interim dividend. As to the picture palaces, the proprietors have for some months been declaring that the Amusement Tax is closing these halls—mostly war babies.

As one effect of the labor troubles in America the coal trade has improved considerably, and in some instances the men have agreed to work overtime. Not only has there been an increased demand from the United States and from Canada, but Germany has been buying and further orders have been received from France and Scandinavia. It is also stated that the home demand is improving, suggesting a corresponding revival of confidence in home industries.

Corporations Show Heavy Losses

The Ebby Vale Co. in a recent report drew attention to the effect of strikes, the company itself disclosing a loss of more than £320,000, compared with a profit the previous year of nearly £400,000. Simultaneously the wages paid fell as the result of strikes by more than £2¾ millions, while the production of coal dropped by approximately 33 per cent. Recent American labor troubles are held to have helped British engineers, enabling them to compete more readily on a price basis. Especially does this seem to apply to electrical engineering in the East.

Many of the annual reports of industrial concerns now being issued reflect very clearly the conditions that

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Machine, Tool, Automatic, Universal, S. H. D.

[illegible] Co., Paris, France

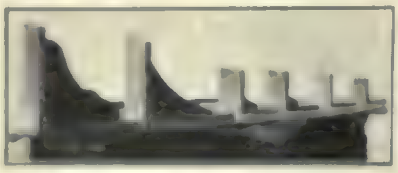
"American Machinist," July 20, 1922

The machine is used for grinding lathe, planer, shaper and slotter tools and can be furnished with attachments for grinding milling cutters and twist drills. It is belt driven, but can be supplied with motor drive. The table carrying the tool holder may be swung to an angle of 90 deg., and the [illegible] may be mounted from either one of two [illegible] placed at right angles to each other. The feed is operated automatically or by hand. Five stops and four graduated index plates for setting and grinding tools to any angle and a gage for setting the tool to the proper height are provided. Equipment: one 8-in. and three [illegible] grinding wheels, to run at [illegible] and 6,000 r.p.m.

Angle Plates, Precision

[illegible] Machine Co., West Newton, Mass.

"American Machinist," July 20, 1922



The angle plates are made in seven sizes and are planed on the outside surfaces and edges. The smallest size is 2 in. wide, 3½ x 2½ in. The largest size is 12 x 12 x 12 in. Beginning with the smallest, Nos. 1 and 2 are without stiffening ribs, Nos. 3, 4 and 5 have one rib and Nos. 6 and 7 have two ribs.

Shaper, Crank, 24-Inch

Hendey Machine Co., Torrington, Conn.

"American Machinist," July 27, 1922

The machine is of the single-belt-drive type, driven from the lineshaft or by an independent motor. It has eight speeds. With an extension the top of the table may be increased to nearly double its regular length. Maximum stroke of ram, 24½ in. Vertical slide travel, 8 in.; swiveled to any angle. Power feed, applied to the slide at any angle, 0.005 to 0.060 in. Table travel, 30 in. Rail vertical adjustment, 14½ in. Power crossfeed range, 0.008 to 0.180 in. Strokes per minute of the ram, 6 to [illegible]. Floor space, 52 x 107 in. Weight, [illegible] pounds.

Wrench, Pipe, "Little Giant"

Greenfield Tap and Die Corporation, Greenfield, Mass.

"American Machinist," July 27, 1922

The wrench is simple in construction and light in weight. With the end opening, it can be fitted to pipes located in corners and can be set in the same manner as a pair of pliers. It consists of a handle and jaw made in one piece, a movable jaw and a hardened steel nut. The fixed jaw has two sets of teeth, so that the movable jaw can be engaged with either set of them. On the 14-in. size and larger, two additional sets of teeth are provided back of the adjusting nut, and the movable jaw can be reversed to engage with them, adapting the tool to various types of work. The tool is manufactured in 8, 10, 14, 18 and 24-in. sizes.

Furnace, Gas, Soft Metal Melting, No. 300

Johnson Gas Appliance Co., Cedar Rapids, Iowa.

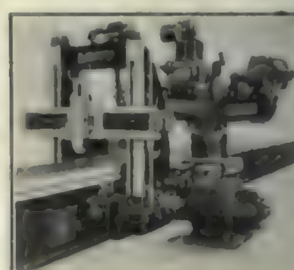
"American Machinist," July 20, 1922

The furnace has a removable cast-iron melting pot with a capacity of 150 lb. of metal. Gas is delivered through three bunsen burners. The burners are equipped with shut-off valves, pilot lights and regulators. The regulators are constructed with orifices that can be adjusted to varying qualities and pressures of gas. A solid jet of gas can be sent up the center of the mixing tube with great pressure and without the use of a forced air blast or blower, and produces a flame of high temperature. Height, 28 in. Weight, 100 pounds.

Planer and Slotter, Locomotive Frame

Liberty Machine Tool Co., Hamilton, Ohio.

"American Machinist," July 27, 1922



The machine is for completely finishing locomotive frames and is a combination of planer and slotter. A standard 36-in. planer forms the major part of the machine and four heads can be mounted on it. It can be driven by motor or by belt. The heads have automatic feeds in all directions. The slotter head has independent automatic feed and rapid traverse both crosswise and lengthwise. The ram has a stroke adjustable up to 14 in. and is driven by a 10-hp. variable-speed motor. Bed, 69 ft. long. Table, 38 ft. long, 30 in. wide. Distance between housing and between the table and crossrail, 37 inches.

Lathe, Engine, Double-Head, "Betts-Bridgeford," 72-Inch

Betts Machine Co., Rochester, N. Y.

"American Machinist," July 27, 1922

The lathe is intended for turning heavy crankshafts and long propeller shafts. It is driven by two 50-hp. motors with automatic starters, and is equipped with a headstock at each end of the bed, two carriages and two tailstocks. It has two lead screws, one on each side of the machine, one screw running the full bed length and the other one-half. It can be converted into two independent lathes, each swinging work 72 in. in diameter and with a maximum distance of 37 ft. between the centers. Twelve spindle speeds are controlled by levers at the front. Power rapid traverse is controlled by levers located at the apron. The carriages and aprons have compound rests and power angular feed. Bed length, 76 feet.

Gear Tester, Odontometer

Pratt & Whitney Co., Hartford, Conn.

"American Machinist," July 27, 1922

The instrument is for testing the accuracy or uniformity of the gear tooth profiles and spacings of the teeth in production work, but the distance can be measured between the two parallel working faces of the instrument. It will check gears of any pressure angle, and can be applied to a gear in the machine. Gears of various pitches can be tested with the same instrument. Each division of the dial represents a movement of 0.0001 in. of the indicating surface. The instruments check gears in the following range of sizes: ½ to 4 pitch, 3 to 10 pitch, and 10 to 24 pitch. Stands are made to hold the two smaller sizes when gears of pinion shaper cutters are being tested. The actual cutting edge of the cutters can be tested.

Clip, paste on 3 x 5-in. cards and file as desired

have prevailed during the past year. Taking a few salient firms, Sanderson Bros. & Newbould, Ltd., the Sheffield makers of high-speed steels, etc., report a loss of £35,685, which is increased to nearly £38,000 by the payment of preference dividend. Among motor firms, Harper-Bean showed a loss, which however is but a fraction of the previous year's, and Wolseley Motors, Ltd., which is one of the Vickers firms, had a trading profit of more than £23,000 converted, after meeting various interest charges, into a loss of £97,030, which is rather more than for the previous year: the directors specially drew attention to the unprecedented fall in the value of stocks. On the other hand Arrol-Johnston show a surplus of £63,396.

An entirely satisfactory report is that of J. Hetherington & Sons, Ltd., Manchester, who are mainly textile machinery manufacturers but who also have a machine tool branch. The chairman at the annual meeting mentioned that, while of all branches of the engineering industry textile machinists were most adversely hit during the war as their plant could not easily be adapted to the production of war material, in the same period there was practically no output of textile machinery and that which was in use had necessarily become worn. The firm for the past two years, in fact, have been fully occupied on export work, a condition which seems likely to continue for the present. The foreign demand, will, it is expected, be followed by fresh calls for the home market.

STAGNATION IN MACHINERY INDUSTRY

Petters, Ltd., Yeovil, makers of small internal combustion engines much used for agricultural operations, converted a loss of more than £11,000 into a credit balance of almost the same amount, after making the usual allowance for debts and transferring £25,000 from the reserve to meet losses from stocks. No dividend is paid, the balance being carried forward. The firm have aircraft works but it has been suggested that these may be abandoned. They are interested in Vickers-Petters, Ltd., manufacturers of semi-Diesel oil engines, a company which has not met with much financial success. The Vickers concern at Barrow are now specially interesting themselves in hydraulic engineering, quite a number of orders for water turbines and other plant from New Zealand, India, and elsewhere having lately been secured.

The machine tool industry remains almost stagnant. It is true that a few orders have been received in the Birmingham district for China, and one or two firms in the Manchester area, Hulse & Co., for example, have obtained some new business. Some Yorkshire firms are also rather better engaged. Scottish firms, like others, report the receipt of a number of enquiries and from this it is concluded that sooner or later something or other will undoubtedly turn up. But in most instances hopes are deferred.

Announcement has been made that the Machine Tool Trades Association failed in their application to the Board of Trade to bring machine tools imported from countries with collapsed exchanges under the special duties authorized by Part 2 of the Safeguarding of Industries Act. The Board held definitely that a *prima facie* case had not been made out.

The automobile industry has kept up exceedingly well.

New Aircraft Entered in Detroit Races

Radical innovations in aircraft design will characterize several of the Navy entries in the Detroit aviation races to be held in the early part of October, and prominent among these will be the Navy BR or Booth Racer in which a lesson from the birds has been incorporated to obtain greater speed.

The entire landing gear of the plane will be retracted into the fuselage once the plane is in the air so that only the wings and fuselage will present resistance to the wind. This follows the practice of birds in flight. The smaller birds, it is known, draw up their feet into their breast feathers when in the air, while larger species such as the ducks and geese tuck their feet under their tail feathers rather than drag them through the air and retard their speed. So the Booth Racer once it has left the ground will draw up the wheels of the landing gear into the body of the plane.

The BR planes are designed by Messrs. Booth and Thurston of the Aerial Engineering Corporation, Hammondsport, N. Y., who a year ago were employees of the Curtis Aeroplane and Motor Corporation and worked on the design of the Curtis Navy Racer which won the aerial classic last year and established a world's record for a closed circuit. It is therefore concluded that the BR planes will incorporate a good deal of the experience of the CR type.

The Booth Racers are equipped with the Wright H-3 special high compression engine developing 400 hp. This engine is an American adaptation of the French Hispano-Suiza—the motor which made the Spad possible during the World War.

Great Telescope for Argentine

One of the largest telescopes in the world, a sixty-inch reflector, has just been completed at the plant of the Warner & Swasey Co., Cleveland, Ohio, for the Argentine National Observatory. This great engine of science will be the largest telescope in the Southern Hemisphere. There are only two telescopes in the world which exceed this one in size.

The new telescope is to be used for photographic and spectroscopic study of the stars and nebulæ rather than for visual observations. The new instrument will be able to detect some 150,000,000 distinct bodies, compared with the bare 5,000 within range of the unaided eye. The camera attached to a telescope of equal size showed in a photographic plate 50,000 stars in a portion of the sky occupying about as much space as the full moon.

With the 72-inch reflecting telescope of the Dominion Astrophysical Observatory, Victoria, Canada, from the works of the Warner & Swasey Co., the astronomers recently discovered twin suns fifty-two quadrillion miles from the earth, each five times larger than any known heavenly body.

Among the great telescopes designed and constructed by the company are the 40-in. Yerkes, 36-in. Lick and 26-in. United States Naval refractors, and the 72-in. Canadian and 36-in. Arizona reflectors.

Structural Steel Sales Increase

Sales of fabricated structural steel in August showed a slight increase over the low figure reached in July. August sales amounted to 65.2 per cent of shop capacity, compared with 62 per cent in July and 72 per cent in June, according to the Department of Commerce.

Reports have been received from 125 firms for each of the 5 months April to August, inclusive. These 125 firms report a total shop capacity of 208,245 tons per month.

Training Camp Established for Naval Aviators

A training camp for naval aviators who are to represent the Navy in the coming aerial races to be held in Detroit October 7 to 14, has been established at the Naval Air Station, Anacostia, and within the past two weeks the entire team has been assembled here for an intensive course of practice flights to fit them for the coming contest.

The Navy team is under the command and direction of Lieutenant-Commander Mark A. Mitscher, U.S.N., and is composed of aviators who have been selected especially for their ability to fly the fast types of racing planes that are to compete in Detroit.

The daily practice flights engaged in represent to a degree the conditions that are to maintain in the forthcoming contest and the skill that will be the determining factor in the air races is being developed to a high point by the Navy pilots.

The two races in the Detroit Aerial Meet in which the Navy will be represented are the Curtis Marine Flying Trophy event and the Pulitzer Race, the former being a class for seaplanes and the latter for land planes. In the training now in progress the pilots are engaged in practicing landings and difficult turns on the water and in low flying and hairpin turns over the land course. The Pulitzer Race which will be around a closed circuit consisting of three legs will be a severe test of the ability of pilots to make turns at high speed over the closed course. This race was won last year by the Curtis Navy Racer which established a world's record for a closed circuit speed run. This plane will again appear in the field this year and will be flown by either Lieut. Fechteler or Lieut. Brow.

August Cost of Living Declines Slightly

The cost of living among wage earners' families in the United States on Aug. 15, 1922, was 54.5 per cent higher than in July, 1914, according to the figures collected monthly by the Nation Industrial Conference Board. Between July 15 and Aug. 15, 1922, there was a decrease of 1.1 point or seven tenths of one per cent. The changes in the budget within the month were decreases in both clothing and food prices, and a considerable increase in fuel prices resulting from the recent strike. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and August, 1922, the cost of living dropped 24.4 per cent.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drilling Machine, Multiple-Spindle, Changes in, D-32

Fox Machine Co., Jackson, Mich.

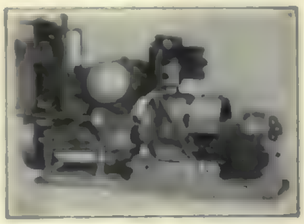
"American Machinist," July 27, 1922

The weight and power of the re-designed machine have been increased, and the drilling head has been enlarged to [illegible] in. in diameter. The base has been enlarged to support the table and motor, and to give a larger trough for the drilling compound. A "Little David" air motor for raising and lowering the drilling head, an interlocking device for preventing the feed from being engaged during the operation of the air control, as well as a rotary table, have been installed. The rotary table is arranged for indexing when station drilling is being done.

Welding Equipment, Engine-Driven

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

"American Machinist," July 27, 1922

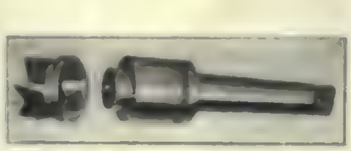


The outfit is for generating the current required in electric welding where electric power for motor drive is not available, and it does not require any auxiliary apparatus or connections. It is made in both stationary and portable models and consists of a single-operator welding generator geared to a [illegible] four-cycle, two-cylinder, low-speed, marine-type gasoline engine. The generator has a rated capacity of 175 amp. and a maximum capacity of 225 amp. at [illegible] r.p.m., and will supply a constant current over the working range from 90 to [illegible] amp. The engine has a force-feed system of lubrication, a Wheeler-Schebler carburetor, a Taco throttle governor, an impulse starter and a honey-comb-type radiator.

Tools, Cutting, Small, Pin-Drive

West Sales Co., 1012 Ford Bldg., Detroit, Mich.

"American Machinist," July 27, 1922

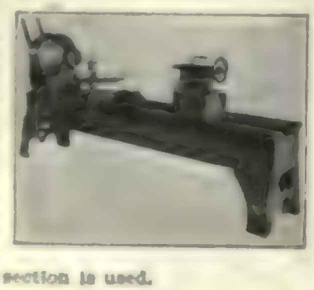


End mills, keyway cutters, counterbores, countersinks, drills and connecting rods particularly adapted to turret work are furnished. Special toolholders to suit the cutting tools and any type of shank to suit the machine are provided. The reamers may be either straight or helical fluted, the drills two- or four-fluted, and the countersinks of either 60 or 80 deg. angle, all being intended particularly for short holes. A short shank on the holder slips into a hole in the counterbore itself, and any size of pilot can be provided. Most of the tools have a small tapered shank on the cutter, which slips into the hole in the bottom of the holder. A small pin placed lengthwise in the grooves in the inside and outside tapers prevents the cutter from turning

Lathe, Patternmaker's

Buffalo Gear & Pattern Works, 16 to 20 Elk St., Buffalo, N. Y.

"American Machinist," July 27, 1922



The lathe will swing 22 in. over the shears, 24 in. over the carriage and will take 6 ft. between centers. The headstock can be swiveled 90 deg., converting the machine into a face lathe with the plane of the work parallel to the bed. For this use, a three-legged base is provided having a base to which the compound rest can be attached. Opening and closing two pairs of interlocking bevel-faced pulleys changes the speed. One pair of pulleys is located on the headstock and the other pair on the countershaft. Interlocking teeth of the pulleys are of wood. A belt of triangular section is used.

Milling Machine, All-Geared, High-Power, Single-Pulley-Drive, No. 3

Rockford Milling Machine Co., Rockford, Ill.

"American Machinist," July 27, 1922

The principal features of the new design are the rectangular overarm, the method of transmitting the drive for the feed motions to the saddle and table, the support at the side of the column for the knee and saddle when under great strain, and the power-driven, quick-return and rapid-traverse motions. Constant-speed drive is employed, by belt or by a 7½-hp. motor. The machine can be fitted with attachments such as the universal milling and drilling attachment and vertical milling attachment. Range of speeds, 12 to 350 r.p.m. in 16 steps. Feed, 12 changes from ½ to 16 in. per min. Weight, 8,000 pounds.

Lathe, Engine, All-Geared-Head, 24-Inch

Springfield Machine Tool Co., Springfield, Ohio.

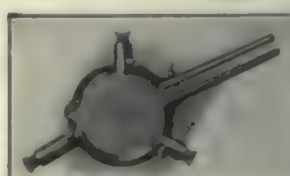
"American Machinist," July 27, 1922

The lathe is equipped with a motor drive, cabinet legs at each end of the bed, steadyrest and other attachments. The head is of the selective type and may be driven directly from the lineshaft or by a motor. The operating levers are grouped at the front of the head. The lathe may be equipped with a quick-change-gear system providing forty changes of feed, or with a system providing only six quick changes. Different types of compound, plain and turret toolposts that are interchangeable with the compound rest, and attachments for performing operations such as taper turning, can be furnished.

Piston-Groove Cleaner, "V-P"

Vedoe-Peterson Co., Norfolk Downs, Mass.

"American Machinist," July 27, 1922



The tool is for cleaning carbon from the groove for the compression rings in automotive pistons. It is placed over the piston, so that the cutters rest in one of the ring grooves. The three cutters are adjusted approximately, by means of the screws that back up each cutter, are locked in place by setscrews and are finally adjusted so that the tool fits the bottom of the groove, by means of the knurled screw holding the two parts of the handle. Two or three turns of the cleaner completely remove the carbon. Two sets of cutters are furnished with each cleaner, for grooves 3/16 and ¼ in. in width. Capacity, pistons from 3 to 4 in. in diameter.

Cutters, Milling, Inserted-Tooth

West Sales Co., 1012 Ford Bldg., Detroit, Mich.

"American Machinist," July 27, 1922

The cutters are made for both light and heavy duty, and for side, face or slot milling. Each tooth is provided with a tapered shank that fits into a tapered hole in the body, and one or more small pins fitting in the grooves in both the shank and hole prevent the tooth from turning. The size of the cutter can be permanently maintained even after sharpening. The outside of the body of a plain cylindrical cutter is made in spiral form with the diameter increasing slightly from one point entirely around the cutter, so that some of the blades are longer than others. Before each grinding, the shortest blade is removed, each blade moved forward one position, and a new tooth placed in the last position. The same principle is employed on slot-milling cutters having teeth on both faces.

Clip, paste on 3 x 5-in. cards and file as desired

Machinery Duties Under New Tariff Bill

By a vote of 43 to 28 the Senate last week adopted the conference report on the McCumber-Fordney Tariff Bill. The bill was sent to the President immediately after its adoption and was signed by him September 22.

To readers of *American Machinist,* the following paragraphs from the bill are of particular interest:

Par. 369. Automobiles, automobile bodies, automobile chassis, motor cycles, and parts of the foregoing, not including tires, all of the foregoing whether finished or unfinished, 25 per centum ad valorem: *Provided, that if any country, dependency, province, or other subdivision of government imposes a duty on any article specified in this paragraph, when imported from the United States, in excess of the duty herein provided, there shall be imposed upon such article, when imported either directly or indirectly from such country, dependency, province, or other subdivision of government, a duty equal to that imposed by such country, dependency, province, or other subdivision of government on such article imported from the United States, but in no case shall such duty exceed 50 per centum ad valorem.*

Par. 370. Airplanes, hydroplanes, motor boats, and parts of the foregoing, 30 per centum ad valorem.

Par. 371. Bicycles, and parts thereof, not including tires, 30 per centum ad valorem: *Provided, that if any country, dependency, province, or other subdivision of government imposes a duty on any article specified in this paragraph, when imported from the United States, in excess of the duty herein provided, there shall be imposed upon such article, when imported either directly or indirectly from such country, dependency, province or other subdivision of government, a duty equal to that imposed by such country, dependency, province, or other subdivision of government on such article imported from the United States, but in no case shall such duty exceed 50 per centum ad valorem.*

Par. 372. Steam engines and steam locomotives, 15 per centum ad valorem; sewing machines, and parts thereof, not specially provided for, valued at not more than $75 each, 15 per centum ad valorem; valued at more than $75 each, 30 per centum ad valorem; cash registers, and parts thereof, 25 per centum ad valorem; printing presses, not specially provided for, lawn mowers, and machine tools and parts of machine tools, 30 per centum ad valorem; embroidery machines, including shuttles for sewing and embroidery machines, lace-making machines, machines for making lace curtains, nets and nettings, 30 per centum ad valorem; knitting, braiding, lace braiding, and insulating machines, and all other similar textile machinery or parts thereof, finished or unfinished, not specially provided for, 40 per centum ad valorem; all other textile machinery or parts thereof, finished of unfinished, not specially provided for, 35 per centum ad valorem; cream separators valued at more than $50 each, and other centrifugal machines for the separation of liquids or liquids and solids, not specially provided for, 30 per centum ad valorem; combined adding and typewriting machines, 30 per centum ad valorem; all other machines or parts thereof, finished or unfinished, not specially provided for, 30 per centum ad valorem: Provided, That machine tools as used in this paragraph shall be held to mean any machine operating other than by hand power which employs a tool for work on metal.

Detroit Air Races Will Have Special Feature

A full scale experiment of the greatest technical interest will feature the race for the Curtis Marine Flying Trophy to be held in Detroit on Oct. 7. Four Navy planes entered are of the same general type with design modifications and different types of engines which it is desired to test out under competitive conditions, and the interest attaching to the race between these four entries will be secondary only to the race in which they have been entered.

The types TS-1 and 2 and TR-1 and 3 are variations of the Navy shipboard combat plane built at the Naval Aircraft Factory and designed by the design section of the Bureau of Aeronautics.

The TS-1 is equipped with a new Lawrance aircooled radial engine rated at 220 hp. This is the last word in aircooled engine development and the race is considered an excellent place to give this engine a severe tryout. The TS-2 is the same plane equipped with the Aeromarine 240 hp. engine.

The TR-1 is the same TS plane with the Lawrance aircooled engine but given special racing wings, and the TR-3 is the same as the TR-1 except that the Wright E-2 220-hp. engine has been substituted.

The outcome of the performance between these four planes will in itself be productive of valuable information along the lines of design for shipboard planes.

British Pig Iron Output Increases

According to reports from London the British production of pig iron in August was 411,700 tons, and of steel 520,800 tons, compared with 390,100 and 473,100 tons, respectively, in July.

Business Items

The Brier Hill Steel Co. directors have authorized the expenditure of $1,000,000 to rebuild the Thomas Works at Niles, Ohio, consisting of 12 sheet mills. The productive capacity of the plant will be increased 25 per cent. Work will be commenced immediately and completed in about six months according to Chairman J. B. Kennedy. There will be no special financing for the rebuilding of the Thomas plant, it was staetd. New steam power and annealing furnaces will be installed, rolls relocated and mills generally rearranged. A warehouse also will be built.

The Consolidated Steel Corporation, New York City, the exporting organization for independent steel companies, will end operations on or about Oct. 1.

The Delaware, Lackawanna & Western Railroad for the year ended Dec. 31, 1921, reports a net income of $19,158,403. This is the equivalent of $10.97 a share on $87,277,000 of capital stock outstanding ($50 par value).

The Dover Machinery Co., Providence, R. I., has been incorporated under the laws of Rhode Island, to conduct a general machine shop. The capital stock of the concern consists of 500 shares common stock without par value, and the incorporators are Henry E. Watjen, 35 Daniel St., Pawtucket, R. I.; Harold P. Watjen, and Henry A. Goodrich.

The American Locomotive Co. during the past ten days has closed contracts, calling for the delivery of 176 engines valued at $13,250,000, according to an official statement issued by the company. The company also announces that the strike at its Brooks Locomotive plant at Dunkirk, N. Y., has been settled and that the men have returned to work.

The W. F. Concannon Shear Co., manufacturers of steel shears, etc., of Milford, Conn., has filed a certificate with the Secretary of the State of Connecticut, increasing the capital stock of the concern to $100,000, from $50,000.

The F. J. Littell Machine Co., Chicago, Ill., manufacturer of roll and dial feeds for punch presses, announces that James Matson, formerly with the Pittsburg Model Engine Co., has been added to the organization as superintendent, and I. L. Pomeroy, formerly with the Auto-Point Pencil Co., is now mechanical engineer and designer.

The C. L. Hyde Construction Company of San Diego, Cal., has filed a petition for voluntary dissolution.

The B. C. Ames Co. of Waltham, Mass., has acquired a substantial interest in the Triplex Machine Tool Corporation of New York City, and the Triplex combination lathe, milling machine and drill press is now being manufactured in the B. C. Ames Co. plant at Waltham, Mass. The general office and showroom of the Triplex Machine Tool Corporation will continue to be located at 18 East 41st St., New York City.

H. A. Clark and E. L. Clark have filed in San Diego, Cal., a certificate of doing busines as the Southern Construction Co.

Philip M. Bush, Inc., of Hartford, Conn., was incorporated September 18 under the laws of Connecticut, to engage in the manufacture of machinery of all classes. The firm will have a capital stock of $50,000, and the incorporators are: Philip M. Bush and G. L. Bush, both of West Hartford, Conn., and James W. Knox, Hartford, Conn.

The Otis Steel Co. stockholders at a meeting in Cleveland last week ratified the increase in authorized capitalization to 1,000,000 shares of common, 330,000 of which are to be sold to stockholders at $11 a share.

The U. S. Hoffman Machinery Corporation for the first half of the year according to preliminary figures made public shows net sales of $2,271,730, an increase of $754,838 over the same period last year.

The Manton-Gaulin Manufacturing Co., 268 State St., Boston, Mass., has incorporated the business with a capital stock of $100,000, and will continue to

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Reamer, Expansion, "No Angle"
[illegible] Co., [illegible], Mass.
"American Machinist," July 27, 1922

The blades are placed at an angle to the axis of the reamer [illegible]. The front face of each blade at the forward end of the reamer has a [illegible] back rake; near the center the face becomes radial and is slightly undercut at the other end of the tool. Nuts at the end of the blade adjust the size of the reamer. Reamers are made in 11 sizes and can be supplied singly or in sets packed in wooden boxes. Smallest size: minimum diameter, [illegible] in.; maximum diameter, [illegible] in.; blade length, [illegible] in., overall length, [illegible] in. Largest size: diameter adjustment, [illegible] to [illegible] in.; blade length, [illegible] in.; overall length 12 inches.

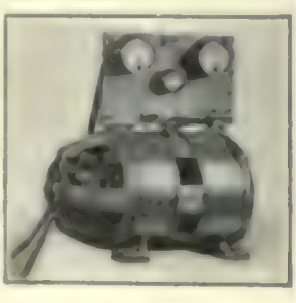
Caliper, Indicating, Swivel-Head, with Stand
F. W. Horstmann Co., 196 Colt St., Irvington, N. J.
"American Machinist," July 27, 1922

The caliper is similar to the former model, but is provided with a swiveling head. The head swings through a complete circle about the plunger and will stay fixed in any position without being clamped. Since the dial is graduated in thousandths of an inch, variation of work from standard size can be easily observed. The tool is made in six sizes with from 1 to 6-in. capacity, each size having a range of 1 in. A stand may be provided for gaging larger sized work. The caliper may be clamped on the stand in either a straight or a tilted position. Larger anvils can be furnished.

Cutter, Circle, "E-Z"
M. A. Butterfield Co., 12 June St., Lowell, Mass.
"American Machinist," July 27, 1922

The tool is intended for cutting round holes from 1 to 3[illegible] in. in diameter, in paper, fiber, rubber, leather and metal up to [illegible] in. in thickness. The distance between the two cutting wheels can be adjusted to the required diameter of the circle. The spindle and the cutters are supported by two braces. The feed pressure is obtained by means of a nut. An extra plate and a short spindle for cutting holes close to a corner are furnished as well as a [illegible]-in. square shank so that the tool may be driven by means of a ratchet wrench or a bit-stock attachment. The device is ordinarily driven by hand, but it can be turned by [illegible].

Battery Charging Outfit, Constant-Potential, HB
[illegible] Brothers Co., Troy, Ohio
"American Machinist," August 3, 1922



With the [illegible] electric [illegible] batteries can be charged in from six to eight hours. Any number of batteries may be connected to the machine [illegible]. The [illegible] consists of a [illegible] ball-bearing motor built in one unit with a 7[illegible]-volt, 200-ampere [illegible] potential generator. The outfit is for charging 6-volt batteries, although it can be adapted to use for 12- or 24-volt batteries. [illegible] Weight [illegible] pounds.

Hammer, Pneumatic, Changes in
Titan Power Hammer Corporation, 25 W. Broadway, New York, N. Y.
"American Machinist," July 27, 1922

In the new model, the valve sleeves and all port holes on the sides of the tool have been eliminated, so that instead of regulating the air by opening and closing the ports, a constant passage of free air is forced through the entire tool between the inner and outer casings. These changes greatly simplify the construction of the tool and prevent the former objectionable heating of the outside casing.

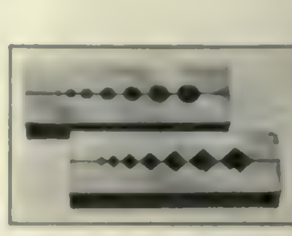
Diehead, Stationary, with Micrometer Attachment
Landis Machine Co., Waynesboro, Pa.
"American Machinist," July 27, 1922

Graduations for all sizes of bolts and pipes within the range of the diehead are stamped on the outer surface of the closing ring. After the head has been adjusted to size by means of the graduations and has been locked, further and finer adjustments can be made by the use of the micrometer screw. Finishing cuts can be taken after roughing cuts, and the size can be accurately repeated. The diehead can be supplied for machines where the work is revolved while the threading head remains stationary, and is equipped with a shank to conform to the dimensions of the turret holes. A special bracket for use on engine lathes and a special dead center for work placed on centers are furnished.

Die-Casting Machine, Automatic, Multiple, Rotary
Automatic Die Casting Co., 1120 Marshall Field Annex, Chicago, Ill.
"American Machinist," August 3, 1922

The machine table carries four similar or different dies and rotates around a central vertical shaft. Two castings are made at a time, and eight castings are made in one complete revolution of the table. On opposite sides of the table two metal boxes are mounted and slide toward the table on a long pivoted arm. Both boxes contain pots for the metal. The piston cannot operate if the spout of the pot is not in the correct position in the die-opening. Gas burners inside the box and surrounding the cylinder maintain the right temperature for the metal. A rotary bush and a powerful jet of air clean the dies for the next casting, and a water circulation system keeps the dies at the proper temperature.

Clamps, Jaw, Vise, Spring
Milliken Machine Co., West Newton, Mass.
"American Machinist," August 3, 1922



The devices are intended for use in a bench vise or in vise jaws or clamps mounted on milling machines, surface grinding machines and similar tools. Each pair has different sizes of holes, for either square or round stock, so that rods, pins or screws can be securely gripped. When the jaws of the vise are released, two springs cause the jaws of the clamp to automatically open and free the work. The clamps are hardened and finished all over. They are made to take stock from [illegible] to [illegible] in. in size.

Clip, paste on 3 x 5-in. cards and file as desired

manufacture dairy machinery, etc. The business is incorporated under the laws of Massachusetts, and the officers chosen are: president and treasurer, John W. Davies, 11 Elkins St., South Boston and Jesse W. Morton.

The Angus Manufacturing Co., Inc., New Haven, Conn., has been incorporated under the laws of Connecticut, to engage in the manufacture of small mechanical devices, etc. The concern will have a capital stock of $5,000, and the incorporators are: C. H. Angus, 78 Court St.; T. K. Ruth, 309 Central Ave.; and Arthur B. O'Keefe, 568 Washington Ave.; all of New Haven.

The Hendry Machine and Engineering Co. has been organized in Fort Meyers, Fla., with $50,000 capital. B. L. Hendry is president.

The Baldwin Locomotive Works has received an order from the Nashville, Chattanooga & St. Louis Railway for seven Mikado freight locomotives at an approximate value of $350,000.

The United Alloy Steel Corporation, in its report for the six months ended June 30, 1922, shows a net income of $1,274,923, which after deducting preferred dividends, is equal to $1.45 per share on 800,000 shares of common stock. Operating income was $1,913,113; non-operating income, $45,916; total income, $1,959,029; net income, $1,274,923; preferred dividends, $115,500; common dividends, $400,000; surplus for period, $759,423.

The Illinois Central Railway Co. has made application to the Interstate Commerce Commission to issue $6,645,000 of equipment trust certificates, the proceeds from the sale to be applied on the cost of 50 locomotives, 15 switch engines and 3,000 gondola cars.

The Micro Machine Co. has been incorporated in Davenport, Iowa, with a capital of $75,000 and will engage in the manufacture of grinding machines. J. W. Bettendorf, Edwin J. Bettendorf and Charles Grilk are the incorporators.

The Studebaker Corporation, according to reports, will deliver between 28,000 and 30,000 cars this quarter, on which net profits after charges and taxes should approximate $5,250,000, equivalent after preferred dividends to about $8.50 a share on 600,000 shares of common outstanding. This compares with net profits of $7,086,552 or $11.52 a share in the second quarter and net of $4,069,848 or $6.49 a share in the first three months.

The Industrial Plants Corporation, 25 Church St., New York City, is offering for quick disposal all patent rights, patterns, jigs, fixtures, drawings, customers' names, records, orders on hand, service parts, finished stock, machinery, and tools used in connection with the manufacturing of the world famous Meitz & Weiss semi-diesel type oil engine. The company manufacturing this engine has been in existence for 28 years and has built and sold approximately 9,000 engines ranging from 4 to 250 hp. The engines are extensively used by the United States and foreign governments and are adapted to any industrial or municipal purposes for light or power, marine or stationary installations.

The Torrington Company's net profits after expenses for the year to June 30 amounted to $1,389,321, which after the annual dividends of 7 per cent on the $1,000,000 preferred is equivalent to $9.48 a share on the 140,000 shares of common stock of $25 par outstanding at the end of the 1922 fiscal year.

The Pullman Company, according to reports, is to form two companies, one for manufacturing and repair work and the other for operating rolling stock. The plan calls for one share of each new company to be issued to each share of Pullman stock now out.

The Crucible Steel Company of America and subsidiaries for the four months ended Dec. 31, 1921, reports a net loss of $218,822. The profit and loss surplus Dec. 31, last, totaled $24,811,378, compared with $26,467,605 Aug. 31, 1921.

The Chicago Flexible Shaft Co. announces the opening of a new district sales office with headquarters in Indianapolis for the handling of furnace sales and Stewart engineering service in Southern Indiana, Southern Ohio, and Western West Virginia. F. W. Odemar will be in charge of this office, the address of which is 305 Merchants Bank Building.

The Lamson Co. announces that on and after Sept. 1, 1922, the office and manufacturing divisions of the company now in Boston and Lowell, Mass., will be consolidated in its new plant located at Syracuse, N. Y.

The E. L. Essley Machinery Co., Chicago, Ill., has recently augmented its force with a view to giving better service to its patrons. H. A. Bruce will be the Michigan representative and C. B. Burns and T. P. Nielsen will handle the Chicago territory, both of whom are well known in machinery circles. Ralph Wirth, formerly with the Toledo Press and Machine Co. and the Niagara Machine and Tool Works will act as a special representative in the sheet metal machinery department.

The Stevens-Prentice Manufacturing Co., Milwaukee, Wis., manufacturer of the Universal Inclinometer, announces a change in address from 62 Mason St. to 377 National Ave., Milwaukee.

Personals

SIR HERBERT AUSTIN, K. B. E., the British automobile manufacturer, will arrive in New York early in October to make a short inspection trip of American automobile plants. The big addition to the Austin plant, which was built to afford room for munition manufacture, has been converted to a manufacturing and assembling plant for the new Austin light car. A description of the plant and the policies adopted by the Austin company in the production of the new car will appear in the next issue of *American Machinist.*

W. S. RUGG, assistant to the vice-president of the Westinghouse Electric and Manufacturing Co., has been appointed general sales manager to take effect immediately.

J. H. SMITH, formerly superintendent of the Ohio Works of the Carnegie Steel Co., has been named general superintendent of the steel plant and car works of the British Empire Steel Corporation. Mr. Smith has been with the British Empire Steel Co. for several years, starting as mill superintendent.

JOHN GOODWIN CARUTHERS, for more than three years district manager of sales for the Illinois Steel Co., Chicago, leaves that position Oct. 1, to become general manager of sales for the Otis Steel Co., Cleveland, Ohio. He will be succeeded by Joseph Buffington, who has been in the general sales department of the Illinois Steel Co. for many years.

ALBERT V. RIGBY, founder of the Rigby Valve and Machine Co., has assumed the position of shop foreman. Mr. Rigby organized the company a number of years ago to manufacture Rigby valves, his own invention. He will succeed Archie Maxwell as foreman, Mr. Maxwell having resigned to go with the Standard Tank Car Co.

C. L. SPANGLER, formerly assistant general foreman of the machine shop at the Three Rivers plant of the Fairbanks-Morse Co., is now assistant superintendent of the big engine division at the Beloit plant of the same company.

FREDERICK H. HOLMES, vice-president and treasurer of the North & Judd Manufacturing Co., of New Britain, Conn., has been chosen a director of the New Britain National Bank.

HERBERT L. GREINER, formerly at the Putnam Machine Company plant of Manning, Maxwell & Moore, Inc., is now designing engineer with the Westinghouse Electric and Manufacturing Company at Philadelphia.

AUSTIN Y. HOY, manager of the London, England, office of the Sullivan Machinery Co., has recently arrived in this country on a business trip to the home office of the company in Chicago.

HENRY SWIFT, formerly production manager with the American Lead Manufacturing Co., Chicago, is now designing engineer with the International Harvester Company.

J. W. ROBINSON, manager of the central station division of the Chicago office, Westinghouse Electric and Manufacturing Co., has been assigned the general responsibility for the sale of supply apparatus in the Chicago territory, and W. A. DALRYMPLE has been made district auditor in the Chicago district.

C. J. WETZEL has joined the American Metal Parts Corporation staff as sales manager, and will make his headquarters at the main office, 28 Brighton Ave., Boston, 34, Mass.

A. M. KINNEY, formerly of the Cincinnati Auto Spring Company, is now assistant superintendent of the Cropper-Kinney Auto Spring Company.

W. L. SOUTHWELL has been made manager of the merchandising division of the Atlanta office of the Westinghouse Electric and Manufacturing Co., and E. V. PETERSON has been appointed to a similar position in the Seattle office.

G. C. KIMMEL, formerly vice-president and works manager of the Cincinnati Grinder Co., has been appointed consulting engineer for the Heald Machine Co., Worcester, Mass.

W. C. ALLEN, formerly in charge of the Philadelphia branch sales office of the Black & Decker Manufacturing Co. has been appointed manager of the company's Chicago branch.

Book Reviews

Jigs, Tools and Fixtures, Their Drawing and Design. By Philip Gates. Published by D. Van Nostrand Co., New York, N. Y. Price, $2.50.

A book of 190 pages, 7½ x 4¾ in., covering the entire subject of jigs, tools and fixtures, must necessarily cover it very thinly. This book has chapters on mechanical drawing and sketching on drill jigs, milling fixtures, chucks and turning equipment, milling cutters, screw cutting tools such as dies, gages, press tools, Brown & Sharpe screw machine cams and even chapters on standardization and the procedure for jig and tool manufacture covering the relation between the jig designing office and toolroom, order blanks, etc., and finally a chapter on special equipment which deals with such widely varying subjects as a trunk jig, a friction screwdriver and a water-tight inlet gland.

If the author had been satisfied to cover a small fraction of the field he might have written a valuable book, because it is apparent that he has clean-cut ideas on the subject of jig design. On the other hand, he presents certain things as being up-to-date and advanced practice which were recognized as standard practice in this country before the beginning of this century. One gets the impression that the author has taken up advanced machine shop practice in late years, that his enthusiasm in discovering for himself certain methods has led him to believe that these methods are advanced and worthy of description.

Notwithstanding all this, the book is written in a very readable manner and could have been made and probably is now of considerable interest to the apprentice and the young mechanic and possibly the young draftsman. However, if this had been the author's intention he should have limited his field materially, he should have confined himself either to tools or to jigs or to gages and not tried to cover all of these subjects in one small volume. He should have remembered that for his young readers a little bit of knowledge may be a dangerous thing.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Agricultural machinery and other machines that are able to compete on Czechoslovakia market—Czechoslovakia. Purchase desired. Quotations, c.i.f. German, Danish or Holland ports. Reference No. [illegible].

Copper, brass, and aluminum sheets, circles, etc.—India. Representation of manufacturers desired. Reference No. 3532.

Iron fittings for adjustable typewriter desks, in gross lots; rollers for office cabinet drawers, in gross lots; cupboard and upholstery hardware; and shop and showcase board fittings—Ireland. Purchase desired by a manufacturer. Quotations, f.o.b. New York. Reference No. 3534.

Steel cables "alsara" cables, steel bands for [illegible] packing boxes and machinery for the manufacture of [illegible] especially [illegible] machinery—Spain. Purchase desired. Catalogues are requested. Quotations, c.i.f. Cadiz. Terms, 90 days from date of lading and cash against documents with discount. Reference No. 3539.

Mechanical engineering supplies—England. Agency desired. Quotations, c.i.f. London or f.o.b. New York. Reference No. [illegible].

Bar and angle iron in quantity of 100 to [illegible] tons; 20 to 30 tons of black and galvanized sheets; 50 to 75 tons of compressed-steel shafting; 30 tons of galvanized iron wire, annealed iron wire; copper in bars; copper wire, sheets, and tubes; brass bars, sheets, and tubes; bar tin; [illegible] pig lead; sheet lead; lead pipe; [illegible] in ingots, and [illegible]—Finland. Purchase and agency desired. Quotations, c.i.f. Helsingfors. Terms, cash against documents. Reference No. 3546.

Adding machines, portable typewriters, [illegible], photograph attachments, office supplies of all kinds, textile machinery, and mill stores—Mexico. Purchase of goods and agency desired. Quotations, f.o.b. New York or Laredo. Terms, cash against documents in Mexico. Reference No. 3556.

Tools, machinery, twist drills, hack saws, leather and balata belting, fittings, tubes, etc.—Sweden. Purchase desired. Quotations, c.i.f. Helsingfors or Malmo. Reference No. 3562.

Hardware, implements and building materials such as metal plate (zinc and steel), fence wire, nails, screws, pumps, shovels, picks, cane knives, belting, rope, corrugated iron for construction, steel wire, water pipe, cement, etc.—Cuba. Agency desired. Quotations, c.i.f. Cuban ports. Reference No. 3563.

Automobile supplies in general, jacks to lift from 1 to 5 tons, and spanners and wrenches of all kinds—England. Purchase or agency desired. Quotations, c.i.f. London. Reference No. 3564.

Fire engines, oil burning, of about 100 horsepower—Italy. Agency desired. Reference No. 3565.

Copper and brass products (black copper wire rods for redrawing, copper and brass rods and plates, etc.)—Denmark. Agency desired. Reference No. 3570.

Sheet brass for drawing, A-1 quality, 0.2 to 0.3 millimeter, in quantity of 2 carloads (200 tons)—Hungary. Purchase desired. Quotations, c.i.f. Budapest or European port. Payment: Irrevocable letter of credit on New York against documents. Reference No. 3573.

Pamphlets Received

Paraguay. Trade and Economic Review for 1921, No. 16, on economic conditions in, and the state of the foreign trade of Paraguay. Published and distributed by the Department of Commerce, Washington, D. C.

United Kingdom. Trade and Economic Review for 1921, No. 15, on the economic conditions in, and the state of foreign trade of the cities of Birmingham, Bradford and Sheffield of the United Kingdom. Published and distributed by the Department of Commerce, Washington, D. C.

Czechoslovakia. Trade and Economic Review for 1921, No. 14, on the economic conditions in, and the state of the foreign trade of Czechoslovakia. Published and distributed by the Department of Commerce, Washington, D. C.

Russia. Trade and Economic Review for 1921, No. 7, on the economic conditions in, and the state of the foreign trade of Russia. Published and distributed by the Department of Commerce, Washington, D. C.

Guatemala. Trade and Economic Review for 1921, No. 6, on the economic conditions in, and the state of the foreign trade of Guatemala. Published and distributed by the Department of Commerce, Washington, D. C.

Australia. Trade and Economic Review for 1921, No. 11, on the economic conditions in, and the state of the foreign trade of Australia. Published and distributed by the Department of Commerce, Washington, D. C.

The Backbone of Automotive Service. This booklet, published by the Jacobs Manufacturing Co., Hartford, Conn., is intended to promote a more general appreciation of the importance of adequate shop equipment in the automobile service station. It has been prepared with the assistance of a number of machine tool builders and contains many useful hints of value to the owner of motor service stations. Individual treatment is accorded to the lathe, drill press, portable electric drill, cylindrical grinder and the arbor press, the place and value of each in the station equipment.

British South Africa. Trade and Economic Review for 1921, No. 12, on the economic conditions in, and the state of the foreign trade of British South Africa. Published and distributed by the Department of Commerce, Washington, D. C.

Norway. Trade and Economic Review for 1921, No. 13, on the economic conditions in, and the state of the foreign trade of Norway. Published and distributed by the Department of Commerce, Washington, D. C.

Hours and Earnings in Anthracite and Bituminous Coal Mining. Bulletin of the United States Department of Labor No. 316, covering the period of January, 1922, in the anthracite regions and the Winter of 1921-1922 in the bituminous regions. The bulletin is a comprehensive survey of the subject implied by its title and contains fifteen comparative tables of especial interest in the light of the present situation in the coal industry. Distributed by the Bureau of Labor Statistics, Washington, D. C.

France. Trade and Economic Review for 1921, No. 8, on the economic conditions in, and the state of the foreign trade of France. Published and distributed by the Department of Commerce, Washington, D. C.

Trade Catalogs

Cadman Metals. A. W. Cadman Manufacturing Co., Pittsburgh, Pa. Engineering Bulletin No. M-1, third edition, containing fourteen pages. The publication is a digest of sixty years' pioneer work in the development of fine bearing metals. Numerous instructive microphotographs of bearing metals are contained in the bulletin with an interesting and instructive discussion of the properties of the Cadman product.

Universal Inclinometer. The Stevens-Prentice Manufacturing Co., 62 Mason St., Milwaukee, Wis. A four-page circular illustrating the Stevens-Prentice universal inclinometer with line drawings and a complete description setting forth its advantages and uses.

Horizontal Boring, Drilling and Milling Machine. The Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 3-T, just issued by the company, covers a new table type horizontal boring, drilling and milling machine. The bulletin contains detailed illustrations and general specifications.

Bearings and Bearing Metals. A. W. Cadman Manufacturing Co., Pittsburgh, Pa. Engineering Bulletin M-2, third edition, fourteen pages. The publication is a semi-technical discussion of bearings, and bearing metals, their requirements, friction in bearings, bearing pressures, alloys and the theory of bearing metals.

Forthcoming Meetings

National Association of Cost Accountants. Third international conference to be held at Atlantic City, N. J. Sept. 25-28. Stuart McLeod, 130 West Forty-second St., New York, is secretary.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society of Mechanical Engineers, regional meeting, Sept. 25, 26 and 27, 1922, Hotel Kimball, Springfield, Mass. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

Second National Aero Congress and National Airplane Races, Detroit, Mich., October 7 to 14, 1922.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922. Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Chicago Metallic Mfg. Co., 542 West 35th St.—large size punch press and one scrap baler (used preferred).

Ill., Collinsville—The Imperial Clock Co., A. Fowler, Purch. Agt.—3 multiple-spindle high speed drill presses, 3 precision lathes, gear cutters, milling machines, screw machines, saws, grinders, punch presses and woodworking machines.

Ill., Joliet—The Central States Steel Equipment Co.—double crank, geared gap, frame press (new or used).

Kan., Valley Centre—A. P. Wright, (garage)—drill press and lathe for power equipment.

Mass., Boston—Pneumatic Equipment Co., 294 Washington St., G. S. Githens, Purch. Agt.—motor driven pipe cutting and threading machine (used).

Mass., Boston—O. Whyte Co., 73 Cornhill, (manufacturers of wire grilles, cables, etc.)—punch press for ⅜ in. stock, ½ in. hole capacity, also small tools for wireworking, (used).

Mass., Roxbury—Kopp & Sandel Co., 69 Conant St., A. Kopp and A. Sandel, Purch. Agts.—complete line of sheet metal working machinery and tools to equip shop (used).

Mich., Detroit—International Mchy. Co., 140 East Larned St., A. Howarth, Purch. Agt.—2 in. or 3 in. Ajax, Acme or National bolt heading and forging machine.

Mich., Detroit—Pennsylvania R.R., 1368 Penobscot Bldg.—equipment for proposed engine repair shop at the Ecorse Yards.

N. Y., Buffalo—C. C. Clifford, 148 Elm St.—automobile repair and garage equipment including one 1,000 gal. tank and pump.

N. Y., Buffalo—Iroquois Beverage Corp., 230 Pratt St.—equipment and tools for proposed motor vehicles repair shop and garage at 648 Ellicott St.

N. Y., Buffalo—J. Jacobstein, 15 West Swan St.—machinery, tools and equipment for proposed garage and repair shop on Fillmore Ave.

N. Y., Buffalo—M. Leweczyk, 1633 Bailey Ave.—machinery and tools for garage and repair shop addition, also storage facilities for 500 gal. gasoline.

N. Y., Buffalo—L. Mossmoud, 56 Pratt St.—tools and equipment for garage and service station on Jefferson Ave. and East Delevan St.

N. Y., Buffalo—S. Siegel, 1393 Genesee St.—equipment for automobile repair shop.

N. Y., New York—Flanner & Co., 400 St. Nicholas Ave., (manufacturer of radio apparatus)—self opening die head for screw machine.

N. Y., Utica—Utica Motor Car Co., 509 Kent St.—machinery and equipment for proposed $100,000 addition to service and repair works.

O., Cleveland—The Newman-Stern Co., East 12th and Walnut Sts., (machine shop)—screw cutting lathe, 8 in. swing, 36 in. bed, motor driven.

O., Niles—Mutual Oil Service Co.—machinery, tools and equipment for gasoline and service station now under construction.

O., St. Marys—Hermann Tire Building Machine Co., O. E. Larson, Mgr.—machinery for the manufacture of tire-making equipment, including drill presses, lathe, grinders, shapers, etc.

O., Sebring—Utility Machine Co., T. B. Hasty, Purch. Agt.—24 in. milling machine, electric drill and 24 in. arbor press. Will receive bids later on welding plant.

Pa., Greenville—Greenville Steel & Iron Co., H. E. McConnell, Genl. Mgr.—3 roll turning lathes, 1 radial drill, 4 drill presses, 2 planers, also grinders.

Pa., Phila.—J. H. Billington Co., 113 Chestnut St., manufacturers of mill supplies, J. Billington, Purch. Agt.—machinery for new machine shops.

Pa., Phila. — Commercial Truck Co., 22nd and Market Sts.—36 in. Bullard lathe.

Pa., Titusville — Titusville Iron Wks., South Franklin St.—machine shop and foundry equipment for proposed addition on South Washington St.

Wis., Racine—T. Collier, 1331 18th St.—sheet metal working machinery, including brakes, benders, etc.

Ont., Ford—Ford Motor Co. of Canada—$150,000 worth of lathes, planers, shapers, milling machines and tools for new machine shops.

Ont., Kincardine—C. Macpherson, Morrison Blk.—equipment and tools for machine, general repair and automobile repair shop.

Ont., Wiarton—Hay & Hoover—equipment for automobile repair shop and garage, to replace that which was destroyed by fire.

Que., Montreal—O. L. Henault, 214 Bishop St.—general equipment for auto repair shop and garage.

Machinery Wanted

Calif., Reedley—M. Deneen, Clk., Reedley Joint Union High School Dist. will receive bids until Oct. 9 for Oliver No. 166B 12 in. hand planer fitted with automatic and circular safety cylinder, with thin high speed knives, bevel fence, rabbiting arm. Bids on similar equipment will be considered. One p. b. safety switch for 220 volt, 5 hp., 3 phase, 60 cycle motor, to drive 24 in. Fay & Egan planer. One Wallace 16 in. band saw, direct motor drive complete, 110 volt, equipped with all necessary guards. Bids on similar equipment will be considered. Guard for Fay & Egan No. 330 circular saw. All prices f. o. b. Reedley.

Fla., Gainesville — Micanopy Moss Ginning Co., A. Selle, Pres.—complete machinery and equipment for moss ginning plant.

Ill., Chicago—G. E. Corbett Boiler & Tank Co., 1332 Cortland St.—oxweld acetylene welding and cutting outfit.

Ill., Chicago—Robey Tank Wks., 2513 South Robey St.—extra heavy 6 x 20 ft. cylinder tank.

Ill., Grayslake — Times (newspaper) — power 7 column cylinder press, belting, motor, and 2 sets rollers.

Ind., Jeffersonville—Falls City Hydraulic Brick Co., R. Ackers, Supt. — machinery and equipment for brick plant, (new).

Ind., Laporte—Advance Rumely Co., (manufacturer agricultural implements)—complete machinery and equipment for proposed branch plant at Harrisburg, Pa.

Kan., Atchison — Blair Milling Co., 300 South 4th St.—machinery and equipment for proposed flour mill.

Ky., Pikeville—Riverside Publishing Co. folding machine, cutter, linotype and press for 7 column newspaper.

La., Ashton—T. A. Labauve—catalogues and prices on rice hullers, polishers, grits and meal mills, bolters and crude oil engines.

La., Monroe—Monroe Glass Co., c/o Chamber of Commerce—machinery and equipment for proposed plant, for the manufacture of lamp chimneys and other glass products.

Md., Security—Security Cement & Lime Co.—machinery and equipment for proposed addition to plant, to increase annual capacity from 950,000 bbl. to 1,400,000 bbl.

Mass., Boston—S. W. Frazer Co., 50 Broomfield St., (art supplies)—small band saw (used), turning table, alternating current, motor and other small machinery and tools for fine woodworking.

Mass., Fall River — Fyans, Fraser & Blackway Co., 83 Anawan St.—several No. 50 Universal winding machines.

Mass., Fall River—Stevens Mfg. Co.—machinery for addition to cotton mill.

Mich., Detroit—Chevrolet Motor Co., 3044 West Grand Blvd.—mechanical equipment for assembling and finishing automobile bodies for proposed plant at Hillside Ave. and 73rd St., Oakland, Calif.

Mich., Grand Rapids—Brewer Mfg. Co., 1103 Front Ave.—screw and spinning machines, punch press, motors, crude oil furnaces, printing office equipment and electrode wire for proposed factory.

Mich., Kalamazoo—Western Paper Makers Chemical Co., River Rd.—machinery and equipment for proposed paper mill at Savannah, Ga.

Mich., Muskegon Heights — Record, (newspaper)—power perforator.

Mich., Suttons Bay — Courier, (newspaper)—power numbering machine.

Miss., Poplarville—Williams Yellow Pine Co.—machinery and equipment for lumber mill, to replace that which was destroyed by fire.

Mo., Valley Park—Barbour Boat Co.—power pony planer, band saw and rip saw.

N. J., Atlantic City — Atlantic Woodworking Co., 2320 Fairmount Ave.—machinery and equipment for proposed addition to plant.

N. J., Frenchtown—M. Davy—complete equipment for job printing.

N. Y., Avoca—Bd. Educ.—complete vocational equipment for new $65,000 high school now under construction.

N. Y., Batavia—P. W. Minor & Son, State St.—complete machinery and equipment for proposed addition to shoe factory.

N. Y., Buffalo—Drive Your Car Co., Burton and Main Sts.—equipment for service station, including one 500 gal. tank and one 1,000 gal. tank with pumps.

N. Y., Buffalo—R. Gray, Dart and Bradley Sts.—machinery and equipment for proposed shop, for producing zinc alloyed rust-proof surface on metal products.

N. Y., Buffalo—F. L. Harrison, 342 Virginia St.—bakeshop equipment.

N. Y., Buffalo—M. V. Holenwood, Hertel and Delaware Aves.—equipment for proposed battery manufacturing plant.

N. Y., Buffalo—S. Strzelecki, 73 Reed St.—machinery, tools and equipment for proposed upholstery factory.

N. Y., Buffalo—A. Weber, 479 Carlton St.—baking machinery for proposed addition to bakery.

N. Y., Elmira—C. B. Wheeler, 1019 College St.—wood saw outfit, either motor or engine driven.

N. Y., Hamburg—Burdick-Atkinson Co., J. S. Burdick, Pres. and Genl. Mgr., (manufacturer steel wire springs for auto upholstery)—complete machinery and equipment for plant on Scott St.

N. Y., Interlaken—J. S. Van Doren—adjustable roll, self feed rip saw, iron frame.

N. Y., Jamestown—Empire Case Goods Co., 158 Foote Ave., (manufacturer of furniture), F. O. Anderson, Pres.—machinery and equipment for 1 story addition to factory.

N. Y., Jamestown—Pittsburgh & Freeport Coal Co., Bank of Jamestown Bldg.—coal loading and unloading machinery for new coal loading plant now under construction on Institute St.

N. Y., Jamestown—Six Hundred Gas Stations, Inc., West 8th St., S. S. Vandervoort, Genl. Mgr.—machinery, pumps and other equipment for proposed chain of gas and service stations in Jamestown and vicinity of Chautauqua Lake.

N. Y., New York—Merit Knitting Mills, 21 Washington Pl.—winder for 34 spools.

N. Y., Olean—Bd. Educ., 123 East State St.—equipment for manual training department of new addition to high school.

N. Y., Penfield—A. and D. Harris—machinery and equipment for apple evaporator plant at Randolph.

N. Y., Rochester—Don-O-Lak Co.—machinery and equipment for paint and varnish factory, to replace that which was destroyed by fire.

N. Y., Rochester—H. B. Miller, 6 Cliff St.—one emery grinder.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Firm position of coke market reflected in stronger pig-iron prices. This week's market characterized by heavy demands on the part of railroads, for rails, machine tools, steel plates for locomotive repair and shapes and bars for general repair work. Demand for oil tank plates also active. Structural shapes and mild steel bars, $2@$2.25, f.o.b. Pittsburgh; the lower figure applying generally on large orders with smaller tonnages going at the higher quotation. Plates, $2 at mill, for car material, on orders previously placed; ordinary current business going at $2.15@$2.25, with small tonnage lots, $2.50 per 100 lb. Blue annealed steel sheets, base size, quoted at a maximum of $3.20 as against $3.10, at mill; galvanized, $4.75 as compared with $4.35 per 100 lb., last week.

Tin up ½c.; lead, ¼c.; zinc, ¼c. and Chinese antimony, ½c. per lb., in New York warehouses, during week. Copper market firm, despite recent wage advance.

Red and white lead, in 100 lb. kegs, up 1c. per lb., f.o.b. New York; representing the first advance since May 31. Linseed oil firm.

Discounts reduced five points in New York warehouses, on bolts, nuts, washers, rivets and other shop supplies, effective, Sept. 15.

Declines—None in New York, Cleveland or Chicago.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	36.64
Virginia No. 2	37.17
Basic	34.00
Grey Forge	33.00
CHICAGO	
No. 2 Foundry, local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	32.50
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	8.0	6.0	5@5½
Detroit	10@12	6.0	3@4
New York	9@10	6.0	4.0
Cleveland	[illegible]	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.50	4.00
No. 12	[illegible]	4.24	3.55	4.05
No. 14	[illegible]	4.29	3.60	4.10
No. 16	[illegible]	4.39	3.70	4.20
Black				
Nos. 17 and 21	3.20@3.35	4.70	4.05	4.70
Nos. 22 and 24	3.25@3.40	4.75	4.10	4.70
Nos. 25 and 26	3.30@3.45	4.80	4.15	4.75
No. 28	3.35@3.50	4.90	4.25	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11	3.35@3.75	4.90	4.25	4.85
Nos. 12 and 14	3.45@3.85	5.00	4.35	4.95
Nos. 17 and 21	3.75@4.15	5.30	4.65	....
Nos. 22 and 24	3.90@4.30	5.45	4.80	5.40
No. 26	5.05@4.45	5.60	4.95	5.55
No. 28	4.35@4.75	5.90	5.25	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	39½	24½
LAP WELD					
2	61	49½	2	34½	20½
2½ to 6	65	53½	2½ to 4	37½	24½
7 to 8	62	49½	4½ to 6	37½	24½
9 to 12	61	48½	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	39½	25½
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	35½	22½
2½ to 4	63	52½	2½ to 4	38½	26½
4½ to 6	62	51½	4½ to 6	37½	25½
7 to 8	58	45½	7 to 8	30½	18½
9 to 12	52	39½	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.29	3.50	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.06	5.50
Cold finished shafting or screw	3.90	3.60	3.70
Cold finished flats, squares	4.40	4.10	4.20
Structural shapes (base)	3.04	2.91	2.92½
Soft steel bars (base)	2.94	2.81	2.82½
Soft steel bar shapes (base)	2.94	2.81	2.82½
Soft steel bands (base)	3.74	3.61	3.55
Tank plates (base)	3.04	2.91	2.92½
Bar iron (2.50 at mill)	2.94	2.81	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
[illegible]	8.00		12@13
¼	6.50		11@12
[illegible] to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.62½
Lead (up to carlots), St. Louis 5.90; New York	6.75
Zinc (up to carlots), St. Louis 6.80@6.85; New York	7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	21.00	20.00
Antimony (Chinese), ton spot	7.25	7.75	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.25	20.50	18.75
Brass tubing (100-lb. lots)	22.50	23.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.75	18.50	15.75
Brass wire (carlots)	18.75	19.50	.....
Zinc sheets (casks)	9.25	9.25	.....
Solder (½ and ½), (caselots)	25.00	23.50	20.00
Babbitt metal (fair grade)	25.00	42.25	36.00
Babbitt metal (commercial)	15.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.25	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.00	4.75
Lead, tea	4.25	4.00	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.80	7.25
IC,	14x20	7.25	6.05	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¾x13¾, per lb.	.075	.06	.10
Wiping cloths, 13¼x20½, per lb.	.08	.096	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville....per net ton		11.00@11.50	
Coke, prompt foundry, Connellsville...per net ton		12.50@13.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	60%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	50-10-5%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.50	$3.35
Cone heads, ditto (net)	5.10	3.60	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1 24	1.40
Cloth	3.02	2 67	3.20

O., Cincinnati—[illegible] & [illegible] [illegible] [illegible] proposed bakery on [illegible] Ave., [illegible]

O., Cleveland—M. [illegible] [illegible] [illegible] [illegible] mixer, [illegible] [illegible] for proposed bakery on [illegible] St. and [illegible] Rd.

O., Columbus—[illegible] Saw Co., [illegible] [illegible] [illegible] W. F. [illegible] [illegible] Mgr.—wood-working machinery for proposed 2 story, [illegible] ft. addition to factory.

O., Columbus—[illegible] Public Welfare Oak and [illegible] [illegible] equipment for [illegible] [illegible] building at the [illegible] Reformatory, [illegible]

O., Columbus—[illegible] Co., [illegible] [illegible] [illegible]—complete equipment for proposed [illegible] factory, capacity [illegible] pairs per day.

O., Newton Falls—[illegible] Products Co. (manufacturer of automobile tires and hard [illegible])—additional machinery and equipment.

O., Toledo—[illegible] Plating Co., [illegible] [illegible] and Wheeler St., H. A. Middle-[illegible] [illegible]—full line of plating and [illegible] machinery.

O., Troy—Daily News—magazine for model [illegible]

Pa., Allentown—Lehigh Portland Cement Co., Young Bldg.—machinery and equipment for proposed plant near Birmingham, Ala.

Pa., Ambler (Phila. P. O.)—J. E. Marsden [illegible] Wat., 923 Chestnut St.—cross cut saw complete for large size lumber.

Pa., Butler—People's Telephone Co.—machinery and equipment for complete [illegible] and [illegible] of plant and exchange at Grove City.

Pa., Midland—Borough, J. P. Stone, Secy., will receive bids until Oct. 2, for furnishing 20 ton truck scales. Estimated cost $1,[illegible]

Pa., Phila.—Atlantic & Pacific Tea Co., [illegible] Ave.—equipment for modern, large capacity bakery.

Pa., Phila.—Harrison Brush Co., 4th and Arch Sts.—cutters, woodworking machines and small tools.

Pa., Phila.—Ice Cream Box Mfg. Co., 609 North Franklin St.—additional scorers, [illegible] cutters and presses for the manufacture of paper boxes.

Pa., Phila.—Spruce Worsted Co., 25th and Spruce Sts., H. A. Ellis, Purch. Agt.—additional worsted spindles and twisting machines for new factory.

Pa., Pittsburgh—Neely Nut & Bolt Co., 26 South 22nd St.—complete machinery and equipment for proposed $250,000 addition to nut and bolt factory.

Pa., Pittsburgh—Stroh Steel Hardening Process Co., Westinghouse Bldg.—foundry equipment for new plant.

Pa., Scranton—Nagelberg Bros., 334 Penn Ave., S. Nagelberg, owner—machinery and equipment for clothing factory, to replace that which was destroyed by fire.

Pa., Tacony (Phila. P. O.)—L. H. Gilmer Co., Cottman and Kensington Aves., manufacturer of [illegible] belting, H. S. MacMillan, Purch. Agt.—additional looms and miscellaneous machinery.

Pa., Warren—C. Hamm, 23 Clark St.—[illegible] machinery to replace those which were destroyed by fire.

Pa., Wilkes-Barre—Amer. Pretzel & Baking Co. [illegible] [illegible] machinery for bakery and pretzel plant. [illegible]

Pa., Williamsport—[illegible] Paint Co., 202 [illegible]—machinery and equipment for [illegible] [illegible] factory.

Pa., Williamsport—Ideal Dust Conveyor Co., [illegible] Mgr.—special machinery and equipment for proposed factory, for the manufacture of patented galvanized [illegible] conveyors.

Tenn., Kingsport—Mead Fibre Co.—machinery and equipment for proposed paper mill.

W. Va., Bluefield—H. M. Waugh, (railroad [illegible]) [illegible] for drilling [illegible] [illegible] operated [illegible] [illegible]

W. Va., Cameron—G. H. Jones, P. O. Box 12—laundry machinery.

Wis., Antigo—C. Malog—[illegible] mill machinery.

Wis., Fond du Lac—[illegible] [illegible] [illegible] [illegible]—dairy machinery including power churns, etc.

Wis., Madison—State Bd. of Control, M. J. Tappins, Secy. [illegible]—machinery for proposed [illegible] at Wisconsin [illegible] for [illegible] [illegible] Grove.

Wis., Milwaukee—G. O. Dallmann, 375 Manitoba Ave.—Universal woodworker for 7 operations.

Wis., Milwaukee—L. Lecy, 946 26th Ave., (woodworker)—band saw.

Wis., Milwaukee—Matuschka-Gerlach Co., 2812 Meinecke Ave., (produce)—ice making machinery.

Wis., Milwaukee—A. J. Pietsch, 3513 State St., (woodwork)—3 drum sander.

Wis., Milwaukee—M. A. Weinreis, 246 Oregon St.—2 belt driven air compressors, from 250 to 300 cu.ft. for 100 lb. pressure.

Wis., Waupaca—Acme Brass & Metal Wks., c/o L. Larsen and J. M. Braun—foundry equipment.

Wis., West Allis—Mertz Tire Shop, 6209 Greenfield Ave.—tire press.

Wis., West Bend—C. Baer, (carpenter and millworker)—planer and band saw.

Wis., Wisconsin Rapids—Weisel-Bloomer Co., c/o J. B. Arpin—machinery to separate coke and other products from cinders.

Ont., Deseronto—Thompson Powder Co.—equipment for mixing house, to replace that which was wrecked by explosion. Loss $30,000.

Ont., Dundas—Colville Feed & Milling Co.—equipment to replace that which was damaged by fire.

Ont., Goderich—Artcraft Furniture Co.—new machinery and equipment for furniture factory, soon to be remodeled.

Ont., Hamilton—Abrasive Co. of Canada, 568 Burlington St., E.—special equipment for furnace building, for treating abrasives.

Ont., Lucan—The Crane Milling Co., Ltd., A. Crane, Purch. Agt.—machinery for flour mill, to replace that which was destroyed by fire.

Ont., Milton—Smith & Stone—machinery and equipment for proposed addition to plant, for the manufacture of electrical supplies.

Ont., Toronto—Galbraith-MacDonald Co., Ltd., 2 St. Claire Ave., W., engineers and contractors, A. J. Boon, Purch. Agt.—Elliot woodworker.

Ont., Windsor—Detroit Steam Motor Corp.—equipment for new $200,000 factory.

Ont., Windsor—Leggatt & Platt Spring Bed Co., 928 McDougall Ave.—special equipment for the manufacture of spring beds.

Metal Working Shops

Calif., Oakland—Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, Mich., had plans prepared for the construction of a 2 story, 146 x 684 ft. factory for the manufacture of automobile bodies, on Hillside Ave. and 73rd St., here. Estimated cost $600,000. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt.

Calif., Oakland—Hebern Electric Code, Inc., Bank of Italy Bldg., awarded the contract for the construction of a 3 story, 100 x 200 ft. factory on 8th and Harrison Sts. Estimated cost $150,000. Noted Aug. 24.

Calif., San Diego—Bureau of Yards and Docks, Navy Dept., Wash., D. C., awarded the contract for the construction of a guard and shop building at Naval Base, Marine Barracks, here. Estimated cost $146,176.

Calif., San Jose—Teachers State College is having plans prepared for the construction of a group of college buildings, including a home economics building, industrial training shops, machine shops, etc., on 7th and San Antonio Sts., here. Estimated cost $206,000. G. B. McDougall, Forum Bldg., Sacramento, State Archt.

D. C., Wash.—J. McReynolds, 819 14th St., N.W., plans to build a service station and show room building. Estimated cost $150,000. F. B. Pyle, Evans Bldg., Archt.

Ill., Chicago—F. G. Arnold Co., c/o Z. E. Smith, Archt., 305 East 55th St., is receiving bids for the construction of a 1 story, 75 x 160 ft. garage on Ogden and Ridgeway Sts. Estimated cost $60,000.

Ill., Chicago—Luther Bros., 2523 North Cicero Ave., are receiving bids for the construction of a 1 story, 100 x 1?? ft. garage on Cicero Ave. near George St. Estimated cost $1??,000. E. P. Rupert, 19 South La Salle St., Archt.

Ill., Oak Park—Snow Bros., 1011 South Blvd., awarded the contract for the construction of a 1 story, 68 x 16? ft. garage at 1011 South Blvd. Estimated cost $100,000.

Mass., Springfield—B. E. Shaw, 124 St. James Circle, awarded the contract for the construction of a 2 story, 88 x 112 ft. garage, on Chestnut St. Estimated cost $100,000.

Mass., Worcester—A. J. Booth, c/o E. T. Chapin, Archt., 340 Main St., will build a 3 story, 95 x 103 ft. garage and service station on Park St. Estimated cost $150,000.

Mich., Detroit—Dodge Bros., 7900 Jos. Campau Ave., will build an 8 story, 200 x 400 ft. factory for assembling and finishing closed bodies for automobiles. Estimated cost $1,500,000. Noted Sept. 21.

Mich., Ecorse—Pennsylvania R.R., 1368 Penobscot Bldg., Detroit, awarded the contract for the construction of a 1 story, 60 x 210 ft. engine house, here.

N. Y., Albany—Kushner & Cooperberg, 15 Central Ave., awarded the contract for the construction of a 2 story, 65 x 240 ft. garage on Columbia St. Estimated cost $75,000.

N. Y., Dunkirk—Skelton Shovel Co., c/o Chamber of Commerce, awarded the contract for the construction of a large shovel plant on East Lake Rd. Estimated cost $125,000. Noted Aug. 29.

N. Y., New York—I. Feldman, c/o C. B. Meyers, Archt. and Engr., 31 Union Sq., has had plans prepared for the construction of a 2 story, 105 x 110 ft. garage, on West 150th St. Estimated cost $85,000.

N. Y., New York—A. Lewisohn, 61 Bway., will build a 2 story, 175 x 230 ft. garage at 4360 Bway. Estimated cost $75,000.

O., Cleveland—J. Mathers, 2061 West 20th St., has had plans prepared for the construction of a 1 story, 66 x 66 ft. garage, at 1860 West 32nd St. Estimated cost $40,000. W. Markowitz, 228 Union Bldg., Archt.

O., Youngstown—P. J. Kahlman Co., plans to build a 48 x 374 ft. steel fabricating plant on Cypress St. Estimated cost $35,000.

Pa., Greenville—Greenville Steel & Iron Co. is having plans prepared for the construction of a steel plant, consisting of a 1 story, 150 x 500 ft. rolling mill, a 1 story, 100 x 150 ft. open hearth building, a 1 story, 60 x 450 ft. boiler house, a 1 story, 50 x 150 ft. machine shop and a 3 story, 50 x 100 ft. warehouse. Estimated cost $3,500,000. Private plans.

Pa., Oil City—E. M. Bowen, Ford Agency, is having plans prepared for the construction of a 3 story, 70 x 80 ft. automobile service and repair station. Estimated cost $45,000. W. H. Crosby, Masonic Bldg., Archt.

Pa., Phila.—Ballinger & Co., Archts., 12th and Chestnut Sts., are receiving bids for the construction of a 6 story, 100 x 329 ft. metal working factory, for Budd Mfg. Co., 21st St. and Hunting Park Ave.

Pa., Phila.—J. J. Greenberg, c/o Nash Motor Co., 901 North Broad St., is having plans prepared and will soon receive bids for the construction of a 5 story, 75 x 160 ft. sales and service station, on Broad and Thompson Sts. Estimated cost $250,000. P. S. Tyre, 1509 Arch St., Archt.

Pa., Titusville—Titusville Iron Wks., South Franklin St., plans to build a large addition to its plant, for the manufacture of oil well pumps, engines and supplies, on South Washington St. Estimated cost between $100,000 and $150,000. Architect not announced.

R. I., Providence—New Down Town Garage, Inc., 704 Industrial Trust Bldg., awarded the contract for the construction of a 2 story garage and service station, with capacity for 250 cars, on Richmond St. Estimated cost $150,000.

W. Va., Wheeling—Centre Fdry. & Machine Co., 2011 Main St., awarded the contract for the construction of a 1 story, 100 x 120 ft. foundry on Warewood Ave. Estimated cost $35,000.

Wis., Oshkosh—Winnebago County, c/o Clerk, awarded the contract for the construction of a 1 story, 58 x 120 ft. garage and repair shop. Estimated cost $40,000. Noted Aug. 24.

Ont., Milton—Smith & Stone plan to build a large addition to their plant for the manufacture of electrical supplies. Estimated cost $40,000.

General Manufacturing

Calif., Petaluma—Poultry Producers of Central California, 323 East Washington St., will soon award the contract for the construction of a 110 x 210 ft. packing plant.

N. Y., Batavia—P. W. Minor & Son, State St., are receiving bids for the construction of a 4 story, 42 x 140 ft. addition to their shoe factory. Estimated cost $100,000.

517

American Machinist

Volume 57 NEW YORK, OCTOBER 5, 1922 Number 14

Salvage and Repair of Railroad Equipment

Salvage of Material Formerly Sold as Scrap—An Air Hammer of Novel Construction A Portable Lathe—Handling Car Wheels

BY S. ASHTON HAND
Associate Editor, *American Machinist*

RAILROADS in their present fight to make ends meet are practising economies not heretofore thought of. That old material formerly sold as scrap is now being salvaged and again put into serviceable use is evidenced by what may be seen in the railroad repair shops in almost every locality.

On the Atlantic Coast Line Railway, the tin roofs on freight cars, when damaged either by rust or accident, are stripped from the cars and sent to the shops, where they are first straightened. Then the damaged parts are cut from the sheets and new pieces inserted and fastened by lock seaming.

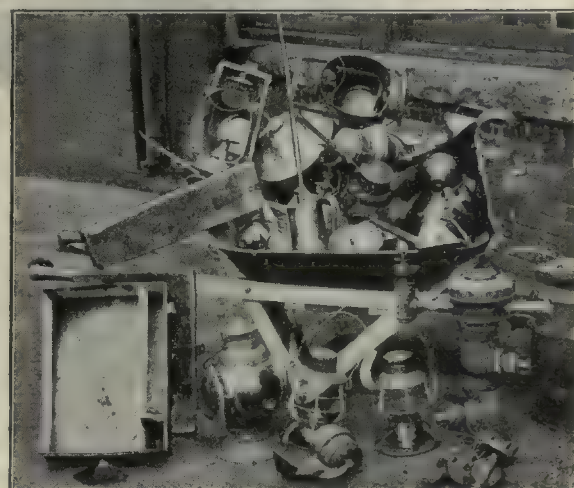


FIG. 1—A PILE OF DAMAGED CAR ROOFS. FIG. 2—LANTERNS, OIL CANS, ETC., THAT WILL BE SALVAGED

Some of the damaged car roofs on the Atlantic Coast Line are shown in Fig. 1 piled up at the Waycross, Ga., shops, where they have been shipped from all parts of the system. Here they will be reconditioned, again to do duty. The average cost of repairing these roofs is \$6.40 each and as a new roof costs from \$50 to \$60, the saving is quite considerable.

A lot of damaged lanterns, car lamps, rear-end signal lamps, switch lamps, oil cans, etc., are shown in Fig. 2, and will all be put in serviceable condition at an average cost of about 45 cents each.

Round rods from worn out or broken ventilating doors of freight cars, from brake rigging and various other parts of rolling stock anatomy were salvaged at these shops in March, 1922, to the amount of 51,547 pounds.

The dining-car stove in Fig. 3 is undergoing thorough repairs, including a new lining of asbestos and the insertion of some new sheets. Formerly this stove would have been scrapped.

Waste taken from the journal boxes of passenger cars is brought to the press shown in Fig. 4 and the oil pressed out of it. The waste is packed in the receptacle at *A*, to which a piston is fitted. Pressure on the piston, supplied by air in the cylinder *B* (which by the way is an old air-brake cylinder) is sufficient to squeeze as much oil out of the waste as can be done by such a method. The waste is then taken from the press and put in a tumbling barrel made of wire mesh, contained in the tank *A*, Fig. 5, where it is immersed in water kept at the boiling point by the introduction of steam. Here the tumbling barrel is revolved, sloshing the waste in the water for 10 or 15 minutes to remove the balance of the oil, after which it is removed and put in the centrifugal separator *B* and the water taken from it. The reclaimed waste and oil are used for packing the journals of freight cars.

It may be wondered if the salvage of materials referred to actually pays, but when consideration is given to the fact that the majority of the work is done in

FIG. 3—A DINING CAR STOVE UNDERGOING REPAIRS

spare time by help that must be paid, whether employed full time or not, it will be conceded that considerable saving has been attained. The air hammer for straightening rods shown in Fig. 6 is made from an 8 x 12-in. air-brake cylinder having the usual non-pressure head and internal spring. A square piston rod has been fitted to it to prevent the die attached to the piston rod from turning, this arrangement being much simpler and cheaper than making guides for the die to travel in. A series of $\frac{1}{4}$-in. holes drilled around the center of the cylinder at *A* allows air to escape when the piston has passed them on the downward stroke. When striking and compressing the spring, the piston is shot upward until the air sends it down again. Thus a very rapid reciprocating motion is secured without any reversing valve, and the greater the air pressure the longer and harder the stroke.

FIG. 4—PRESSING OIL OUT OF JOURNAL-BOX WASTE

Staybolts in locomotive fire boxes have small holes known as tell-tale holes drilled in them longitudinally, so that should a staybolt break, the break will announce itself by the leak of water or steam.

A machine for drilling tell-tale holes is shown in Fig. 7, in which stations and fixtures are provided for six bolts around a central column. The bolts are held in V-blocks as at *A* and *B*, Fig. 8, and the drills are guided by bushings as at *C*. The fixtures are mounted on vertical slides, each having a roller bearing on the cam *D* below. In operation, all stations revolve around the central column and are pushed upward by the stationary cam *D* as they revolve, bringing the end of the bolt against the drill. It will be understood that the depth of the hole drilled is controlled by the height of the rise on the cam. When the roller attached to a slide reaches the low part of the cam at *E*, drilling of the bolt in that station is completed, and it can be taken out and replaced by another. It will be seen that the cam has a rise and fall at *G* which allows the slide to fall and then rise again before the drilling has been completed. There are several such places in the cam, and their purpose is to allow the slides to drop down at stated intervals so as to bring the bolts below the drill and clear the holes from chips.

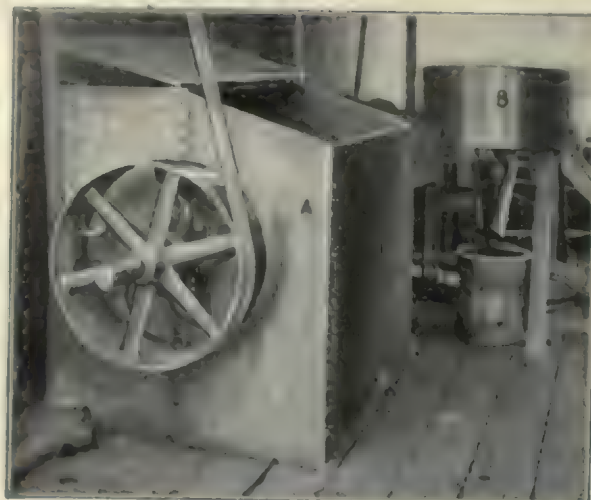


FIG. 5—WASHING AND DRYING JOURNAL-BOX WASTE

In delivering car wheels after they are bored, they are lowered by the crane attached to the boring mill so that one edge strikes the top of the iron tripod shown in Fig. 9. Further lowering tilts the wheel so

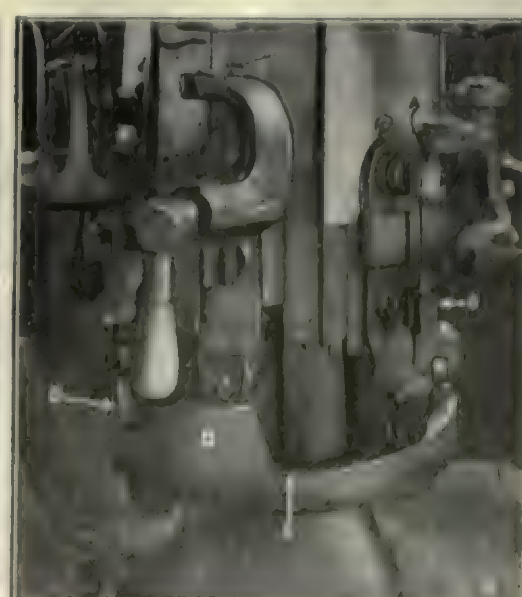
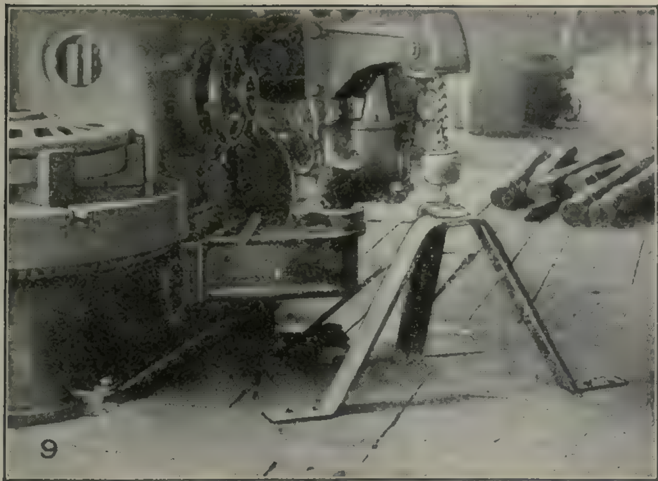
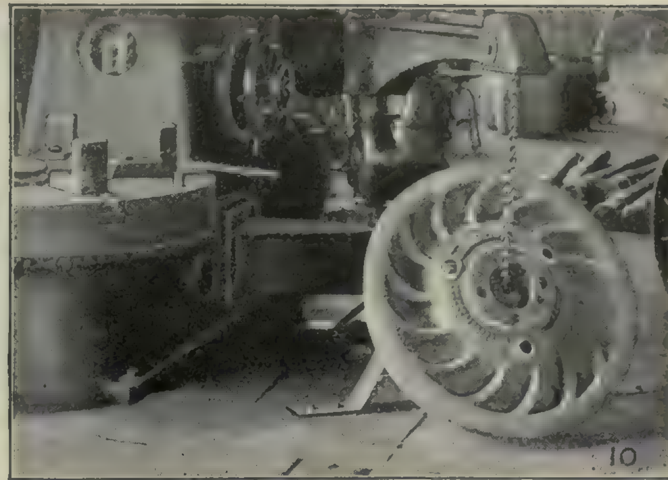


FIG. 6—A HOME-MADE AIR HAMMER. FIG. 7—MACHINE FOR DRILLING STAYBOLTS. FIG. 8—CLAMPING FIXTURES AND CAM OF STAYBOLT DRILLING MACHINE





FIGS. 9 AND 10—HANDLING CAR WHEELS AT THE BORING MILL

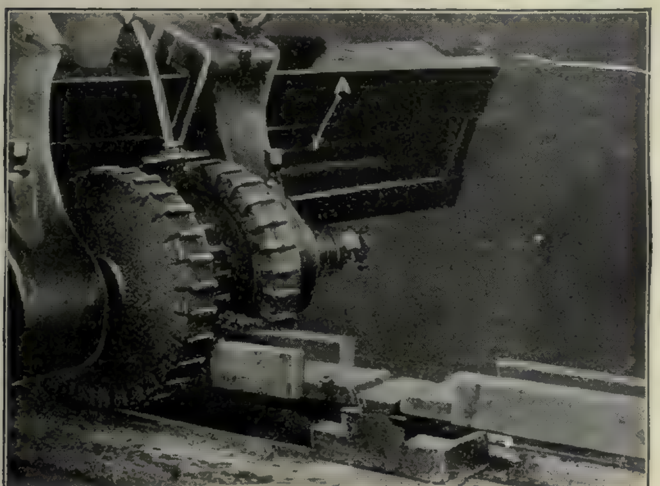


FIG. 11—MILLING SHOES AND WEDGES

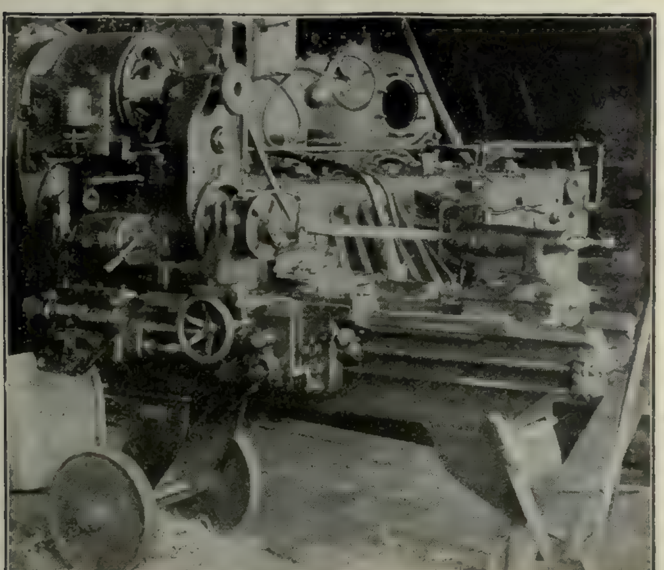


FIG. 12—A PORTABLE LATHE

that when the flange touches the floor, the wheel is an almost vertical position as in Fig. 10, and can be readily rolled away. Wheels to be bored are rolled up to the tripod and rested against it. From that position it is an easy matter to attach the crane chain and hoist them up and deliver them to the boring mill table.

Shoes and wedges are set up in a string on an Ingersoll planer-type milling machine, as shown in Fig. 11, and the three inside and two of the outside surfaces finished by a gang of cutters at one setting. This method leaves the bearing surface only to be finished in another operation.

The result of having to use "McAdoo mechanics" during the war is shown in the badly bent feed screw in the cross rail at *A*. The damage was done by allowing the head to come against an obstruction while being traversed by power.

It is getting to be general practice to have one or more portable lathes in the erecting shop and to place them directly beside the engine being worked on. Fig. 12 shows a motor-driven LeBlond lathe mounted on wheels so that it can be easily transported to any part of the shop. Such lathes are a great convenience since, among other lathe jobs, there are many taper bolts to be turned and fitted to place in overhauling an engine, and to carry them to and from the shop to the engine several times between cuts to try the fit is a tedious process. Also much other work can be more conveniently done if the lathe is close to the work.

Balanced Equipment

By Robert Grimshaw

Just as a chain is no stronger than its weakest link, few plants have any greater capacity or efficiency (please note the difference between "capacity" and "efficiency," because there is a wide gulf fixed between them) than is permitted by the least productive machine or the one with the least output.

In a properly equipped manufacturing plant, each production center should be able to take care of all the work from that preceding it and keep the next one exactly and profitably busy. We find this balanced condition infrequently and particularly seldom in small plants, or rather in those where each process or operation is performed on but one or two machines. In consequence, the idle time account of some machines or production centers is excessive.

In a tour embracing about forty manufacturing plants in this country, I found but one in which there was perfect balance. In this case there were large groups of machines for each operation or process. It is easy to see that, if six machines of one kind cannot take care of the output of five or the kind preceding, another may be added much more efficiently and economically than where one of a sort cannot handle the product of the one back of it.

Standardizing Machine Shop Equipment

Advantages Which Justify the Cost—A Successful Method of Improving Old Tools—Tapers Reduced to One Standard and Two Sizes

By H. L. Wheeler

It is pleasing to note that the subject of standardization is now receiving some favorable consideration which is based upon a desire to establish better conditions in commerce and industry. As an example of the need for standardization. I recall a disastrous fire some years ago in a neighboring town. The fire got beyond the control of the local apparatus and the near-by city department was summoned for assistance. After several pumps had arrived on the scene, ready for business with a full head of steam, it was discovered that the hose connections would "not go." The fire could not be extinguished, and a quarter of a million dollars in property went up in smoke. Since then I have given much thought to the subject of standardization. Figuratively, this fire is an example of what goes on in business and in industry every day in the year through the lack of standardized conditions and methods, and I would not hazard a guess as to the probable amount of money lost in this way.

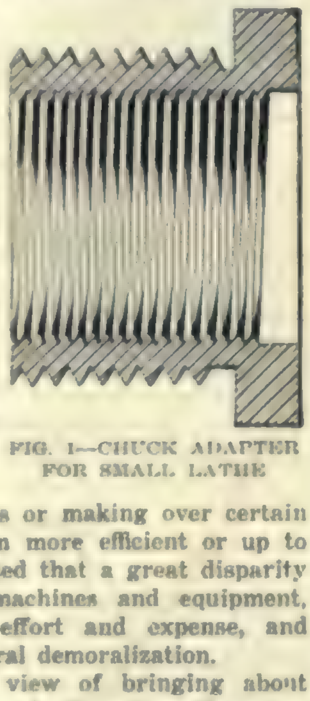


FIG. 1—CHUCK ADAPTER FOR SMALL LATHE

In machine shops long established and still using equipment built in the last forty years, for there are many such, numerous details of machines and equipment may be standardized with profit to the shop. This sometimes involves a change of method in doing certain jobs, rebuilding machines or making over certain details of them to make them more efficient or up to date. It has been fully realized that a great disparity prevails in the details of machines and equipment, which necessitates surplus effort and expense, and occasionally results in a general demoralization.

It is with the object in view of bringing about greatly improved conditions and of making the practices of the industry more economical and universal, that standardized conditions should prevail in the shop. Standardizing equipment is quite distinct from activities along similar lines in other fields, but the fundamental principles are the same. So many advantages are to be derived from standardization, that the cost of making the necessary changes is of secondary consideration. Perhaps a limit should be set on the amount of money to be spent for such work. From the writer's experience, an amount equal to 25 per cent of the original cost of the machine is not too high a figure, providing of course that the results to be obtained are sufficiently promising. Good judgment and plain horse sense, however, should be the guide in this undertaking.

It is sometimes necessary to make radical changes and to eliminate a list of items which have long been looked upon as indispensible. The first step in this work should be to make a careful study and survey of the equipment and conditions, and to collect data.

In the average machine shop are found machines, small tools and sundry equipment of many different makes, none of which agree in important details that have to do with the saving of time and money. Tapered holes in milling machines, lathes and drill-press spindles, bolt slots in milling machines, shapers and planers, width of steps on cone pulleys, square and hex heads for wrenches that are frequently used and threads on lathe spindles, are a few details suggesting others.

Several different tapers in a shop are a constant source of annoyance and needless expense when one standard taper would serve all practical purposes. This standard would eliminate many bent arbors, broken drills and centers, ruined drill chucks and burred and cut spindle holes, would save much time now wasted, and would appreciably reduce the small tool expense. Here in one item alone, standardization would save ten times its cost every year.

It may not be possible to induce the machine builders to adopt a standard taper and other standard details, but the individual shop can have a standard of its own. The work of making the necessary changes can in most cases be done right in the shop. Some ideas and a method of standardizing equipment successfully employed by the writer, may be of use to others.

After a survey of the machines, tools and other equipment was made, a special shop order was issued, to which all labor and material connected with the work were charged. The next step was the selection of a man who was considered capable of carrying out the work to its completion. The whole situation was gone over with the man selected, who was an excellent mechanic, and the object in view was explained to him. He was allowed a free hand and was instructed to use his own head. One machine at a time was standardized and repaired where needed, so that the work did not interfere with the regular production.

As most of the lathes in this shop were of an old model with solid spindles, some hollow spindles were designed by the writer to take their places. As the chucks had seen many years of service, they were not considered worth repairing, and so were replaced by new chucks. The threaded ends of the old spindles were

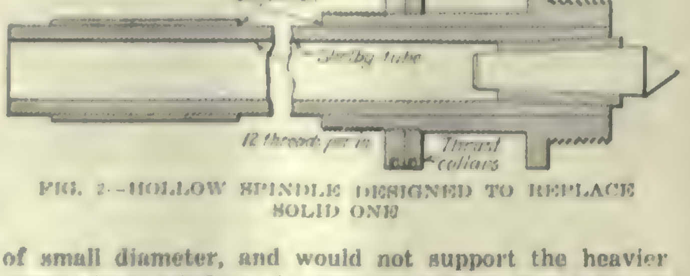


FIG. 2—HOLLOW SPINDLE DESIGNED TO REPLACE SOLID ONE

of small diameter, and would not support the heavier chucks in use today. In designing the new spindles it was possible to use the same thread on the spindle noses for lathes of the same size, and so to make all chucks and faceplates interchangeable. As the chucks were seldom all in use at one time, by this arrangement, three chucks were amply sufficient to serve six 18-in.

lathes, and one chuck served both the 20- and the 24-in. lathes. Two sizes of chucks were purchased for the 18-in. lathes and by using an adapter, shown in Fig. 1, the smaller chuck was made available for a 12-in. lathe.

For one lathe, an 18-in. Putnam, a little more modern than the others, a special spindle was designed, as shown in Fig. 2, and was fitted with a set of new Hendey spring chucks. This feature became a great favorite with the men for getting out small orders of special screws, studs and other round parts made from bar stock. Under the old order, this class of work had to be cut off, centered and turned between centers on account of the solid spindles.

In making the hollow spindles, Shelby steel tubing was used. This material can be purchased in a variety of sizes and will give excellent results. It also eliminates the expensive operation of deep hole drilling, something that every shop is not equipped to do. For the taper hole, the Morse standard was adopted. Two sizes, Nos. 2 and 4 were all that were needed for our work. In some shops, three or more sizes may be required. Two tapered gages and two tapered finishing reamers of corresponding sizes were purchased for this work, which should be carefully done to the correct standard gage. Otherwise, serious trouble will develop in the interchange of tools. Centers were made all of one size, except for one 8-in. lathe which required a special center.

Odd Screw and Wrench Sizes Eliminated

The work of changing the spindles of drill presses and milling machines is practically the same as that described for lathes. There were three drill presses in this shop, and each had a different taper. This condition required the use of different sized adapters, and chuck shanks.

If a man desired to use a drill chuck in a lathe or in some other machine for which the shank was not fitted, he would have to drive out one shank and put in another. Often a new man, not on to the "ropes," would endeavor to use a chuck or the wrong adapter in some machine for which it was not intended. Occasionally, he would get away with the job by packing the adapter with paper or by some other slip-shod method. With this practice, for years such tools were always in a bad state of repair and many were on the sick list a good part of the time. Manifestly, the ideal condition is to have a single standard taper in two or three sizes.

Square and hex heads on setscrews, bolts, nuts, toolpost screws and vise screws that are frequently used in making adjustments, setting up and operating a machine, may be standardized and many odd sizes may be eliminated. In the case of milling machine vise handles, for instance, a common size can be used so that the handles will be interchangeable on vises of different makes.

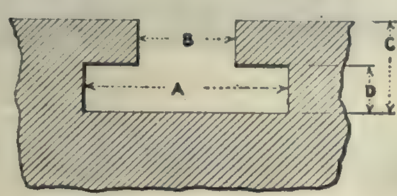
Standardization is also an advantage in toolpost binding screws and in many other places. Frequently a vise handle or toolpost wrench is mislaid and cannot be found at the exact moment it is needed; or perhaps some one has borrowed it and will not bring it back until he is finished with it. But if he can turn right around and use the handle or wrench on the next machine, how much more time he will save than if he wastes 10 or 15 minutes in hunting for a wrench and finally is forced to use a monkey wrench.

A feature about binding screws, of which many mechanics are ignorant, is the chance of straining the screw by using too large a wrench. This is what often occurs to milling-machine vise screws and toolpost binding screws, when a heavy monkey wrench is used in place of the right wrench that cannot be found.

Reducing the Variety of Bolt Slot Sizes

Bolt slots in machines should also be developed to a minimum number of sizes, so as to reduce the variety of sizes required to serve all machines, and to thereby reduce the time lost in looking for bolts in setting up a machine. A standard may be arrived at after comparing the sizes of the slots in the several machines to be changed. In a group of several planers, milling machines or shapers of approximately the same size a single bolt slot size may be possible.

Milling out the slots to the desired size is a simple operation. An example of this procedure is illustrated in Fig. 3, which gives the details of a slot for four different machines. The data for standardizing this group of slots are shown in the accompanying table. It will be apparent from this arrangement, that one sized bolt will serve the four machines, whereas before, four sizes were required and three out of every five bolts were always unserviceable. This method may be followed for any number of machines in one group.



	1	2	3	4	Std.
A	1 1/16	1 1/8	1 1/8	1 1/8	1 1/8
B	13/16	11/16	7/8	11/16	7/8
C	1	1 1/16	1 1/32	1 3/16	1 3/16
D	7/16	9/16	17/32	1/2	......

FIG. 3—DETAILS AND SIZES OF BOLT SLOTS FOR FOUR DIFFERENT MACHINES

Many machine-shop managers are skeptical as to the value of making the changes which have been outlined. The changes are small details in themselves and are seldom considered worth changing, although the average shop is required to support many items of expense which might easily be reduced by one-half through the simple process of standardization. The popular excuses for maintaining these conditions are the lack of time and the expense of making the necessary changes.

No matter how busy your shop may be, if you haven't got the time, take it and standardize every possible detail of machinery, tools and equipment. In the purchase of new equipment, it is well to consider the details that conform to the standard adopted, or the details that can be changed with the least expense.

The field of standardization offers many opportunities for saving both time and money in every machine shop, regardless of the size or the nature of the business. Does it pay? Yes, absolutely, it pays in dollars and cents right from the start and is a permanent improvement. It is a divided-paying business proposition, and deserves just as much attention from machine shop proprietors as standardization receives in other lines.

Perhaps in no other kind of business is there a greater lack of standardized conditions than in the average machine shop. Conditions, traditions and environment stand in the way of many improvements and standardization, particularly in small details.

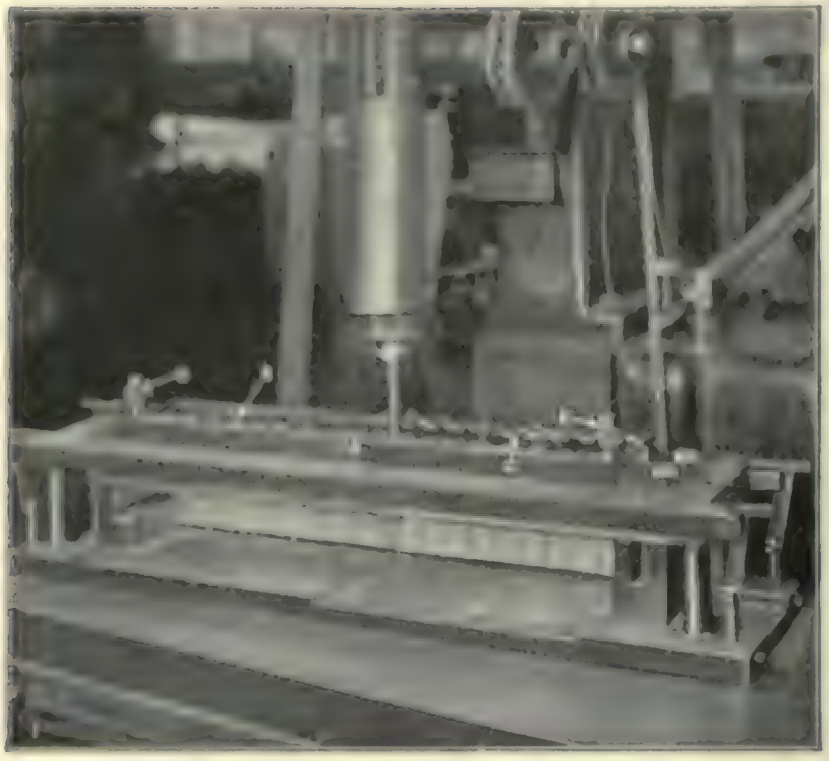


FIG 1—MILLING WINDOWS IN COVER. FIG. 2—DRILLING THE END HOLES

Machining An Aluminum Carriage Cover

Die-Castings Used for Uniformity Rather Than for Elimination of Machine Work—Profiling, Drilling and Milling in Special Fixtures

BY FRED. H. COLVIN
Editor, American Machinist

IN ORDER to secure aluminum castings that are uniform and true to shape, the Monroe Calculating Machine Company, Orange, N. J., is utilizing die-castings as a starting point for its machining work. While on small work die-castings are used to eliminate machine work, this company has not found it advisable to do this in pieces as large as are required in the parts for its calculating machines, such as cases and covers. As castings, however, they work out very nicely, as they fit into jigs and fixtures remarkably well and are uniformly solid.

The piece shown herewith is a cover for the moving carriage and contains many windows through which the numbers show in reading the results of the calculations. There are several sizes, the largest cover being about 21 in. long.

After testing for straightness the cover is placed in the fixture shown in Fig. 1, where the windows are milled under a single-spindle vertical drilling machine. The holes are cast with a very thin web through which the milling cutter forces its way as the spindle is moved down into the milling position. The cover *A* of the fixture carries two serrated plates *B* and *C*, which guide the milling cutter in cutting out the windows as the whole fixture is moved along the drilling machine table. The top plate is held by four latches at the ends and is easily removable to change pieces.

The end holes are first milled and the hardened plugs *D* and *E* put into place to insure against possible movement of the piece in the fixture. Then the fixture is simply moved from window to window, being guided by the plates *B* and *C*. The plate *B* extends the whole length of the cover, while *C* is but half as long. Each hole is tested by an oval plug gage to insure uniformity.

The cover then goes to a multiple-spindle drilling machine as in Fig. 2, for drilling the end holes which support the shafts carrying the numbered wheels. This

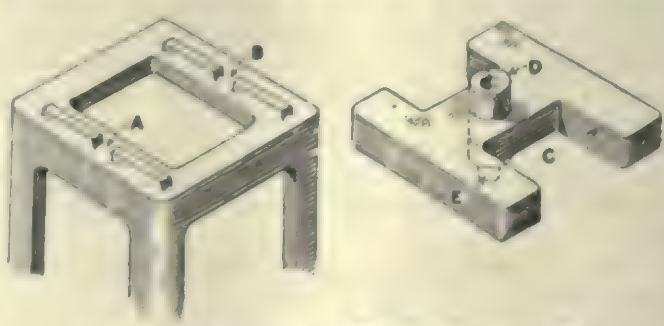


FIG. 3—GAGE FOR DEPTH OF COUNTERBORE

figure gives a good idea of the fixture and the way in which the cover is held. The curved blocks *A* and *B* fit up inside the cover and support it, while the edge rests on the pins *C* and *D*. The straps are held by the swinging bolts at the right, and each strap carries a clamping screw which bears on the high part of the cover holding it tightly against the curved blocks.

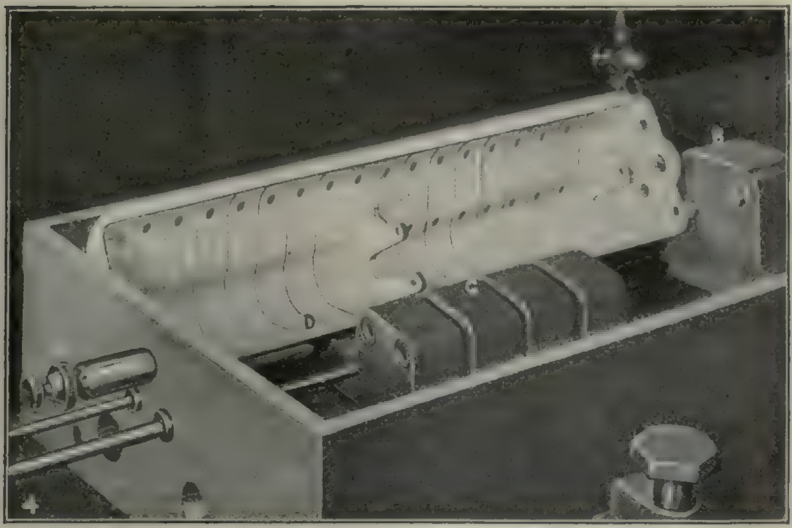
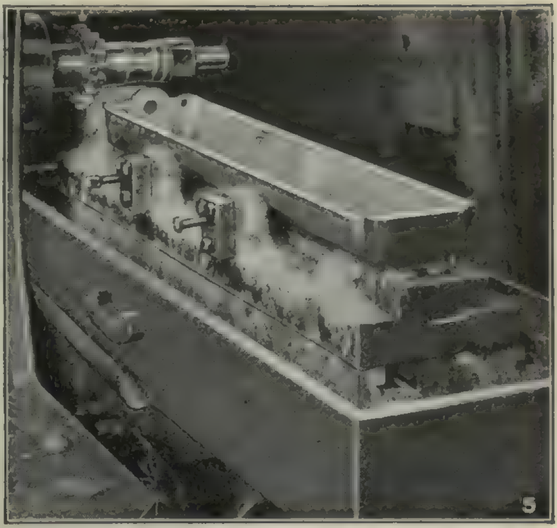



FIG. 4—DRILLING THE CENTRAL HOLE. FIG. 5—MILLING EDGE AND FACE OF COVER

Both ends of the fixture have raised feet which are surfaced both for drilling and for gaging the depth of the counterbore. This is shown in detail in Fig. 3, the raised feet being indicated at *A* and *B*. The gage shown at *C* rests on the feet and can be moved from hole to hole to see that they are all counterbored to the same depth. The flush pin gage at *D* tests the depth of counterbore, the lower portion of the plug at *E* being the gaging point that is brought to bear on the bottom of the hole.

The drilling of the holes in the central or supporting partition presented something of a problem, but it was solved by using a gun drilling lathe secured at a government sale. The fixture, shown in Fig. 4 accommodates three sizes of covers, the one shown being the shortest. The cover is positioned in the box-like fixture by pins which fit the end holes previously drilled. The pins are shown at *A* and *B*. Those at *B* are located in a block which can be moved inside the fixture itself, to accommodate the different lengths of covers.

The central block is fixed in position, but has three slots so positioned as to fit the different sizes of covers. This block is fitted with bushings which guide the drills *D* and insure accuracy in the alignment of the three holes which carry the wheel shafts. This operation requires considerable care on the part of the workman to be sure that no chips prevent the proper seating of the cover in the fixture, and to properly seat the guiding pins at each end of the cover. The results are very satisfactory, however, and the assembly goes along very smoothly when it is being done by a man who understands the work.

The final machining operation on the cover is milling the edge to insure proper seating when assembled on the machine. Here again the cover is located by the end holes, as shown in Fig. 5. It is carefully supported, both at the ends and at two other points, to avoid any springing of the casting under the milling cut, even though this is very light. The two cutters shown face both the edge and the side at one operation.

Filing Technical Articles

By Jasper H. Carlstrom

Many of the articles in the *American Machinist* are very useful to refer to in my work, especially those on tool engineering. As it would be inconvenient for me to carry the entire copies of the magazine to my work, I find it necessary to cut out those articles not likely to be of benefit to me. I usually allow the copies to accumulate a couple of months, and, having read them through, proceed by means of a sharp safety razor blade to remove those pages I want to keep.

The pages having been piled in their numerical order, the headings of the articles are then copied down with their corresponding page numbers on a piece of paper. The articles are now placed in manila paper envelopes, ten by twelve inches in size, preferably those whose flaps are fastened by a cord. It may be necessary to trim off the bottoms of the pages. The volume and page numbers are then marked on the envelope, as, for example, Vol. 56, pages 413-844.

I now proceed to make up the index as articles are classified into five divisions: Tool Engineering, Auto Tools and Methods, General Machine Work, Dies, Die Work and Small Tools, Theoretical and Miscellaneous Articles. The index is made up on sheets of typewriter paper about $5\frac{1}{2}$ x $8\frac{1}{2}$ in. in size by typewriting at the top the classification of the articles, followed by the headings of the articles with their corresponding page numbers. These are copied from the list already made up and checked from it as copied.

—INDEX—

Auto Tools and Methods

By this means any article may be quickly found by referring to the classified index for the volume and page numbers which, as already stated, are marked on the envelope in which the article is filed. The index sheets are placed in a smaller envelope and this is kept in the latest large envelope to be filled. The material is always readily available and can be easily located by referring to the index and then finding the proper envelope.

Mass Production in British Motor Industries

British Manufacturers Beginning to See Difference Between Mass and Standardized Production—Plans to Utilize Facilities of Big Austin Plant

By Henry Obermeyer and Arthur L. Greene

"Mass production on the American model was the dream of several English automobile manufacturers not very long ago. Each felt that if he could get on the job first he could collar the market. That was a dream from which we woke up with a bang."

Thus the sales manager of the Austin Motor Company, Ltd., whose factory sprawls over the acreage of a fair-sized town just outside of Birmingham, England, and which company was one of the big concerns to feel the rocks as the result of over zealous productivity immediately after the war, is about to place on the market a new light pleasure car in competition with the popular priced automobiles of American manufacture. The details of the car and plans for its manufacture have only just been announced.

THE POPULAR-PRICED RUNABOUT RECENTLY ANNOUNCED BY AUSTIN

The war embarrassed many countries with certain kinds of "riches" whose peacetime utility was comparable to a white elephant. Many of these have not been properly liquidated or even disposed of yet. This condition, of course, was especially true of machine factories most of which found themselves, after almost superhuman activity, possessed of a suddenly idle army of workers and a hugely distended plant.

In England the inflated plants were a standing temptation. English manufacturers had long envied their American compeers the ability to do big things in a big way, to turn out by hundreds what they themselves sweated to produce by tens. They had the idea that American success in that direction lay in big organizations, in factories which were cities in themselves. Here at the British hand was just such an organization, born of necessity and obviously fitted for just one thing—quantity.

So, for a time, did the English dream come true. For two years following the war the chimneys belched their smoke and the hum of a tremendous activity throbbed through all the shops. A stream of cars sped from the factory to the outflung posts which were the agents. For a few months the agents had all they could do. It really did seem as if English motor manufacturing had gone through its revolution. Then, even more suddenly than it began, the boom ended. There was talk of bankruptcy. One or two actually did go under. The rest gasped and struck for shore.

Austin Motors believe they know the reason for the fiasco. "In the first place," they say, "we overestimated the market. In the second place, in our haste we sent out faulty products. In the third place, the idea was silly and should never have been seriously considered at all. The domestic market for cars at that time was fair, but only fair. The Colonial market, the great prop and staff of all English industries, was almost non-existent. Given something like a normal demand in the colonies, particularly Australia and New Zealand, the dream might not have been beyond the range of possibility. But here again the project caused so many complaints among car users who felt they had been cheated with an inferior product that the very shadow of a worldwide market was blotted out from the beginning. As a result of the situation mass production in England has received a shock from which it is never likely to recover. British manufacturers have learned what is to them the amazing truth that quantity and size are not, after all, the essential features of American industry. Say "mass production" to an Englishman today and he will pretend not to know what you're talking about. At best he will correct you to the use of "standardized production," thus proving that he has grasped the fundamentals of the problem.

"After all, you know, mass production is the result, isn't it?" they said in Birmingham. "It's the means that are important, and in this case they consist of the principle of duplication, the single-purpose machine, the die stamp. Duplication means not merely accuracy, but speed, interchangeability, and, most of all, economy."

This fairly obvious aphorism was expressed with all the wonder of a discovery. It is important, however, as indicating the lines on which certain British manufacturers of motor cars propose to work. The Austin Motor Company, Ltd., consider that they are now operating on a system of standardized production and Austin automobiles and engines are turned out by single-purpose machines. The parts are assembled by being swung into place, where they fit without a trial.

While the Austin Motor Company, Ltd., has spanned the gulf between individual production and standardized production, it has not thus far been wholly successful in educating the market to the advantages of the new method. It has been found necessary to maintain an entire shop solely for the construction of models of

special design, which are, it is true, in decreasing demand, but are still a very potent factor in automobile manufacturing abroad.

Henry Ford has estimated that in America only five per cent of the automobile buying public normally exhibit any preference for special variations to suit special tastes in the construction of their cars. The English public is still far from achieving such an ideal of uniformity. Many an Englishman regards his automobile in much the same way as his home. He wants it to express something of his personality. In addition there is the deeply ingrained prejudice against any system which seems to rob the workman of the traditional pride and interest in his product. England is a land of apprentices. A handmade watch or a handmade bit of lace may be inferior to the machinemade article, but it is more likely to command the Englishman's respect.

Thus, educating the market to a more pronounced faith in standardized production is the goal which Austin Motors, among others, has set for itself. In the fulfillment of this aim the Austin company is among the leaders. From motives of pure self defense it must be a leader if for no other reason than its tremendous facilities which, otherwise, would be like so many cancers eating up the profits of the business without making a return.

Mushroom Growth of the Austin Plant

For factories like the Austin plant the war was a modern Atlas which shifted the weight of armaments to the shoulders of the industrial Hercules without making provision for relief. The Austin Motor Company, Ltd., now occupies about fifty-three acres in the Longbridge section of Birmingham and is divided into three parts, known respectively as the South, West and North works. In 1914 only six of these acres, situated in a small corner of the South works, were used for manufacturing, in short, nearly a ninefold increase in only four years. The increase in personnel was proportionate.

During the early stages of the war, the Austin company was asked only to concentrate on transport and tank equipment, which required comparatively little alteration either of product or method. Armored cars, lorries, aeroplanes, aero engines and tractors were supplied in ever increasing quantities. But the original factory became inadequate for the growing demands of the Government. A call for guns and shells on a large scale developed. Not only were the old South works extended, but engineers hastily constructed a new factory on the west side for the specific production of 18-lb. shells, and still another plant to the north for the manufacture of 8-inch shells and 4.5 howitzer guns. This last, incidentally, is said to be one of the largest individual shops ever built. It is 900 feet long and was ready for work within six months after the first stone was laid.

Market Lags Behind Plant Capacity

Such is the gigantic machine which Sir Herbert Austin, founder and managing director of the company, has to his hand today. Imagine the producer of anything you choose starting off modestly on a small scale to supply a profitable but strictly limited market with his commodity. Imagine his astonishment and eventual dismay at finding that his plant has grown mushroomlike over night (kept pace with by overhead expenses) without either his volition or desire. Consider his panic at discovering that his market had not only failed to grow in proportion to his plant, but had actually contracted. Consider especially, as we do here, his attempts to deal with the situation.

It has been shown how Sir Herbert and some of his competitors began by what seemed at least the most obvious method, that of engaging in large scale production in apparent imitation of American firms. That stage has now passed, perhaps forever, into a fitful memory. But the factories are still there. There are, therefore, two roads open to the British manufacturer of automobiles. He can attempt by enterprising salesmanship to increase the market where it exists, or he can seek a new one. Here again, he can look abroad, although it is not unlikely that American competition will drive him out. He can even create a new market at home. In the latter case he is just as much an innovator as Henry Ford, who foresaw a popular demand for his car, not merely for pleasure but for business purposes and proceeded to supply the demand when other manufacturers were still concentrating on racing cars.

A New Light Car

We doubt if Sir Herbert Austin has any ambition to become the Henry Ford of the British Isles. Nevertheless, for the past two years he has been at work in his experimental shop on a new type of roadster which will, it is expected, combine the speed and durable qualities of more expensive cars with the cheapness and economy of operation of the motorcycle. Admittedly, this is a large order to fill. At any rate, the first three cars of the new type have left the factory and successfully passed all required tests. The great body of Austin agents, who were called in meeting for an announcement of the new car a few weeks ago, are said to be most enthusiastic and have shown their faith in the model by ordering up to capacity. The machines themselves will be in their hands in small quantities by fall and more widely, it is hoped, by the first of the new year.

Such a car, if at all successful, should have the advantage of a unique market in England which exists in America only as a reflection. For years, England with its splendid roads, its charming scenery, has been in a special sense a cycling nation. In America the bicycle was a fad which had its day and passed. In England the cycle is a necessity. Lately it has been superseded, in the case of those who can afford it, by the motorcycle. There may not actually be more motorcycles, especially sidecar combinations, on the roads than there are automobiles, but to the casual eye it would seem so.

Tremendous Market Assured

Here without doubt is a tremendous market for the man who can reach it. Ford has not done so. With transportation and duty charges, his car is still beyond the financial capacity of the motorcyclist. Such attempts as have been made to wean the motorcyclist from handlebars to the steering wheel have been largely makeshift, consisting of three-wheeled affairs with motorcycle engines or tiny roadsters at a cost only less than that of more serviceable machines. Sir Herbert in most particulars has tried to design "a car what is a car." His sales manager expresses it most succinctly. "We want to convince the purchaser that he really owns an automobile while charging him the price he would spend for the original cost and upkeep on a motorcycle."

In addition to the cyclist group, the Austin Motor Company, Ltd., also hopes to attract those two other vitally important classes, the woman driver and the commercial traveler. For reasons which will be apparent further on, no attempt is to be made now at the manufacture of light trucks from this type of car.

The appearance of the Austin "Seven," as it is called to distinguish it from the "Twelve" and "Twenty," is apparent from the picture. It has a four-cylinder water-cooled engine with a bore and stroke of 2¼ and 3 inches respectively, capable of 7.2 hp. as rated by the R. A. C. Ignition is by high tension magneto controlled from the steering wheel. The seating capacity is for two persons and luggage or for five persons including three small children. A road clearance of nine inches is allowed.

Dimensions of Car

The dimensions of the car, over all, are 8 ft. 8 in. by 3 ft. 10 in., weighing 650 lbs. As a matter of actual road performance, the "Seven" has attained a speed of fifty-two miles per hour. Under perfect conditions it has achieved a consumption record of 78½ miles to the gallon, although fifty-five miles are said to result in normal operation. Complete running cost is estimated at 1½d. per mile.

The new car, ready to ride, is to be put on the market at £225, or approximately £50 more than the best type of motorcycle combination. This is said to be only preliminary, however, a price settled on by the agents themselves, who agreed to take as many cars as the factory can turn out for many months. In time it is the expressed intention of the company to bring the price of the Austin "Seven" in more direct competition with that of the cycle combination, the manufacturers of which are themselves believed to be about to make substantial reductions.

Further operations of the Austin Motor Company, Ltd., will depend largely on the reception given to the new car. As requirements express themselves certain changes will undoubtedly be found necessary in the design. The wire wheels, for example, are approximately of motorcycle dimensions and, despite more than satisfactory tests, give the appearance of flimsiness. At any rate, they may be found to detract from the "carlike" appearance of the automobile and time may see the substitution of more substantial looking rims and hubs.

Yearly Models Frowned Upon

The company is strongly opposed, however, to the principle of periodic changes in design, which have been customary abroad as well as in America to attract the crowds at the yearly Motor Exhibition. This custom, which is based rather on faddism than utility, is obviously disastrous to a perfect system of standardization, and will be ignored, so far as possible, in the construction of the Austin "Seven."

As indicated above, the Austin "Seven" is peculiarly a pleasure car. This ignores a principle, which is fairly well established in America, that the automobile, whatever it was in the past, is now at least and in the future is to be both a business necessity and a personal luxury. To the great disappointment of British manufacturers and the astonishment of American exporters, the English commercial classes, slower, perhaps, than Americans to adopt new ideas, have failed to appreciate the possibilities of the automobile in business. In England the motor is still a toy to a very large extent, and as such is quick to feel a temporary trade depression.

The Austin Motor Company, Ltd., has been given as an example of certain conditions in the British motor world because it has shown itself quickest in adaptation to the unfortunate circumstances brought about by the war, circumstances which may, however, in the end prove the reverse of unfortunate. Other automobile factories have the same problem to deal with and may be expected to apply similar methods of treatment. It is not too much to prophesy that Great Britain will be ready to make a serious fight when the markets of the world reopen.

Temperature Recommendations for Thermit Welding

In order to compensate for the lower melting point of cast iron as compared with steel, the Metal and Thermit Corporation, New York, recommends that in preheating cast-iron sections, preparatory to thermit welding them, these sections be heated little more than necessary to show color, such as a dull red heat. If this advice is followed, we are told, a quieter pour will be obtained and the fusion will be just as perfect. This practice has now been tried successfully in numerous cases, the most important being a thermit weld on a large cast-iron press head which required 1,100 lb. of thermit. The weld was absolutely perfect, with good fusion to the extreme of the edge of the collar, although the cast-iron section was heated only to a dull red heat.

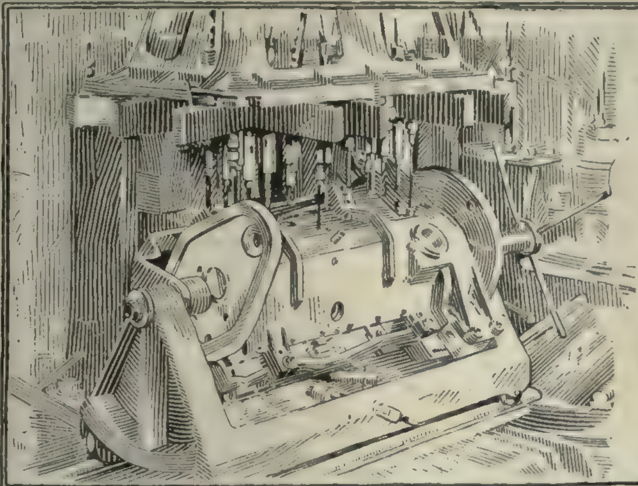
It is believed that this point is very important and that operators will find that it will overcome possible difficulties which they may be experiencing in cast-iron welding. One might suppose that, as the cast iron of the parts being welded is not quite so fully expanded at this lower temperature, there might be a slightly greater tendency for hairline cracks to appear in the thermit steel collar perpendicular to the line of break. In actual practice, however, this has not been found to be the case, probably because of the fact that the expansion curve is much greater up to a red heat than it is from the red heat to the white heat and that the sections are, therefore, practically fully expanded at this dull red heat. It is certainly also true that the thermit steel at first heats and expands the sections with which it comes in contact and that the slight difference in preheating is negligible.

Bonus for Long Service

By A. L. De Vinne

Until an employee commences to get worthless he is a more valuable hand after years of service than when he came, even than after he got into his stride. He knows where things are, he can do some one thing automatically better than any new hand and he can do other things reasonably well from long association with the work and occasional assisting and substitution. He has proved himself likely to stick, and not apt to have a yearning for "fresh fields and pastures new."

This being so, it is well to pay an annual bonus—without any promise, expressed or implied, after the expiration of a given period; the percentage of the wages and the length of the period depending upon the scarcity of the kind of labor in question and the length of time required to learn that particular work.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Details of Design of Blanking Dies Continued—Laying Out Work and Punch Positions Single- and Double-Run Layouts—Double Blanking Dies

IN THE previous article we have discussed a number of general matters pertaining to the design of blanking dies. In these general statements we have endeavored to illustrate points of importance which apply not only to the blanking of the metal or cutting it into shape, but also to the progress of the work through the die and other matters which affect the design generally.

We shall now go into the matter in much greater detail and illustrate a number of points in the design of blanking dies in a graphic manner, bringing out principles which apply to the subject and treating the entire matter from its fundamentals so that the designer will thoroughly understand the principles on which the science of die design is based. It is not our intention to show a great variety of dies for different purposes and for different forms which are to be cut out of metal. Such matters could be presented in very extensive form if it appeared desirable; but there are so many applications of punches and dies to different kinds of work that it seems better to deal almost entirely with principles of design, making each point

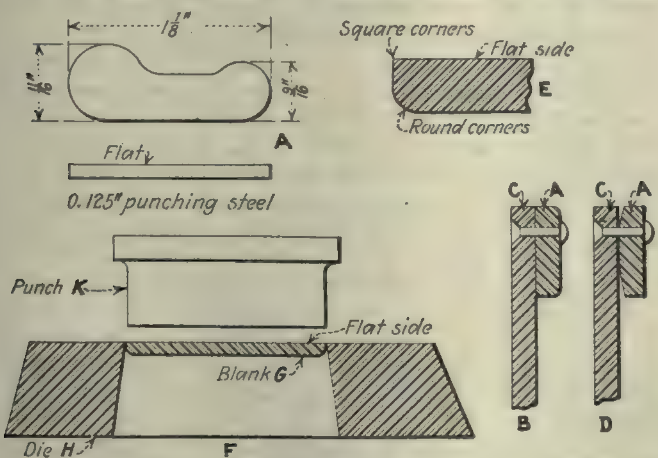


FIG. 450—IMPORTANCE OF ROUND AND FLAT SIDES OF BLANKED WORK

as clear as possible, and then illustrate the application of these principles by means of a comparatively small number of actual examples of dies themselves.

The first point to be considered when it becomes necessary to make up dies for a given piece of work, is the shape of the work which is to be blanked. When considering this matter it must be remembered that all stampings from blanking dies have a round and flat side. The flat side is that next to the punch, while the side which first passes through the die is slightly

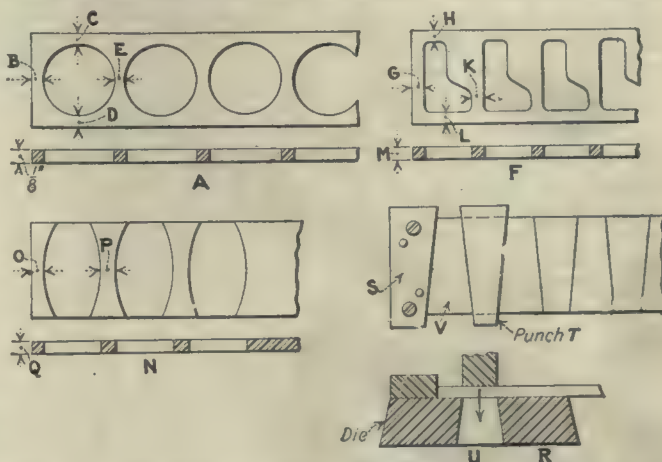


FIG. 451—POSITION OF PUNCH IN BLANKING OPERATIONS

rounded on the corners. When parts are to be assembled with other pieces after blanking, it is necessary that the flat sides should be adjacent to each other. If the work is not symmetrical, the flat side should be specified on the part drawings. Therefore, in designing dies for a given piece of work and in making the most economical layout possible, this point should be considered first. Fig. 450 shows several of these points very clearly.

The part shown at *A* is not symmetrical and it must be laid out so that it will be forced through the die in such a manner that the side which is adjacent to the piece of which it is to form a part will be flat and not round. Referring to the sectional view at *B*, the part *A* is shown assembled with *C* by means of rivets, and it can be noted that the two parts lie closely together. On the other hand, if the curved side of the work *A* were to be assembled as shown at *D*, the piece would not lie close to its fellow and an imperfect unit would be the result.

A sectional view with the conditions greatly exaggerated is shown at *E*, in order to illustrate the differ-

ence between the round and flat sides of a blank. The reason for this difference is clearly indicated in the sectional view at *F*, in which the work *G* is forced through the die *H* by means of the punch *K*. The rounding of the corner is not noticeable on stock under 1/16 in. thick and does not need to be considered; but when any work above this amount is blanked, particular attention must be paid to the matter.

In laying out the position of the punch in blanking dies, the part to be punched must be so located that the greatest possible number of blanks will be produced for each length of strip stock. In punching out a round piece such as that shown at *A* in Fig. 451 there is really only one way in which this layout can be made. One point of great importance in connection with the laying out of dies is the distance between the blanks. The space between the blanks and the amount of stock around the blank on the edges should usually be equal to the thickness of the stock being punched. For example, if the work at *A* were ⅛ in. thick, the various dimensions at *B*, *C*, *D* and *E* should also be not less than this amount.

In the example at *F* the blank is somewhat more irregular, but the same rule applies here and the various distances at *G*, *H*, *K* and *L* should be uniform and of the same size as dimension *M*. There are occasional cases when it is not necessary to allow a distance equal to the thickness of the stock on the edge of the blank, due to the shape of the work. An example of this kind is shown at *N*. Here the blank is of such shape that the ends do not require trimming so that the only scrap produced is the small piece between each blank; the distances *O* and *P* are equal to the thickness *Q*, but no allowance is made on the edges. If considerable accuracy is required on the width of the blank it may be necessary to select an accurate width of stock, or

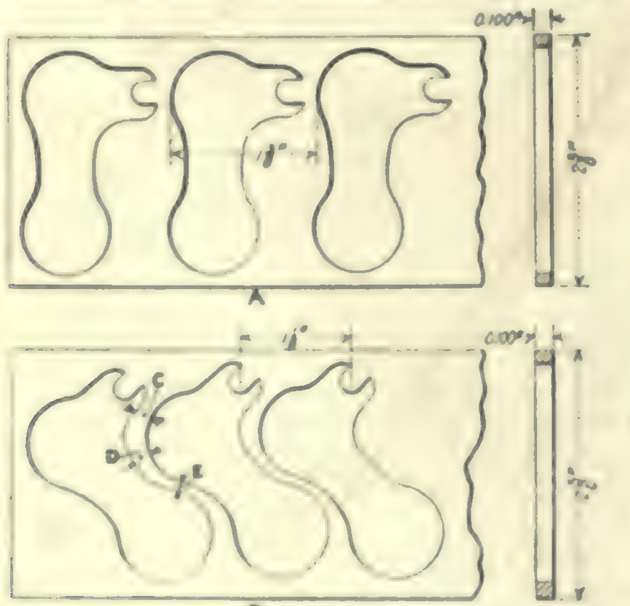


FIG. 452—SINGLE-RUN LAYOUTS, SHOWING TWO METHODS

to run the stock through a "shaver" set to produce the required width.

Another example is shown at R in which the blank is produced without leaving any scrap, and no allowance is made between blanks or on the edges. The work is forced up by the operator against a stop *S*, and the punch *T* is so positioned that on each stroke of the press two parts are produced. One of the blanks passes down through the die, as indicated at *U*, while the other remains on top in the position shown at *V*. Layouts of this kind are unusual, but there are certain times when they may be found an advantage. Naturally the final accuracy of the work has some effect on the selection.

Two methods of laying out a work blank for a single run are shown in Fig. 452. The stock from which the blank is to be made is 0.1 in. thick. In order to illustrate the advantages of a correct layout, a com-

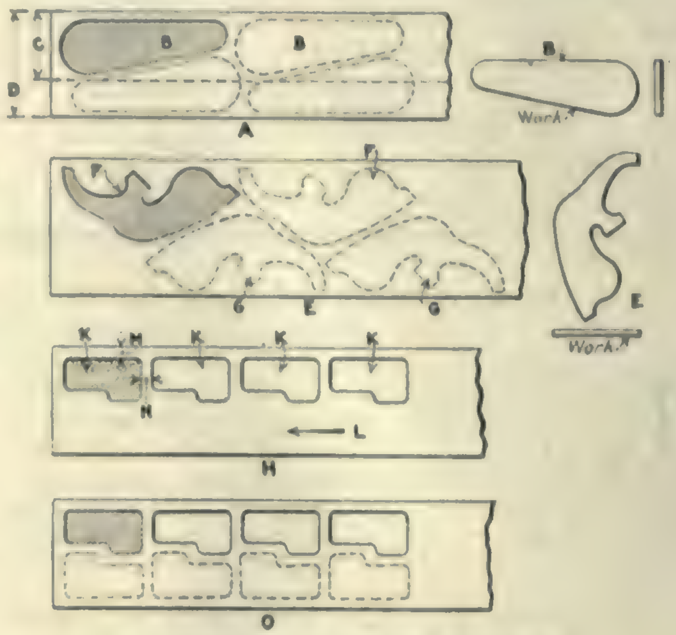


FIG. 453—DOUBLE-RUN DIE LAYOUTS

parison may be made between the two methods indicated. In the example *A* the blank is laid out straight and a distance equal to the thickness of the metal is allowed between blanks. A corresponding amount is also allowed on the edges. The width of the stock required in this method of laying out is 2⅜ in., the amount of stock required for each blank is 1⅜ in., and it will be noted that there is a considerable amount of scrap in this layout.

In the example shown at *B* the work has been turned around at a slight angle, so that the width of the scrapped stock is uniform at points *C*, *D* and *E*, and an equal allowance is made from the blank to the edges of the stock. In this layout the distance between blanks is 1⅛ in., which is considerably less than that required by the other method. Stock for work of this kind usually comes in lengths of 72 in. The following method can be used to find the number of blanks per strip that can be punched from one sheet of metal, as follows:

$$\frac{\text{Total length of sheet-metal strip}}{\text{Length of blank} + \text{Distance between blanks}} = \text{Total number of blanks per strip.}$$

In the example *A* we find that 52 blanks can be obtained from a 72-in. strip, whereas in the case *B* 64 blanks are obtained from the same strip of metal. There is a gain of 12 blanks per strip by using the method *B*.

In irregular work the designer usually makes pasteboard or paper forms the exact size of the blank, and by adjusting them in various positions and tracing around them it is easy to find the most economical angle at which the punch can be set. This method is commonly used when laying out a die.

A double-run is the term used for a layout in which stock is run through the die twice. Several examples

of double-run die layouts are shown in Fig. 453. In order to illustrate the difference between a single and double run, let us refer to the example *A* in which the blank to be produced is shown by the dotted lines at *B*. If this work were to be made in a single-run die the width of stock might be as shown at *C*, while if a double run were to be made the total width of stock required would only be equal to dimension *D*. In using a die laid out in this manner the stock is blanked on

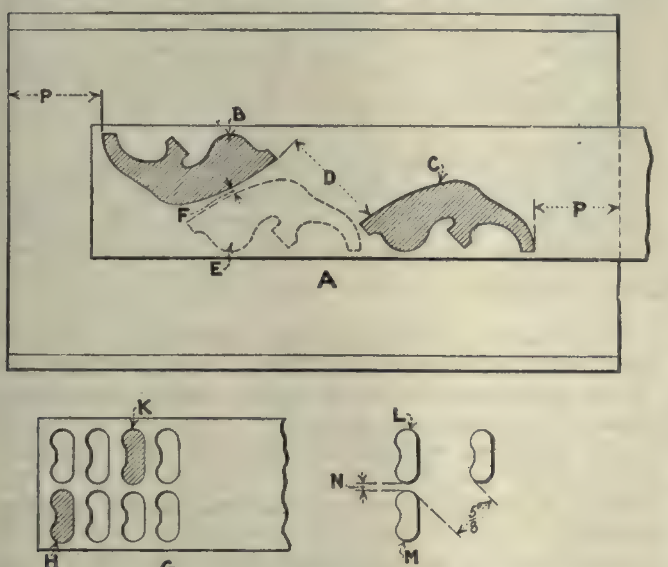


FIG. 454—DOUBLE BLANKING DIE LAYOUTS

the first run in the usual way, and then the strip is reversed and run through the die the second time.

The shape of the part determines whether or not a double run should be used. It must always be remembered that there is considerable time wasted in reversing a strip of stock and getting it ready to run it through the second time, so that a double-run die is not always as advantageous as it may appear at first thought. The amount of stock saved in the double-run layout shown at *A* is in that saved in the width of the stock. The blank can, of course, be arranged in a different way and a layout made so that the parts would be produced across the strip instead of lengthwise. This arrangement would take somewhat longer stock and there would be no gain in the final results obtained.

In the example shown at *E* the work is considerably more irregular in shape, but the same principle is applied and a double run made in order to produce the work more economically. The work is fed through the die twice, as in the first case, the blanks being produced at *F;* and then the stock is reversed and the other blanks produced as shown by dotted lines at *G*.

Another example, shown at *H*, illustrates a double-run layout for the blank *K*. The stock is fed in the direction indicated by the arrow at *L* and the blanks are formed successively, stock allowance being made at *M* and *N* according to the thickness of the metal. After the stock has been run through along one edge, the strip is turned and the opposite side blanked, as shown at *O*. In determining whether it is better to make a single- or double-run die the shape of the piece is a governing factor. If less waste is produced by a double run and a considerable saving effected, it is evident that this method is to be preferred.

Double blanking dies are often confused with double-run dies, although there is a distinct difference between them. A double blanking die stamps two pieces at one time, although the layout of the blanks may be the same as that used for a double-run die. A good example of this sort of a layout is shown in Fig. 454 in which the strip *A* is for the same part which was illustrated in Fig. 453. The width of the stock and the number of blanks per strip are exactly the same; but it is unnecessary in a double blanking die to turn the stock around, as the punches and dies are so arranged that the two blanks shown solid at *B* and *C* are cut at the same time at one stroke.

One of the most important points in the design of double blanking die is to make sure that a proper distance between punches is obtained. In the example shown the distance *D* is sufficient for a layout of this kind. If punches were located so as to produce the blanks shown at *B* and *E* at the same time, the distance between holes in the dies would be only the amount shown at *F*, which construction would probably cause distortion in hardening and short life to the die, even if no breakage occurred in hardening.

The size of the die itself should be great enough to permit a generous amount of stock all around the openings, as indicated at *P*. Another example, shown at *G*, brings out this point clearly. In a double-run die for this piece of work the punches should be located so as to produce blanks as at *H* and *K*, in order to allow a sufficient amount of stock to give a long-lived die. If punches were to be located as shown at *L* and *M*, the distance *N* would be too small and trouble would be likely to occur. By locating as shown the distance between holes is much greater and the dies will have a great deal longer life.

A general rule which applies to double blanking dies for stamping work up to $\frac{3}{16}$-in. thick is that the distance between the punches should never be less than $\frac{5}{8}$ in., and for heavier work this amount should be increased. These points are of great importance when laying out

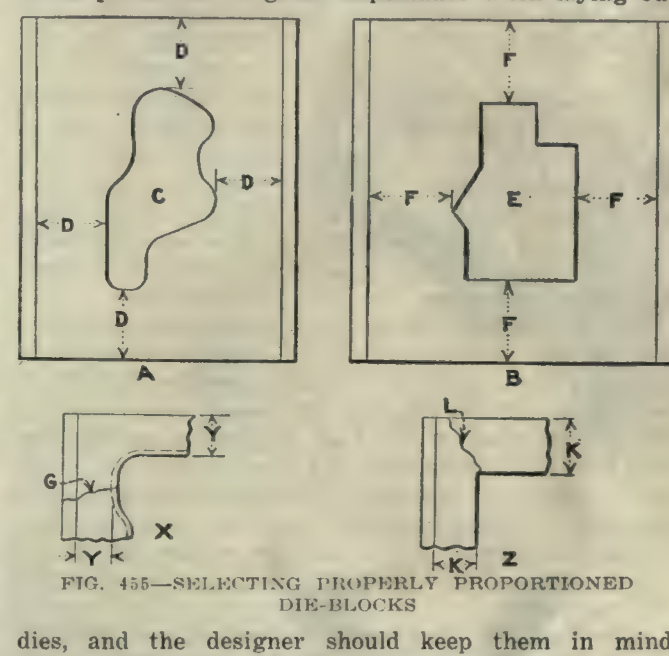


FIG. 455—SELECTING PROPERLY PROPORTIONED DIE-BLOCKS

dies, and the designer should keep them in mind.

In addition to double blanking dies, there are occasional cases when multiple blanking dies may be used. The principles on which these dies are designed are exactly the same as those employed in the design of double blanking dies, the only difference being that multiple dies make more parts at one time. It is sometimes found profitable to use something of this kind where high production is desired when blanking.

Mention of the standardization of die-blocks has been made in a previous article; but it is well to speak of the importance of selecting a die-block of generous size, so that it will have long life, and will not be subject to distortion or cracks in hardening on account of an insufficient amount of material being allowed. Fig. 455 graphically illustrates a number of these points.

In the example shown at *A* the die is made to blank the form *C*, which has round corners throughout. The distance between the die opening and the edges of the die as shown by dimensions *D* should be not less than 1¼ in. for stock up to 3/16-in. thick. By making provision of this kind in selecting a standard die-block no trouble will be experienced from distortion in hardening or from breakage caused by thin walls. As the stock increases in thickness the distances around the opening should be increased.

In the example *B* the shape of the blank *E* is to be made, and as this blank has sharp corners the dimensions *F* should be, if anything, somewhat greater than those shown at *A*. The danger of cracks in hardening is greater when sharp corners are required. In the example shown at *X* the distances *Y* are too small, and weakness may develop so that a crack may be formed in hardening, as shown at *G*. A somewhat similar condition is illustrated at *Z*, where the distances *K* are also too small so that a crack develops in the corner as shown at *L*, thus ruining the die. The defect is doubtless accentuated by the sharp corner; yet if sufficient metal were allowed here, there would probably be no difficulty if the hardening were to be done carefully.

A list of standard die-blocks has been given in a previous article, and the dimensions given in this list will be found very useful in connection with the data given here in selecting a die-block for any size of blank.

Moving Pictures in the Machine Tool Industry

By D. S. Hazen

The use of moving pictures as both educational and advertising factors has great possibilities in the machine-tool industry. The first factor, classified as service instruction, includes those films which are specifically built to aid the users and operators of machine tools.

The second factor, classified as educational propaganda or advertising, consists of those films which are built for the specific purpose of interesting potential buyers. In this illustrative way, the features of the processes or products are so presented that the buyer may recognize their good qualities.

The main difficulty up to the present time has been the distribution of the pictures. This has been due to the fact that the purchasers of the films did not first determine to which of the two classifications the film belonged, and did not lay their plans far enough in advance of the making of the film. Advertising managers or company owners would not contemplate any other campaign without a careful study of the whole proposition, and yet they have rushed whole-heartedly into the making of moving pictures without first learning where or to whom the films could be shown.

The wide differences between the two types of films and between the results to be obtained from them, point out how necessary it is to determine, first of all, the purpose of the film. In the second place, examine the field in which it has been decided to use the film, and find out the chances for the distribution which must be obtained in order to accomplish the purpose of the film. In the third place, carefully pick out those specific features of the product or process which will appeal to the prospects in the field in which the film will be used.

After these features have been worked out, the making of the film becomes comparatively simple. Some general rules for film-editing are as follows:

(1) Make the film as short as possible without omitting any of the necessary processes which should be shown.

(2) Arrange the various processes in a logical order so that the reader of the film may easily follow the idea to be conveyed. In other words, get good continuity.

(3) Reduce "still" scenes to a minimum. (You can send plain photographs for these scenes.) Blend the "live" scenes together so that there will be no apparent break. In other words, get action.

(4) Consider every part of the film from the viewpoint of the potential audience; that is, include what will be of interest to them rather than to the maker of the film.

Outside of an actual demonstration, there is no better way of showing a machine tool or a mechanical process to a man than by a moving picture. Sometimes the "movie" will show the workings of a machine even better, as in the same of the so-called "slow-motion" pictures. Advertising films, which are educational in a way, should show those features of the product which make it a "worth-while buy" for the customer. In the case of machine tools, they should not only illustrate the uses, and the results of the uses of the machine, but also should describe the mechanical reasons why such good results are obtained.

Distribution of Films

It is the writer's opinion that the best distribution scheme of a machine-tool "movie" is the direct circulation from the offices of the machine-tool builder. The more or less technical character of the film as well as the special character of the field in which the film will be welcomed, makes the circulation problem rather a strange one to the general distributing agencies unacquainted with the machine-tool industry.

A centralized bureau is needed as a clearing house to collect all the types of films and to offer specific fields for them. This is presumably the idea back of the co-operation plan of the National Association of Manufacturers and of the government. The latter is undertaking the distribution of well-made films through a special department in the Bureau of Foreign and Domestic Commerce.

The more important work of the Bureau will be the exploitation of American products in the foreign markets through an educational campaign which uses moving pictures as the medium. Several foreign countries are now using the "movies" to show their products in the foreign fields. However, the well-known superiority of the American-made film gives our film advertising a much easier start. By the use of moving pictures, the difficulty of explaining technical processes or machines in a foreign tongue is also overcome.

Blanking and Piercing Tools for Watch Parts

Escapement Is Important Feature of Movement—Accurate Workmanship Essential Pillar-Type of Sub-Press Used—All Working Parts Ground and Lapped

By I. BERNARD BLACK

IN THE design and construction of dies for watch parts a great deal of time, care and forethought is demanded because of the extreme accuracy required of the product of the tools; and of no part of the watch mechanism is this more true or the work more exacting than in making those tools that are to produce the several pieces comprising what is known as the "escapement." This escapement is, perhaps, the most vital part of the watch movement, and in its making and adjustment none but the services of an expert can be employed if the time-keeping qualities of the watch are to be assured.

In this article the writer will endeavor to describe the dies that produce the pallet, a very important part of the escapement, and in order to make clear to the reader the necessity for extreme accuracy in their design and construction, will briefly explain the functions of this part.

The escapement is that part of a watch movement by means of which the rotative movement of the wheels is transformed into the vibratory, or oscillatory, motion of the balance. The members included in the escapement are the escape wheel, the pallet, the fork, the impulse pin, and the roller or rollers. The balance itself is not properly included.

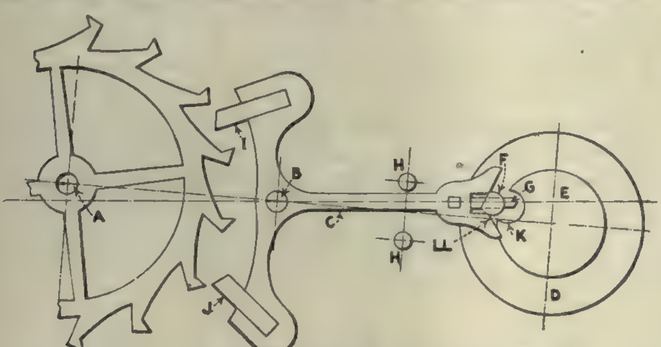


FIG. 1—DIAGRAM OF THE ESCAPEMENT

In Fig. 1 is shown a diagram of the movement, the letters referring to the various parts as follows: *A* is the escapement wheel; *B*, the pallet; *C*, the fork; *D*, the impulse roller; *E*, the safety roller; *F*, the impulse pin; *G*, the guard pin; *HH*, the banking pins; *I*, the receiving, or right, stone; *J*, the discharging, or left, stone; *K*, the roller crescent; and *LL*, the fork horns.

As may be seen in the sketch, the pallet is the part that holds the stones that lock and unlock the teeth of the escapement wheel, causing it to move intermittently. The forward and backward movement of the pallet, a movement governed by the balance but which really derives its actuating impulse from the escapement wheel, is what times the watch. If the pallet should be inaccurate in regard to any one of its many features, such as the position of the arbor hole, a wrong position or angle of the slots that hold the stones, or the fork horns not being punched in exactly the right place or at the correct angle, the timing would be defective.

In Fig. 2 is shown a drawing of the pallet, which will serve to show how truly complicated is its design. There are many styles and kinds of pallet, each design involving an amount of calculation that would astonish the uninitiated; yet the slightest error in any one of the many calculations would greatly affect the value of the watch as a time-keeper. The writer has handled

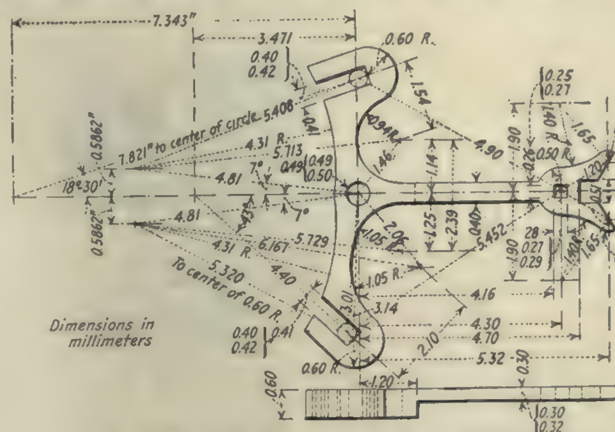


FIG. 2—DRAWING OF PALLET. DIMENSIONS IN MILLIMETERS

Swiss watches that were guaranteed to keep time within 15 seconds fast to 20 seconds slow in 24 hours, a variation so slight that it is hardly appreciated by the average watch-owner. Slight as this variation is, however, it can be improved upon and the watch factories of today are working toward that end.

In Fig. 3 is shown the way in which the stock is shaved before it is fed to the die. The stock used is strip brass 11/16 in. wide by 0.024 in. thick, and comes to this operation in 6-ft. strips. The strip is run through the blanking tools twice, as will be explained later.

A three-station die, mounted in a pillar-type sub-press, is used to blank the pallet, and in Fig. 4 may be seen a section taken through the second station. At the first station the two pilot holes and the pallet-arbor hole are pierced, and a part of the stock cut away around the fork horns to relieve the blanking tools of a part of the burden. At the second station the pallet is blanked out of the stock, but is immediately pushed back into it again by the action of the shedder on the up-stroke of the press. At the third station the completed blank is pushed out of the stock and falls through the die into a receptacle beneath the press.

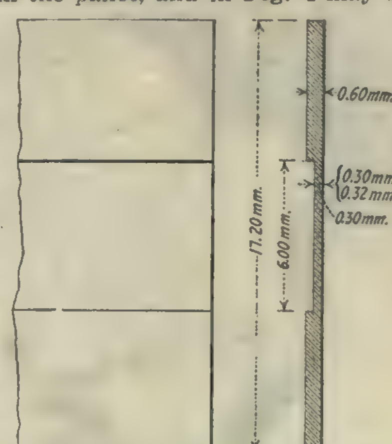


FIG. 3—STOCK PREPARED FOR BLANKING

Part *A* is the die holder, made of machine steel and pack-hardened; part *B* is the blanking die, which is made of tool steel in three pieces; part *C* is the shedder,

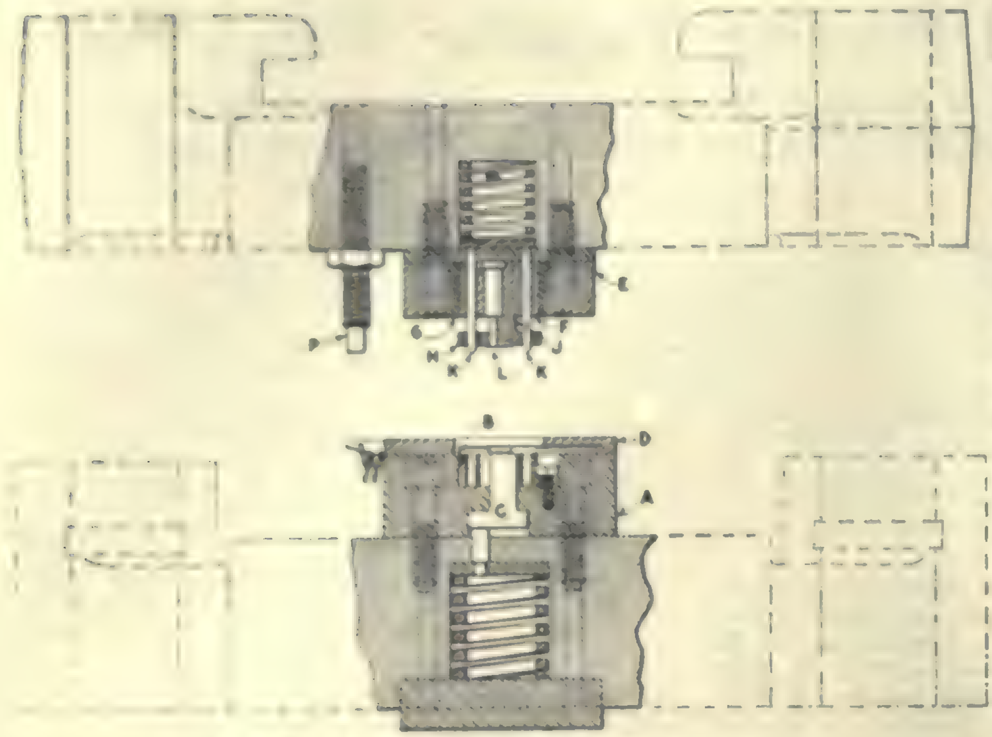


FIG. 4—SECTION THROUGH THE BLANKING DIES

also of tool steel and a sliding fit in the die; part *D* is the stripper, made of machine steel, pack-hardened and provided with a runner as shown in the drawing so that the shaved portion of the stock will always bear against a straight-edge to prevent mis-alignment while piercing and blanking.

Part *E* is the punch block, made of machine steel and pack-hardened. Part *F* is the blanking punch, the body portion of which is ground and lapped to a drive fit in the bushing *G* of the punch holder, while the punch portion is made to correspond to the contour of the die but is 0.012 mm. smaller all around than the latter. Part *H* is a spring stripper, made of tool steel, hardened, and ground out to fit the blanking and piercing punches, and it is retained in place by three screws, part *J*.

Parts *KK* are the pilots, made of tool steel, hardened, ground and lapped to a drive fit in *F* and a sliding fit in the bushed holes of the stripper. On the downward stroke of the press the blanking punch *F*, the gutting punch *L*, and the pilots *KK* enter the blanking die, compressing the stripper and shedder springs. On the up-stroke the blank, which at this time is out of the stock and lodged in the die, is pushed back into the stock by the shedder, through the action of its spring.

In Fig. 5 is shown a plan view of the blanking dies. Here may clearly be seen what operations take place in each of the three stations.

It will be noticed that two stops are used. In order to feed the stock accurately up to the automatic stop *M*, the temporary stop *N* is used and the stock fed by hand until the automatic stop is reached, when the roll feed is thrown into action. On the second stroke of the press the stock is pulled over the pin *O*, and upon the third stroke the temporary stop *N*, a sketch of which

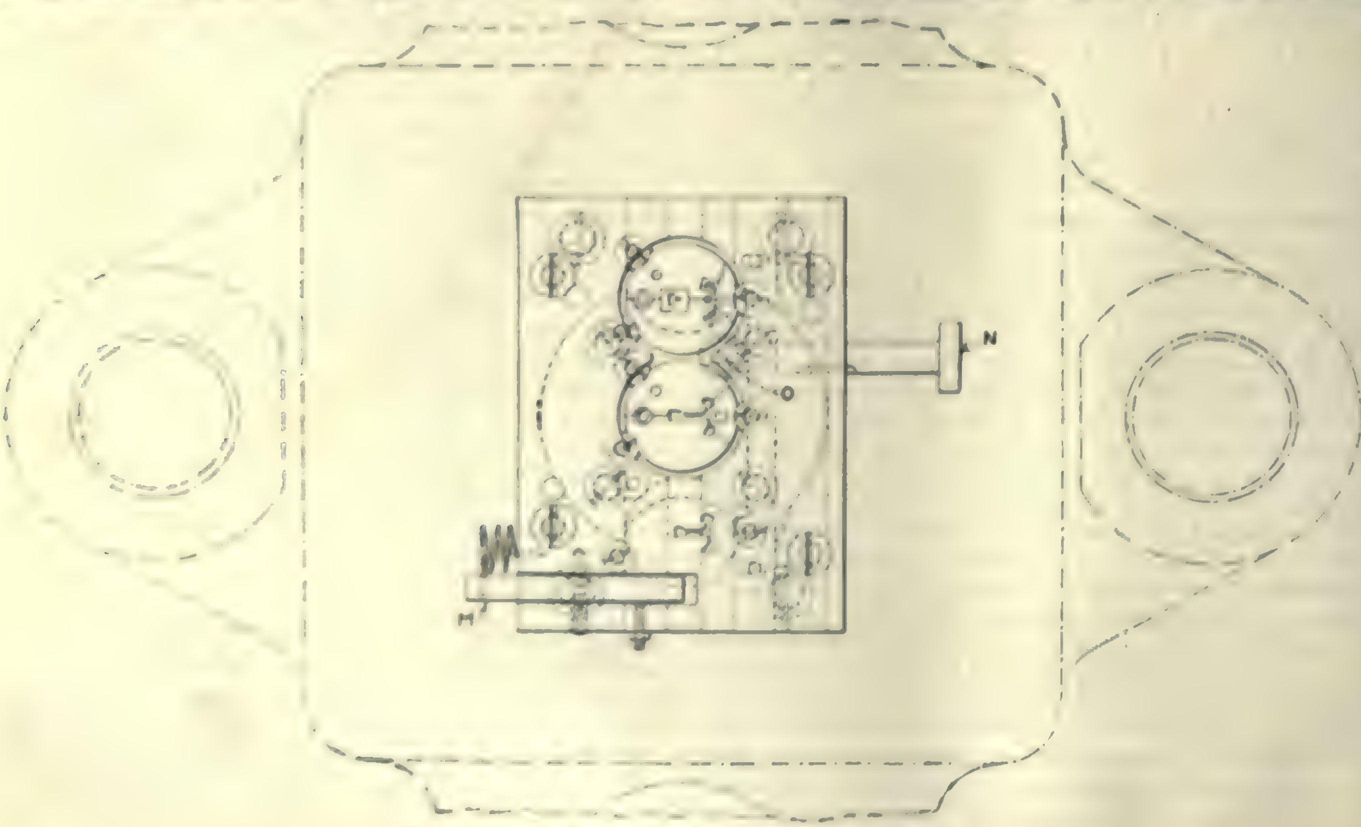


FIG. 5—PLAN VIEW OF THE BLANKING DIES

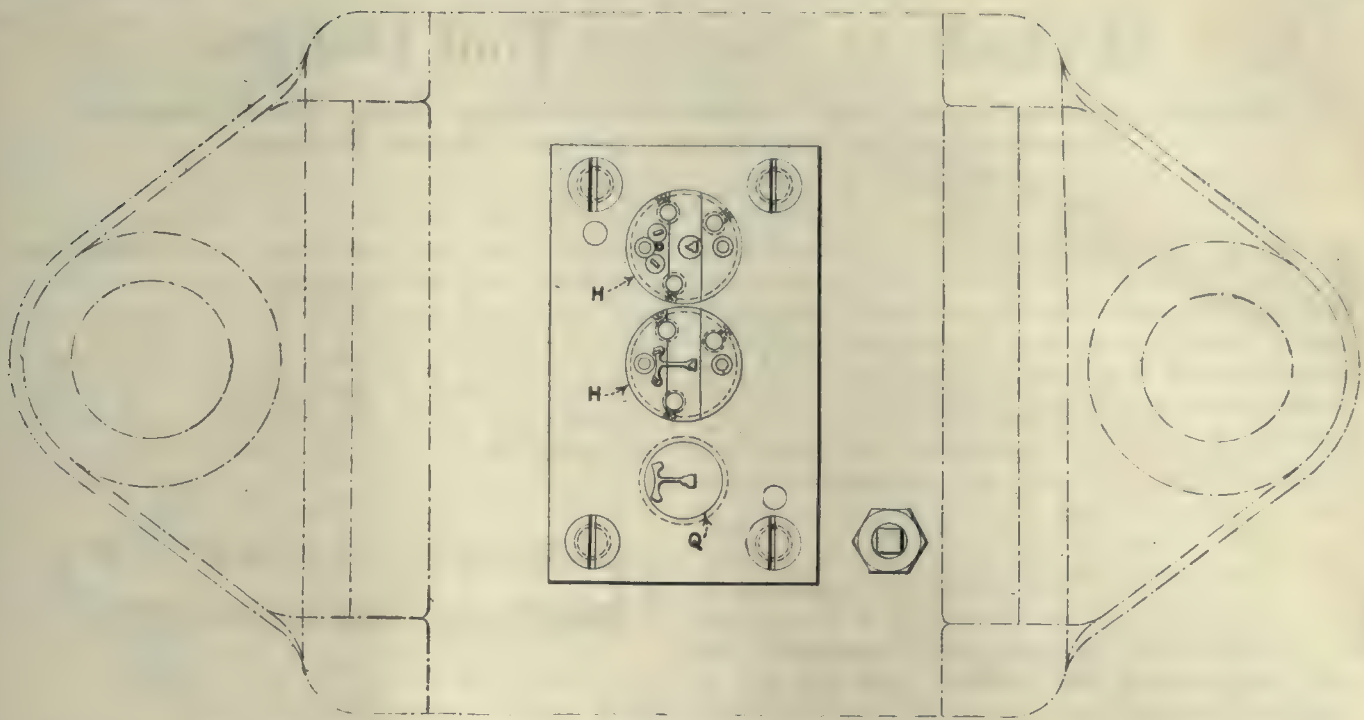


FIG. 7—PLAN OF THE PUNCHES

appears in Fig. 6, is pushed in, causing the pin *O* to go below the surface of the die. The automatic stop is of the trigger type with a projecting end against which the adjustable screw *P* (Fig. 4) contacts as the press descends.

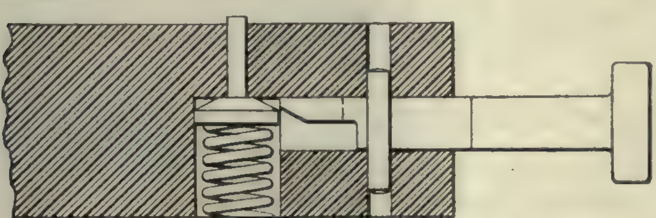


FIG. 6—DETAIL OF AUXILIARY STOP

In Fig. 7 is shown a plan view of the punch block. Here may be seen the two spring strippers, parts *HH*. The knock-out punch *Q* is made to conform to the contour of its die, but is 0.05 mm. smaller.

In Fig. 8 is a sectional view showing the construction of the piercing and gutting punches. The two outside punches *RR* are the piercing punches for the pilot holes and are lapped to a driving fit in the punch holder. The piercing punches *S* and *T* and the gutting punch *U* are a driving fit in the punch holder and a sliding fit in the stripper bushings.

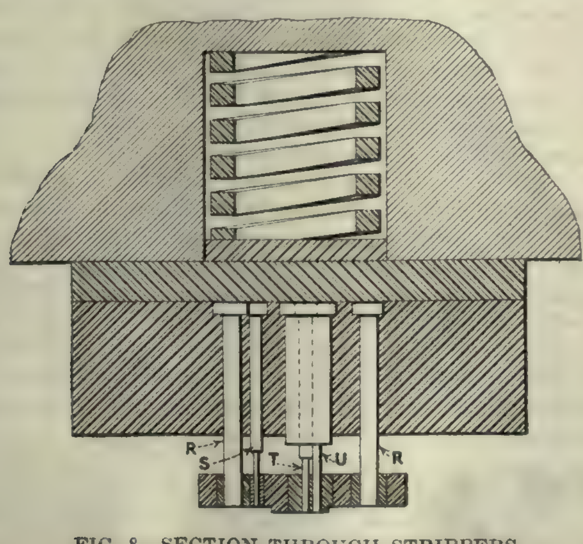


FIG. 8—SECTION THROUGH STRIPPERS

Very little trouble was experienced from breakage of the punches in using this die because of the fact that they were fully supported by the strippers during the time of cutting.

The Foreman and the Management—Discussion

By Arthur Seekay
Lynford Gardens, Essex, England

On page 898, vol. 56 of *American Machinist*, A. W. Brown attempts to define in a few words the position of the foreman in regard to the management. In my opinion no hard and fast rule can be laid down on this subject. I am convinced, by experience, that in small shops, employing anywhere up to 300 hands, the foreman must, without any qualifying clause, take part in the management of the works.

Much depends upon the efficiency and sagacity of the management, as a matter of course, but it must be acknowledged that there is often lack of consideration for the foreman and, in such case, the foreman should watch the interests of those working under him. He is in the best position to understand their temperaments and troubles. On the other hand, by refusing to associate himself with silly grievances and petty demands he can often overcome trouble and save his managers much loss of time and temper.

There should be no question of "running with the hare and chasing with the hounds." If he fails to determine what is right and just, or to exert his influence to achieve those ends which are proper, he will never have the confidence of either side.

Methods of Machine Tool Design

Continuing the Section on Feed Mechanisms for Machine Tools—The Problem of Expansion Due to Temperature Changes—Thrust Bearings

By A. L. DeLEEUW
Consulting Editor, American Machinist

IN MANY cases half nuts are used in connection with a feed screw. It is well known that opening and closing half nuts cannot be used with the square thread. Without going into an analysis or graphical demonstration of the reason why a square thread cannot be used, we may picture for ourselves a shaft with a number of square threaded collars turned on it—a kind of cylindrical rack of which the teeth have the contour of a square. A half nut, if we are permitted to call it a nut at all, could be brought to bear on this shaft. The reason why this is possible is that the threads are at right angles to the axis; in other words, that there is no lead. If there were any lead at all it would not be possible to bring the half nut down on the screw except that, if the lead were inconsiderable and some clearance were left between screw and nut, it would still be possible to bring the nut on the screw simply because there would not be a true fit between the two. If there were such a fit we could overcome the difficulty by making the thread slightly taper, say with an angle of one or two degrees on a side. We would have to increase this angle when we increase the lead.

The Acme thread has sufficient angle to permit of throwing in the half nut with most ordinary leads. However, when we try to obtain greater efficiency of the screw by increasing the lead, as we should, we may find interference between screw and nut. This interference is greatest at the points of the half nuts where they join, and it is quite customary to bevel the half nuts as shown in Fig. 154. Even this is not sufficient with large leads, or as we should rather say, with large angles of helix. If, for any reason, we do not wish to increase the angle of the thread beyond a certain amount—for instance, we wish to use the Acme thread—we will find that we are not permitted to use an angle of helix beyond a certain point; and if this would not give us a sufficient lead, then we would have to increase the diameter of the screw. In many machine tools very long screws must be used. Such screws should always be arranged to have them in tension when under load. Buckling effect, as a result of being in compression, will cause the screw to bind hard in its nut and in the bearings, besides being liable to cause severe jumping of the tools, as a screw would act very much like a spring. In lathes where practically all cuts are taken toward the headstock, this condition is automatically met, because the logical place to have a thrust bearing for such a screw is at the headstock end. Nothwithstanding this natural way of constructing the screw, some screws of heavy lathes have come under the writer's observation which have the thrust bearing at the tailstock end, so that they do their heavy work under compression. Such construction is indefensible.

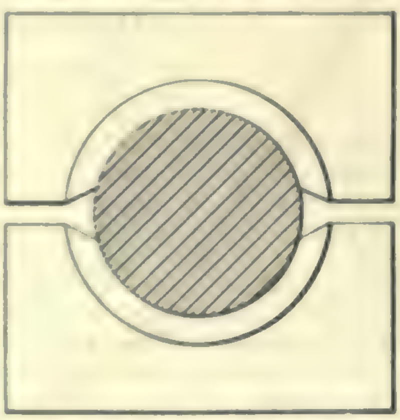


FIG. 154—PAIR OF HALF NUTS WITH BEVELED EDGES

There are cases in machine tool construction where a screw must do work in both directions. This happens, for instance, in plate planers. In such cases we will have wrong conditions at whichever end we place the thrust bearing, and for that reason there should be two thrust bearings, so placed that the screw will be in tension in whichever direction the cut is taken. Fig. 155 shows such an arrangement in diagram.

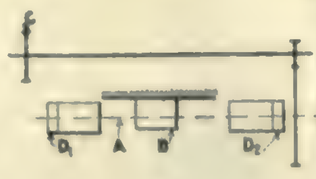


FIG. 155—PLATE PLANER LEAD SCREW WITH TWO THRUST BEARINGS. FIG. 157—FEED SCREW DRIVEN THROUGH SEPARATE SHAFT. FIG. 158—LEAD SCREW USED AS FEED ROD

There is no necessity for the use of such a thrust bearing arrangement except when the screw is fairly long, and when this is the case we may find that there is enough difference in expansion and contraction between the screw and the frame of the machine to require special attention. If, for instance, the length of this screw between the thrust bearings is 40 ft. and if the highest temperature to which this screw may be subjected under working conditions is 90 deg. and the lowest temperature when the shop is shut down during the night or over Sunday is 10 deg., we would find that the total difference in length of the screw and bed between these temperatures would be

$$0.00000636 \times 480 \times 80 - 0.00000556 \times 480 \times 80 = 0.2442 - 0.2135 = 0.0307;$$

in which 0.00000686 and 0.00000557 are the linear expansion of steel and cast iron respectively per unit length for one degree Fahrenheit; 480 is the length of the screw in inches, and 80 is the temperature difference to which the screw may be subjected. We find, then, that there will be a possible difference in length of screw and bed of 0.030 in.; so that if the screw were of the proper length for the higher temperature it would be practically $\frac{1}{32}$ in. short at the low temperature.

In the case of a plate planer it is quite simple to overcome this difficulty by leaving a certain amount of looseness; for instance, making the screw $\frac{1}{32}$ in. longer than the distance between the thrust bearings on the bed.

This looseness would be taken up at every reversal of the stroke and no harm would result.

In the case of a feed screw on a lathe, where it should be necessary to have thrust bearings at both ends (which is only rarely the case) the same method might be applied. If such a screw also must be used as a lead screw it it not advisable to follow this construction and it may be better to give the screw a length which is correct, not exactly for the highest temperature, but for

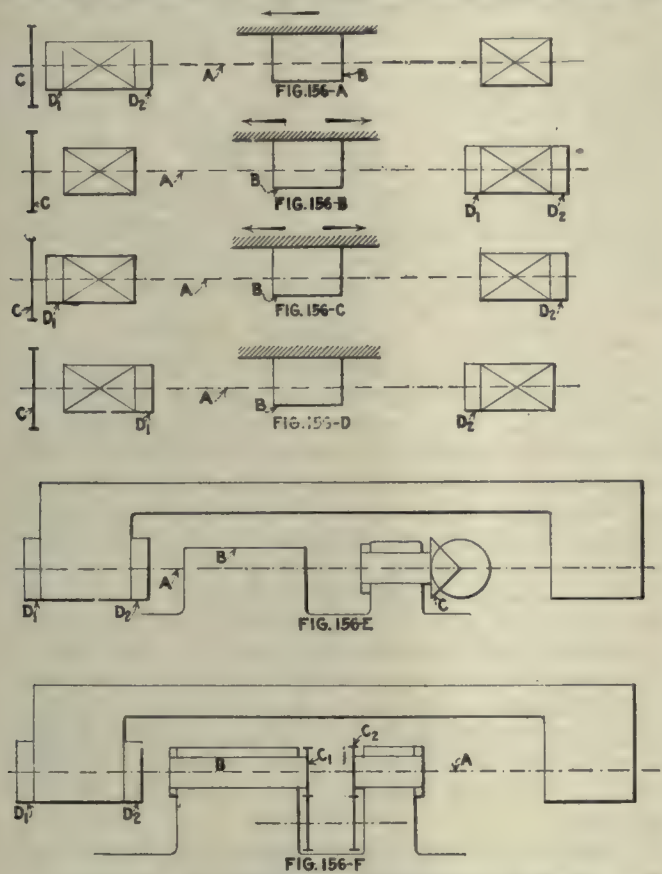


FIG. 156—VARIOUS ARRANGEMENTS OF FEED SCREW PARTS

the average temperature in the shop, say 65 deg. There might then be a looseness due to 25 deg. difference in temperature during hot summer days, whereas during a cold winter night there might be a difference in the opposite direction of 55 deg.

Under these latter conditions the screw would be subjected to a certain amount of tension, due to the fact that there would be a difference of 0.020 in. in length between the bed and screw. If the material of this screw had a modulus of elasticity of 30,000,000 lb., this difference in length would cause a stress in the screw of $20/480 \times .001 \times 30{,}000{,}000 = 1{,}250$ lb. to the square inch. This amount is not harmful to the screw, but adds very largely to the pressure on the thrust bearings. If, for instance, we should have a screw of which the core is $2\frac{1}{2}$ in. in diameter and therefore has a cross section of 4.9 sq.in., there would be an added pressure on the thrust bearings of $4.9 \times 1{,}250$ lb. $= 6{,}125$ lb., and it would therefore be necessary to have a much enlarged thrust bearing or much heavier ball bearings, or perhaps an entirely different arrangement to take up the thrust.

In Fig. 156-A to -F are shown various arrangements of feed screw, nut, driving gear, and thrust collars. In Fig. 156-A the thrust collars are placed close to the driving gear, so that if the feed takes place in the direction of the arrow the screw will be in tension, the thrust collar D_1 will function, and the distance between the driving gear and the active thrust collar will be a minimum.

In Fig. 156-B the thrust is taken up at the far end of the screw, so that when the feed takes place in the direction of arrow 1, thrust collar D_1 will be active and the screw will be in compression. There is, of course, a certain amount of torsion in the screw between the gear C and the nut B on account of the load and the friction in the nut; but in this arrangement of the elements there will be additional torsion due to the load at the thrust bearing. When the feed takes place in the direction of arrow 2, thrust collar D_2 is active, the screw is in compression and again is subjected to the additional torsion caused by the friction of the thrust bearing.

Expansion and Contraction of Screw

In Fig. 156-C the thrust bearings are so located that the screw is always in tension in whatever direction the feed may take place. In this construction provision must be made for expansion and contraction. When the feed takes place in the direction of arrow 2, the entire length of the screw is in torsion due to the driving gear and thrust collar being at opposite ends of the feed screw. There are cases where a feed screw must be kept of small diameter; for instance, where it has to be laid in a long boring bar. In such a case the torsion of the screw is quite considerable, causing a shortening of the screw which, in its turn, causes a considerable pull on the far thrust bearing. This pull may become so great that, if the screw were driven by a pulley instead of a spur gear as shown in the illustration, the belt might not be able to turn the screw, and that notwithstanding the legitimate load might be quite small. This is a case of building up of resistance which we often meet in machinery where the elements have not been properly designed.

There are cases where it is unavoidable to have the thrust bearing at the far end of the screw and where it is not possible to make the screw as heavy as might be desirable. In such a case it is well to take the driving member C off the screw and place it on a separate parallel shaft, and then drive the screw at the far end close to its thrust bearing; see Fig. 157. Though the total amount of torsion has been increased, there is no tendency here to build up. Fig. 156-D is practically the same arrangement as that shown in Fig. 156-C, except that the thrust collars are placed on the opposite side of the bearings. This construction brings the screw in compression at all times, and we could hardly imagine any case where it would be justified.

Screw Fixed and Nut Rotating

In the foregoing four cases the screw was being driven while the nut was fastened to the member which was to be advanced. It is equally possible to have the screw held in the member to be advanced. This case is shown in Fig. 156-E. The sleeve bevel gear C drives the screw which, of course, must be provided with a spline. It is undesirable to use a splined screw, though there may be cases where such may be the best possible compromise. This matter of splined screws will be touched upon later. In all the foregoing cases the screw was the rotating member. It is, of course, possible to have the nut rotate, in which case the thrust bearing must be at the nut and not at the screw. This con-

struction has the advantage of avoiding all torsion in the screw with its consequent change of lead, and of having the thrust close to the drive, and therefore never exaggerated by torsion in the driven member.

It is also possible to drive both screw and nut, as indicated in diagrammatic form in Fig. 156-F. In that event both screw and nut must be provided with thrust bearings. The rapidity of the feed depends on the difference in speeds of screw and nut. If, in the case illustrated, the screw had a right-hand thread, were rotating alone, and in a right-hand direction, it would cause the table to move to the right. If the lead were ½ in. and its speed 300 r.p.m., the rapidity of the feed would be 150 in. per minute and in a right-hand direction. If the nut alone were revolving, and also in a right-hand direction and at a speed of 300 r.p.m., the rapidity of the feed would be again 150 in. per minute, but this time in a left-hand direction.

If both screw and nut were revolving simultaneously with the same speed and in the same direction, there would be no feed at all; if in the opposite direction the feed would be 300 in. to the right or left, according to whether the screw would be rotating right- or left-hand. If screw and nut were revolving in the same direction, but at different speeds, the feed would be equal to the difference of the feeds which would be obtained if either of the two members were running alone and in the direction which would be caused if the fastest member only were running. For instance, if the screw were running 300 r.p.m. and the nut 280 r.p.m., we would obtain 10 in. feed per minute in the direction of the feed which would be given by the screw alone, that is, right handed. If, on the other hand, the screw were running 280 r.p.m. and the nut 300 r.p.m., the feed would again be 10 in. per minute, but in the opposite direction.

Such an arrangement lends itself very well for various functions of automatic machines, as rapid traverse in either direction, feed in either direction, and stopping all can be obtained with simple members. It should be noted, however, that it is necessary to lock the stationary member against rotation caused by the friction between it and the rotating member.

Bearing Requirements

It is of the greatest importance to arrange for the proper thrust bearings, and in general for the elimination of friction when using the arangement of rotating screw and nut. We will suppose the screw to run 300 r.p.m. and the nut 298 r.p.m., which will give 1 in. feed per minute if the lead of the screw is ½ in. as was assumed. In order to feed 1 in. the screw must make 300 revolution under the full feed pressure, and the nut at the same time must make 298 revolutions under the same pressure.

To show how very inefficient such a drive would be, we will select a concrete example, making the screw 2 in. in diameter, ½ in. lead, single thread, and therefore with a pitch diameter of 1¾ in. We will assume the load to be 4,000 lb., the thrust washers on the nut to have an inside diameter of 1¼ in. and outside diameter of 3¼ in., while the thrust washers on the nut will have an inside diameter of 2½ in. and an outside diameter of 4½ in. Then the amount of work done for advancing the load 1 in. will be 4,000 in.-lb. As the screw has rotated in the nut 2 revolutions for 1 in. advance, the work done for overcoming friction in the nut will be 5½ × 0.15 × 4,000 × 2 = 6,600 in.-lb. (5½ is the pitch circumference of the screw and 0.15 the coefficient of friction of the screw in nut).

The work done for overcoming friction at the thrust washers of the screw is 11/4 × 22/7 × 0.08 × 4,000 × 300, in which 11/4 is the average diameter of the thrust washer, 300 the number of revolutions of the thrust washers for 1 in. feed, and 0.008 the coefficient of friction of the thrust washers. This amount is equal to 829,710 in.-lb. The work done for overcoming the friction at the thrust washers for the nut is 3½ × 22/7 × 0.08 × 4,000 × 298, in which 3½ is the average diameter of the thrust washers and 298 is the number of revolutions made by the nut for 1 in. feed. This amount is equal to 1,048,960 in.-lb., so that the total amount of work is 1,048,960 + 829,710 + 6,600 + 4,000 = 1,889,270 in.-lb. for a useful amount of work done of 4,000 in.-lb. The efficiency is therefore 4/1,889 or less than one-fourth of one per cent. The actual efficiency will be even less than this amount because friction in bearings, etc., has not been figured in.

Effect of Anti-Friction Bearings

This shows that the arrangement of rotating screw and nut is not practical unless a different construction for thrust bearings is used. Substituting ball bearings for the thrust washers, we will find the following: With a well constructed ball bearing the coefficient of friction is well within one-hundredth of one per cent, so that the two large amounts we found for friction in the thrust bearings may be divided by 800. Besides, the average diameter of the ball bearing will be considerably less than the average diameter of the thrust washers we had assumed. We will find, then, for the work done at the thrust bearing of the screw something like 800 in.-lb.; for the thrust bearing at the nut about 1,000 lb.; so that the total amount of work done would be 800 + 1,000 + 6,600 + 4,000 = 12,400, which gives a total efficiency of a little more than 30 per cent.

It should be kept in mind that all the figures here were assumed and are only fit to give a rough impression of the relative efficiency of this kind of drive with and without ball bearings as compared to that of the ordinary feed screw. When it comes to actual construction, the designer should carefully investigate the data and not accept the rough figures taken here.

Feed screws are often constructed with a spline. This spline is sometimes used to drive the screw and sometimes for the purpose of driving some other part by the screw. The splined screw is often condemned indiscriminately and without considering the purpose of the spline. If the spline is merely for the purpose of driving the screw and if conditions are otherwise as they should be, there is little to be said against such a construction. The points to be considered to make such a drive successful aré: In the first place, the careful removal of all burrs where the threads of the screw meet the spline. Preferably these threads should be rounded over slightly for a short distance. In the second place, the length of key should be sufficient to make up for the fact that its bearing surface has been reduced by the threads. In the third place, the key should be of hardened steel if possible.

We have a different set of conditions when the screw drives some other member. As illustration we may take the quite common construction of a lathe apron in which the screw is used both as lead screw and as feed rod. When used in this latter capacity the screw drives

some gear which is used to transmit motion to the rack pinion. Such a screw must have one or two bearings in the apron besides the half nuts. To make clear what will happen when such a screw is used for these different purposes we shall assume certain figures, see Fig. 158. The lead of the screw is supposed to be $\frac{1}{4}$ in. and we shall further suppose that it is geared in such a manner to the rack opinion that one revolution of the screw causes an advance of $\frac{1}{16}$ in. when it is used as a feed rod.

When the screw is used as a lead screw it will cause an advance of $\frac{1}{4}$ in. per revolution. As the bearings in the apron advance the same amount as the half nuts, namely $\frac{1}{4}$ in. per revolution, the screw will travel in these bearings just as if they were nuts and it will cause the wear in these bearings to take the form of a shallow thread. If now later on the same screw is used as a feed rod, it will cause the apron with its bearings to advance $\frac{1}{16}$ in. so that the edges of the thread of the screw will act as cutting tools and cut out the thread worn in the bearings. This action will be repeated and it will be only a very short time before the screw will be very loose in its bearings, will be practically unsupported, and will cause looseness in the subsequent gearing. A lead screw should not be used as a feed rod.

On the other hand it is permissible to drive a screw by means of a spline, whether it is used for feed only or for producing the lead in screw cutting.

What Are the Worker's Prospects in the Machinery Building Industry?

By Gaylord G. Thompson

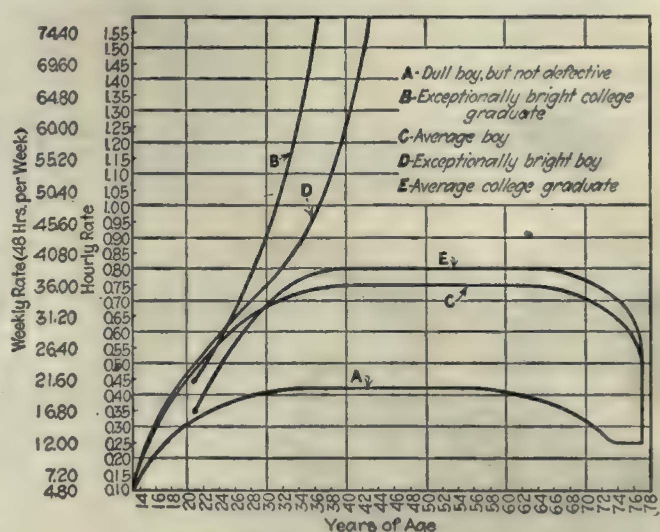
The article under the above title by A. W. Forbes, appearing in the *American Machinist*, Vol. 55, page 667, is an excellent preliminary to the possibilities of developing standard curves for ascertaining the impartial monetary valuation of labor.

I am submitting a drawing of curves which takes into consideration not only the starting point of a worker's career, but also the approximate ending of his services. In fact these curves represent the periods of increased returns, constant returns, and diminishing returns, as they concern the value of the worker's period of uninterrupted service to the employer.

In analyzing the proportional values of the curves as submitted by Mr. Forbes, I have come across an element wherein the "exceptionally bright boy starting machine work at fourteen years of age," is given considerable advantage over the "exceptionally bright boy entering machine industry after graduating from college." Apparently, Mr. Forbes contends that a bright boy beginning at fourteen years of age and working three years until seventeen years of age, is of the same value to a concern as a bright boy graduating from college at the age of twenty-two years.

It is hard to conceive of any concern that would place a higher monetary value on a boy of seventeen years old with three years machine work experience, than on a matured young man of twenty-two years, a graduate from college. Picture these two young men standing before you. You have their applications for a position. On reading over their outline of experiences you could not evade the impulse to concentrate your attention to the college graduate. He already has the foundation upon which to build rapidly, the particular structure that may fit him in as an important cog in your organization. Of course the college graduate will be hired in preference to the seventeen-year old boy especially when the wage rate is equal. Even though a bright seventeen-year old boy who has worked for you for three years is unconciously drawn into the controversy as a basis of comparison with the college graduate for labor value, you would still feel that you were grabbing a bargain if this technically trained man would start work for the same amount paid to the seventeen-year-old boy.

The argument may be advanced, however, that a worker who has been with a company for a number of years is of more value to a concern from a production point of view, than a recent college graduate who is not familiar with the manufacturing methods of that particular concern. I believe this to be true only when the shop man has gone through a sufficient number of years training that will in a measure counteract the advantage which the college graduate has in his technical training. We must not lose sight of the fact that college graduates who intend entering the machinery manufacturing industry are considerably advanced in actual manufacturing experience due to the intensive training which they receive in machine shop practice during their



WAGE RATES IN THE MACHINE SHOP

school terms and summer vacations. Consequently, when such men enter into the manufacturing field, their rise, starting from a slightly lower level than the existing wage rate of the exceptionally bright worker and on equal footing with the ordinary worker, is more rapid than these two classes of workers. The lines of valuation should converge. The line representing the most rapid increase in value of service will cross all others that are the nearest competitors. This line, which represents an exceptionally bright college graduate, is shown in the accompanying chart as *B*.

Line *D* represents an exceptionally bright boy who has found time to acquire technical training outside of his working hours. It will be noticed that this line does not show such rapid strides in the attainment of increased valuation of services as line *B*, until approximately six years after the same achievement has been accomplished by line *B*. Owing to the fact that *D* is compelled to obtain his technical training under conditions that do not allow him to devote his full time to

that phase of the work, he must necessarily be reconciled to the necessity of delayed realities of visualized ideals.

I believe that I voice the opinion of the majority in that the ultimate attainment of high remuneration is most quickly brought about through the instrumentality of a college education preceding practical experience.

The curves, as shown by Mr. Forbes, representing the college graduate (C') and the exceptionally bright boy (C), are in my opinion directly opposite to the correct interpretation of them. It does not seem logical that the worker without college education preceding practical experience, should show quicker results than a college training supplemented by practical experience.

Line *C* represents the ordinary worker who is content with being an all around machinist, toolmaker, or the head of some department whose functions contribute to office routine.

Curve *E* represents the average college graduate who comes under the same category as curve *C*, but owing to his advantage of a college education his curve of service valuation should be more pronounced at the beginning and gradually terminating at a slightly higher stationary valuation than *C*. Likewise we have consistent relativity with curves *B* and *D*.

Curve *A* represents a worker lacking in college training, who is satisfied to remain in the class of a machine operator or clerk. In this class of workman, the element of physical ability is the barometer of labor valuation. In this curve it will be noticed that a slow increase in value is given from twenty-five to forty years old. I based this curve on the fact that unless the worker betters himself intellectually, whatever increase in value that he becomes to his employer will be only the result of length of service. After the worker becomes forty years of age, any longer service with the company could not qualify for increased valuation. From forty to fifty-eight years of age, the worker's value to the company from point of service remains stationary, after which the physical element enters into his value which brings about a decline in his value to the company until he strikes a low level which is in proportion to the value of the duties which he is able to perform. When an old worker ceases to be worth $12 per week, he should be removed from duty or placed on a pension.

The ends of curves *C* and *E* show a sharper decline than curve *A* because of the fact that curves *C* and *E* savor of an element of brain work and skill which does not require the physical qualifications of curve *A*. Consequently the period of decreased labor valuation does not start until some time after *A* and after declining slowly for a few years, suddenly drops to the low level. The class of workers represented by lines *C* and *E* are usually in a position to retire before the low limit has been reached.

The workers represented by curves *B* and *D* having once started their climb, do not encounter any great degree of stationary valuation, but on the contrary "carry on" until they retire or are called by death.

In summing up the whole proposition as to these curves on labor valuation, I have based my conclusions on the fact that the rapidity of absorbing knowledge is most pronounced in the first few years of learning and that it gradually tapers off until the highest value has been reached. Only technical training will reverse the curve and give it a sharp incline toward the pinnacle of increased returns.

I wonder what the moral effect would be to hang a large reproduction of these curves on the bulletin board in the office or shop with full explanations and headed, "Which of These Curves Represent You?"

Some Grinding Operations at the Marmon Plant

Fixtures and Methods Used in Finishing Gears, Valve-Stem Rollers, Valve Lifters, Steering Knuckles, Spring Shackles, Axle Housings and Connecting Rods

SPECIAL CORRESPONDENCE

THE accompanying illustrations give a good idea of the extensive use of grinding machines in building the Marmon car. Fig. 1 represents simply grinding the bore of a timing gear, and is only shown to illustrate the use of hardened pins for holding the gear at its pitch line in a draw-in chuck.

The grinding of the small rollers which go in the valve push rod is shown in Fig. 2. These rollers are held in the chuck *A* by means of the sliding washer, which is tapered sufficiently to force them against a suitable seat at the back end. This is an easily handled device for work of this kind.

Two of the grinding operations on the push rod itself are shown in Figs. 3 and 4. The method of holding for the first grinding operation can be readily seen by examining the driving dogs at *A* and *B*, Fig. 3. The dog at *B* has a push rod in place and is all ready to be placed in the grinding machine. The use of inclined tracks, shown by the machine, makes it possible to pass work from one machine to the next.

Another grinding operation on the push rods is seen in Fig. 4, where the ends are being ground square by a cup wheel. The rod is easily clamped in the small fixture at *A* and the operation proceeds very rapidly.

The somewhat unusual steering knuckle used in the Marmon car is shown in Fig. 5, where the portion which goes in the axle is being ground. This view shows the method of driving the knuckle for grinding.

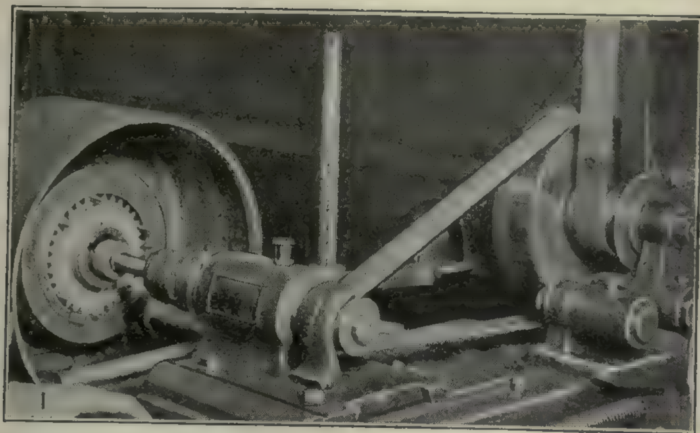
Another unusual grinding job is shown in Fig. 6, where a spring shackle is being held on a magnetic chuck while the side is being faced by a cup wheel. The projecting portion of the shackle has been previously ground between centers, as shown in Fig. 7.

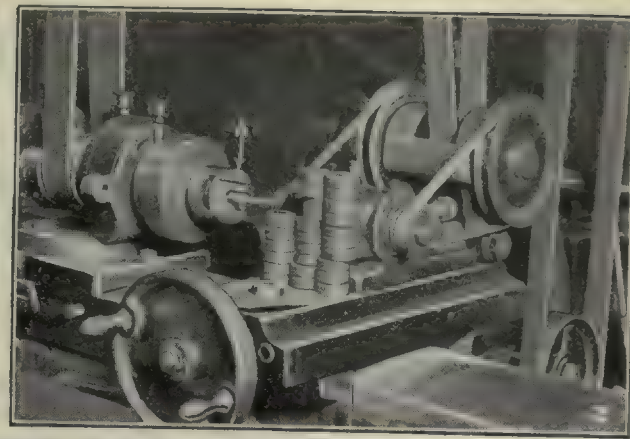
In Fig. 8 is shown how the sheet-steel rear axle housing is ground at the outer end for the wheel bearing. The end carries a plug which serves as a center.

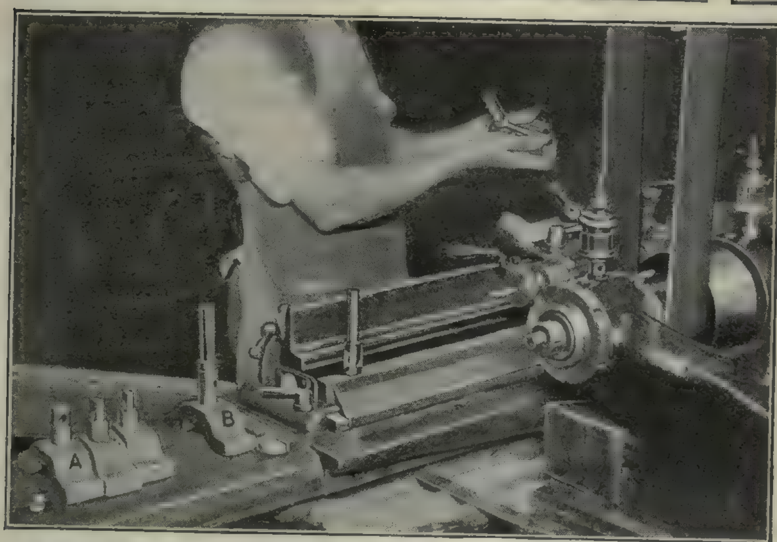
The connecting rod and cap joints are carefully ground to insure a solid metal-to-metal seat. The fixtures used and the method of locating and clamping can be clearly seen in Fig. 9.

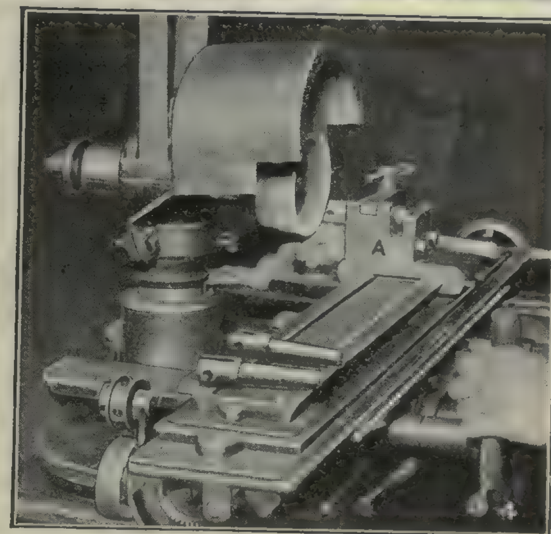
The valve rocker arm is being ground in Fig. 10, a simple fixture locating it and holding it in position. The cup wheel used has a long life on account of the depth of the cup.

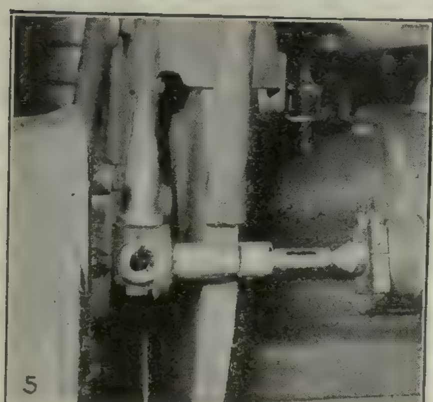
The foregoing examples are by no means all of the interesting grinding operations in the Marmon shop, but will serve to show a few of the ways in which grinding methods are utilized on general work.

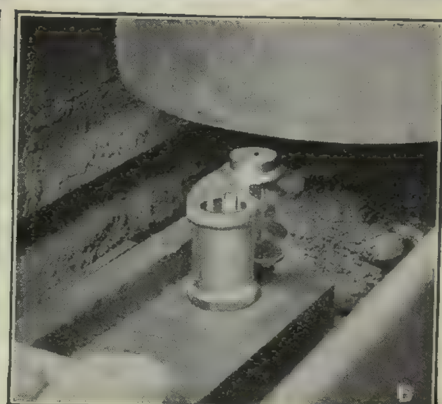


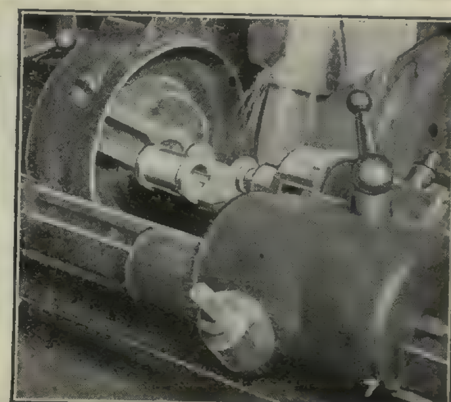


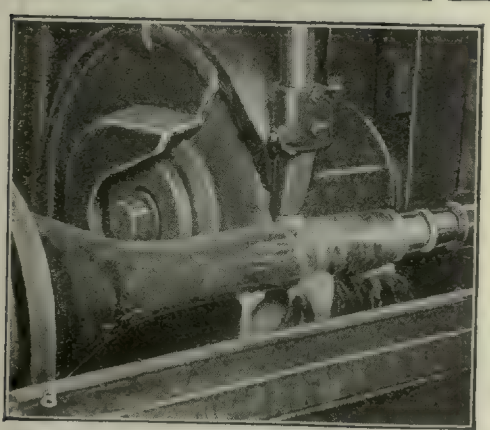


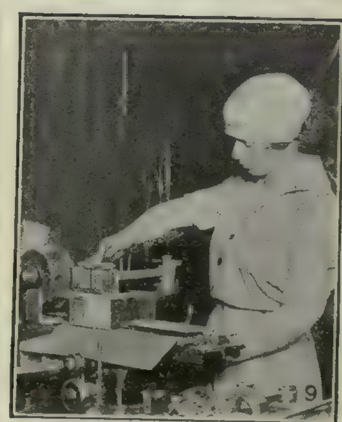












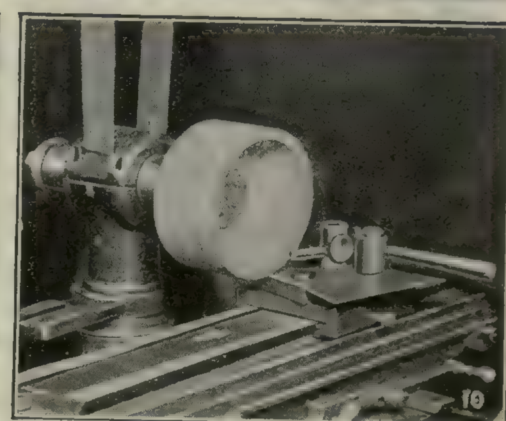


FIG. 1—GRINDING BORE OF GEAR. FIG. 2—GRINDING ROLLERS FOR VALVE ROD. FIG. 3—GRINDING VALVE RODS. FIG. 4—SQUARING THE ENDS OF PUSH RODS. FIG. 5—GRINDING THE STEERING KNUCKLE. FIG. 6—FACING SPRING SHACKLE. FIG. 7—GRINDING END OF SHACKLE. FIG. 8—GRINDING REAR AXLE HOUSING. FIG. 9—FINISHING CONNECTING ROD FACE. FIG. 10—GRINDING VALVE ROCKER

Standardization from the Consumer's Point of View

Standardization an Aid to Buying and Selling as Well as to Production—Different Kinds of Standardization—The Federal Specification Board

By N. F. Harriman
Technical Secretary, Federal Specifications Board
A paper presented at the National Exhibit of Chemical Industries, New York, Sept. 15.

In recent years, attention has been concentrated upon the material and mechanical side of production and distribution in industry. Physics and chemistry have revealed the secrets of raw materials and the modern manufacturer can determine the most suitable material and the most economical method of treating it to obtain the desired results.

One of the most modern sides of industry is standardization, now recognized as being of great importance to both producer and consumer. It is sometimes said that the benefits of standardization are mainly to the field of production.

This is actually not the case. They are quite as important to both the field of buying and of selling. In industrial standardization it is the consumer who is ultimately benefitted most but the immediate benefits are largely to the producer. It at once simplifies his work and enables him to produce what is required by the consumer cheaply and expeditiously. With lower production costs comes more extended use of the standard article. It is a law of economics that when costs increase substitutes appear.

No Bar to Initiative

Objectors to standardization frequently urge that it would stifle initiative and progress and that the adoption of a standard prevents advance through improvements in the arts of manufacture. Of course, this is not the case. A standard should remain standard only until something better is developed but it should not be changed until justified from all points of view. Any given standard, to achieve its object, must be suitable for the intended use in the majority of cases. The exceptional case requires special consideration and actual perfection will never be attained. The economies and benefits of standardization, as applied to qualities of products and processes of manufacture, have been so thoroughly demonstrated within the past few years that they are entirely outside the argumentative field.

Standardization, like efficiency, is not an easy term to define. It is not always understood in its true sense and by many is looked upon with doubt and suspicion. The general idea of standards is not new but its application to science, engineering and industry has been developed within comparatively recent years.

Standardization may be defined as the unification of the methods and practices involved in manufacture, construction and industry, and all lines of endeavor which present the necessity of repetition work. It may be considered under several aspects.

Standardization of nomenclature enables buyer, seller, and manufacturer to use and understand the same language. It is very important that there be acceptable definitions of terms used in specifications and contracts. Purchasing is often done by persons who are quite familiar with the legal side of drawing up contracts but who are not familiar with the technical details involved. The efficiency of many purchasing officers is lessened by their lack of knowledge of the nature and names of the articles they are intrusted to buy.

Standardization of variety, or simplification, involves the elimination of unnecessary types, shapes, grades and sizes of manufactured articles. Waste in industry is largely due to on over-multiplicity in the number of products, as well as to inefficiency of process. Waste due to idle stocks of material and products through deterioration, obsolescence and capital charges carried, is large, especially with large stocks.

Dimensional Standardization

Dimensional standardization ensures ready interchangeability of supplies, and the proper inter-working of parts which may be manufactured or assembled by different manufacturers.

Standardization of specifications and methods of test puts bids on as easily comparable basis, promotes fairness in trade competition, and ensures the proper grade of material for a given use.

The amount and intensity of standardization work now being done all over the world is surprising. One continually hears of "mass production" and the statement that the extensive introduction of it into industry, through standardization, is an economic necessity. National industrial and engineering standardizing bodies have been formed and are now functioning in fifteen of the most prominent nations of the world. Germany has been especially active in dimensional standardization, while the efforts of the British and American standardizing bodies have been directed more particularly toward matters concerned with purchases and contracts, such as specifications for materials, performance of machines and devices, methods of test, etc. A notable exception to this general statement is the dimensional standardization work of the automobile industry in this country.

Many Applications

From a broad viewpoint, standardization may be applied to materials, methods, products and uses.

Materials—The raw materials used in the manufacture of a product must be of standard and uniform quality, if the process of manufacture and the grade of the product are to be maintained. Sometimes it costs a little more to adhere rigidly to definite standards for raw materials, but the economies effected offset this.

Methods—A product made continuously from standard grade material more readily permits standardization of each step in the process of production. This is attained by the adoption of the one best and most economical method of doing each thing as taught by

plant and engineering experience, and making it standard practice.

Product—A standardized product, made to definite specifications, permits an output to the maximum uniformity possible within the limits of manufacturing skill. A uniform product made and sold continuously permits a steady production schedule, building up stocks during periods of low demand and depleting them during periods of high demand. On the unstandardized basis, the only alternative is to follow the "feast and famine" method. The definitely standardized product is manufactured to meet particular wide needs, according to definite specifications, and is constantly tested to ensure its being up to standard grade. The ordinary purchaser is not an expert on quality of supplies, and in many cases the quality can be lowered and he would be none the wiser until the material is put into service.

Uses—One type, shape, grade or size of an article will not meet all the requirements of the consumer, neither is it desirable to have such an extensive variety that the differences are small and meaningless. The ideal condition is to have just enough variety to meet all the real needs with no overlapping. Sound industrial economy demands the elimination of the special or little used product and its substitution by the standard or most widely used and most efficiently produced goods.

Specifications Standardized

Standardization of specifications is the most important phase of the subject, from the purchaser's viewpoint. It is the first and most essential step in the economy that arises from the purchase of materials or supplies in large quantities and is a necessary factor in the improvement of the quality of materials purchased and the adaptation of quality to definite uses.

The specification is the common meeting ground for the manufacturer, dealer and user and it is at once a statement of the users needs and what the maker is required to supply. Purchase by competitive bids on specifications is preferable to purchase on sample. The latter method implies that each bidder's product must be considered independently and it is often a very difficult matter to decide between different combinations of quality and price. The specification should include limiting values for the properties necessary to meet the required service, with proper tolerances. A correct specification is one which enables bidders to know exactly what is desired or required and what procedure the purchaser will follow to satisfy himself that the specification has been complied with. Defective and incomplete specifications, whether due to compromise of quality for temporary economy, or through lack of data, should be replaced by those in which the best magnitude of each property involved is so specified as to predetermine the definite quality best meeting the need. There is a growing appreciation of waste in industry due to the use of defective and improper materials.

To determine the value of any material for a given purpose, its properties must be measured, assuming that the proportion upon which its use depends are known and are measurable. The testing of materials may prove a needless waste of time, energy and money unless due consideration is given to the nature of the tests applied, the conditions under which they are made and the interpretation of results. Quality may be determined directly by a service test, indirectly by a test under simulated service conditions, or still less directly by a laboratory test of individual properties upon which the quality is known or assumed to depend. These may vary from a simple visual inspection to an investigation involving laboratory and technical work of the most difficult and precise nature. Friction and controversy between buyer and seller often arise as to the question of facts concerning the results of tests, especially when different methods or different equipment are used. Standardized methods of test consider all of these conditions, and are a necessary part of an ideal specification for a material or a manufactured article.

The United States Government is probably the largest purchaser of materials and supplies in the world and the greatest impetus that could be given to standardization from the purchaser's point of view would be for the Federal Government to adopt standard purchase specifications for the more important materials and supplies purchased by it. This has recently been initiated by the establishment of the Federal Specifications Board, in the office of the Bureau of the Budget, which has brought together the experts of the various departments. As a result specifications representing the best commercial and engineering practice are being selected for the use of all departments and bureaus alike in the purchase of supplies.

The selection and adoption of specifications or standards, without due regard to the manufacturing problems involved, would be equally as serious as for manufacturers to establish standards without a careful consideration of the needs of the purchaser. In the selection of specifications for Government use, the Federal Specifications Board is co-ordinating these two interests, and the standards adopted will eventually be used for all Government purchases. This procedure will undoubtedly serve as a model to be followed by corporations, municipalities, States and the general public.

With many large corporations, the standardization of purchases, and the resulting simplification of store stock varieties of materials offer a fertile field for economy. The purchasing officer with a technical knowledge of materials and supplies, together with a knowledge of standardization principles, is best equipped to secure maximum results.

Change of Product

By A. W. Brown

There comes a time when the market for a product slumps or disappears. Hoop skirts are an example of such products. Cigars seem to be yielding place to cigarettes. Detached cuffs for men's shirts have almost disappeared from shops and laundries. Where are the bustles of yesteryear? And the men's long boots? And mittens, tall white beaver hats, "bone-breaker" bicycles, quill pens, letter-copying presses, bar fixtures, and dozens of other things?

So almost every factory may have to confront compulsory change of product. In emergencies, as in war time, they find it advantageous to drop their regular line and take something entirely different. In the Great War the stove foundry turned out shells while the type-writer plant made machine-gun parts.

It is then well for every factory to have a card up its sleeve and know what it would make for a change if its line of product went out of fashion or use. This is entirely independent of so-called "chink-in work," taken to fill up dull times in the regular line.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Straddle-Milling in the Lathe

By Henry M. Clary

The job here described was observed in the plant of the Central Machine Co., Detroit, Michigan. A large lot of small drop forged steel accelerating levers came in to be milled on both sides of the small end, the finished dimension being [illegible] in. As all the milling machines were in use, a pair of side milling cutters was mounted on a nut arbor and put into an old Rahn-Carpenter lathe.

A pin was then screwed into a small angle plate, the pin being of the diameter of the hole in the large end of the lever and so located that when the angle plate was bolted to the toolrest, the lever would be held in the position shown in the illustration. A block and thumb nut on a stud supplied the necessary clamping action. As the pin that held the lever was not over $\frac{1}{2}$ in. long, one or two turns of the nut were sufficient to allow the work to be changed. A block attached to the end of the angle plate nearest the cutters served as a rest for the lever. The operator fed the work in and out by hand and obtained a production of 100 per hour.

STRADDLE-MILLING IN THE LATHE

The Art of Milling in 1750—Discussion

By Matthew Harris

In an article under the above title by L. L. Thwing appearing on page 267 of *American Machinist*, Mr. Thwing draws the conclusion that the milling machine and cutter were the invention of a clock maker. By the same token it was a clock maker who devised the first universal milling machine, covering the principles of all such machines in use today.

Joseph R. Brown, originally a clock maker of Providence, R. I., invented the universal milling machine about 1861 or 1862. According to Professor Roe's "English and American Tool Builder," the first machine was built and sold to the Providence Tool Co. for making twist drills to be used in drilling the holes in percussion nipples for muskets. This was in 1862, at which time the Providence Tool Co. was engaged in a government contract for Civil War muskets.

An Ordinary Rotary Table as an Indexing Device

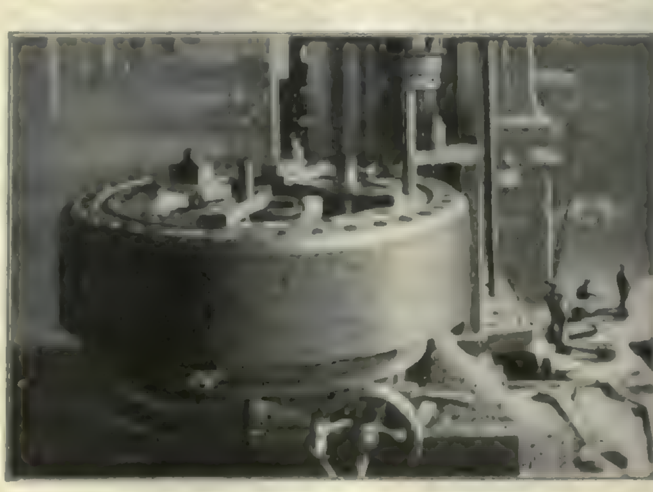
By J. M. Henry

The boring of a double circle of holes in a grinding fixture necessitated the use of an indexing device to locate the holes properly. The ordinary vertical milling machine, with rotary table, is neither large enough to handle the job, nor do the graduations on the table lend themselves to the required spacing. In addition to these reasons, the spindle of the machine is not considered sufficiently accurate as, although the spacing is not arbitrary to a minute degree, the holes when bored must stand perfectly square with the surface of the jig.

We found, by trial, that the handwheel of a Brown & Sharp rotary table in making one turn moved the table through an arc of three degrees. The outer circle of the work contained 36 holes and the inner one 28 holes, involving $3\frac{1}{3}$ and $4\frac{2}{7}$ turns of the handwheel respectively. We did need, therefore, to reduce our calculations to minutes of arc, but only to provide for thirds and sevenths in the rotation of the handwheel.

The logical solution of this was to divide the handwheel into 21 equal spaces and this was done by placing it upon an arbor between the indexing centers of the milling machine and using the regular dividing head.

A stationary mark for a point of departure was provided by clamping a suitable strip of sheet steel under a convenient screw head and scribing a line upon it, when the device was ready for service. The spacing for the holes of the outer circle was made by turning the handwheel 3 turns and 7 lines, while, for the inner circle, 4 turns and 18 lines were required. The holes were spotted, drilled, bored and reamed to a limit of accuracy in diameter of 0.00025 in. upon a Pratt & Whitney Jig Boring machine.

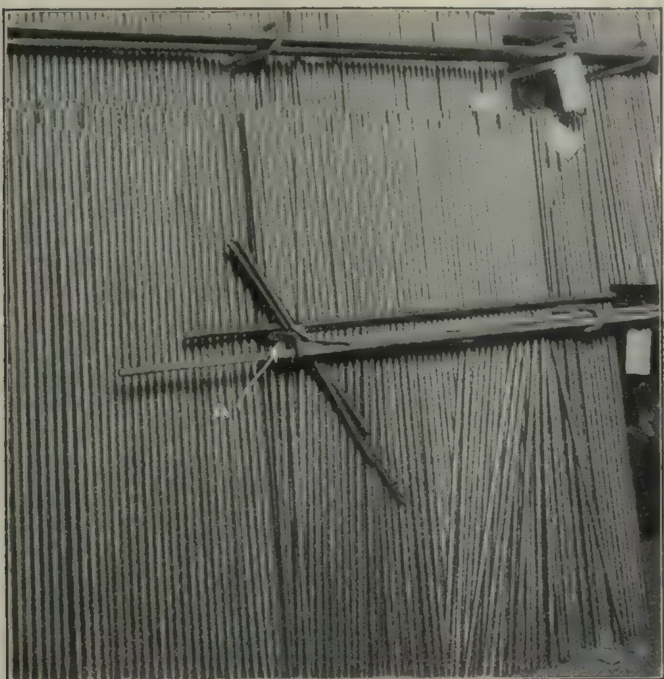


AN IMPROVISED INDEXING DEVICE

Storing Screw Machine and Similar Stock

By Herbert Crawford

The illustration shows a convenient method of storing screw machine stock in a small space and with safety. The loops shown are welded to flat bases which are bolted to the plates of the rack. The loops have cross bars or partitions, as can be seen at *A*. The stock is placed on end against the rack and, when the bars are all in place, one or two bars are slipped through the loops to tie the bars in position and prevent their being pulled over forward. This rack is in use by the Hoover Suction Sweeper Company at its plant in Canton, Ohio.



STORAGE RACK FOR BAR STOCK

Improvised Forms for Coiling Pipe

By I. B. Rich

Here is a pipe bending or coiling kink I ran across in the Griffith Machine Works, Los Angeles, some time ago. This shop does much experimental work and this job had a long pipe, coiled into a sort of a bed spring effect as shown in Fig. 1. The trick was to coil the pipe without kinking it and to have the coils uniform in diameter and appearance. Like many difficult jobs, it was comparatively easy after you realized the correct way to go about it. Fig. 2 shows the way it was done.

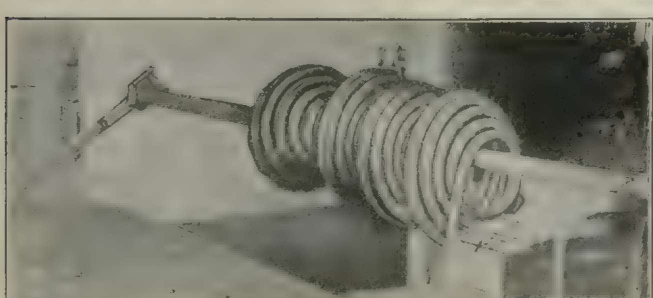


FIG. 1—THE COIL AS WOUND

A wooden form was turned up of the proper diameter to make the desired shape and the outside had a spiral groove to match the pipe. These forms were made in two parts, as at *A* and *B*, the two halves making a complete double cone. The cones were placed on a mandrel to center them and the pipe wound around them as in Fig. 1. The coils were then spread enough to let half the form come out, as in Fig. 2, and both halves were removed through the same opening. The coils were then sprung back and there was no trace of the forms having been removed.

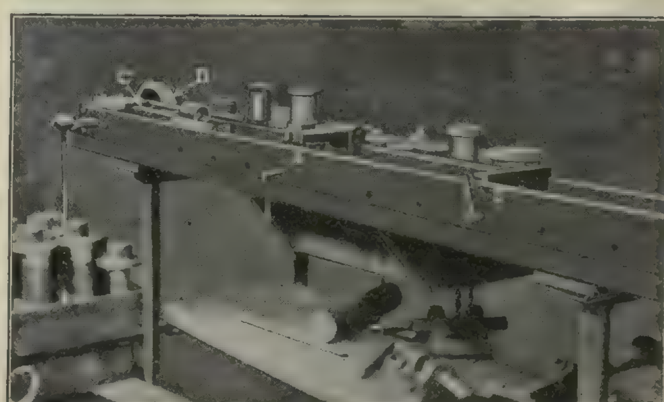
FIG. 2—REMOVING THE FORMS

Pressing Bushings on Long Rods

By Frank C. Hudson

Here is a useful little press which the Lucas Machine Tool Co., Cleveland, Ohio, uses to press bushings on the ends of long rods and screws. Instead of tapping the bushing on with a lead hammer and sometimes springing the screw, the screw is laid in suitable bearings, at *A* and *B*, and clamped fast. Then the bushing is placed on the end and forced on by a ram at *C*.

The ram is actuated by a pinion on a shaft which carries the wheel *D* on the other end. For rapid traverse the operating handle is placed on the pinion shaft and moves the gear direct. For power in forcing on the bushings another shaft is provided which carries a pinion meshing into an internal gear cut inside the wheel *D*. This arrangement gives a powerful gear ratio and has the advantage of operating in the same direction as the direct drive, which avoids confusing the operator. A ratchet wrench is used when desired, making it easy to get the pull at convenient angles. The holes in the side of the press show different positions at which the clamping blocks can be placed.



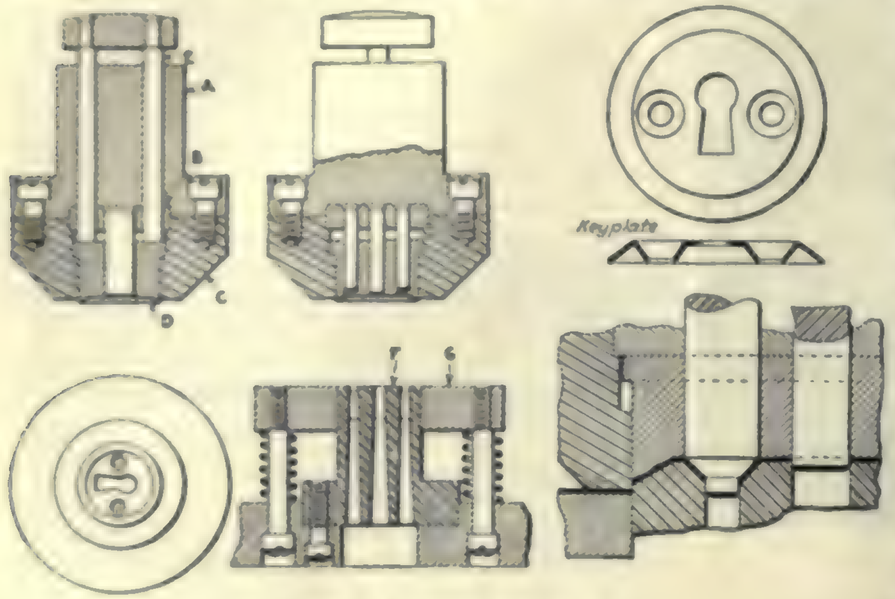
PRESSING BUSHINGS ON SCREWS

Die for Blanking, Piercing and Countersinking

By S. A. McDonald

In the accompanying illustration is shown a small set of tools for blanking, piercing and forming a keyplate. The plate is blanked from the strip, the holes pierced and countersunk, and the edge of the plate beveled at a single stroke, a complete plate being thrown out at each movement of the press.

The die is of the inverted type and is constructed as follows: The machine steel die holder *A* is turned to fit the press slide and contains the piercing-punch



DIES FOR MAKING KEYPLATE

plate *B*, the blanking die *C*, and the knockout *D*. The double knockout stem *E* extends through the die holder and piercing-punch plate and rests on the knockout so that it moves with it.

The punch *F* is located in a plate which is bolted to the bolster of the press. The stripping ring *G* is secured around the punch by the filister-head screws which have the pressure springs on them as shown.

Two unusual features of this die are that the cutting edge of the punch is beveled to 30 deg. and the holes for the screws are countersunk to suit the angle of the flat head screws. This does not seem to affect the cutting of the dies.

An enlarged sectional view of the cutting edges just as the key plate has been struck is shown to the right.

The die operates as follows: When the die descends the countersunk holes are formed and as the movement continues, the screw holes are punched and at the same time the blank is cut. As soon as the blank is cut the knockout comes up against the plate *B*, so that the key plate is bumped on the punch. This sharpens up the angle of the bevels and gives the key plate a neat appearance.

On the up-stroke the stripper ring strips the stock from the punch and when the die nears the end of its stroke the knockout bar of the press forces the knockout stem down in the die against the knockout pad *D* and thus strips the key plate off the three punches.

As the press is inclined, the work falls down a chute through the back of the press while the scrap punchings pass through the bolster to a scrap can.

Instructions to Workmen —Discussion

By T. Taylor
Chelmsford, England

In the *American Machinist*, page 954, Vol. 56, was published an article under the above title by C. J. Morrison. In it the author gives an instance of a workman who, by following instructions strictly to the letter, as given on the operation card, did not produce work as economically as might have been the case had the workman and shop superintendent been given the liberty to use their discretion and experience. The above example is not confined to America as I have experienced it since the war in one of the largest motor car works of England.

One of my jobs was machining brass magneto-platform castings, the sides of which must be milled central with the bore of the flange, providing true alignment with the magneto spindle. The first operation on the card issued by the planning office, called for boring and facing the flange. For operation two, the casting was bolted on the fixture on the milling machine table, locating the work from the bore. The sides and bottom were then milled, the workman trying to mill the two sides an equal distance from the center of the bore of the flange by repeated trial cuts and the use of gages. The result was that nearly always one side or the other was a few thousands out of center, although the instructions had been carefully followed throughout.

The next operation (not on the operation card) was closing in the sides in a strong vise to provide a little metal to rectify the job, known in the midlands as "doing Brummagen." Upon my suggestion to the shop superintendent that a better method would be to reverse the operations and first mill the sides and bottom, secondly bolting the casting on a jig, locating it from the sides, then bore and finish on a capstan lathe, the superintendent quite agreed that such should be the method but that unfortunately his hands were tied by the operation card issued by the planning office, under the control of the chief of that department, who has full authority.

I submit that the system of independent planning offices does not work for efficiency and for the shop superintendent or foremen to offer suggestion to the planning office is quite as disagreeable a job as offering suggestions or a little criticism to the drawing office.

I consider that best results can be obtained by giving the foremen the power and responsibility to plan the general operations of a job, subject, of course, to the approval of the works manager or superintendent. Tool layout and jigs should be left to the tool room department. With bad planning systems, foremen in some large works are nothing better than glorified clerks, which is very discouraging to men of initiative. What is more important, the firms concerned are ignoring a valuable asset. When a better way is seen, there is no wisdom in performing a job in an inefficient and expensive manner, simply because the man who first planned the work did not see all the possibilities.

Milling Clearance on Combination Center Drills

By King J. Bogardus

In the small machine shop where a great deal of centering is done, little difficulty is experienced in making a center drill, as far as turning the blank and milling the two grooves is concerned, but when it comes to filing the clearance it is found to be difficult and unprofitable.

The blanks can be turned in any lathe very rapidly by placing a center drill in the chuck or collet and setting the tool in correct position for turning, as illustrated in Fig. 1. The crossfeed will not have to be disturbed, and by moving the handle operating the carriage traverse by hand the angle and diameter can be turned with the same movement. Feeding with the compound rest handle, having the rest set on an angle of 1 deg., instead of feeding with the carriage handle, will make a better blank, due to clearance on the body of the drill.

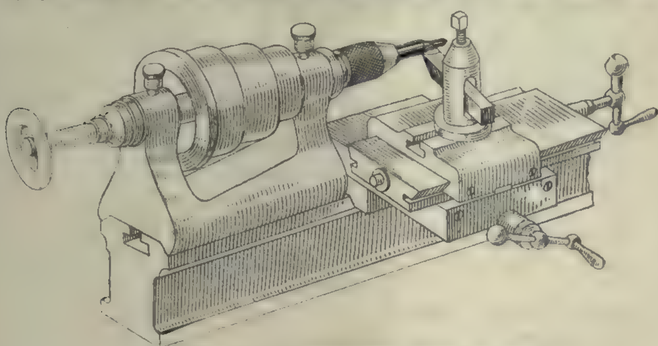


FIG. 1—TURNING THE BLANK

When the blank is ready for milling the clearance there may be rough-turning marks as the result of not feeding on the angle with the compound rest set at 30 deg., and there may also be a ragged edge on the flutes after milling; but all of these will be removed when the clearance is milled, and the milling will also correct the angle if necessary. The set-up for milling the clearance is shown in Fig. 2.

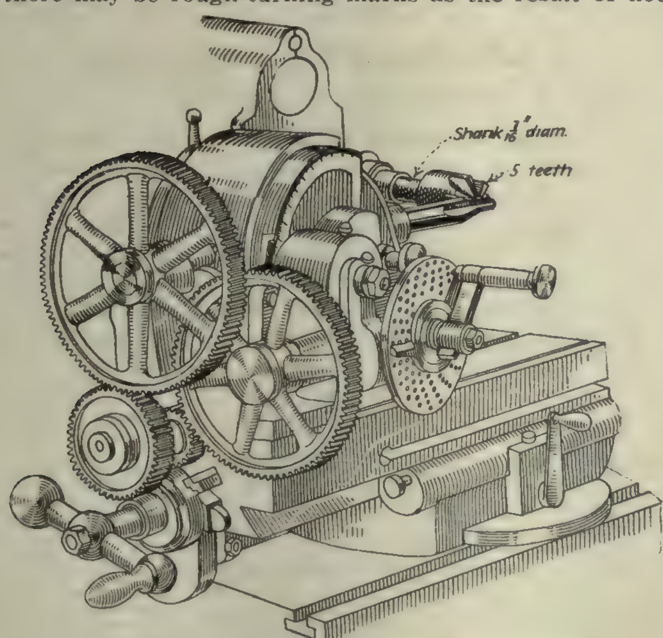


FIG. 2—MILLING THE CLEARANCE

Holding the cutter in the chuck of the milling machine spindle and the drill blank in the chuck of the dividing head, we are ready to mill this clearance. As most milling machines cannot be geared for milling spirals of shorter than ⅝ in. lead by gearing to the worm on dividing head, the gear is placed on the spindle of the dividing head which is revolved, feeding the table by turning the handle of the dividing head by hand.

Improvised Tools in the Oil Country

By Frank C. Hudson

In turning rods for oil pumps, which are about 6 ft. long and perhaps 1½ in. in diameter, the device shown in Fig. 1, has been found very useful. It consists merely of a plate *A* supported by the two substantial arms *B* and *C* bolted to the side of the saddle of the lathe carriage at *D*. The plate *A* carries two cutting tools on the front side, and three guiding rollers on the face shown. This device is in reality an improvised follow rest with roller guides, and has proved very satisfactory for work of this kind.

Another device in connection with oil pump work is shown in Fig. 2. This is an attachment for a vertical drilling machine, used in turning the pump valve cage,

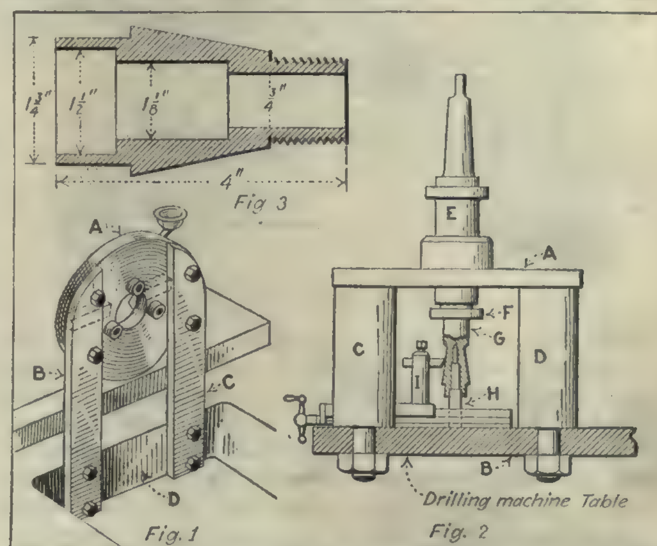


FIG. 1—ROLLER REST FOR TURNING PUMP RODS. FIG. 2—TOOL FOR TURNING AND BORING ON DRILL PRESS. FIG. 3—THE PIECE TURNED

shown in Fig. 3. The device consists primarily of the plate *A*, which is supported on the drilling machine table *B* by means of sleeves *C* and *D* held in position by the through bolts shown. The plate *A* carries the guide *E*, through which a special spindle, driven from the spindle of the drilling machine, works. The spindle carries a collet *F*, in which the stock *G* is held. Bolted in position on the table *B*, is a base carrying the combined drilling and boring tool *H* and also a tool slide with a toolpost *I* for turning the outside of the cage. The toolpost *I* can be adjusted to or from the center, so as to regulate the depth of cut, and also to turn straight or taper, as desired.

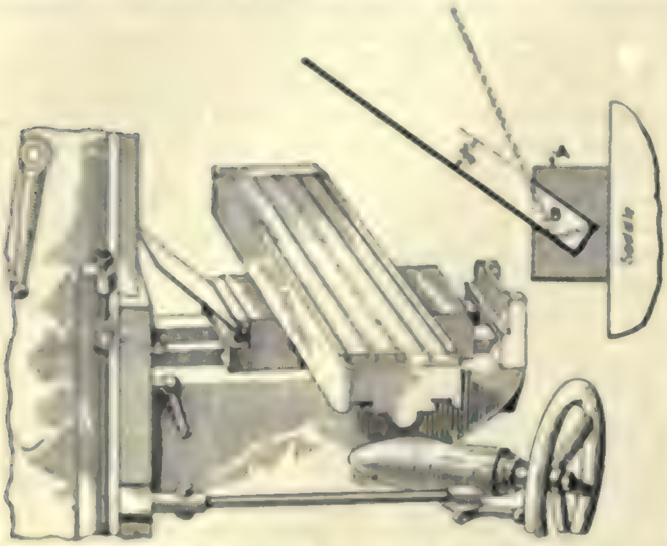
This is simply one of the many devices by which a vertical drilling machine can be used for turning, and was designed only because it was impossible to obtain a suitable turret lathe at the time. It has since been discarded but served its purpose well when it was necessary. These devices are from the shop of the Houston Pump & Supply Co., and were made under the direction of the guiding spirit, Mr. Thomas. The approximate dimensions of the piece turned are shown in Fig. 3.

Chip Catcher for the Milling Machine

By A. W. Freeman

The device shown in the sketch provides a means for keeping the saddle ways on a milling machine free from grit and shavings, thereby eliminating the cause of a great deal of trouble and wear to the machine.

The holder *A* was made from ½ x ¾-in. key stock and fastened to the inner side of the saddle, extending over each side of the knee about 2 in. The slot *B*, 3/16 in. wide by ½ in. deep, was milled its entire length. Three pieces of sheet metal of 20 gage were cut in different widths from 4 to 10 in. and long enough to overhang



CHIP GUARD FOR MILLING MACHINE

either side of the knee. One edge on each piece was turned up to approximately fit the milled slot, as shown.

By placing the metal plates in the holder, flanged side up, the flange will keep the plate from dropping down beyond the angle of the slot, which is about 25 deg., and will also allow it to raise up as shown by the dotted line when it comes in contact with the column. The different width plates are used at different settings, depending on the position of the saddle.

Re-Echoes from the Oil Country —Discussion

By J. T. Towlson

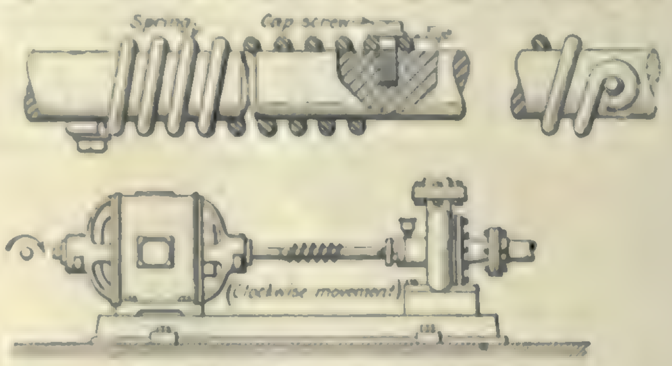
In an article under the above title by E. W. Tate, and published on page 963, Vol. 56 of *American Machinist*, Mr. Tate refers to the way an inside thread was cut on the end of a 40-ft. drill shank on a lathe with a 24-ft. bed. It was a great performance and showed what could be done when necessity demanded.

I have cut threads on bridge suspension-rods 40 ft. long in a lathe having a 16-ft. bed. The work was 4 in. in diameter and the threads were 2 per in. The length of the threaded part was 24 in. It was permitted to waste 1 in. of the rod, and three-quarters of this inch was used for chucking. The work was run in two steadyrests, one on the lathe bed and the other on blocking further along. The thread was started at the required position on the rod and, being right-hand, was cut toward the chuck. After the threading was finished, the rod was cut off at the chuck end, using a ¼-in. parting tool.

A Shock Absorbing Spring Coupling

By Joe V. Romig

When a motor is direct connected to a machine the armature shaft of the motor and the drive shaft of the machine should be connected by a flexible coupling to allow for any deviation in alignment. The accompanying illustration shows a flexible coupling which is merely



A SHOCK ABSORBING SPRING COUPLING

a spiral spring with an eye at each end for attaching to the shafts by cap screws.

The inside diameter of the spring should be slightly larger than the diameter of the shafts to absorb the starting shock. In applying the spring it should be stretched so as to be under tension when fastened in place and thus keep the abutting ends of the shafts together. Care should be taken to have the eyes on opposite sides of the spring and to have the ends of the shafts slightly rounded.

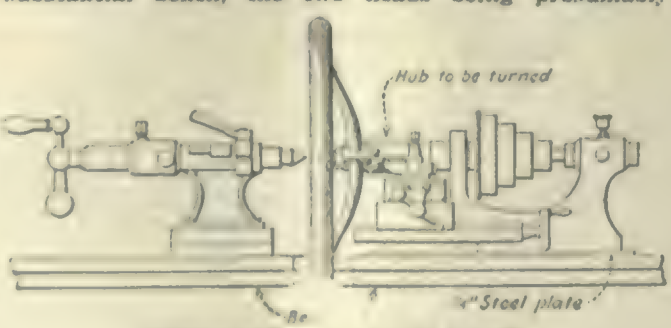
In addition to its ease of application and its smooth running qualities, this type of coupling is the cheapest that can be applied.

A Left Handed Gap Bench-Lathe

By Frank C. Hudson

In a small automobile repair shop where they make a specialty of putting on locks for steering wheels, I found the little lathe illustrated herewith. Installing the locking device necessitates turning the hub of the wheel to fit the locking sleeve, so the wheel is mounted in the improvised gap lathe shown, for the turning.

The headstock and tailstock are simply bolted to a substantial bench, the two heads being presumably



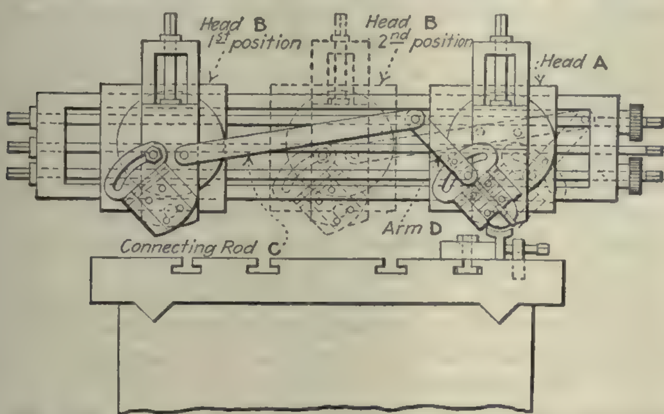
IMPROVISED BENCH LATHE

somewhere nearly in line. A gap is cut in the bench so as to allow large steering wheels to swing, as shown. The headstock has a ¼-in. steel plate between it and the bench and on this plate the small slide rest is mounted, as shown. The slide rest carries the tool for turning the wheel hub. It will be noted that the headstock is on the right.

Generating a Radius on a Planer

By Louis Hornbuger

We received a job the other day, 12 ft. long and 2⅛ in. wide, to be machined with a 1⅜-in. radius. The specifications called for accuracy and high class finish. Due to the length of the work, it was impossible to mill it except by making several settings which would not be good practice. The next thought was to do the work on the planer which we rigged up as shown in the illustration. Having an extra tool slide which had been discarded we milled it to clear the work and mounted it on head *A*.



HOW THE PLANER WAS RIGGED TO PLANE THE RADIUS

After making connecting rod *C* and arm *D* and attaching them, as shown in the sketch, to heads *A* and *B*, the head *A* was tightened on the rail central with the work. By means of power feed, head *B* was traversed from first position to second position and this moved the clapper block on head *A* through an arc, completing the operation and making a first class job.

Catching the Thread by the "Jump" Method —Discussion

By J. T. Towlson
London, England

In an article under the above title by B. A. Donley, published on page 970, Vol. 56 of *American Machinist*, Mr. Donley boosts the jumping method, whereas the writer, if he caught one of his men or boys acquiring such a disreputable practice when correct means were easily available, would himself do the jumping by way of having no further use for "the jumpers" services. Threads of both fine and coarse pitches have been cut for generations and in hundreds of shops without reverse belts, without dials and without "jumping" the thread.

There is no need of going to railroad shops hundred of miles from anywhere to discover an absence of dials and reverse belts, for ninety shops out of a hundred in England possess them not. The fact is that such helps to the amateur were a war measure and an assistance to the war mechanics who escaped service by working on munitions, though they had never worked in a machine shop before. Bona fide lathe hands do not need these helps, neither do they stoop to the "jumping" method. They just run the lathe and, after taking the first cut on the thread, they put a chalk mark on the face plate and another on the gear on the lead screw and then run the carriage back to a fixed position.

By always stopping the carriage at the same place on the return, and revolving the spindle until the chalk marks on the faceplate and gear are in the same relative positions as when made, the tool will be in the proper location, the half nut can be closed on the lead screw and the cutting of the thread proceeded with. The value of the reverse belt, as applied to particular cases, is by no means belittled by what has been stated above. There are some jobs such as cutting worms for wheels of diametral pitch when neither the chalking or "jumping" methods are practical. Such pitches are either multiples or fractions of 3.1416 and pitches that are sub-multiples of this dimension are rather fine fractions.

These threads *can* be cut by the chalking method but there is a risk and a waste of time in bringing the marks to their relative positions. Obliged to cut many hundreds of worms having diametral pitches of 4, 5 and 6, I made lead screws of 6 diametral pitch for two of our lathes. With such screws I was able to cut multiples or fractions of 3.1416 with the ordinary change gears and by the chalking method.

Blue Printing from Typewritten Sheets—Discussion

By Chester G. Salmon

In an article under the above title by H. Broome, published on page 271 of *American Machinist*, Vol. 57, Mr. Broome lays great stress on the importance of using a special ribbon for the purpose of writing on the copy for making plue-prints. We have in our factory about 35 data and part number books which are continually being revised and additions made, new prints being issued accordingly. The data sheets being mostly drawings were, of course, on tracing cloth but the part number sheets were quite a problem as we didn't care to print the part numbers on tracing cloth by hand. It would take up too much space and would almost require the services of one man changing the sheets and making additions, so we tried the tracing cloth in the typewriter, but with little success. Then we tried some Japanese tissue paper put out by the Remington Typewriter Co., with and without a carbon reversed. We found that the tissue with the carbon reversed, worked fairly well but we were not satisfied with it. It had to be run too slowly through the blue-print machine to get the best results.

We have some prepared oil that is sold by the Eugene F. Dietzgen Co., called "Transperento" which we use on van dykes, etc. to lighten their density. We tried this oil on the tissue paper after typing, got the very best results from it, and have been well satisfied with our success. We put the oil on the paper with a brush and then wipe off the surplus with a cloth. allowing the oil to dry before printing, and find that the paper has the greatest possible degree of permanent transparency.

Summing up, nothing out of the commonplace is needed except the oil and that can easily be obtained from almost any dealer of drafting supplies. In case only a few blue-prints need to be made from the original, gasoline or benzine can be used, but they evaporate quickly from the paper and leave it in the same condition as before. The oil can be used on heavier grades of paper but not with the best results. Sketches can be made on paper and then oiled and good blue-prints obtained. It would be advisable to use ink or a very soft pencil in making sketches.

Editorial

Charity Begins at Home—or Should

It would seem that a concern doing weaving should consider that weaving equipment has first call on whatever money is to be expended for improvements. Similarly, one engaged in spinning should make its investments primarily in spinning machinery and equipment, and not for a new and improved coal handling device. Again, a concern which manufactures its products with the help of machine tools, should give these machines first claim on investments.

Strange as it may seem, this is not the case in a great many, perhaps, the majority, of instances. The old lathe is still good enough, much too good to be replaced so long as it is in production, and, of course, it stays in production so long as its holds together or can be made to hold together by patching and repairing. The company cannot afford, just now, to spend $3,000 to replace a tool which is still active.

And yet, this same company is spending $50,000 on a new power plant because it is a good investment. It will borrow the money, if necessary, because a 10 per cent return has been promised.

This picture is not overdrawn. The cause of this peculiar phenomenon is possibly that the power plant promises a saving of coal, something tangible, whereas nobody has the temerity to guarantee a definite return on the investment when improved machine tools are bought. The machine tool builder does guarantee the performance of the machine, but he is not in position to translate the increased output into dollars and cents.

The man who sells the engine for power plant in general can point out that the saving in coal will be 3 tons a day, that this coal costs $6 a ton, and that there are 300 working days a year, so that the total saving will be $5,400 per year. This admits of an investment of $54,000 with a return of 10 per cent. As the outfit he tries to sell calls for $50,000 only, he has a good proposition and is very apt to convince the prospective customer.

Such a simple procedure is not possible when machine tools are sold. There is the operator to be considered, and besides, many different jobs are done on this one machine. Moreover, the real values of these jobs are not accurately known and it is difficult to compute the amount of savings due to the new machine. There are several other reasons, perhaps, and yet, it seems to us that the owner of a machine shop should first look after machine tools and similar equipment, that the owner of a drop forge shop should first consider his hammers, his presses and furnaces, and that, generally speaking, charity should begin at home.

On the other hand, a machine tool machine needs to be but little more productive to give 10 per cent on the investment. To save $200 a year with a $2,000 machine should be easy. It might even be done though the new machine is in no way different from the old one, just because it is new and requires less attention and repairs and interests the operator, much as a new automobile puts the chauffeur on his best behavior.

Give Them a Long Vacation

The statement in this morning's paper that President Harding believes the members of Congress should have a long vacation is very welcome. Mr. Harding is quoted as having said that the country is fed up with Congress and its actions and he is absolutely and entirely correct, so far as this Congress is concerned at any rate.

It seems as though the national legislators had been in practically continuous session since our entry into the World War. Of course they have not, but, if the extent to which they have irritated the average citizen is any criterion, they might as well have been.

With Congress out of the way business can proceed more freely. No uncertainty as to pending legislation hangs over business men and they are assured of at least a fair breathing space before more laws can be passed. Bad as the taxation and tariff acts may be, they are at least definite and steps can be taken to meet their requirements.

As usual the majority leader has pointed with pride to the number of bills passed, something over four hundred. If quantity were the only requisite no fault could be found, but when it comes to quality—well, just consider how many obsolete, worthless and unenforceable laws there are on the statute books. One of the obvious defects of our form of government is the ease with which such laws can be passed. Truly we have a "government of laws."

How our problems would be simplified if only a Congress could be assembled to repeal the unnecessary legislation which encumbers the business of living. But what a Herculean task it would be!

China Trade Bill Becomes a Law

During the past week, the President signed the China Trade Bill. It is now a law after a campaign for its enactment which lasted nearly three years. Unfortunately, with tariff legislation occupying the foreground in national affairs, the purport of the bill and the placing of it upon our statute books has not been accorded the publicity it properly deserves.

In brief, the bill is designed to aid Americans, desirous of engaging in commercial or industrial activity in China, by relieving them of a two-fold tax burden. Under the Hongkong ordinances, British companies, and their personnel operating in China, were exempted from corporate and personal income taxes in Great Britain. American enterprise was thus placed at a distinct disadvantage. Corporate taxes were paid at home and abroad. Upon the personnel sent out from the States was laid a similar burden.

Living in China even under the best conditions is far different from what it is in the States. The cost of housing, food and other necessaries, everywhere in the Far East, is exceedingly high. Conveniences for unmarried men, not to mention those with families, are trying even under the best circumstances. To lighten their burdens and those of their companies should be our first thought.

Editorial

What Should We Do About It?

We have before us a copy of the *New York Commercial* in which appears a lecture given by Mr. Floyd W. Parsons, Editor, *Gas Age Record*, before the Advertising Club of New York on Sept. 20. In this lecture Mr. Parsons points out and condemns the fearful waste of materials of which this country is guilty. He goes so far as to say that, just as we are speaking now of the stone age, the bronze age and so on, so will future generations speak of the present era as the age of ivory domes. We have no fault to find up to that point for ivory is a nice, genteel material and quite valuable. But when he said a little later that it was established beyond doubt that we (in common with the rest of the inhabitants of the U. S. A.) were possessed of domes of solid bone, we sat up and took notice. We felt that we had to look a little further into this matter before we could accept the verdict.

The lecturer pointed out how much coal could be saved by using our water power, something which cannot easily be denied. He then went further and showed how we are depleting our reserves of iron ore, how the consumption of iron had increased since the beginning of this century and how it is still increasing. Copper also, Mr. Parsons claims is used at a rate which may exhaust the supply in a few years, while oil is already burned at a rate much beyond the rate at which it is produced in this country and this rate itself must exhaust the visible supply in a generation.

The picture is indeed a sad one. It reminds us of the lamentations of Jeremiah and also of Mark Twain when he said: Everybody complains about the weather, but nobody seems to do anything about it. (We quote from memory).

That's it. What is Mr. Parsons going to do about it, or what does he expect us to do about it? We are willing to obey orders if somebody is willing to give them and assume responsibility.

He does give orders about coal. He says: "Develop our water power," Good, we'll do that, we have already started. Truth compels us to remark at this point that, if we wish to utilize this developed water power, we'll need more copper than ever. Or is there perhaps a way to avoid it? Aluminum? Then we'll begin to exhaust that material. Oil is used almost entirely where water power can do no good, for automobiles, trucks, steamers, so that it seems as if the most promising way to save oil is not to use it. This method also goes for iron. There is at present no material which can take its place. But how can we live the life we wish to live without iron?

The trouble with articles and lectures such as Mr. Parsons' is that they are merely complaints. They are not constructive, they do not help. Of course we can cut down the consumption of anything by lowering our standard of living. We can even go back to the single stove in the home and perhaps family relations might be improved if all the members were sitting around it each night. We might become sturdier and hardier if all other rooms in the house were left cold. Maybe.

Candles made from the tallow of home butchered sheep may make electric light and its copper and even kerosene unnecessary. And, as we have butchered our own meat, the butcher does not need a delivery truck, which saves more oil. Also we do not need to call him up by telephone, which saves more copper.

Oh yes, we could, but would we?

The End of the Bonus

President Harding has justified the country's faith in his sound judgment by his veto of the so-called adjusted compensation bill, passed by Congress. At the same time, Congress has, by its action, added one more point to its score of mistakes. There seems little reason for doubt that most members of both Senate and House, who voted for the bill, did so with an eye to the votes to be gained by so doing. It is our feeling, however, that they were mistaken in their estimate of public sentiment and we have evidence to support our view in what happened at the primaries to some of the strongest advocates of bonus legislation.

Commendation is also due those Senators who sustained the President's veto. Perhaps they should be praised as much for their political acumen as for their support of an executive action which is undoubtedly for the good of the country. At any rate, they did a good job and American business men will breathe more freely as a result of the laying of the bonus specter.

Aside from the merits of the case as to whether or not ex-service men should receive a bonus, the bill, which has just been disposed of, was faulty in that it failed to provide means for securing the funds needed to carry out its provisions. It deserved its fate.

Just Suppose

Just suppose a big strong man, a giant of a fellow, were the employer of a number of men and wanted these men to turn out more work per hour and work more hours per week. Suppose that the men being unwilling, he fired them all and said to them:

"You are suspended until you make up your minds to work for me on my conditions, but don't you dare to go to another shop. If you do, I'll do everything in my power to break you and bring you to poverty. You have your job just as before, but I won't let you work at it and I won't pay you for it."

Now suppose some of the men, having no sense of honor, fairness, or decency go to the big man's neighbor, ask for and obtain a job and the big man, hearing this, knocks some of his neighbors down, kills one of them and burns the factory of another. Don't you think he is perfectly right and that no court should stop him with a fool injunction?

Nonsense, such things may be done by strikers but not by—

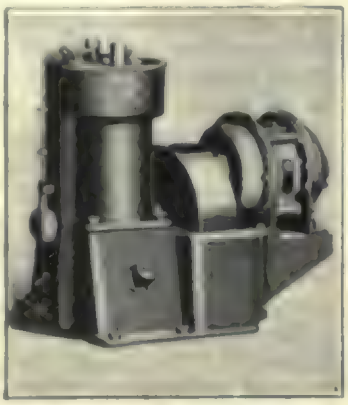
Well, but

Just suppose.

Shop Equipment News

Ingersoll-Rand Small Vertical Air Compressors

A line of small vertical air compressors known as Type 15 has recently been brought out by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y. At the left of the accompanying illustration the plain belt-driven machine is shown, and at the right the self-contained electric-motor-driven outfit. The machine is built in four sizes in either style. With the motor drive, the compressor may be driven by means of a pinion and internal gears, or by a short belt. Both motor and compressor are mounted on a common sub-base, so that they are not dependent upon the foundations for correct alignment.

INGERSOLL-RAND VERTICAL AIR COMPRESSORS

The principal features of the construction lie in the constant-level lubrication system, the constant-speed unloader for the belt-driven machine, and the centrifugal unloader for controlling the starting and stopping. The base of the compressor forms an oil reservoir. Above this reservoir and directly underneath the connecting rod is a constant-level pan to which a small pump forces oil from the reservoir. If the amount of oil in the reservoir, is kept between the high- and the low-level pet cocks that are provided, the system will continue to function and keep the oil at a constant level in the pan. A projecting stem on the connecting rod dips into the pan and distributes the oil to the bearings.

When the receiver pressure rises above that at which the unloader is set to operate, the constant-speed unloader automatically opens the inlet valve, so that no more air is delivered. When the receiver pressure has fallen to a predetermined amount, the unloader automatically releases the inlet valve and allows the compressor to again return to work.

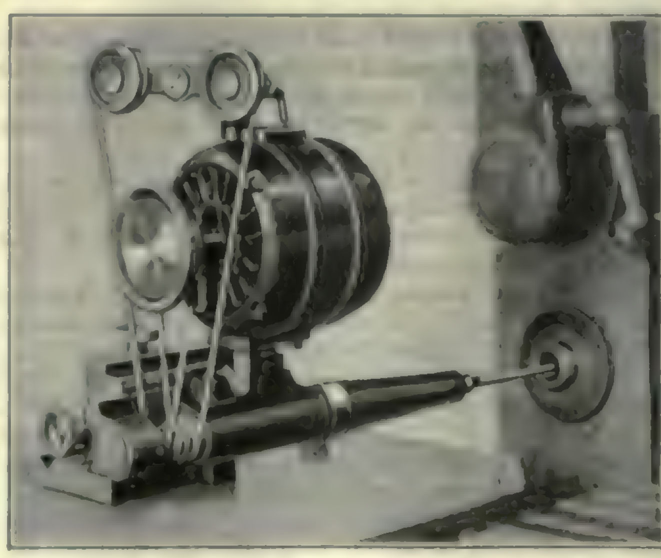
The centrifugal unloader permits the compressor to start under "no load," as is essential when automatic start-and-stop control is used, and it allows the driving motor to come up to full speed before the load is thrown on. This unloader operates by holding the inlet valve open until the motor has reached full speed.

The smallest size of the machine is built with either a ribbed cylinder for air cooling, as shown at the left of the illustration, for use where the service is intermittent, or with a water-jacketed cylinder of the reservoir type for constant service. All other sizes are built with the water jacket, as shown at the right. The reservoir pots are of large size and capacity.

"Precision" Extension Spindle and Housing for Thread Grinder

An attachment consisting of an extension housing and an extension spindle for all models of its multi-graduated thread grinder, such as described on page 160, Vol. 52 of *American Machinist*, has recently been placed on the market by the Precision & Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa. The device is applicable to deep internal grinding and can grind to a depth of 12 in. on holes 2 in. or greater in diameter, and to a depth of 6 in. on holes ½ in. in diameter.

The device has a number of uses, and can be mounted on machines of different types. It is shown in the illustration herewith mounted for grinding the tapered bore of a milling machine spindle. Such an operation can be quickly performed, so as to give perfect concentricity to the bore after it has become scored or worn. The tapers of lathe spindles can be ground in the same manner, with the grinder mounted on the toolpost. Besides grinding deep holes in jigs, fixtures and other work, holes that are difficult of access because of projecting obstructions can be reached.



EXTENSION SPINDLE ON "PRECISION" GRINDER

The extension housing is screwed directly on the threads at the front of the spindle cap of the grinder. The extension spindle couples on the end of the regular spindle by means of a tapered joint. It is supported by double radial and end-thrust ball bearings at the extreme outer end of the housing. The mounting is stated to give rigidity at the wheel end of the spindle.

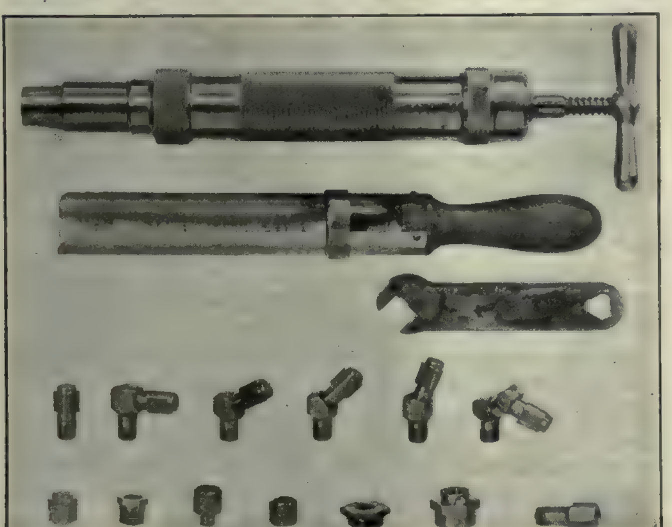
"Dot" High-Pressure Hand-Operated Bearing Lubricator

A device for forcing oil or grease into bearings has recently been placed on the market under the name of the "Dot" lubricator by the Carr Fastener Co., Boston 39, Mass. The lubricator, which is hand operated, is adapted to use on all sorts of machinery where shafts or bearing surfaces require lubrication, such as cranes, stokers, conveying machinery, machine tools and automobiles.

Nipples are applied to the bearing boxes in the position where the oil hole or the oil cup is normally placed. Each nipple is provided with a spring loaded ball in the top that automatically closes the opening except when pressure is applied on it. Thus the hole is normally closed to prevent both the escape of oil from the bearings and the entrance of dirt. The nipples can be furnished to face at all angles, so that they can be easily reached by the lubricator itself. At the bottom of the accompanying illustration are shown a number of styles of nipples. A small dust cap is placed over each nipple, but can be readily removed for oiling. Extensions can be furnished in any length required. Reducing bushings and couplings, also shown, can be supplied in the desired sizes.

The lubricator proper consists of a pump which is fitted with a plunger for ejecting the oil from the forward end. This plunger is screw operated by turning the handle at the rear. The nozzle is an integral part of the device, so that no flexible coupling is necessary. The inside of the nozzle has a special triangular shape to fit the nipples. It is applied to the nipple, and the handle given a slight turn to the right, so that the nozzle locks to the nipple.

With further turning the valve in the lubricator



"DOT" LUBRICATOR AND FITTINGS

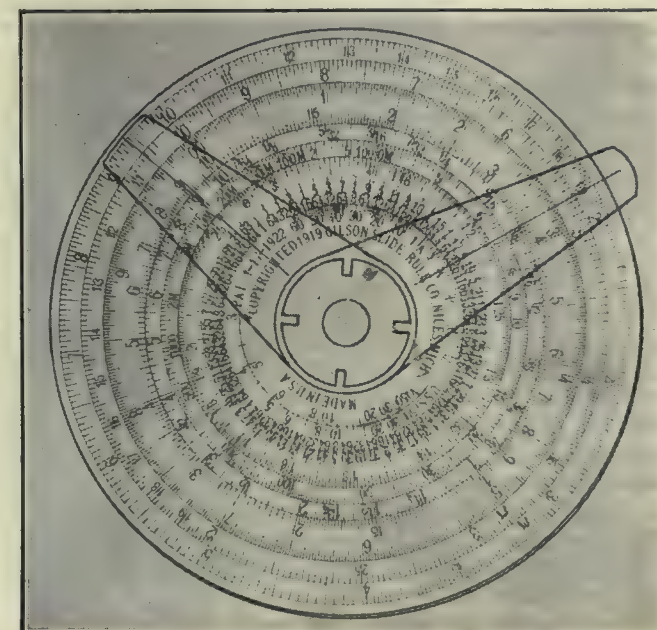
opens and the oil or grease is forced under high pressure into the nipple and to the bearing surfaces. A quarter turn of the handle to the left releases the nozzle from the nipple. No further turning back of the handle is necessary to prevent the escape of lubricant from the lubricator, as the valve automatically shuts off the passage.

Since such a high pressure can be obtained by the use of the device, either oil or grease may be forced into the bearings. If desired, kerosene may be employed before putting in the oil, thus washing off the surfaces. For use with grease, the filler shown in the illustration is furnished. The principal feature in the operation of the device is the fact that it can be used with one hand only, so that places difficult of access can be reached. The operator can thus lubricate bearings very rapidly.

Gilson "Midget" Circular Slide Rule

A circular calculator has just been placed on the market by the Gilson Slide Rule Co., Niles, Mich., under the name of the "Midget" slide rule. This instrument has all of the scales of the regular slide rule and several additional features which make it especially useful in the shop and drafting room.

There are nine engine-divided scales on the front side of the instrument and two celluloid indicators with hair lines for close reading. The long indicator always gives the answer to the problem that is being solved.



GILSON "MIDGET" CIRCULAR SLIDE RULE

On the back side are scales for giving sines, tangents, cosines and cotangents of all angles from 0 to 360 deg., and the decimal equivalents of fractions to six places.

The binary scale is divided into 64ths, 32nds, 16ths, etc., so that fractions and mixed numbers can be multiplied and divided without changing them to decimals. There is a scale divided into equal parts for reading to 0.001 in., concentric with a scale divided into 64ths, so that fractions and decimals may be added and subtracted and the result can be read as a decimal or to the nearest 64th.

Concentric with these two scales are the thread and drill size scales. The sizes of all drills from 60 to 1 and from A to Z are given in thousandths and to the nearest 64th of an inch. The thread scale gives the size of drill to use with any size tap having any V or U.S.S. thread from 3 to 50 per in. The size of the drill may be read as a fraction, a decimal, or a numbered or lettered drill.

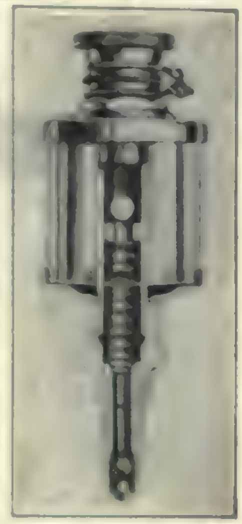
As the rule is 4 in. in diameter, the outer or C scale is about 12 in. long. This scale is for the ordinary operations of multiplication and division. The A scale gives square roots and the corresponding powers. There is a log-log scale which is a spiral and is graduated between 1.15 and 1,000,000. This scale gives every

possible root and power of any quantity. It also gives the natural logarithms (base e) of all numbers between 1.15 and 1,000,000. Another scale gives the common logarithm (base 10) of all numbers. There is a graduation at 0.3937 in. marked "c" which is equal to 1 cm., and other useful graduations as 3.1416 and 0.7854 are indicated.

With the exceptions of the log-log, thread and drill scales, all of the graduations are on circles. It is therefore impossible for the answer of a problem to fall off the end of the scale, as often happens when a straight slide rule is used. The graduations are on white celluloid mounted on aluminum, and are waterproof.

Auto-Vac Ball-Feed Bearing Lubricator

A lubricator for machine bearings designated as the "auto-vac" ball-feed lubricator has recently been placed on the market by the Kelly Lubricator Corporation, 107 N. Franklin St., Syracuse, N. Y. The device, which is shown in the accompanying illustration, is stated to be adaptable to practically all bearing speeds so that lubrication is positive and automatic at any speed.



AUTO-VAC BALL-FEED LUBRICATOR

A small ball fitted at the bottom of a sliding tube rests on the shaft to be lubricated. This ball is free to rotate in its tube, in which are small oil channels, and which is held in place against the shaft by means of a small spring. The oil adheres to the surface of the rotating ball and is carried to the bearing surfaces by the revolving of the shaft. As soon as the oil film has been formed between the sliding surfaces of the bearings, the film seals the opening between the ball and the end of the tube, so that no more oil is fed to the shaft. It is stated that more oil does not leave the cup until this film has become broken. Since oil is fed only when it is needed on the bearings and not when the machine is at rest, a considerable saving is stated to be possible. The positive lubrication is of value particularly on bearings using high speed, such as on blowers and grinders, as the shaft is always kept lubricated. After the lubricator has once been adjusted, no further adjustment or setting is necessary when starting or stopping the machine.

The oil cup has a large opening at the top for filling it. The glass body is held in place by a brass top and bottom fitted with gaskets. The base of the cup has standard pipe threads and the stems are made in various lengths to suit the thickness of bearing cap to which the lubricator is fitted. The lubricator is made in four sizes having capacities of ¼, ½, 1 and 2 ounces.

Grinding Off Stock

By Entropy

The other day I dropped into a shop where they make among other things some good sized axes. The axes are, of course, first forged and then ground to get their shape, then hardened, tempered and ground to sharpen them. In the room where they were doing the first grinding I looked at the wheels and the work and watched the men. It looked as though they were working unnecessarily hard and as though it was taking more power to do the job than it should, and that they might do the work faster, and do less work and use less power if they used a softer wheel. I asked the superintendent, who was going through with me, if they had ever tried using a softer wheel. He said that they had, that he thought the softer wheel was the right thing, but that their shop was "different" and that it did not pay.

Further inquiry brought out this state of affairs. The men are piece workers, they have many of them been in that kind of work for years, back to the time when such work was all done on natural grindtsones, and when it was considered that an emery wheel would ruin the work if used. They were used to bearing on very hard. When the soft wheels were tried the men bore on just as hard as ever, with the result that they overheated both work and wheel. They ran up their earnings very fast, but they had a great number of mishaps due to bursting wheels, which could only be laid to the overheating of the wheel. Consequently, the management went back to their standard grade, and the accidents ceased and everybody was satisfied, except the firm that did not make as much money and the workmen whose earnings went back to their old rates.

Difficulty of Training the Workers

The superintendent found it impossible to educate these older men to bear on somewhat less, and to be satisfied with something less than the maximum rate of pay which they might have made. He had thought of letting out all the old hands and training up a new crop of men to take their places who would not have any oldtime experience to unlearn, and who would be willing to learn the way the shop thought best, but sentiment was strong and he did not want to see these older men out of a job with no place nearby to go.

So grinding becomes a labor problem rather than a scientific one, unless it can be said that sizing up of human nature is scientific, which does not seem likely. Here is an industry handicapped by the fact that its workmen have a rich and long experience, and know how in their own minds to do a given job. They do not accept the new-fangled idea of making their own work lighter and their pay envelopes heavier, but prefer to continue their old laborious methods.

Of course the solution lies in employment of younger men who have no precedents to break down, but who must take a long time to learn to shape these axes so that they will hang well and be acceptable to the men in the woods who buy them. But these older men are entitled to credit for what they do know, and their experience has to be weighed against the inexperience of the new men. The firm has to decide whether it will uninterruptedly turn out axes acceptable to the men in the woods and let the cost run high, or whether they will cut down the cost by employing men who cannot get the correct shape every time and whose product is less expensive but also less saleable.

In this instance the cost of sales is considerable, for these axes cannot be sold direct from the shop to the consumer but must be distributed to every hardware store and every general country store on the continent and then to some more continents. Here the cost of selling something that did not just exactly suit a customer of whom the factory knew nothing outweighed a very substantial reduction in the cost of manufacture.

News Section

National Airplane Races Will Draw Big Crowd to Detroit

Widespread interest is being centered in the National Airplane Races which will be held at Selfridge Field, Mt. Clemens, Detroit, October 7, 12, 13 and 14. The races will be conducted by the Detroit Aviation Society, and are sanctioned by the Aero Club of America.

The official program of the races which has just been issued, schedules the following events:

Event 1. October 7, Detroit Aerial Water Derby, including the Curtiss Marine Flying Trophy. This will be a free-for-all race for flying boats and seaplanes. First prize, $1,200; second, $600; third, $200, and award of Curtiss Trophy to winner. Distance 160 miles.

Event 2. October 12, Detroit News Aerial Mail Trophy. This will be a race for large-capacity multi-motored airplanes. Cash prizes, the same as in Event 1, and award of trophy to the winner. Distance 240 miles.

Event 3. October 12, Aviation Country Club of Detroit Trophy. This will be a race for light commercial airplanes. Cash prizes, the same as in Event 1, and trophy to the winner. Distance 240 miles.

Event 4. October 13, Liberty Engine Builders' Trophy. This will be a race for observation type (2 passenger) airplanes. Cash prizes, the same as in Event 1, and trophy to the winner. Distance 240 miles.

Event 5. October 14, Pulitzer Trophy, free-for-all race for high-speed airplanes. This race promises extraordinary features because of the new types of high speed craft which are entered. Cash prizes, the same as in Event 1, and award of Pulitzer Trophy to the winner. Distance 160 miles.

Power Exposition Will Draw From All Industries

Engineers well known in industrial and public utility power generations make up the advisory committee which is guiding the National Exposition of Power and Mechanical Engineering. This exposition will open at the Grand Central Palace, New York City, on Dec. 7 at noon and will extend through to Dec. 13 (except the intervening Sunday). It will immediately follow the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. Irving E. Moultrop of the Edison Electric Illuminating Co., Boston, heads the advisory committee, and his colleagues are: Dexter S. Kimball, president the American Society of Mechanical Engineers; Alexander G. Christie, chairman, power division, A. S. M. E.; Fred Felderman, national president, National Association of Stationary Engineers; Milan R. Bump, president, National Electric Light Association; N. A. Carle, vice president, Public Service Production Co. of New Jersey; E. B. Katte, chief engineer, Electric Traction, N.Y.C. R.R. Co.; Fred R. Low, Editor *Power;* David Moffat Myers, consulting engineer; Calvin W. Rice, secretary, A. S. M. E., and the managers, Charles F. Roth and Fred W. Payne.

The list of firms who have already reserved space shows that all apparatus and materials used in harnessing the energy released from fuels will be represented.

All members of the American Society of Mechanical Engineers who attend the meeting will receive the half fare return certificate which will enable them to attend the exposition.

Italy as a Market for American Machinery

It would doubtless pay American manufacturers to watch the Italian market, says a correspondent writing from Switzerland. While during the last few months German, English and Swiss sales agents are to be found in almost every large city seldom is an American salesman met in Italy. And yet there are many opportunities for American machinery manufacturers. American-made machines are in high favor in that country and a special opportunity is being offered by the extension of most of the Italian seaports.

The Italian Parliament has just passed a law according to which no less than 1,500 million lire will be appropriated for the extension and reconstruction of some of the foremost Italian ports. The harbor of Genoa will receive 144 million lire for this purpose, Venice 85 million lire, Bari the same amount, Savona and Cotrona receive 84 million lire each, Palermo on the island of Sicily, 66 million lire, Naples 50 million lire. Ostia, the port of Rome, is to receive 47 million lire, Messina and Spezia 40 million lire each and Catania, 36 million lire.

The rest of the amount will be spent for reconstruction and extension work on the ports of Leghorn, Oneglia, Ancona, Riposto, Corsini, Ortona, Civita-Vecchia, and Rimini. Manufacturers of dredging and excavating machinery, pumps, etc., should pay special attention to the possibilities offered in Italy during the next few years.

Cost Accountants Elect Officers

The National Association of Cost Accountants in convention last week in Atlantic City elected J. P. Jordan, industrial engineer of New York, as president; C. M. Finney, of New York, first vice president; S. L. Whitestone, Schenectady, second vice president, and Harold Dudley Greeley, of New York, as treasurer. The secretary is named by the executive board.

C. R. Stevenson and W. S. Gee, of New York, were elected directors for three years and William M. Lybrand and H. B. Fernald, New York, for one year.

American Bankers Association Convention

Plans for one of the greatest financial congresses in the history of the nation are contemplated in the arrangements for this year's convention in New York City of the American Bankers Association, falling as it does at a particularly formative time in the new era of world business, it is declared in a preliminary announcement of the program issued by the association during the past week.

The convention, which is the forty-eighth annual meeting of the association, will be held at the Hotel Commodore, New York City, Oct. 3, 4 and 5.

The Right Honorable Reginald McKenna, formerly Chancellor of the British Exchequer and now chairman of the London Joint City and Midland Bank, will discuss 'Reparations and International Debts.' Thomas W. Lamont of J. P. Morgan & Co. will treat world finance from the American viewpoint. Henry J. Allen, the fearless, aggressive Governor of Kansas, will discuss the responsibility of the government for industrial justice and the relation of the Federal Reserve System to American business.

Gear Manufacturers to Hold Semi-Annual Meeting

The American Gear Manufacturers Association will hold its semi-annual meeting at the Drake Hotel, Chicago, Ill., October 9, 10 and 11. An impressive program has been outlined which in addition to reports of committees and routine business, will include a number of interesting addresses. Among these will be "The Evolution of the Gear" by George L. Markland, Jr., president of the Philadelphia Gear Works; "Apprenticeship" by P. C. Molter, superintendent, Department of Industrial Education, The National Metal Trades Association; "What the Association Needs from Committee Men, After Nearly Six Years Secretarial Observation" by Frank D. Hamlin, vice president, The Earl Gear and Machine Co.; "Why Buy a Pig in a Poke" by L. G. Hewins, sales manager, The Von Dorn & Dutton Co.; "Sandardization of Gear Sounds" by Prof. Daniel L. Rich, University of Michigan; "Engineering Research" by Prof. A. E. White, Department of Engineering Research, University of Michigan, and others.

The regular informal banquet will be held on Tuesday October 10. John B. Foote, president of Foote Bros., Gear and Machine Co., Chicago, who is one of the older members of the association will be toastmaster. The speakers on this occasion will be the Hon. Marcus Kavanagh, Judge of the Superior Court of Cook County, Illinois who has announced as his subject "Business Man and Law Enforcements"; and General John V. Clinnin who will speak on "Effect of the Late War of the World."

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

AT MY request checks for comparatively large amounts on 14 of the more important New York banks and trust companies were cashed last week. "20's" and "50's" were asked for but the currency in which payment was desired was not otherwise specified. Against these checks the payees received an average of about 60 per cent in gold certificates or "yellow backs."

These "yellow backs" as is generally known, are receipts certifying that the equivalent in gold has been deposited with the United States Treasury and is payable to the bearer on demand. I arranged to have the checks cashed to ascertain whether there was any basis for the report that the banks were making an effort to get gold into circulation. The result seems to indicate that such an effort is being made.

As to its purpose opinions differ, but it is plain that if a substantial portion of the gold now impounded in the Federal Reserve Banks is put into circulation a reduction in the reserves, the reserve ratio and the lending power of the banks will follow. As the gold held by the Federal Reserve Banks gained $15,000,000 last week and the reserve ratio stands at 78.4 per cent the distribution of a few millions of gold does not make much difference just now, but the fact that the gold which was so jealously accumulated two years ago is now being paid out unasked for seems to suggest that the banks realize that its retention where it can be seen might incite inflation and that they are doing what they can in a quiet way to get it out of sight.

Incidentally it may be observed that if we ceased to import gold and the banks succeeded in forcing any considerable amount of their holdings into circulation the resulting reduction in reserves would be reflected in higher interest rates and a decline in the price of bonds and those dividend paying securities that fluctuate in inverse relation to the money market.

Coming events sometimes cast their shadows before and it may be that the decline in Liberty Bonds and other high class obligations is due to the selling of some long headed financiers who foresee "tighter money" sooner than is generally expected. Meantime all the Liberty 4¼ per cent issues are again below par and the enormous transactions recorded during the week indicate that some very large holdings have been disposed of.

These considerations and the expectation that Secretary Mellon will shortly undertake some very important refunding operations that will temporarily tie up much capital lead me to feel that for the present at least any further advance in the security market is unlikely.

Special stocks may be put up for special reasons but commercial loans are gradually increasing and bankers probably foresee a further demand for money from merchants that would make it difficult to finance a concurrent boom in stocks.

As to our domestic trade in merchandise all the indicia continue favorable. Some hesitancy has, however, been induced by the apparent truculence of Kemal and the fear that he may compel Great Britain to resort to force or attract the support of the Russian Soviet army. The news from Constantinople and Asia Minor may, in fact, be interpreted according to taste. No one really understands its import or can foresee the future. Most thoughtful Americans are disposed to be cautiously confident of peace, although we are so isolated that the outcome will not make much difference to us in a material way except as it may affect Europe's ability to buy of us and our export trade.

> **Although confident of peace, thoughtful Americans are looking upon the situation in the Near East with caution. While our trade on this side of the Atlantic and with the Orient may not be greatly affected, an outbreak of hostilities would, without doubt, disturb seriously our commerce with Europe.**

But when we consider our own tariff bill and the impoverishment of Europe it becomes a question of whether we can expect much transatlantic export trade in any event. Three of the largest American life insurance companies have announced their withdrawal from all Europe except England and our financial and commercial relationships with the territory thus abandoned are likely to become more and more tenuous pending the re-establishment of fiscal and political order.

This is why I doubt whether business in the United States would be much shocked by an actual outbreak of hostilities abroad. From the standpoint of the humanitarian such a contingency is horrible to contemplate but it would not much effect our trade on this side the Atlantic or with China and Japan.

The decline in sterling exchange, which is selling at 4.36 as I write, is, however, about the only item in the week's financial news that can be interpreted as distinctly unfavorable. Marks are a shade lower but what else could be expected with an increase of 19 billions in the quantity outstanding, which is now about 290 billions.

Considered in detail the commodity markets have acted normally. Wheat advanced when the dogs of war came nearer and declined as they retired. But upon the whole the wheat market seems to be intrinsically stronger. Cotton reversed the action of wheat as it always does when war threatens, but with the South selling about 50,000 bales a day at an average of $100 per bale and thereby strengthening its cash position at the rate of 30 million dollars a week an advance was hardly to have been expected. After a few weeks of this the cotton planters will be able to hold the rest of the crop comfortably and this is what they threaten. Meantime the American spinners seem wisely disposed to buy freely as the market approaches 20 cents, below which it is unlikely to go at present.

Wool is firm both here and abroad. So is silk, burlaps, jute and paper. The demand for all grades of the latter article is said to be in excess of the supply. Rubber is sharply higher in the London market and sugar is slowly creeping up as the strength of the position becomes better understood. A further advance on both rubber and sugar seems to be clearly indicated. Hides, leather and the shoe trade comprise another group of which increased activity at better prices is reported. Glass, lath, flooring and most building material except brick are also higher. Steel continues firm with the railroads large buyers at higher prices. Copper is static at 14 cents although the demand is large.

The trade in woolen, silk and cotton textiles is good, but there is a scarcity of staple cotton goods and some of the New England manufacturers are demanding higher prices.

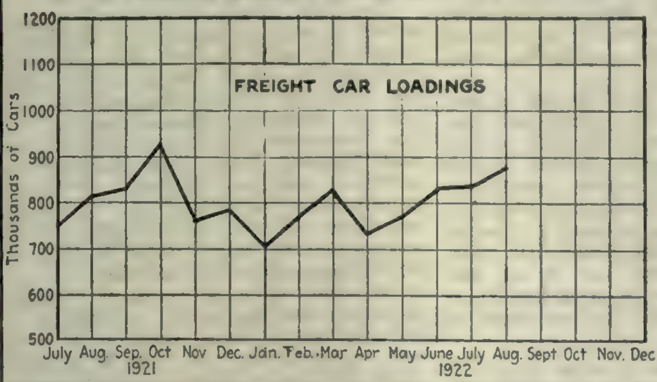
On the whole the feeling seems to grow more and more cheerful the farther one gets from the Stock Exchange and this cheerfulness of feeling was especially noticeable in Dayton, Detroit and Cleveland, to which cities I paid a hurried visit last week. Nearly everyone in the Middle West seems hopeful and Henry Ford's popularity has been greatly increased by the decline in bituminous coal which is justly or unjustly ascribed to his boldness in fighting the coal profiteers.

The fact is that coal for which $9 was asked three weeks ago can now be bought at $5. I don't know who is responsible for the drop but everybody except the coal dealer is now singing "Praise Ford from whom all blessings flow."

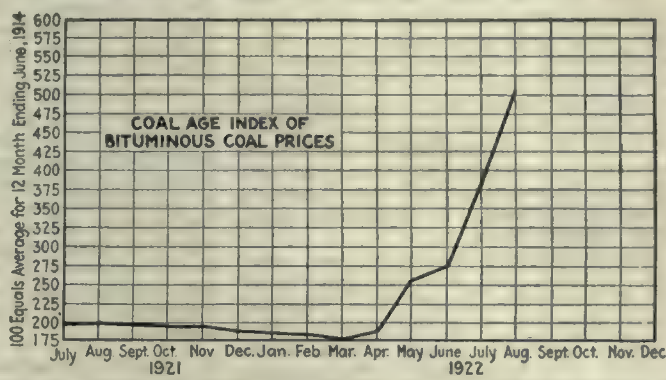
The railroads are doing an enormous business. There is now a shortage instead of a surplus of cars and loadings during the week ending Sept. 16 totalled 945,919 cars.

There is every prospect of an acute freight blockade later in the season but this is generally an incident of good times, and prohibitive rates for money is about the only thing that will check the expansion that appears to be in prospect.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



LOADINGS of revenue freight on American railroads during August averaged 887,000 cars a week. During the first half of the month weekly loadings remained nearly stationary as compared with the July period. The movement of coal and grain in the latter part of the month, advanced loadings sharply from 856,219 cars on August 19 to 890,838 cars on August 26. Since that time the weekly advance has continued rapidly, the week ending September 16 witnessing a total of 945,919 cars loaded.

Automobile production during August, with 246,941 passenger cars and 24,064 trucks, recovered some of the ground lost during July. The month of June holds the record with a total of 289,011 cars and trucks. During July, production dropped to 245,414 machines, a seasonal falling off which was not unexpected. In August, however, contrary to expectations the seasonal slump did not continue. Neither did the coal and railway strikes have the depressing effect looked for in many quarters. The advent of new models and a sharp fall buying movement resulting from a desire to take advantage of price reductions, stimulated an increase in production over July.

Share markets continued their upward advance during August, the average price of 50 stocks, 25 rails and 25 industrials, reaching 86.66 as compared with 81.25 for July. In the movement starting in the early part of July new high records were established in the last seven days of August. Strikes in the railroad, textile, coal and steel industry had practically no effect on prices, the public buying high grade seasoned rails and industrials with supreme confidence in the country's prosperity. Excellent crop prospects added stimulus to the buying activity during the month.

Comparative Prices of Shop Supplies

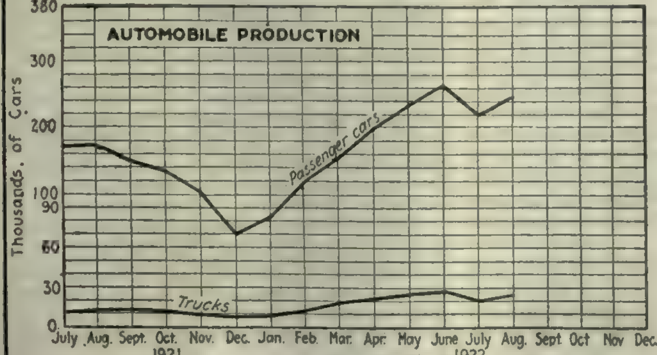
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	\$0.0289	\$0.0280	\$0.0273
Cold finished shafting	per lb.	0.0373	0.0360	0.0384
Brass rods	per lb.	0.1717	0.166	0.1350
Solder (½ and ½)	per lb.	0.228	0.221	0.202
Cotton waste	per lb.	0.115	0.11	0.113
Washers, cast iron (½ in.)	per 100 lb.	4.30	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

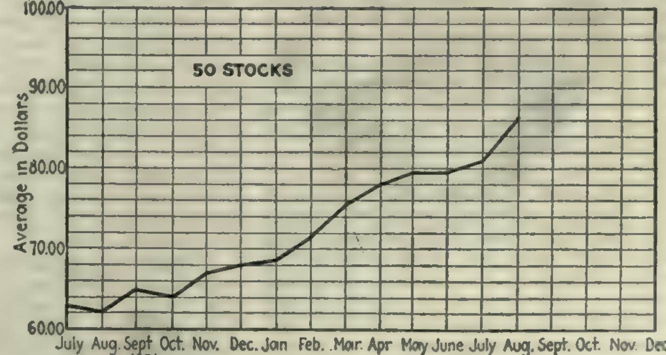
Bituminous coal prices, as indicated by *Coal Age* index, averaged 507 during August, the average spot price for the same period being \$6.14. While the accompanying chart shows merely the monthly fluctuations, the highest point reached during the recent strike was on July 31, the index rising sharply to 556. August 7 witnessed a drop to 511. On August 14, due to a lack of available spot coal, the index again rose to 550. From this point there has been a continued downward movement, the index reaching 437 on August 31, resulting in an average for the month of 507. Despite the increase in supplies as the mines have opened, consumers have postponed buying, the weakened demand bringing prices down.

Reserve ratio of the Federal Reserve System remained practically unchanged during the week ending September 27, at 78.4 per cent. Foreign exchanges were downward with sterling at \$4.39¼, the lowest in three months. French francs and Italian lire show but slight change as compared with the week previous. Bank of England's reserve declined slightly, from 19.61 per cent on September 21, the year's high point, to 19.40 per cent on September 28.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Machine Tool Exhibition Widely Attended

One of the most satisfactory and widely attended exhibitions of machine and small tools ever held in New England closed Saturday, September 23, after a three days' run. The exhibition, which was under the joint auspices of Yale University, the New Haven branch of A.S.M.E., and the New Haven Chamber of Commerce, was held in the Mason Laboratory of the Sheffield Scientific School, 9 Hillhouse Ave., New Haven, Conn.

The exhibitors numbered well over one hundred and included practically all of the better known New England firms identified with the machine tool trade. Exhibits ranged from small cutting tools, drills, taps, reamers, saws, etc. measuring tools and instruments of precision, to the larger and heavier classes of automatic and semi-automatic production machinery.

The growing importance of the elimination of friction in moving machinery was attested by the exhibits of the ball bearing manufacturers, all of whom in New England were represented. Manufacturers of abrasive wheels showed entertaining and instructive exhibits of the stages and processes that go to the making of a complete wheel from the raw materials. Steel manufacturers were represented with exhibits showing fractures of various grades of steel, the steps taken in its manufacture, and records of its performances.

Automatic Machinery Progress

Small precision machine tools for use in watch, tool and gage work, in the production of which class of machinery New England has always taken a premier position, were well in evidence. Some of this machinery was in operation on actual production work and attracted a good deal of attention.

Perhaps the most noticeable tendency in machine design disclosed by the exhibition is the trend toward automatic production in operations that have hitherto been looked upon as necessarily manual. A few years ago machine tool builders were satisfied to furnish a machine or tool that would do its allotted work quickly and well under the guidance of a skilled operator. Today in many cases the machine is expected to be left to itself after being supplied with work, and to go on repeating its cycle of operations as long as any material remains.

Notable among this class of machinery was the engine lathe, which would take a bar of stock from a magazine, put it on centers, turn and face various shoulders, discharge the finished product and pick up another piece; repeating this cycle as long as there was any material in the magazine. Automatic die-sinking machines, once furnished with a master die and material to work upon, would go on duplicating the master die as long as might be desired with very little attention from the operator.

Drilling and grinding machines also have become infected with the automatic bug and even the humble lathe chuck, that once we were content to operate with wrench or key, will now obligingly open and close itself at the bidding of the operator without the necessity for stopping the lathe.

The advance in the art of taking precise measurements and making minute comparisons was well attested by the exhibitors of tools and gages for this purpose. To these instruments the one-hundred-thousandth part of an inch is a reality amply capable of demonstration.

Portable tools for drilling and grinding, stimulated by the remarkable development of the small electric motor, have made rapid strides and it is now possible to do many minor operations of machining that heretofore required the service of a permanently located machine, upon smaller tools that may be transported to and set up on the job, needing only to be attached to a convenient lamp socket to put them in operation.

Many Important Papers Read

The speaking program of the exhibition was opened upon Thursday evening by Kenneth F. Lees, Chairman of the Committee for the New Haven branch A.S.M.E., who introduced L. P. Breckenridge, professor of mechanical engineering at Yale, as chairman of the meeting. Greetings from the New Haven Chamber of Commerce were extended by Henry B. Sargent of that organization. Charles H. Warren, dean of Sheffield Scientific School, earnestly advocated closer co-operation between the colleges and the machine tool industry. James T. Hartness, Governor of Vermont and an ex-president of the A.S.M.E., delivered an address upon the "Influence of the Machine Tool in America."

On Friday evening, M. D. Liming, manager of the Boston Chamber of Commerce, spoke upon the "Outlook for Industry in New England" and Earle Buckingham, engineer at Pratt & Whitney Co., gave a talk upon "Precision, Standardization and Production," followed by an address upon the subject of "Standardization Activity in Germany" by Oscar Wikander, Consulting Engineer with the S.K.F. industries.

Saturday evening's programme included a talk by William Calkins, Metallurgist for the Detroit Twist Drill Co., upon the "Design, Manufacture and Performance of Twist Drills," the talk being illustrated with the stereopticon; "Application of Graphic Control to Machine Manufacture" by Gardner T. Swarts, Jr. of the Educational Exhibit Co.; and "Analysis of Income in the United States" by Oswald W. Knauth, Secretary National Bureau of Economic Research.

On Friday and Saturday afternoons the moving picture projectoscope belonging to the Laboratory was pressed into service and a number of interesting films dealing with processes of manufacture were shown. Among them were: "The Hydroil Grinder" by the Greenfield Tap & Die Corp., "The Spirit of Progress" by the National-Acme Co. of Windsor. Vt.; "The Manufacture of Small Tools" by the L. S. Starrett Co.; "Where and How Fords Are Made" by the Ford Motor Co.; "The Manufacture of Twist Drills" by the Cleveland Twist Drill Co.; and "The Machinery and Processes Used in the Manufacture of Carborundum" by the Carborundum Co. of Niagara Falls.

Though no record was kept of the attendance the throngs about the various booths attested the popularity of the exhibition and promise of a more extensive exhibit for next year.

New England A.S.M.E. Holds Regional Meeting

The New England regional meeting of the American Society of Mechanical Engineers was held at Hotel Kimball, Springfield, Mass., Sept. 25-27, under the auspices of the Engineering Society of Western Massachusetts, with the Worcester, Providence, Connecticut and Eastern New York sections and affiliated technical societies of Boston represented. Charles L. Newcomb, manager of the Worthington Pump and Machinery Co.'s plant in Holyoke, was chairman of the sessions.

At the opening session Monday morning the discussion related to industrial power plants, with C. C. Chesney, manager of the General Electric Co.'s Pittsfield (Mass.) plant, acting as chairman. R. A. Packard, superintendent of power and shop for the Ludlow Manufacturing Associates, led the forum with a paper on "Multiple Source of Power for Reliable Industrial Plant Operation."

Tuesday morning there were simultaneous sessions on textiles and tools, with Dr. H. C. Emerson and A. L. Bausman as the respective chairmen. In the textile division a paper was read by Wendell S. Brown, of F. P. Sheldon & Son, Providence, on "Preservation of Decaying Wood Roofs," telling how the destructive effects of "damp rot" due to high or great humidity in mills and shops could be combated.

Machine Tool Standardization

In the tool section a paper on "Suggestions as to the Standardization of Machine Tools," by Fred H. Colvin and K. H. Condit, editors of the *American Machinist*, was read. The subject was treated from the viewpoint of the user, as related to work-holding and tool-holding devices. He further suggested as a probability that the machine tool builders may find standardization desirable in a greater degree, thus tending to simplify manufacture and reduce the number of tools, gauges and bearings carried in stock. While the engineer may recommend standardization, the decision of the manufacturer alone can assure its extention. Here the question resolves itself into a "selling" problem, for which the average engineer is not temperamentally suited, but for which machinery already exists in the American Engineering Standards Committee.

This was followed by a paper on "Standardization of Small Tools," by C. J. Oxford, chief engineer of the National Twist Drill and Tool Co., Detroit. He said that while the total elimination of special tools is impracticable, there is no doubt that their number can be greatly reduced, and engineers and designers responsible for the design of both manufactured product and the various jigs and fixtures must be brought to realize the great economic advantage of standard tools. Obsolete styles and designs should be stricken from the standard tool list, and tools substituted which that experience and research have shown to be more efficient.

Plants visited during the meeting, besides the Strathmore, included the Fisk Rubber Co., the Hartford Electric Light Co.'s steam generating station, the Turners Falls Power Co.'s plant at Montague City, and several industries of Holyoke.

What the 67th Congress Accomplished

Despite lengthy debates over leading measures and the political atmosphere which was spread over many of the proceedings, the second session of the Sixty-seventh Congress, which came to an end Sept. 22 after having extended from Dec. 5, 1921, enacted considerable important legislation.

The Democratic minority, although overwhelmingly outnumbered, was active and well led throughout the session in both branches of Congress. The Republican majority proved unwieldy because of its size, this fact tending to slow the transaction of business rather than to expedite it. The session developed and solidified the "bloc" system—that is, the agricultural bloc in both Senate and House, the farm tariff bloc in the Senate and the Henry Ford-Muscle Shoals bloc in the House, each bi-partisan in character, with indications that a ship subsidy bloc of similar nature probably will make its appearance at the next session.

During the session, appropriation bills providing for the expenditure of upward of $2,250,000,000 were passed, estimates having been reduced more than $300,000,000. There were 251 laws enacted at the session.

On the negative side, the session failed to take final action on the administration ship subsidy bill, the $5,000,000 Liberian loan, a corrupt practices act, the anti-lynching bill, extension of land reclamation, disposition of the Muscle Shoals project and a large number of measures less before the public eye.

Tariff the Chief Business

Enactment of the Fordney-McCumber tariff bill, the first permanent Republican protective tariff written on the statute books since the Payne-Aldrich bill of 1909, was the outstanding accomplishment of the session which affects business interests directly.

Excepting in isolated instances, the new tariff rates are higher than those of the Underwood-Simmons Democratic tariff law of 1913, but with the exception of the duty on raw wool and the rates of the agricultural schedule, the new tariff is lower than the Payne-Aldrich bill. The new tariff act marks a distinct advance in such legislation in its flexible tariff section, by which rates may be increased or decreased by Presidential proclamation upon proper showing, and by the section through which the authority of the Tariff Commission is broadened greatly with a view toward having a more scientific basis of framing future import duties. Among other important acts of the last session of Congress were:

Approval of seven treaties resulting from the Conference on Limitation of Armament, and legislation to scrap certain naval vessels in accordance with these treaties.

Reduction of personnel of the army and navy, with consequent reductions in appropriations.

Provision for the appointment of 24 additional judges for Federal district courts, and one additional circuit court judge.

Extension of the 3-per cent immigration law for two years.

Extension of the War Finance Corporation and enlargement of the revolving fund of the Farm Land Bank, together with provision for appointment of a "dirt farmer" on the Federal Reserve Board, for the agricultural interests.

Appropriation of $17,000,000 for additional hospitals for veterans of the world war.

Provision for organization of irrigation districts.

Passed the China trade act, the forerunner of other legislation to bring American corporations operating abroad on an equal basis with foreign competitors regarding taxation and protection.

Monthly payment of civil war pensions.

Appropriation of $7,500,000 to continue work on Wilson dam at Muscle Shoals.

Creation of the allied debt refunding commission.

Passage of the grain futures bill to overcome objections pointed out by the Supreme Court.

Congress also passed the bonus bill for veterans of the world war, but this was vetoed by the President because it made no provision for raising revenue to meet the obligations it created, and the veto was sustained by the Senate.

Business Items

The General Motors Corporation directors at their meeting held in New York last week declared the regular quarterly dividends as follows: Six per cent preferred, $1.50 a share; 6 per cent debenture, $1.50 a share; 7 per cent debenture, $1.75 a share. These dividends are all payable November 1, 1922, to stockholders of record at the close of business October 9, 1922.

The Davis Boring Tool Co., St. Louis, Mo., manufacturer of boring tools and expansion reamers, has just purchased a factory site fronting on Forest Park Boulevard on the corner of Spring Ave., and preliminary work has been started for the erection of a modern three-story factory.

The International Combustion Engineering Corporation has acquired the entire capital stock of the Green Engineering Co., East Chicago, Ind. The works of the Green Engineering Co. are located about fifteen miles from Chicago and the company is engaged in the manufacture of chain grate stokers, auxiliary boiler room equipment, special furnace arches and general foundry work.

The Armstrong Steel Co. plant will be constructed in Houston, Tex., at a cost of $2,000,000 and will employ several thousand men. Headquarters of the plant, now located in Fort Worth, will be moved to Houston after the plant is completed. The new plant will have a capacity of 60,000 tons annually, turning out manufactured steel products from a combination of pig iron and scrap iron by an open hearth process. The capacity of the company's plant in Fort Worth is 40,000 tons annually.

The Milwaukee Air Power Pump Co., Milwaukee, Wis., manufacturer of the Milwaukee air power water system, is building a new factory on Keefe Avenue, near Humboldt Boulevard, which is to be completed by the first of the year. John R. Ball is president and H. S. Rogers is vice-president and engineer in charge.

The Westinghouse Electric and Manufacturing Co., announces the establishment of a central station division in its Boston office, with C. M. Bates as manager and F. L. Nason as assistant manager. A merchandising division also has been established in the office with Mr. Nason as acting manager. J. P. Alexander has been appointed manager of the new transportation division in the same office.

The Chicago, Indianapolis & Louisville Railroad Co., according to an announcement made recently by officials in Indianapolis, has let contracts for eight new locomotives to be built by the American Locomotive Co. Five of the new engines are for freight and three for passenger service. It also was announced that orders have been placed with the Haskell-Barker Corporation at Michigan City for 150 new coal cars. Five new passenger coaches also have been ordered.

The Baldwin Locomotive Works, according to reports last week, had unfilled orders on its books aggregating about $37,000,000 in value and that the plants were now employing about 11,000 men and operating at approximately 60 per cent of capacity.

The Racine Metal Stamping Co., of Racine, Wis., Albert O. Falkenrath, president, announces a change in its corporate name to Racine Screw Works.

The Chicago Pneumatic Tool Co. earnings are running at a rate slightly above its dividend requirements and the volume of its business is about two and one-half times that of the early months of 1922, according to Charles M. Schwab, chairman of its board of directors.

The Ford Motor Co., according to reports, has been given a new production mark to aim at next year. Orders have been given to all general foremen to speed up production and install additional machinery with the view to making 6,000 cars a day by April 1, 1923.

The Packard Motor Car Co. according to reports is expected to show for the fiscal year ending August 31, net profits after charges and taxes, in excess of $1,000,000, or just about dividend requirements of $1,035,286 on $14,789,800 7 per cent preferred stock. In the preceding year the loss was $3,487,366 from operations and inventory depreciation, and after dividend payments of $1,346,410, there was a deficit of $4,833,776.

The Florida East Coast Railway, for the year ended Dec. 31, 1921, reports gross earnings of $13,579,109, a decrease of $122,082 from the previous year. Surplus earnings after all charges and taxes totaled $766,705, a decrease of $1,444,291 compared with 1920.

The Midwestern Tool Co. has been organized with Carl O. Swenson as president and Samuel R. Swenson as secretary, treasurer and general manager, and will be located at 5215 Ravenswood Ave., Chicago, Ill. The company has taken over the assets of the Ajax Tool Co. and will engage in the manufacture of hobs, milling cutters, tools, jigs and fixtures, and will also manufacture oversizes pistons for

the automotive trade. Samuel R. Swenson is well known to the trade through his former connections with the Goddard Tool Co., the Illinois Tool Co., and the Barber-Colman Co.

The American Machine and Foundry Co. stockholders have been called into a special meeting to be held on October 17 to vote upon a proposed increase in the company's capital stock from $2,000,000 to $10,000,000.

The Wiley-Hughes Supply Co., Trenton, N. J., has been incorporated in that city with a capitalization of $125,000 to deal in engineers' supplies. Leroy Wiley, Fred W. Hughes and Joseph Ashton, Jr., all of Trenton, are the incorporators.

The Westinghouse Electric and Manufacturing Co. makes the announcement that in its San Francisco office, the power division is changed to the central station division and W. P. L'Hommedieu has been appointed manager. Mr. L'Hommedieu will also be responsible for the sale of supply apparatus in the San Francisco district. The railway division has been changed to the transportation division and E. A. Palmer has been appointed manager. The establishment of a merchandising division, with H. L. Garbutt as manager is also announced.

The Republic Iron and Steel Co. is running its plants at about 80 per cent of capacity and the company, it is said, is booked practically full until the end of the year.

The Auburn Automobile Co., has declared the regular quarterly dividend of 1¾ per cent on its preferred and 1 per cent on its common stock, payable Oct. 1.

The Bethlehem Export Corporation, which has been incorporated in Delaware with a capitalization of $1,000,000, is the export subsidiary of the Bethlehem Steel Corporation. The action of the Bethlehem Steel Corporation in organizing an exporting subsidiary follows the decision to liquidate the Consolidated Steel Corporation, which has been handling the foreign business of 11 steel companies in this country.

The Ford Motor Co. is reported to have purchased recently a tract of fifteen acres in the eastern section of Toronto, Can., whereon it will erect an assembly plant to have approximately 150,000 square feet of floor space.

The Union Pacific Railroad system for August reports gross railway operating revenues of $17,627,803, against $20,041,541 in the same month last year. Of the $2,413,738 decrease in gross, $1,799,841 was due to smaller revenues from freight and $362,436 to smaller passenger revenue. Operating expenses aggregated $13,127,553, against $1[illegible] last year.

The Nash Motors Co. has declared a quarterly dividend of $1.75 on its preferred stock, payable Nov. 1.

The Rockwood Manufacturing Company, of Indianapolis, is to remodel its foundry into a machine shop and will build a one story extension to the present building, according to George O. Rockwood, president. The contract has been let and work is expected to begin shortly. The building, when added to and remodeled will be of brick and heavy mill construction, with wood block floors, steel sash, a gravel roof and a traveling crane.

The Hudson Motor Car Co., will pay its regular quarterly dividend of 50 cents per share on the capital stock on Oct. 5.

The Westinghouse Electric and Manufacturing Co. announces the following appointments in its St. Louis office: S. W. Perry as chief clerk; W. F. Barnes as manager of the industrial division; J. S. Warren as manager of the central station division and G. F. Leake as manager of the merchandising division.

The Springfield Commercial Body Co., Inc., has been formed in Springfield, Mass., with a capitalization of $200,000. Charles B. Ring is president and L. Philip Smith is treasurer of the new company which will engage in the manufacture of automobile bodies.

The Hermann Tire Building Machine Co., Columbus, Ohio, has been sold to W. H. Hermann, as has also the plant of the A. R. McDonald Co., St. Marys, Ohio. Machinery for making tools used in the production of casings and tubes will be installed in the latter plant.

The Willys-Overland Co. and subsidiaries for six months ended June 30, 1922, reports a net loss of $163,305 after depreciation and interest charges. After charging out $35,000 for contingencies, $250,000 for inventory losses and $570,909 for discount and expense of gold note issue deficit was $1,019,214 from which $26,750, which was deducted as dividend stock of employes and others returned to company, leaving net deficit for the period $992,464.

The Velie Motors Corporation has declared the regular quarterly dividend of 1¾ per cent on its first preferred stock, payable Oct. 2.

The Thomaston Knife Co., Thomaston, Conn., recently incorporated under the laws of Connecticut with a capital stock of $60,000, to engage in the manufacture of knives, cutlery, etc., organized the past week by the election of the following officers: president, Henry S. Hitchcock; secretary and treasurer, James D. Wedgewood, both of Woodbury, Conn.

The Holbrook Co., Hudson, N. Y., manufacturer of automobile bodies, plans the construction of additional plant capacity at a cost of approximately $100,000.

The American La France Fire Engine Co., Inc., has declared the regular quarterly dividend of 2½ per cent on its common stock, payable Nov. 15.

The Youngstown Sheet and Tube Co., dividend, payable October 1, was increased to 75 cents a share at the meeting of the board of directors held recently at Youngstown, Ohio. The previous quarterly payment was 50 cents the share. The regular quarterly preferred dividend of $1.75 a share, also payable October 1, was likewise declared. The dividends in each instance are payable to stock of record September 20. The increase in the common rate is the first since the improvement in the steel industry. It is just one-half of the quarterly rate first paid on the common after the original shares of preferred of $100 par value were each split into four shares of no par value in 1920. The increase of 25 cents a share will add $200,000 to that company's quarterly disbursement on October 1.

The Asa S. Cook Co., Hartford, Conn., manufacturer of wood screw and bolt machinery, has moved its Cleveland office to 344 Engineers' Building, that city. Ernest W. Duston is the sales engineer in charge.

The Hupp Motor Co. will pay its regular quarterly dividend of $1.75 on the preferred stock on Oct. 1.

The Brown Instrument Co., announces the opening on Sept. 1, of its New England Branch 185 Devonshire Street, Boston, Mass., with George Goodman in charge.

The Ford Automobile Co. is reported to have bought a large tract of land on the outskirts of Antwerp, where an assembling plant will be erected. The plant will be ready for operation early next year. The factory force will be made up chiefly of Americans. Automobile parts will be sent from Detroit to Brussels and the cars assembled here.

The Southern Pacific Co. reports for August a decrease of $756,215 in net railway operating income, after expenses, rents, etc., as compared with the same month a year ago, thereby reducing that figure to $4,566,641. Operating revenues totaled $23,160,148, a decrease of $1,052,764. The drop in earnings is largely due to the result of the second month of the railway shopmen's strike.

Personals

Dr. Federico Giolitti, Italian metallurgist, was the guest of honor at a luncheon at the Bankers' Club, 120 Broadway, New York City, last week, where he was met by members of the iron and steel committee of the American Institute of Mining and Metallurgical Engineers. Dr. Giolitti was managing director during the war of the great Ansaldo works at Genoa.

Samuel MacCutcheon, assistant secretary of the North & Judd Manufacturing Co., New Britain, Conn., manufacturer of hardware, tools, etc., has been elected treasurer of the concern, by the directors, at a meeting held recently.

P. G. Merrow, secretary and treasurer of the Merrow Machine Co., Hartford, Conn., recently sailed for an extended trip abroad on business in the interests of his company. Mr. Merrow expects to visit the company's connections in Great Britain and on the Continent.

W. C. Leitch, formerly representative at St. Louis, Mo., of the general sales division of the Gilbert & Barker Manufacturing Co., Springfield, Mass., has recently been transferred to the general offices at Springfield. E. F. Blackburn, who has been representative of the company at Fort Worth, Tex., succeeds Mr. Leitch, at St. Louis.

Frank L. Atwood, who has been vice-president of the Midwest Engine Co., Anderson, Ind., will become general manager of the Hill pump plant in the same city, October 1. The sales and mechanical departments of the Hill plant will be moved from Indianapolis to Anderson.

L. A. Nye of the Cleveland office of

the Norton Co., has been transferred to the Cincinnati office, taking the place of A. F. Mellon, who resigned recently.

C. H. WESTON of the drafting department of the Norton Co., Worcester, has assumed the duties of Robert H. Cannon, recently transferred to the Cleveland sales staff.

E. H. ANTHONY has been appointed manager of the Chicago office for the Union Twist Drill Co., to succeed E. P. Walker, who is now with the S. W. Card Tap Co.

FREDERICK M. HOLMES was, during the past week, elected president of the North & Judd Manufacturing Co., manufacturers of hardware, tools, etc., New Britain, Conn., succeeding the late HOWARD C. NOBLE. Mr. Holmes has held various capacities since joining the company in June, 1900.

ROBERT H. LIBKE, formerly a member of the E. L. Essley organization, has been appointed Chicago district manager for the Toledo Machine and Tool Co.

F. W. PRATT, formerly advertising manager for the Goodell-Pratt Co., Greenfield, Mass., has been appointed to the post of manager of production, retaining his former title of assistant to the president.

ROBERT H. CANNON, for some time past connected with the sales engineering department of the Norton Co., Worcester, Mass., has joined the sales staff of the Cleveland office of the company.

H. H. COLBUS, formerly sales representative of the Halcomb Steel Co., has become associated with the Down Tool Works, Inc., Fleetwood, Pa., manufacturer of high speed drills and tools, with headquarters in Philadelphia.

H. G. HOBBS has recently become associated with the Gilbert & Barker Manufacturing Co., Springfield, Mass., as the company's representative in southern Ohio, making his headquarters in Columbus. Mr. Hobbs was formerly located in Winnipeg and Toronto, Canada, for the company.

SIDNEY W. FARNSWORTH of Evanston, Ill., former aide to Commander McDowell, a member of the staff of Admiral Sims during the war and more recently associated with the Steel and Tube Co. of America, has been appointed by Postmaster General Work as chief engineer of the Post Office Department. The position is a new one created in order that a mechanical engineer may pass upon the labor-saving devices which the Post Office Department may require in order to secure expeditious handling of the mails.

Obituary

MARCELLUS L. BAILEY, treasurer of the Union Manufacturing Co., manufacturer of chucks, gray iron castings, etc., New Britain, Conn., died at his home in that city, Sept. 26, following a long illness. Mr. Bailey was born in New Britain Dec. 31, 1856. He has been with the Union Manufacturing Co. for forty-five years.

J. W. KINNEAR, president of the American Stainless Steel Co., Pittsburg, Pa., died at his home in that city on September 8.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Shoemaking machinery of all descriptions for making cloth shoes—Spain. Purchase desired. Quotations, f. o. b. New York. Reference No. 3643.

Rubber sheeting 8 by 4 feet and $\frac{1}{16}$ to 1 inch thick, proof canvas and tarpaulin, complete with eyelets, 24 by 18 feet; and tool spring and cast steel, flat, round, and octagon—India. Purchase desired. Quotations, c. i. f. Karachi. Terms, cash against documents. Reference No. 3666.

Soft steel or puddled iron wire of best quality, galvanized for telegraphs; cast-iron pipe for water, interior diameters 50 to 250 millimeters and 3 and 4 meters in length; concrete mild steel bars; beams, T's, double T's, U's, and angles; and plain and corrugated galvanized sheets, 0.3 to 1.2 millimeters thick—Greece. Agency and purchase desired. Quotations, c. i. f. Piraeus. Payment, confirmed letter of credit in New York or against documents. Correspondence, French. Reference No. 3669.

Vulcanizer molds, assorted sizes, from 30 by 3 inches to 35 by 5 inches—Scotland. Purchase is desired. Quotations, f. o. b. nearest port. Payment, cash. Reference No. 3670.

Electric plants, machinery, hardware, groceries, timber, plain and galvanized iron, paints, woolen goods, soft goods, boots and shoes, leatherware, motor cars, motor lorries, tractors, drills and tools, and any lines required by the Government or general merchants—South Africa. Reference No. 3673.

Iron piping for gas, from $\frac{1}{2}$ to 4 inches in diameter; and steel piping for drilling and boilers, from 5 to 18 inches in diameter—Italy. Purchase and agency desired. Quotations, c. i. f. Genoa. Reference No. 3675.

Machinery for manufacturing glucose—Mexico. Purchase desired. Catalogs of such machinery and instructions as to the proper way of manufacturing are requested. Quotations, f. o. b. American port. Payment, cash. Reference No. 3679.

Outboard motors of $2\frac{1}{2}$ and 5 horsepower—Egypt. Purchase and agency desired. Quotations, c. i. f. Port Said. Cash will be paid against documents for samples. Reference No. 3683.

Telephone equipment, electric generators, internal-combustion power plants, low-pressure water wheels, rotary pumps, electric lighting equipment, and lighting equipment—Egypt. Representation of manufacturers desired by importers. Reference No. 3709.

Pamphlets Received

The Western European Division and American Business. Department of Commerce bulletin describing that part of the department's organization which specializes in aiding American business in its foreign trade with Western Europe.

Our World Trade. Foreign Commerce Department of the U. S. Chamber of Commerce. This publication is a detailed analysis of American foreign trade covering the period from January to June, 1922, with statistical tables showing value and volume of exports and imports.

Latin America. Trade and Economic Review for 1921, No. 9, on the economic conditions in, and the state of the U. S. trade with Latin America. Published and distributed by the Department of Commerce, Washington, D. C.

Hongkong. Trade and Economic Review for 1921, No. 10, on the economic conditions in, and the state of the foreign trade of Hongkong. Published and distributed by the Department of Commerce, Washington, D. C.

How the Far Eastern Division Serves the Business Public. Bureau of Foreign and Domestic Commerce Publication, containing instructive information regarding that part of the Department's organization which specializes in furnishing aid on Far Eastern commerce matters.

Trade Catalogs

Chucks. The Skinner Chuck Co., New Britain, Conn.—An interesting little book, "Chucks and Their Uses," has just been published by the Skinner Chuck Co. In order to facilitate the use of this book and standardize courses of instruction on the proper use of chucks, a supplementary booklet has been issued, to be distributed together with "Chucks and Their Uses." The title of this supplement, "Questions and Answers," indicates the nature of the booklet, which includes a series of the most logical questions arising in the minds of people handling chucks and gives correct and helpful answers to these questions.

Steel Stools and Chairs. The Angle Steel Stool Co., Plainwell, Mich. A folder with illustrations describing a varied line of steel stools and chairs suitable for factory and office use. The company has also just published a supplementary catalog illustrating and describing, not only its chair and stool line, but its various types of steel trucks, merchandise conveyors and steel cans for oily and other waste substances.

Signalling and Alarm Instruments. The Brown Instrument Co., Philadelphia, Pa. This company has just issued a new publication, known as catalog No. 85, containing considerable technical data, illustrations and charts bearing on its automatic control signalling and alarm instruments, its pyrometers and other apparatus for temperature control.

Expansion Reamers. The Davis Boring Tool Co., St. Louis, Mo. An illustrated folder with line drawings and complete details regarding the Davis line of expansion reamers.

Forthcoming Meetings

American Welding Society, Fall Meeting, October 2 to 5, in Chicago, Ill. Secretary, Howard C. Forbes, 33 West 39th St., New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

Second National Aero Congress and National Airplane Races., Detroit, Mich., October 7 to 14, 1922.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Demand for car materials strongest feature of the market. Standard rails advanced $3 per ton, Oct. 1. Steel plates, $2@$2.15 per 100 lb., f.o.b. Pittsburgh, for fair tonnages on ordinary business; $2.25@$2.50, however, quoted on small tonnages and for immediate deliveries. Demand for structurals light; $2@$2.15 quoted, with occasional small lots at $2.25. Shortage of steel bars. Few mills taking on new steel business except on indefinite delivery basis. Steel sheets up 15c.@20c. per 100 lb. at Cleveland warehouses. Hoop steel, shapes, plates, bars and bands up 10c. in New York.

Electrolytic copper, 14¾c. as against 14⅝c.; tin, 32¾c. advanced from 32⅜c. and lead, 6¾c.@6⅞c. as compared with 6⅝c. per lb., f.o.b. New York, last week. Chinese antimony advanced and fabricated brass products up ¼c.@½c. per lb. in New York and Cleveland warehouses. Zinc higher in East St. Louis. Fabricated copper prices, stable. Long terne plates (base) up 20c. per lb. in Cleveland. Connellsville coke $1 per ton higher, for prompt furnace and foundry.

Declines—Slightly softer pig-iron market due to increased production. Higher prices expected, however, owing to advance in coke.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$34.27
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	36.64
Virginia No. 2	37.17
Basic	34.00
Grey Forge	33.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	32.50
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	8.0	6.0	5@5½
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill.

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	[illegible]	4.29	3.80	4.10
No. 16	[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.15	5.30	4.80	....
Nos. 22 and 24	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	39½	24½
LAP WELD					
2	61	49½	2	34½	20½
2½ to 6	65	53½	2½ to 4	37½	24½
7 to 8	62	49½	4½ to 6	37½	24½
9 to 12	61	48½	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	39½	25½
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	35½	22½
2½ to 4	63	52½	2½ to 4	38½	26½
4½ to 6	62	51½	4½ to 6	37½	25½
7 to 8	58	45½	7 to 8	30½	18½
9 to 12	52	39½	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.50	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.06	5.50
Cold finished shafting or screw	3.90	3.60	3.70
Cold finished flats, squares	4.40	4.10	4.20
Structural shapes (base)	3.14	2.91	2.92½
Soft steel bars (base)	3.04	2.81	2.82½
Soft steel bar shapes (base)	3.04	2.81	2.82½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	2.91	2.92½
Bar iron (2.60 at mill)	3.04	2.81	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{1}{16}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	32.75
Lead (up to carlots), St. Louis.... 6.15; New York,	6.75@6.87½
Zinc (up to carlots), St. Louis. .6.86@6.90; New York...	7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	21.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	29.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.25	9.50	.....
Solder (½ and ½), (caselots)	25.00	23.50	20.00
Babbitt metal (fair grade)	25.00	42.25	36.00
Babbitt metal (commercial)	15.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.25	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.00	4.75
Lead, tea	4.25	4.00	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.075	.06	.10
Wiping cloths, 13¼x20½, per lb.	.08	.096	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		12.00	
Coke, prompt foundry, Connellsville...per net ton		13.50@14.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	60%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	50–10–5%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	\$5.00	\$3.50	\$3.35
Cone heads, ditto (net)	5.10	3.60	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55–5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40–5%	40½%	50%
Heavy grade	30–5%	30–5%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40–10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ariz., Superior—Magma Copper Co.—shaper, vertical drill, power hacksaw, pipe threading machine, bolt machine and wet and dry grinder.

Mass., Boston—A. T. Stearns, 53 Merrimac St. (sheet metal worker)—foot punch press, [illegible] power shears and electric drill (used).

Mich., Detroit—Standard Gear Co., 2821 Brooklyn Ave.—additional gear cutting machines.

Mo., Kansas City—R. Connor, 1521 McGee St. (machine shop)—electric drill.

Mo., Kansas City—The Standard Steel Wks., 14th and Holmes Sts.—pipe bending machine.

N. J., Jersey City—W. W. Kellogg, 117 Westside Ave. [illegible]—shop equipment, including lathes, drill presses and planers for addition to plant.

N. Y., Rouses Point—J. B. White—machinery, tools and equipment for proposed garage and service station.

N. Y., Buffalo—W. D. McGuire, 1479 Hertel Ave.—machinery, tools and equipment for proposed garage and repair shop.

N. Y., Rochester—C. Cunningham, 53 Hamilton St.—machinery, tools and equipment for garage and repair shop.

O., Dayton—Dayton Power & Light Co., 4th and Jefferson Sts.—machine shop equipment for plant at Millers Ford.

Pa., Bradford—The Gun Shop, 18 Chambers St.—one small lathe, foot or motor driven.

Pa., Eau Claire—W. H. Burkett—machinery, tools and equipment for garage and repair shop, to replace that which was destroyed by fire.

Pa., New Castle—Fowler Radiator & Mfg. Co. (manufacturer of radiators, boilers, etc.), E. L. Brundage, Mgr.—machinery and equipment for proposed addition to factory.

Pa., Oil City—E. M. Bowen—machinery, tools and equipment for proposed automobile repair and service station.

Pa., Scranton—T. F. Leonard Estate, 505 Lackawanna Ave.—mechanical equipment, tools, etc., for proposed garage on Adams Ave.

Pa., West Fairview—Holmes Garage Co.—machinery, tools and equipment to replace that which was recently destroyed by fire.

Va., Richmond—Chesterfield Motor Co., 11 Petersburg Pike—automobile repair machinery, incl. drill press and lathe.

Va., Richmond—J. L. Cottrell, 4024 Williamsburg Ave. (automobile repairs)—shaper, drill press and lathe.

Va., Richmond—H. L. Grow, 1 Midlothian Pike (automobile repairs)—expansion reamer.

Va., Richmond—Kersey Motor Co., 1800 [illegible] St.—automobile repair machinery, including lathe, press, etc.

Va., Richmond—L. M. Walton, 3827 8th St. (automobile repairs)—lathe, drill press and boring machine.

Wis., Monroe—The United Telephone Co., R. M. Austin, Mgr.—automobile repair machinery for proposed garage.

Wis., Sheboygan Falls—Wisconsin Regrinding Co., A. P. Schneidewind, Pres.—machinery for cylinder and crank shaft grinding and [illegible] repair work, for proposed machine shop at [illegible].

Wis., Wisconsin Rapids—R. A. Ebbe—automobile repair machinery.

Ont., London—[illegible] Motors, Ltd., [illegible] St., F. B. Isaacs, Mgr.—complete equipment for proposed automobile service station and repair shop.

Que., Montreal—Red Star Refineries Ltd., Canada Cement Bldg., M. Chatfield, Ch. Engr.—1,250 bbl., 5,000 bbl., 10,000 bbl., 35,000 bbl., 55,000 bbl. and 80,000 bbl. storage tanks, 18 x 30 ft. station tanks, agitators, [illegible] tanks, 10 x 20 ft. and 10 x 40 ft. stills, pipe stills, preheaters, exchangers for vapor and liquid, coolers, towers, condensers, pumps, compressors, machine tools and machinery.

Machinery Wanted

Calif., San Pablo—San Pablo Pottery Co., Inc.—machinery and equipment for proposed addition to works, including large kilns and presses (new).

Colo., Denver—Denver Custom Garment Co., 1517 Lawrence St., A. Johnson, Purch. Agt.—machinery for proposed factory.

Ill., Chicago—J. Drexler, 2263 Marmora Ave., (machinist)—air compressor, Gardner Rix, 2 stage, preferred.

Ill., Kankakee—The Kankakee Daily Republican—linotype, (No. 5 preferred).

Ill., Salem — The Republican, (newspaper)—one 30 in. power paper cutter.

Ind., Orland—A. D. Wells, (job printer) —one 25 to 28 in. power paper cutter.

Kan., Lincoln Center (Lincoln P. O.)—Brice Printing Co., O. A. Brice, Purch. Agt.—automatic press and a 32 in. paper cutter.

Kan., Wichita—J. W. Krebs, 241 North Millwood Ave. (planing mill)—belting, hangers, band saw and shafting.

Kan., Wichita—Peoples Finance Co., 124 East First St.—lumber saw mill, belting, band saw, log saw and other lumber equipment.

Mass., Southbridge — Hamilton Woolen Co.—machinery for addition to plant.

Mich., Detroit—Printers' Exchange, 2325 Grand River Ave.—power presses, 8 x 12 in. and 12 x 18 in.

Mich., Detroit — O. B. Whipple, 8011 Woodward Ave.—paper cutter, press and equipment for small print shop.

Minn., Bemidji — Minnesota Associated Lumber Co.—machinery for proposed lumber mill.

Minn., Minneapolis—The Star Laundry, 906 Hennepin Ave., G. M. Carter, Pres.—additional machinery and equipment for proposed laundry.

Minn., Monticello—Monticello Creamery Assn., A. H. Lauterbach, Secy.—complete set of equipment for new creamery, incl. 2 ripeners, one churn, one refrigerating machine, pumps, etc.

Neb., Lincoln—V. M. McVey, Brownell Bldg.—power presses, 10 x 15 in. and 12 x 18 in.

Neb., Nebraska City—The Press Printing Co.—wire stitcher, No. 5, either Boston or Monitor make.

N. H., Harrisville—Cheshire Mills (manufacturers of woolen goods)——machinery for addition to plant.

N. Y., Albany — The State Hospital Comn., receiving bids until Oct. 11 for additional laundry equipment for Utica State Hospital, Utica.

N. Y., Brooklyn—Rubel Coal & Ice Corp., Glenmore Ave.—ice making machinery for proposed plant.

N. Y., Buffalo—Angola Tire & Rubber Co., 270 North Division St.—machinery and equipment for proposed addition to factory.

N. Y., Buffalo—M. Lewis, 580 Ellicott Sq.—machinery and equipment for vinegar and pickle plant.

N. Y., Buffalo—W. Maynard Co., 17 Nowell St.—equipment for abbatoir.

N. Y., Cheektowaga (Buffalo P. O.)—Live Poultry Transit Co., Bway.—machinery and equipment for proposed fertilizer and car repair plant at Forks.

N. Y., Elma Center—J. Geyers—equipment for blacksmith shop to replace that which was destroyed by fire.

N. Y., Jamestown—Herby Bros., 610 West 7th St.—additional mechanical equipment for proposed addition to wagon and automobile truck body factory and shop.

N. Y., Jamestown—Jamestown Chair Factory, 20 Winsor St.—woodworking machinery and equipment for proposed addition to factory.

N. Y., New York — Bd. of Purchase, Municipal Bldg.—receiving bids until Oct. 11 for laundry machinery.

N. Y., New York—Superior Ice Co., Inc., 50 East 42nd St.—ice making machinery for new plant at Sheepshead Bay.

N. Y., Oswego—Tioga Milk Producers' Assn.—machinery and equipment for new creamery and milk plant.

N. Y., Rochester—Electric Storage Battery Co., 131 South Clinton St.—machinery and equipment for proposed storage battery and products factory.

N. Y., Rome—Rome Wire Co., Railroad Ave.—machinery and equipment for proposed plant for the manufacture of cable wire, at Niagara Falls, Ont.

N. C., Speed—Edgecombe County School Bd.—vocational equipment for new school at Crisp.

O., Blanchester—Fulflo Specialties Co.—one belt driven, modern air compressor, 100 to 350 ft. at 100 lb. pressure.

O., Cleveland—G. T. Marks, 2197 East 82nd St.—woodworking machinery for pattern shop.

O., Columbus—General Fixture & Supply Co., 61 East Spring St. (manufacturer of refrigeration machinery), E. L. Farmer, Genl. Mgr.—woodworking machinery, including one groover, 2 planers, several drills, etc.

O., Delaware — Sterling Stone & Lime Co., J. T. Herrick, Genl. Mgr.—machinery and equipment for proposed stone crushing plant, capacity 1,200 ton per day.

O., Middletown—Gardner-Harvey Paper Co.—machinery and equipment for proposed $150,000 addition to factory.

O., Ravenna—W. Sidovan, Coats Bldg.—one 8 x 12 in. and one 7 x 11 in. press, also other printshop equipment.

O., Warren—G. N. Anthony, 515 South Austin St.—5 ton wagon and truck scales.

Okla., Oklahoma City—Tower Gasoline Co., 212 Mercantile Bldg.—machinery and equipment for proposed addition to refinery at Blackwell, and also for proposed refinery and gasoline plant.

Pa., Beaver Falls—B. Keefer, 21st St. and 5th Ave.—machinery and equipment for carpenter and pattern shop.

Pa., Bellefonte—R. Smith—machinery and equipment for proposed addition to ice cream plant, 600 gal. capacity.

Pa., Bradford—A. Gillis, 1 Mechanic St. —engine and power machinery outfit for pumping two oil wells.

Pa., Clarion—Berney-Bond Glass Co.—machinery and equipment for proposed glass factory.

Pa., Easton—C. K. Williams & Co., (manufacturer of dry colors)—one rotary kiln, 8 ft. in diam. and about 85 ft. long, Vulcan type.

Pa., Kinzua—E. G. Anderson—machinery and equipment for sawmill to replace that which was destroyed by fire.

Pa., Lititz—The Stiffel & Freeman Co., Inc. (manufacturers of locks, safes, vaults, etc.)—machinery and equipment for proposed one story addition to factory.

Pa., Phila.—M. J. Hunt's Sons Co., 251 Richmond St., (steel fabricators)—double drum electric hoist, 5 ton capacity.

Pa., Phila.—Manyunk Plush Mfg. Co., 108 Levering St.—additional looms for proposed mill.

Pa., Phila.—Pennsylvania R.R., Broad St. Sta., M. Smith, Purch. Agt.—two 250 ton, six 15 ton, one 50 ton, two 25 ton and two 60 ton cranes.

Pa., Pittsburgh—W. H. Ritenour, 1315 West Liberty Ave. (job printers)—stereotype steam table.

Pa., Wilkes-Barre—The Candlemas Collieries Co., 713 Coal Exchange Bldg., N. Chrisman, Solicitor—machinery and equipment for mining, preparing and shipping of coal.

Pa., Williamsport—Demarest Silk Co., 606 Railway St.—machinery and equipment for proposed addition to silk factory.

Tenn., Chattanooga — Signal Mountain Mining Co., L. S. Berg, Genl. Mgr.—hoisting and conveying machinery and other equipment for development of coal properties in Suck Creek field.

Tenn., Nashville—Douglas Coal Mining Co., 504 Fourth and First National Bank Bldg., A. Lackel, Pres.—hoisting equipment, electrical machinery, dump cars, mine locomotives and other equipment for

development of coal mining properties near Island, Ky.

Tex., Galveston—Goliad School, 31st and L Sts., A. Brown, Purch. Agt.—complete line of tools for vocational school work.

Va., Richmond—L. R. Kelly, 215 East Marshall St.—battery charging outfit.

Va., Richmond—W. F. Lipford, 602 State St.—printing presses.

W. Va., Nitro—Nitro Pencil Co.—machinery to replace that which was destroyed by fire.

Wis., Colby—Colby Buick Co., c/o H. J. Cornelius—air tank and gas storage tank with pump.

Wis., Menomonie—Boothby Print Shop—No. 14 linotype.

Wis., North Milwaukee—North Milwaukee Fdry. Co., Commerce Ave.—cupola (new).

Wis., Milwaukee—A. C. Beck Co., 1 East St.—woodworking machinery, including band saws.

Wis., Potosi — Tennyson Co-operative Creamery Co., J. H. Schafer, Pres.—dairy machinery

Wis., Reeseville—The Reeseville Canning Co.—canning and conveying machinery, belting, shafting and hangers for proposed factory at Clyman.

Wis., Sheboygan—City Upholstering Co., 1542 Silbey Court, W. E. Ahrens, Mgr.—machinery for upholstering furniture.

Wis., Stevens Point—Stevens Point Cleaning & Dye Wks., 446 Clark St.—dyeing and cleaning machinery and equipment for proposed plant (new).

Wyo., Glenrock—Mutual Oil Co.—machinery and equipment for proposed addition to refineries here and at Cowley.

Ont., Paris—Penmans, Ltd.—machinery and equipment for the manufacture of woolen underwear.

Ont., Sarnia—Mueller Mfg. Co., H. Burleigh, Mgr.—machinery for the manufacture of special lines of plumbing goods, for proposed addition to plant.

Ont., Toronto — Surgis Baby Carriage Co., 60 Sumach St.—machinery and equipment for proposed factory at Brampton.

Metal Working Shops

Conn., Norwalk—The E. M. Jennings Co., 27 Harrison St., Bridgeport, awarded the contract for the construction of a 1 story, 55 x 155 ft. garage and service station, on West Ave., here. Estimated cost $40,000. Noted Aug. 29.

Ill., Elgin—F. D. Chase, Inc., Archt., 645 North Michigan Ave., Chicago, are receiving bids for the construction of a 3 story factory, on State and Schiller Sts., here, for Elgin Stove & Oven Co., 14 Chicago St. Estimated cost $100,000.

Ill., LaGrange—Fugard & Knapp, Archts., 212 East Superior Ave., Chicago, are receiving bids for the construction of a 1 story, 70 x 160 ft. garage, here, for Fleck & Buchholtz, 19 West Railroad St., Downers Grove. Estimated cost $50,000.

Ind., Alexandria — Ziegler Mfg. Co., manufacturer of metal stampings and screw machine products, is building a 1 story, 60 x 200 ft. addition to its factory.

Ind., Indianapolis—Indiana Battery Service Co., 1007 North Meridian St., is having plans prepared for the construction of a 1 story, 60 x 200 ft. automobile service station. Estimated cost $30,000. F. S. Cannon, 21 Virginia Ave., Archt.

Ind., Indianapolis—Rockwood Mfg. Co., 1801 English Ave., is having plans prepared for the construction of two 1 story machine shops, 100 x 200 ft. and 75 x 100 ft. Estimated cost $40,000. Mothershead & Fitton, 540 North Meridian Ave., Archts.

Ind., Richmond—Automotive Gear Co. is receiving bids for the construction of a 1 story, 400 x 600 ft. gear factory, on 8th St. Estimated cost $35,000. J. A. Mueller, Archt. Noted Sept. 7.

Ia., Des Moines—E. W. Nothstine is having plans prepared for the construction of a 6 story, 127 x 264 ft. garage, on 5th and Chestnut Sts. Estimated cost $300,000. Proudfoot, Bird & Rawson, 810 Hubbell Bldg., Archts.

Mass., Great Barrington — Whalen & Kastner awarded the contract for the construction of a 1 story, 70 x 140 ft. garage and service station. Estimated cost $42,000.

Mass., Roxbury (Boston P. O.)—The Albert Griffiths Saw Co., 30 Whittier St., plans to build a 1 story, 40 x 90 ft. addition to its factory, on Columbus Ave. Estimated cost $20,000. Private plans.

Mich., Dearborn—Ford Motor Co., Highland Park, has had plans prepared for the construction of a 1 story, 200 x 800 ft. experimental laboratory. A. Kahn, 1000 Marquette Bldg., Detroit, Engr.

Mich., Holland—Bd. Educ. is having plans revised for the construction of a 3 story, 110 x 160 ft. high school, including manual training department, laboratories, printing and machine shops, etc., on River Ave. Estimated cost $260,000. B. Parks & Son, Grand Rapids, Engrs. Robinson-Campau, 715 Michigan Trust Bldg., Grand Rapids, Archts.

Mich., Lansing—The Y. M. C. A., West Michigan St., is having preliminary plans prepared for the construction of a 5 story, 50 x 120 ft. building, including swimming pool, gymnasium, machine shop, etc., on West Allegan St. Estimated cost $400,000. J. Wilson, Secy. N. McMillan, 348 Madison Ave., New York City, Archt.

Minn., Buhl—The Hanna Ore Mining Co., 909 Fidelity Bldg., Duluth, awarded the contract for the construction of a 2 story, 80 x 106 ft. machine shop, a 2 story, 38 x 124 ft. warehouse and office building, a 1 story, 24 x 52 ft. garage, and a 2 story, 20 x 20 ft. oil house, at the Wabigon Mine, here. Estimated cost $115,000.

Mo., Kansas City—White Co., 2001 Grand Ave., awarded the contract for the construction of a 2 story, 100 x 250 ft. garage and sales building on 29th and Walnut Sts. Estimated cost $100,000.

N. J., Newark—Dept. of Streets and Public Improvements, City Hall, is preparing plans for the construction of a 2 story, 70 x 150 ft. addition to its garage on Franklin St. Estimated cost $175,000. Private plans.

N. Y., Bemus Point—J. B. White is having plans prepared for the construction of a 2 story garage and service station. Cost will exceed $40,000. Johnson & Ford, Fenton Bldg., Jamestown, Archts.

N. Y., Buffalo—Klepfer Bros., 1029 Main St., are receiving bids for the construction of a 2 story, 235 x 570 ft. automobile service and repair station. A. H. Hopkins, 447 Main St., Archt.

N. Y., New York—Dept. of Water Supply, Gas and Electricity, Municipal Bldg., plans to build a garage on East 24th St. and Ave. A. Estimated cost $50,000. Private plans.

O., Cincinnati—The J. A. Fay & Egan Co., John and Front Sts., is having revised plans prepared for the construction of a 1, 2 and 3 story machine shop with about 80,000 sq.ft. of floor space, on Paddock Rd. and Tennessee Ave. Estimated cost $400,000. C. M. Stegner, Archt. and Engr.

O., Cleveland—The Grabler Mfg. Co., 6565 Bway., manufacturer of automobile accessories, is having plans prepared for the construction of a 2 story, 60 x 160 ft. addition to its factory at 1401 East 40th St. Estimated cost $60,000. C. H. Foster, 1401 East 40th St., Mgr. H. E. Shimmin, 2031 Euclid Ave., Archt.

O., Cleveland—West Center Sales Co., West 30th St. and Lorain Ave., awarded the contract for the construction of a 2 story, 50 x 130 ft. garage. Estimated cost $40,000.

Pa., Manor—Amer. City Eng. Co., Peoples Bank Bldg., Pittsburgh, is receiving bids for the construction of a 1 story, 110 x 130 ft. machine shop and a 30 x 65 ft. foundry, here, for the Robertshaw Mfg. Co., Youngwood.

Pa., Monongahela—Keystone Garage is receiving bids for the construction of a 2 story, 60 x 200 ft. garage and service station. Estimated cost $50,000. C. K. Downer, 248 Boylston St., Boston, Mass., Archt. Noted Sept. 21.

Pa., Oil City—E. M. Bowen is receiving bids for the construction of a 3 story, 70 x 80 ft. automobile repair and service station. Estimated cost $45,000. W. H. Crosby, Masonic Bldg., Archt. Noted Sept. 28.

Pa., Phila.—The General Electric Co., River Rd., Schenectady, N. Y., is receiving bids for the construction of a 7 story, 140 x 175 ft. addition to its switch factory, on 7th St. and Willow Ave., here. Private plans.

Pa., Phila.—The Traylor Eng. Co., Broad St. and Lehigh Ave., awarded the contract for the construction of an 8 story, 124 x 205 ft. automobile factory. Estimated cost $455,000.

Pa., Pitcairn—Pennsylvania R.R., Broad St. Sta., Phila., will soon award the contract for the construction of a 62 x 107 ft. paint storage and airbrake shop, a 40 x 200 ft. rivet cutting building, a 103 x 424 ft. paint shop and bake oven, a 100 x 760 ft. freight car repair shop, a 14 x 26 ft. oil house, a 43 x 203 ft. store house and welfare building and a 16 x 31 ft. oxygen and acetylene storage building, all one story, here. Estimated cost $500,000. A. C. Shand, Broad St. Sta., Phila., Ch. Engr.

Pa., Pittsburgh—Hanlon Gregory Galvanizing Co., 24th St., is having plans prepared for the construction of a 1 story, 100 x 400 ft. factory, on 56th and Butler Sts. Estimated cost $100,000. J. E. Dwyer, Forbes Murray Bldg., Archt.

Pa., Scranton—T. F. Leonard Estate, 505 Lackawanna Ave., will receive bids about Nov. 1 for the construction of a 2 story, 80 x 130 ft. garage on Adams Ave. Estimated cost $40,000. Architect not announced.

R. I., Providence—Colvin Fdry. Co., 185 Globe St., awarded the contract for the construction of a 1 story, 100 x 100 ft. addition to its foundry. Estimated cost $75,000.

R. I., Providence—The Olneyville Realty Co., Inc., 18 Plainfield St., plans to build a 1 story garage and service station, with capacity for 70 cars. Estimated cost $40,000. Architect to be announced later.

Tenn., Knoxville—The Mahan-Kerr Motor Co., Market St., is having plans prepared for the construction of a 3 story, 90 x 100 ft. showroom and garage on Market and Cumberland Sts. Estimated cost $150,000. Barber & McMurry, Burnwell Bldg., Engrs. and Archts.

Wis., Colby—Colby Buick Co., c/o H. J. Cornelius, plans to build a 2 story, 50 x 80 ft. garage. Estimated cost $40,000. Architect not selected.

Wis., Milwaukee—The Luick Ice Cream Co., 183 Ogden St., is having preliminary plans prepared for the construction of a 2 story, 120 x 120 ft. garage, on Van Buren St. Estimated cost $75,000. Leenhouts & Guthrie, 424 Jefferson St., Archts.

Wis., Milwaukee—E. G. Schroeder Co., Engrs. and Archts., 405 Bway., is receiving bids for the construction of a 1 story, 130 x 150 ft. factory and office building, on Keefe Ave., for Milwaukee Air Power Pump Co., 886 3rd St.

Wis., Monroe—The United Telephone Co. plans to build a 2 story, 40 x 65 ft. garage, etc. Estimated cost $40,000. R. M. Austin, Mgr. Private plans.

Wis., North Milwaukee—The North Milwaukee Fdry. Co., Commerce Ave., plans to build a 1 story, 50 x 150 ft. foundry, to replace the one which was recently destroyed by fire.

Wis., Racine—F. J. Greene Eng. Wks., 1028 Douglas Ave., is having plans prepared for the construction of a 3 story, 53 x 100 ft. factory. Estimated cost $50,000. E. B. Funston Co., 503 Robinson Bldg., Archt.

Wis., Racine—Jacobson Auto Co., 1820 West 6th St., awarded the contract for the construction of a 2 story, 60 x 120 ft. garage. Estimated cost $40,000. Noted March 30.

Wis., Rhinelander—Wisconsin Regrinding Co., Sheboygan Falls, plans to build a 1 story, 50 x 90 ft. machine shop, here. Estimated cost $40,000. A. P. Schneidewind, Pres. Architect not selected.

Ont., London—Middlesex Motors, Ltd., 781 Dundas St., will receive bids Oct. 16 for the construction of a 75 x 200 ft. automobile service station and repair shop. Estimated cost $55,000. F. B. Isaacs, Mgr.

Ont., Niagara Falls—Rome Wire Co., Railroad Ave., Rome, N. Y., plans to build a 2 story, 40 x 250 ft. factory, here, for the manufacture of cable wire. Cost will exceed $75,000. Architect not announced.

Ont., St. Thomas—The Windsor Machine & Tool Co., 312 Pitt St., Windsor, plans to build a plant, here, for the manufacture of pistons and piston rings. Estimated cost $100,000.

Ont., Sarnia—Mueller Mfg. Co. plans to build an addition to its plant for the manufacture of special lines of plumbing goods. Estimated cost $100,000. H. Burleigh, Mgr.

General Manufacturing

Ala., Birmingham—Lehigh Portland Cement Co., Young Bldg., Allentown, Pa., plans to build a large plant on tract near here, with a capacity of 1,000,000 bbl. per year.

Calif., Petaluma—Poultry Producers of Central California, 323 East Washington St., will have plans revised for the construction of a 110 x 210 ft. packing plant. Noted Sept. 28.

Calif., Sacramento—The State of California awarded the contract for the construction of a 2 story, 160 x 160 ft. printing plant on 11th and O Sts. Estimated cost $94,800. Noted Aug. 29.

Calif., San Francisco—Ferro Bros., 2522 33rd St., have had plans prepared for the construction of a 2 story, [illegible] x [illegible] ft. addition to their bakery. C. Fantoni, 550 Montgomery St., Archt.

Calif., San Francisco—Millbrae Dairy, [illegible] Octavia St., is having plans prepared for the construction of a 2 and 3 story dairy on McAllister St. near Laguna St. Estimated cost [illegible]. J. Reid, Jr., First National Bank Bldg., Archt.

Conn., Stamford — Emmens & Abbott, Archts., Washington Bldg., are receiving bids for the construction of a 3 story, [illegible] x [illegible] ft. factory for the manufacture of clothing, on Beckley Ave., for S. and J. Gruber, 244 Main St. Estimated cost [illegible].

Ga., Savannah—Western Paper Makers Chemical Co., Riverview Rd., Kalamazoo, Mich., plans to build a paper mill here. Estimated cost [illegible].

Ill., Chicago—Amer. Casket & Mfg. Co., 1311 West [illegible] St., awarded the contract for the construction of a 3 story, 25 x 70 ft. addition to its factory. Estimated cost $30,000.

Ill., Chicago—The Enterprise Parlor Furniture Co., 2315 West Huron St., awarded the contract for the construction of a 3 story, 100 x 125 ft. addition to its factory. Estimated cost $50,000. Noted Sept. 14.

Ill., Chicago—Florence Art Co., c/o Minchin [illegible] & Co., Archts., 19 West Jackson St., awarded the contract for the construction of a 4 story, 50 x 108 ft. factory for the manufacture of art lamps, on North California and George Sts. Estimated cost [illegible].

Ill., Chicago—Illinois Publishing Co., 327 West Madison St., awarded the contract for the construction of a 3 story, 125 x 240 ft. printing plant on 26th and LaSalle Sts. Estimated cost $500,000.

Ind., Evansville—General Cigar Co., Upper 2nd St., plans to construct a 4 story, [illegible] x 150 ft. cigar factory. Estimated cost [illegible]. A. E. Neucks, Peoples Bank Bldg., Archt.

Ind., Hammond—Hammond Dairy Co. is having plans prepared for the construction of a 2 story, 53 x 70 x 153 ft. dairy building on Oakley St. Estimated cost $100,000. A. C. Berry & Co., Ruff Bldg., Archts.

Ind., Princeton—Tip Top Creamery Co. plans to build a 2 story creamery. Estimated cost $30,000. Architect not selected.

Ind., Richmond—Consumers Service Co. plans to build a 1 story refinery, will require [illegible] tanks of 100,000 gal. capacity. Estimated cost $200,000. Architect not selected.

Kan., Atchison—Blair Milling Co., 300 South 6th St., is receiving bids for the construction of a 6 story, 36 x 83 ft. flour mill. Horner & Wyatt, 306 McMillan Bldg., Kansas City, Mo., Archts.

Kan., Salina—H. D. Lee Flour Mills Co. awarded the contract for the construction of a cleaner house, temping bins, elevator, 8 tanks, 22 ft. diameter, capacity 300,000 bu. Estimated cost $190,000. Noted Aug. 24.

Me., Dexter—A. Abbott Co., manufacturer of woolens, plans to rebuild its 2 story plant which was recently destroyed by fire. Estimated cost $100,000.

Mass., Clinton—Lancaster Mills, 1 Green St., awarded the contract for the construction of a 1 story, 20 x 180 ft. addition to its woolen mill. Estimated cost $25,000.

Mass., Dorchester (Boston P. O.)—Liberty Marble Co. 10 Granite St., South Boston, will build a 1 and 2 story, 50 x 122 ft. marble shop, on Dillingham St. Estimated cost [illegible].

Mass., East Braintree, (Boston P. O.)—Massachusetts Oil & Refining Co., 209 Washington St., Boston, plans to build an oil separator plant on Quincy Ave., here. Estimated cost [illegible]. Private plans.

Mass., Millbury—The Felters Co., West St., manufacturers of felt, plans to build a 1 story dryhouse. Private plans.

Mass., Northampton—[illegible] Bros., 284 Pleasant St., awarded the contract for the construction of a 2 story, 60 x 80 ft. woodworking factory. Estimated cost $25,000.

Mass., Springfield—Victor-Wright-Ditson Co., Birnie Ave., awarded the contract for the construction of a 2 story, 60 x 150 ft. addition to its factory, for the manufacture of sporting goods. Estimated cost [illegible].

Mass., Worcester—Waldorf System, Inc., 269 High St., Boston, is having plans prepared for the construction of a 1 story bakery, etc., on [illegible] and Summer Sts., here. Estimated cost [illegible]. J. M. Gray, 112 Water St., Boston, Archt.

Mich., Detroit—Kroger Grocery & Baking Co., 617 Main St., Cincinnati, O., awarded the contract for the construction of a 2 and 3 story, 203 x 424 ft. bakery and warehouse on Merritt Ave., here.

Mich., Three Oaks—The Warren Featherbone Co. has had plans prepared for the construction of a 2 story, 68 x 140 ft. factory. Estimated cost $45,000. G. W. Allen, Laporte, Ind., Archt.

Minn., Bemidji — Minnesota Associated Lumber Co. plans to build a large lumber mill for cutting and preparing 40,000,000 ft. of birch timber. Estimated cost $500,000. Architect not announced.

Minn., Chisholm—Bd. Educ. will receive bids about Dec. 1, for the construction of a 3 story junior high school, including manual training and industrial departments. Estimated cost $750,000. E. Drew, Clk. German & Jensen, Exch. Bank Bldg., Duluth, Archts.

N. Y., Batavia—P. W. Minor & Son, Inc., awarded the contract for the construction of a 4 story, 43 x 140 ft. addition to their shoe factory, on State St. Estimated cost $100,000.

N. Y., Brooklyn — The United Last Co., 191 Worth St., New York City, awarded the contract for the construction of a 3 story, 80 x 131 ft. and a 1 story, 16 x 50 ft. additions on Classon Ave. and Clifton Pl., here.

N. Y., Brooklyn—The Rubel Coal & Ice Corp., Glenmore Ave., will build an ice plant on Atlantic Ave. Estimated cost $500,000. E. M. Adelsohn, 1778 Pitkin Ave., Engr.

N. Y., Buffalo—Angola Tire & Rubber Co., 270 North Division St., awarded the contract for the construction of a 1 story, 30 x 80 ft. addition to its factory. Cost will exceed $5,000.

N. Y., Buffalo — W. Maynard Co., 17 Newell St., plans to build a 2 story, 50 x 100 ft. abbattoir. Estimated cost $40,000. Architect not announced.

N. Y., Forks—The Live Poultry Transit Co., Bway., Cheektowaga (Buffalo P. O.), plans to rebuild its fertilizer and car repair plant, here, which was destroyed by fire. Estimated cost $100,000. Architect not selected.

N. Y., Jamestown—Herby Bros., 610 West 7th St., plan to build an addition to their wagon and automobile truck body factory and shop. Estimated cost $5,000. Private plans.

N. Y., Jamestown — Jamestown Chair Factory, 20 Winsor St., plans to build a 4 story, 50 x 67 ft. addition to its factory. Estimated cost $20,000. Architect not announced.

N. Y., Jamestown—Jamestown Worsted Mills Co., 225 Harrison St., is having plans prepared for the construction of a 4 story, 70 x 180 ft. factory (No. 16). Estimated cost $250,000. Lockwood, Greene & Co., 1556 Hanna Bldg., Cleveland, O., Archts. and Engrs.

N. Y., North Tonawanda — The Auto Wheel Coaster Co., manufacturer of coaster wagons and sleds, plans to rebuild portion of its factory, on Schenk St., which was destroyed by fire. Estimated cost $25,000. Architect not announced.

N. Y., Rochester—Don-O-Lak Co. plans to rebuild portion of its paint and varnish factory which was destroyed by fire. Estimated cost $50,000. Architect not announced.

N. Y., Sheepshead Bay (Brooklyn P. O.)—Superior Ice Co., Inc., 50 East 42nd St., New York City, is having plans prepared for the construction of an ice plant, on Ave. Z and East 17th St., here. Estimated cost $250,000. W. Mortensen, 209 West 76th St., New York City, Archt. and Engr.

O., Cleveland—M. Braduloo, 9123 Laisy Ave., (baker), awarded the contract for the construction of a 1 and 2 story, 68 x 109 ft. commercial building and bakery on East 116th St. and Buckeye Rd. Estimated cost $45,000.

O., Cleveland—J. O. Stein & Co., (real estate), 822 Leader-News Bldg., awarded the contract for the construction of a 2 story, 25 x 50 ft. ice cream factory, at 10521 Superior Ave. Part of building is leased to the Hoffman Ice Cream Co., 10521 Superior Ave. Estimated cost $40,000.

O., Cleveland—The Van Gastel Cleaning Co., 2420 Cedar Ave., plans to build a 1 and 2 story dry cleaning plant. Estimated cost $70,000. H. Van Gastel, Mgr. Architect not selected.

O., Columbus — The Columbus Varnish Co., 262 Cozzens St., is having sketches made for the construction of a 1 story, 100 x 200 ft. addition to its factory. Estimated cost $40,000. Jones & Abernethy, Dispatch Annex, Engrs. and Archts.

O., Mansfield—Dept. Public Welfare, Oak and 9th Sts., Columbus, is having plans prepared for the construction of a 2 story industrial building at the Mansfield Reformatory, here. Estimated cost $150,000. R. S. Harsh, Ohio-Hartman Bldg., Columbus, Archt.

Pa., Brackenridge — Atlantic Bottle Co., Brackenridge, and 90 West Bway, New York City, plans to rebuild its factory, here, which was recently destroyed by fire. Estimated cost $300,000. Architect not announced.

Pa., Clarion—Berney-Bond Glass Co. plans to rebuild its facory which was recently destroyed by fire. Estimated cost $400,000. Architect not announced.

Pa., McKees Rocks—The Chesebrough Mfg. Co., 17 State St., New York City, manufacturers of vaseline, will soon award the contract for the construction of a plant, consisting of seven buildings, including a power house, boiler house, warehouse and manufacturing buildings, here. Estimated cost $1,000,000. Hunting Davis Co., Century Bldg., Pittsburgh, Archts. Noted June 8.

Pa., Phila.—Harrison Brush Co., 4th and Arch Sts., awarded the contract for the construction of a 3 story, 30 x 110 ft. factory for the manufacture of brushes, at 4712-14 Market St. Estimated cost $80,000.

Pa., Pittsburgh—The Atlantic & Pacific Tea Co., 309 Carson St., awarded the contract for the construction of a 4 story, 75 x 120 ft. bakery on Dallas Ave. and Lynn Way.

Pa., Warren—C. Hamm, 28 Clark St., plans to rebuild portion of woodworking shop which was destroyed by fire. Estimated cost $30,000.

R. I., East Providence—Atlantic Refining Co., 715 Hospital Trust Bldg., Providence, is having plans prepared for the construction of a receiving and distributing oil plant, including 20 large storage tanks, pump houses, garages, etc., at Kettle Point off Barrington Parkway, here. Private plans.

R. I., Manville — The Manville Co. awarded the contract for the construction of a 1 and 2 story addition to its plant for the manufacture of cotton goods. Estimated cost $100,000.

R. I., Pawtucket—J. and P. Coats, Inc., 366 Pine St., will soon award the contract for the construction of 2 and 3 story, 95 x 370 ft. and 95 x 270 ft. mill buildings, for the manufacture of thread, etc. Estimated cost $375,000. Private plans.

R. I., Wakefield—Wakefield Textile Mills awarded the contract for the construction of a 2 story, 45 x 80 ft. addition to their woolen mill, including picker room building and dyehouse. Estimated cost $25,000.

S. C., Greenville—Judson Mills, Community Bldg., manufacturers of cotton goods, is having plans prepared for the construction of a 2 story, 175 x 300 ft. textile mill. Estimated cost $800,000. J. E. Sirrine Co., South Main St., Archts.

Tenn., Kingsport—Mead Fibre Co. plans to build a large paper mill. Estimated cost $750,000. Management Eng. & Development Co., c/o owner, Engrs.

W. Va., Nitro—Nitro Pencil Co. plans to rebuild its pencil factory which was destroyed by fire. Estimated cost $90,000. Architect not announced.

W. Va., Charleston—The Owens Bottle Co., 1401 Nicholas Bldg., Toledo, O., is having plans prepared for the construction of a 1 story, 300 x 360 ft. addition to its factory, here. Estimated cost $150,000. The Devore Co., 908 Nicholas Bldg., Toledo, O., Engrs. and Archts.

Wis., Brillion—Calumet Canning Co. plans to build a 2 story, 50 x 110 ft. canning factory, here. Estimated cost $45,000. J. E. De Master, 623 End Court, Sheboygan, Pres. Private plans.

Wis., Crandon—The Vulcan Last Co. plans to rebuild its 2 story, 60 x 120 ft. shoe factory, which was recently destroyed by fire. Architect not selected.

Wis., Oconto—Elsnore Veneer Co., Conneaut, O., plans to build a 1 story, 50 x 90 ft. veneer factory, here. Estimated cost $30,000. H. A. Truesdale, Local Mgr. Private plans.

Wis., Sheboygan—The Ko-No Mfg. Co., Pennsylvania Ave. and North Water St., awarded the contract for the construction of a 3 story, 40 x 80 ft. factory for the manufacture of novelties, on Water St. Estimated cost $30,000.

Wis., Union Grove—State Bd. of Control, M. J. Tappins, Secy., 902 Garfield St., Madison, will receive bids until Oct. 3, for the construction of a 1 story, 50 x 90 ft. laundry at the Wisconsin Home for Feeble Minded, here. Estimated cost $40,000. A. Peabody, Capitol Bldg., Madison, Archts.

American Machinist

Volume 57 NEW YORK, OCTOBER 12, 1922 Number 15

How the Black & Decker Drill Is Built

Machining on Automatic Turret Lathes—Shaping and Hobbing Gears—Successful and Unsuccessful Fixtures—Heat-Treatment—Testing by Prony Brake

BY S. ASHTON HAND
Associate Editor, *American Machinist*

WHILE the component parts of portable electric drills require good workmanship, the amount of labor necessary in their production is comparatively small owing to the use of automatic machines.

One of the drills made by the Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., is shown disassembled in Fig. 1.

The field case, gear case and gear-case cover are aluminum castings. The outside of the field case is hexagonal in shape except at the ends which are round.

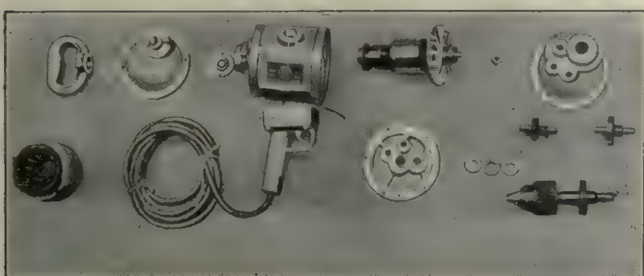


FIG. 1—PARTS OF THE BLACK & DECKER DRILL

This shape, with the round interior, gives greater strength with the same amount of metal than would be the case if the case were round both inside and outside and provides extra thickness of metal at the corners of the hexagon. If the drill were dropped it would probably strike on one of the corners where the greater thickness of metal would protect it against injury.

The hexagonal shape of the field case is an aid in its machining as the flat sides of the hexagon form excellent bearings for chuck jaws and but little pressure is required in chucking, as the wide bearing of the chuck jaws on the flats prevents the case from turning, consequently the danger of distortion from tight squeezing in the chuck is greatly eliminated.

Field cases are machined on Potter & Johnson automatic turret lathes as shown in Fig. 2. Rough- and finish-boring, turning and facing, together with spotting, drilling and reaming the central hole at the rear are all done in one chucking at the rate of 150 in $8\frac{1}{2}$ hours.

Gear cases and covers are likewise turned and faced in Potter & Johnson machines. Fig. 3 shows a gear-case cover in the chuck and the tool set-up in the turret and on the toolslides of the carriage.

Drilling a field case for attaching gear cases and covers is done on a Natco multiple-spindle drilling machine as shown in Fig. 4. In operation, the field case is located by a pilot on the fixture *A*. The jig plate *B* is lowered simultaneously with the drilling head until it rests on the work. Further lowering of the drilling head to bring the drills into action, compresses the springs *C* and *D*, pressing the jig plate down on the work and holding it firmly in position. The production is 500 in $8\frac{1}{2}$ hours.

As the armature runs at a very much higher speed than the spindle it is necessary to make considerable reduction between the two and as the space in the gear case is limited, the gears are compounded. In order that the gears shall run as noiselessly as possible the center distances of the holes in the gear case must be very accurate. The jig shown at *A*, Fig. 5, was made for drilling and reaming the holes to receive the bronze bushings that act as bearings for the gear shafts, the hole in the center of the gear case being bored and reamed at the time the case is turned, recessed and

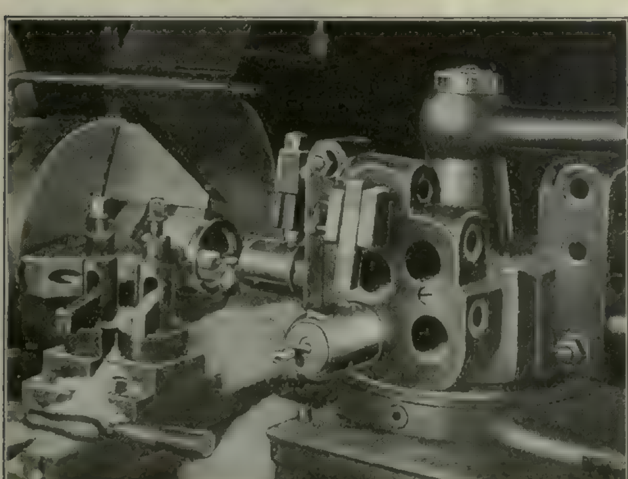


FIG. 2—MACHINING FIELD CASES. FIG. 3—MACHINING GEAR-CASE COVERS

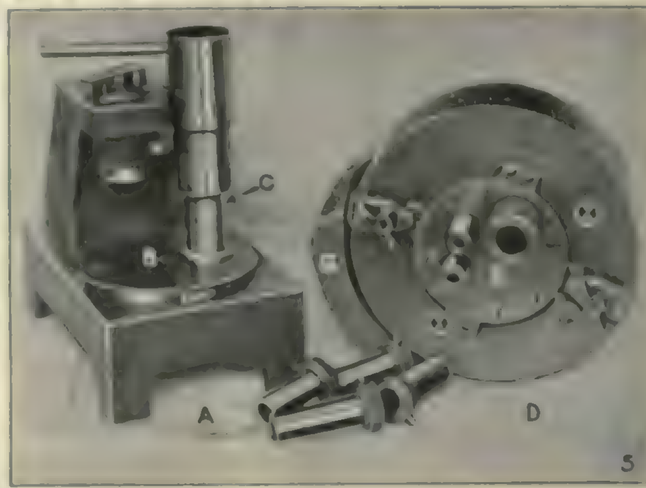


FIG. 4—DRILLING FIELD CASES. FIG. 5—FIXTURES FOR BORING GEAR CASES

faced. Notwithstanding that the jig was made with great care and that the work was located on the pilot *B* and held by the snug fitting, hardened and ground, plug *C*, through a hole previously drilled and reamed, the jig did not produce work having the accuracy demanded. The jig failed in its mission because it was impossible to have drills and reamers fit tightly enough in the bushings to prevent more or less crowding to one side or the other while doing the work.

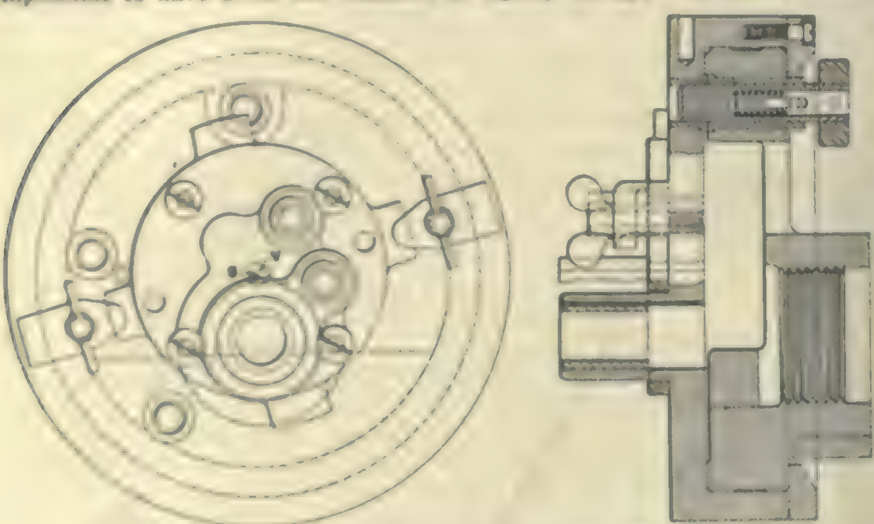


FIG. 6—DETAILS OF FIXTURE FOR BORING GEAR CASES

It was then decided to make a fixture for drilling and reaming the holes and to mount it on the spindle of a turret lathe so that the work would revolve and the tools remain stationary, except for motion in the direction of feed. Accordingly the fixture *D*, Fig. 5, was made and has given satisfactory results. The work is located on the pilot *E* and held by the clamps shown.

To insure further accuracy, the turret tools for boring and reaming are piloted in the bushings to be seen projecting from the work pilot *E*. As the holes in the work are grouped, though not equidistantly, about the center it is necessary to mount the fixture eccentrically on the machine spindle and to counterbalance it by the weight *G* to overcome vibration.

The whole front of the fixture is indexed for the holes around a plug, and held in any one of the desired positions by an index pin at the rear.

As previously stated the centers of the holes in the work are not equidistant from the center of the fixture and these unequal distances render it necessary to locate the pilot *E* out of the center so as to bring the centers of the holes equidistant from the indexing center.

Details of the fixture are given in the line drawing, Fig. 6, where *A* represents the center of the pilot and *B* the center of indexing.

All the holes are bushed with bronze to make good wearing bearings for the gear shafts. The bushings are made in a Cleveland automatic screw machine with magazine attachment as shown in Fig. 7, where they can be seen in the magazine at *A*. The blanks are double the length required and are drilled, reamed and rough-turned for one-half of their length, then reversed in the magazine when the former operations are repeated and the blanks cut in half, each blank making two bushings. The operations of the machine are entirely automatic, the only work required on the part of the operator being to keep the magazine loaded. The outside diameters of the bushings are finish-turned in a subsequent operation.

Pinions and gears all have stub teeth and are cut either on Fellows gear shapers or on Barber-Coleman hobbing machines, operations on the former being shown in Fig. 8 and on the latter in Fig. 9.

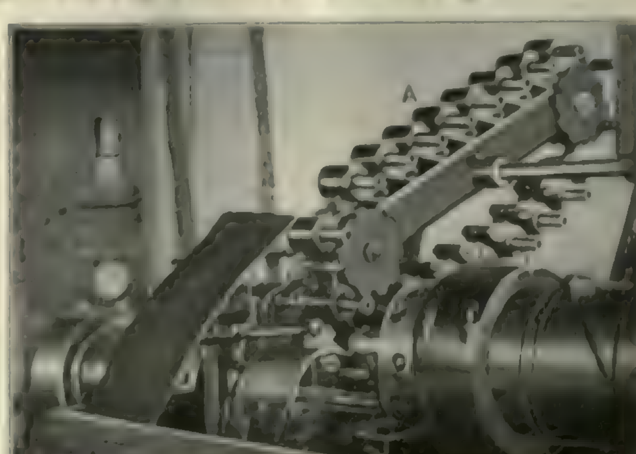


FIG. 7—MAKING BEARING BUSHINGS

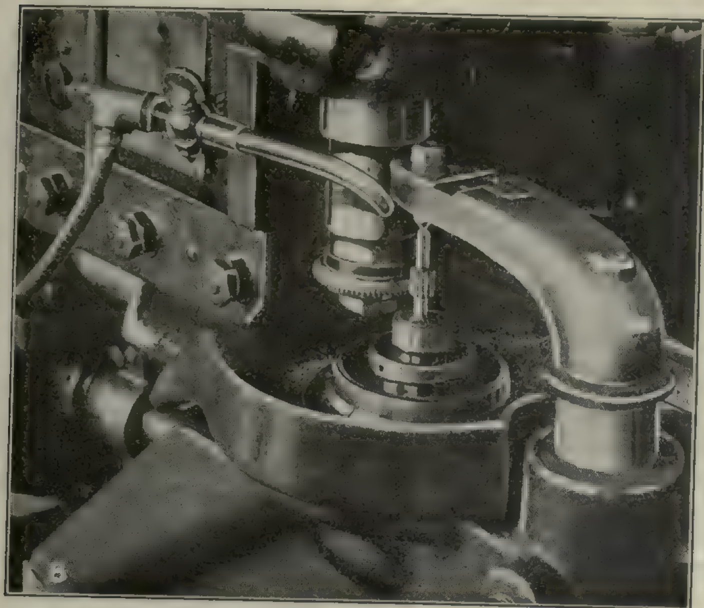


FIG. 8—CUTTING PINIONS.

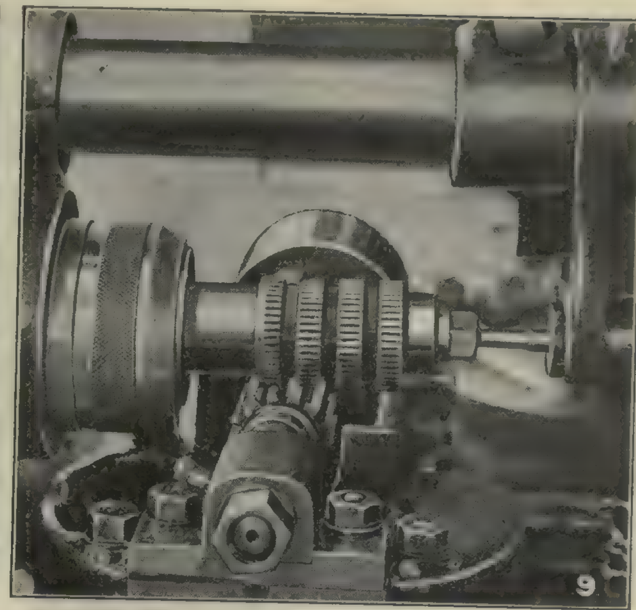


FIG. 9—HOBBING GEARS

Gear and pinion blanks are made from bar stock in automatic machines. All pinions, except the armature pinion, are integral with their shafts, the armature pinion being internally threaded and screwed on to the armature shaft. As before stated, the gears are compounded, a gear being mounted on each pinion shaft and arranged in the gear case in the same way as the gears in a clock or watch. The gear seats on the pinion shafts are knurled to make the gears a tight fit when pressed on.

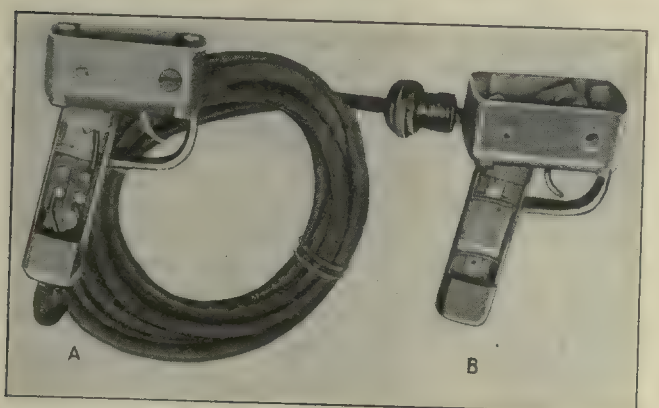


FIG. 10—SWITCH HANDLES

The gears and all other steel parts are heat-treated, being brought to temperatures suited to the work they have to perform and then quenched in oil and drawn by holding them in molten saltpeter for 10 min. and finally quenched in water. The average heat for the first treating is 1,450 deg. F., and for drawing in saltpeter, 750 deg. F. Before heating, all parts are washed in soda water to remove the grease and to prevent the formation of scale.

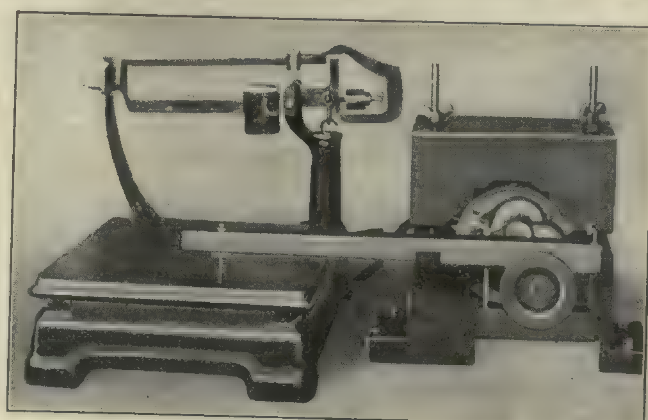


FIG. 12—WEIGHING THE LOAD

The switch handles shown in Fig. 10 are die-cast

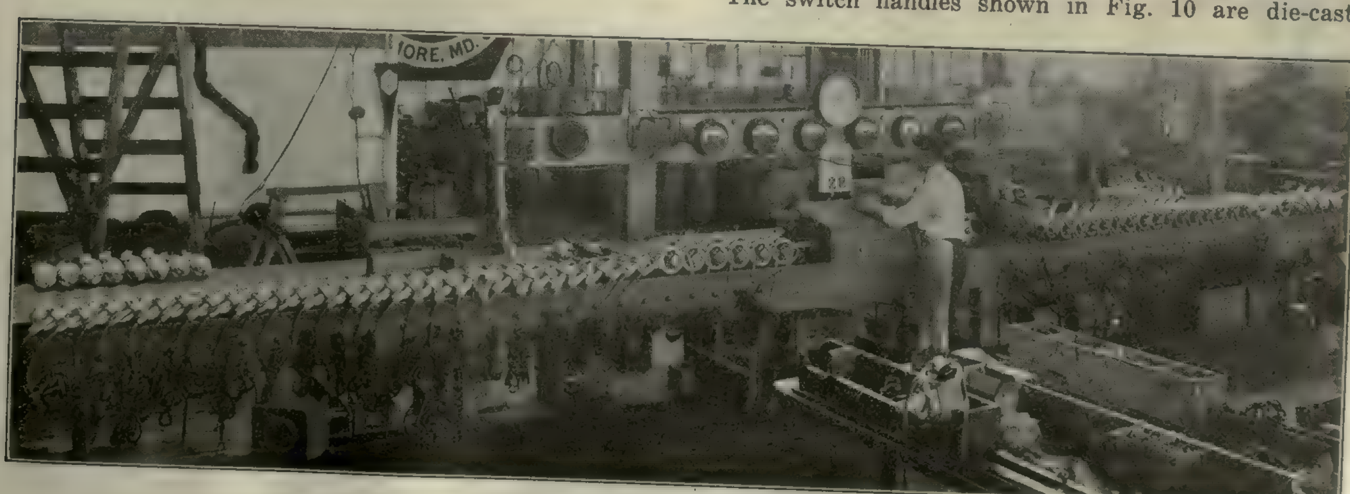


FIG. 11—THE RUNNING TEST

aluminum, the one at *A* having the wiring and insulating blocks in place while the one at *B* has not.

Electrical connection to the motor is made or broken by pressing the trigger which imparts a quarter turn to an insulated block spanned by brushes and having contacts on two opposite sides. The brushes are long and the block on which they are mounted is pivoted so that their tension is equal on both sides of the revolving block. All leads and wires are conected by screws and as no solder is used, the wires can be connected or disconnected by the use of a screwdriver.

The ball retainers for the thrust bearings are made from brass rod on a Brown & Sharpe automatic screw machine and then jig drilled for the ball pockets. The thrust washers are made from steel bars, hardened and then ground on a Heald rotary surface grinder, being held on a magnetic chuck.

All drills are run on a test for 2 hr. on the bench, shown in Fig. 11, which holds about 150 drills when fully loaded. After the running test each drill is given a brake test by the small Prony brake shown in Fig. 12. The length of the brake lever is 1 ft. from the center of the pulley to the center of the screw that bears on the scale platform. To pass this test the drill must deliver the full rated power without slackening in speed when the scale beam tips at 5 pounds.

The brake is lined with brake lining so that it is not necessary to use any oil.

The armatures and field coils are purchased from outside so that no electrical winding is done on the premises.

Samples of the insulated wire furnished with the drills are given periodic practical tests for the ability of the insulation to stand up under great abuse. For instance one sample of wire was laid across the roadway where it would be subject to all kinds of weather and to being run over by automobiles and heavily loaded trucks. This wire was put out in November, 1921, and tested weekly for breakage and leakage. In April, 1922, it was still in good working condition.

Forced and Shrink Fits—Discussion

By Frank C. Hudson

On page 210 of *American Machinist*, W. S. Standiford gives allowances for press and shrink fits which are so much greater than usual practice as to attract my attention immediately. They seem to average about double the usual allowance so, in order to make sure that the practice has not changed enough to make me a back number, I secured data as to the best practice of some of the modern shops. These data seem to bear out my impression that the allowances given by Mr. Standiford are much too great and should not be depended on for average work.

The Nordberg Manufacturing Co., which is a well-known builder of large engines and air compressors, uses 0.001 to 0.0015 in. per inch of diameter up to a 12-in. shaft. Above 12 in. it uses 0.001 in. per inch of diameter.

The Chandler & Price Co., makers of printing presses in Cleveland, Ohio, has smaller sizes. Its table is of special value because it gives both diameter and length of hole as well as the pressure required. It should be noted that the table gives total pressure and total oversize allowance on the shaft. The table is as follows:

Table of Force Fits and Pressures

Diameter of hole	Length	Oversize of shaft
5 tons pressure		
2½ in.	3 in.	0.003 in.
3 in.	3½ in.	0.003 in.
3½ in.	3¾ in.	0.003 in.
3 tons pressure		
Diameter of hole	Length	Oversize of shaft
2½ in.	3 in.	0.002 in.
3 in.	2½ in.	0.002 in.
3½ in.	3¾ in.	0.002 in.

A well-known railroad, which does not wish to be quoted, gives $\frac{1}{16}$ in. per foot of diameter for shrinkage of tires on its older locomotives, and $\frac{1}{32}$ in. per foot of diameter on the newer and heavier power. These are, of course, shrink fits.

In only one case, that of a locomotive shop which also desires to remain incognito, do I find allowances as great as those proposed by Mr. Standiford. On cast-iron wheels the allowance varies rather erratically from 0.002 in. per inch of diameter on a 2-in. bore, to nearly 0.003 in. per inch on a 7-in. bore and back to 0.002 in. on a 12-in. bore. The pressures given vary from 7 to 9 tons per inch of diameter.

For cast-steel or rolled-steel wheels the allowance is increased to 0.005 in. per inch for a 2-in. bore, but drops back to 0.003 in. per inch for a 7-in. bore and to a trifle over 0.002 in. per inch for a 12-in. bore. Pressures run from 11 to 15 tons per inch of diameter. These allowances seem to be based on the amount of pressure which the wheel will stand without bursting, rather than the allowance and pressure required to hold them on the axles. These figures indicate that Mr. Standiford's allowances may not come as near to bursting the piece as might be supposed. But the fact that other makers use a much smaller allowance successfully, would seem to show that excessive allowances and pressures are seldom necessary to hold the two parts together. It is certainly desirable in every way to use the least allowance which will give satisfactory results in holding the parts together. This reduces stresses and the parts go together more easily.

Use of Double-Acting Machines

By Robert Grimshaw

If the double-acting steam engine is a step in advance from the single-acting, why not apply the same principle wherever practicable? We already see the advantage of the double-acting wire-nail machine, the heavy recoil of which, after heading one nail, is not taken up uselessly in the bearings, but utilized in making another nail at the other end of the machine. Of course, owing to the necessity of putting in fresh coils of wire, and of sharpening, replacing or adjusting the cutting-off bits and the heading dies, the capacity of the double-acting nail machine is not twice that of the single on the same size product and with the same length of wire in all the spools. But the difference in labor cost and power consumption per product unit is marked, and pays.

The metal planer seems to me to be the best subject for thorough experiments in double acting. I think that the "jack-in-a-box" tool, such as one finds once in a while in Great Britain, might be used to advantage, with the same table speed—that at present used in cutting—in both directions. This would also diminish the jar occurring at present at the end of the back trip.

Methods of Machine Tool Design

Further Continuation of the Section on Feed Mechanism—Concluding the Discussion of Lead Screws—Various Types of Feed Screw Nuts—Thrust Bearings

By A. L. DE LEEUW
Consulting Editor, *American Machinist*

A PECULIAR use is made of the feed screw in connection with hydraulic feed. For the very heaviest kind of turning and boring, feed pressures are required beyond the capacity of a screw of practicable size. Generally speaking there is, of course, no reason why a screw could not be used with a diameter of 10 ft., but practical considerations such as the size of bearings, nuts, especially if half nuts are used, etc., limit the size. On the other hand, it is a very simple matter to obtain almost any feed pressure by means of hydraulic apparatus. If, for instance, water were used under a pressure of 1,000 lb. to the square inch, which is a very moderate pressure for a hydraulic cylinder, and if a feed pressure of 300,000 lb. were required, which is very high, it would be necessary only to have a hydraulic cylinder with an area of bore of 300 sq.in. which requires about a 10-in. bore. On the other hand, it is exceedingly difficult to regulate the amount of advance per minute when using hydraulic pressure. Differences in sharpness of the tool, size of cut, and nature of the material, would make the tool advance sometimes fast, sometimes slow, and it would be practically impossible to keep the advance uniform under all conditions of the cut.

The Use of an Auxiliary Mechanism

When it is necessary, then, to use hydraulic apparatus in order to obtain the required pressure, some auxiliary mechanism should also be used to regulate the speed of advance. A mechanism of this kind might be called a releasing mechanism, because it will hold back the action of the hydraulic pressure until this mechanism is set in motion and then it permits the hydraulic piston to advance at a speed determined by the speed of this auxiliary mechanism. One interesting way of obtaining this result is the following: An extension of the piston of the hydraulic cylinder is provided at one end with a steep screw thread. By some means or other the piston is prevented from turning. As this piston advances the screw thread must pass through its nut and, of course, cannot do so without rotating it. By making the angle of spiral of the thread greater than the friction angle it is possible to have the screw overhaul the nut. If the angle of the thread were very close to the friction angle, say a few minutes only, it would be able to drive the nut; but a small resistance brought to bear against the nut would prevent it from turning and would stall the piston. If this resistance were released—that is, if the nut were permitted to turn—the piston would advance and the full pressure of the hydraulic cylinder would be exerted against the member driven by the piston.

It is, of course, exceedingly difficult to determine beforehand exactly what angle should be used, particularly so as the conditions of metal of screw and nut cannot be predicted. There might be a difference of several degress in the friction angle between two screws and nuts made of the same material. In order to overcome this difficulty the spiral angle is made large enough to be certain that it exceeds this friction angle; and to overcome the difficulty which then arises, namely that considerable pressure must be brought to bear against the nut in order to keep it from rotating, the following method is applied:

The outside of the nut is made into a wormwheel and the angle of the teeth is such that it will overhaul the worm. To be sure again that the angle of the teeth will be sufficient, a reasonable excess is allowed, so that one will be sure that the angle is more and never less than the friction angle. Instead of applying the resistance against the nut, we now apply the resistance against the worm. The fact that we have allowed for a certain excess of angle in the screw may cause the nut to require a resistance of quite an appreciable percentage of the total load. However, it is well possible to keep this percentage down to less than 10. In that case, a resistance of 10 per cent of 300,000 or 30,000 lb. would be required at the diameter of the thread; or, let us say, 20,000 lb. at the outside of the nut or the pitch diameter of the wormwheel.

Allowing again for an excess of 10 per cent, we would then have to apply a resistance of 2,000 lb. to a diameter equal to the pitch diameter of the worm, or of 1,000 lb. to a diameter twice as great. A positive feed mechanism can be arranged giving all the necessary feeds required for the machine, and of which the last member is not directly applied to the carriage or boring head, but to a disk or gear or some member keyed to the shaft of the worm. The pressure required at that point being only 1,000 lb. can easily be supplied by the positive feed mechanism.

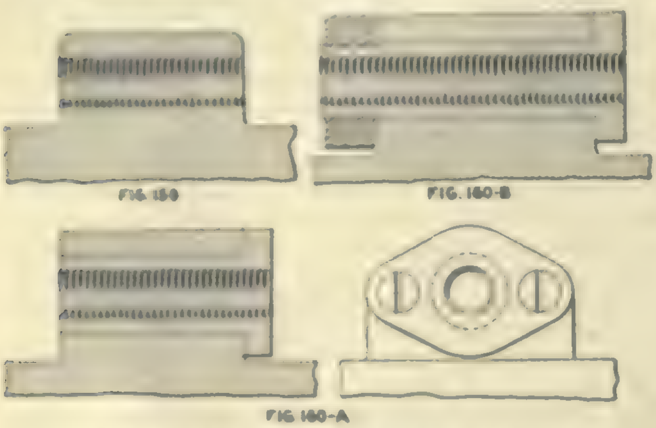
Allows for Ample Pressure

So long as the pressure in the hydraulic cylinder is sufficient to make the tool penetrate the amount prescribed by the positive feed mechanism, the feed will be uniform; but if the hydraulic pressure is not sufficient to cause the tool to penetrate, then the positive feed mechanism would have to supply the additional feed pressure required. As this might be quite considerable, it is advisable to allow for a rather large excess of hydraulic pressure so that at all times there shall be enough pressure for the penetration of the tools. Mechanisms of this kind have been successfully applied to large ingot boring and turning lathes.

In the previous paragraphs mention has been made of the desirability of large lead for feed screws. The amount of lead depended to a certain extent on the diameter of the screw, the essential requirement being that the angle of spiral should be rather large. When a screw is used as lead screw there is another requirement of equal importance, especially if the screw is used for thread cutting.

If a lead screw were made with 1-in. lead and we had to cut threads of 1, 2, 3, 4, 5, 6, pitch, and if we used the open and closed nuts, we would have the following condition: The operator throws the nut in, takes the first cut, throws the nut out at the end of the cut, returns the carriage, sets the tool in a certain distance, and throws the half nut in again. It makes

no difference what time he throws this half nut in, he is bound to catch the thread again which he has cut. Suppose the nut had been thrown in for the first cut in such a position that a thread which we will call A is in the center of the nut, and suppose we call the threads to the right of this $A + 1$, $A + 2$, $A + 3$, etc.; and to the left $A - 1$, $A - 2$, $A - 3$, etc. Suppose, then, that we should have thrown the nut in on the second pass in such a manner that thread $+ 2$ had come in the center of the nut; then this would simply mean that two complete revolutions of the screw are required before things are in the same condition again as on the first pass. The same thing would have happened if we had thrown it in on $- 2$, provided, of course, that there was room enough between tool and work to make such a thing possible. Speaking in general, the lead of the screw should be a multiple of all the different leads to be cut in order to make it possible to throw a half nut in without any precautions. This means that the lead must be either 1 in. or a multiple. If the lead were ½ in. it would have produced the same result when we throw the nut in on $+ 2$, but not when we throw it



FIGS. 159 AND 160—FORMS OF LEAD SCREW NUT CONSTRUCTION

in on $+ 1$ or $+ 3$, because this would have the tool brought to the right ½ in. or 1½ in. and this is not a multiple of the lead to be cut. This lead of ½ in. would have been all right for ½ in. or ¼ in. or ⅛ in. or ⅙ in. pitch, but not for ⅓ in. or ⅕ in. or ⅐ in. pitch.

Giving the lead screw a lead of 1 in. meets all commercial threads except 11½ per inch. This thread also might be included if the lead of the screw were 2 in. but, as a rule, this is too much for moderate sized lathes on which threads of 11½ to the inch are apt to be cut. The common practice of making lead screws with ⅛ in., ¼ in. or ½ in. lead should be discouraged, as it is very well possible, even in moderate sized lathes, to give the screw a lead, though not necessarily a pitch, of 1 in.

The simplest way to construct a nut for feed or lead screw is to cast a lug to the member to be moved and tap it out to suit the screw. Though this may be the simplest in principle, it is not necessarily the simplest in execution because it may be difficult to get at the nut for tapping. Besides, merely tapping a hole would not be satisfactory for larger or more accurate work and where the nut is made in one with a large casting it becomes exceedingly difficult to chase it in a lathe. Fig. 159 shows this simple construction. Fig. 160 A shows a better construction. Here the lug of the casting is merely bored out and faced. The nut is made cylindrical in form and provided with a flange so that it can be bolted on to the lug of the main casting. It is possible now to turn this nut and chase it in the lathe and for a higher degree of accuracy it can be put on a threaded arbor and finish-turned or ground from

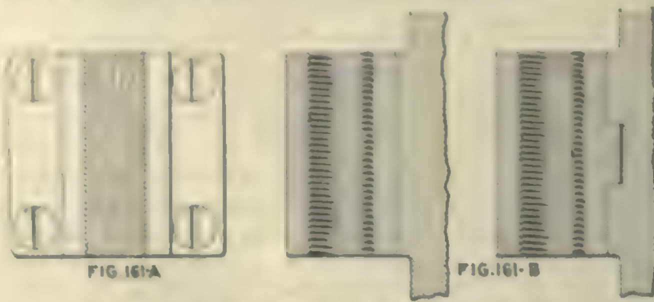


FIG. 161—BOLTED-ON LEAD SCREW NUT

the thread, so that there is a reasonable assurance that the thread will be concentric and in line with the bored hole in the lug.

Fig. 160 B shows the same construction with the exception that a collar has been provided at the end of the nut opposite the flange. When pressure occurs in one direction only, or when the pressure in the opposite direction is always light, a construction such as shown in Fig. 160 A is satisfactory; but when there is a possibility that heavy pressure may be exerted in the opposite direction, then it is not safe to rely on the necessarily small screws which hold the nut to the casting. The collar at the other end of the nut takes care of this pressure.

A nut bolted to the casting is shown in Fig. 160 A. This may have certain advantages when conditions of the casting are such that the boring out of a lug would be difficult. With this construction, however, one depends entirely on the resistance of the bolts against shear. It is frequently difficult to get bolts of sufficient size or in sufficient number for the fastening of such a nut because of the probable crowded condition of the mechanism.

Even without such a condition, it is unwise to have the fastening of the nut in shear. To overcome this objection, a nut is often made as shown in Fig. 161 B where it is provided with a pilot. This pilot may be round, as shown in the illustration, a tongue cast on to the nut, or even a cross key. The tongue and cross key require cross planing of the piece, which may be difficult to accomplish. It is always easy to provide a hole for a pilot. This, however, offers another practical difficulty which should be considered when a selection is made of the nature of fastening of the nut.

In Fig. 162 the nut is shown in heavy lines and the slide to be moved by that nut in light lines. The screw has its bearings in the slide whereas the nut

FIG. 162—EFFECT OF BORING PILOT HOLE OFF CENTER

has its pilot in the stationary piece, or vice versa. The pilot of the nut is shown off center. It is always exceedingly difficult to bore this short crosshole exactly central with the centerline of the screw. A small error of one or two thousandths of an inch might not cause much trouble when the nut is central between the two

bearings of the screw, especially if the screw is of a fair length; but if the slide has been moved so as to bring either bearing close to the nut, the screw would bind and might cause serious trouble.

On the other hand, if the construction is as shown

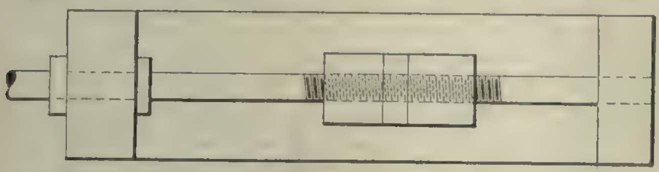


FIG. 163—LEAD SCREW NUT LOCATED BY CROSS KEY

in Fig. 163—with tongue or cross key—a small error in the direction of that key (that is, when it makes an angle of less than 90 deg. with the centerline of the hole), would also cause the same inaccuracy which we found when the pilot was off center, but this inaccuracy has the same effects whether the nut is midway between the two bearings or whether it is close to a bearing. This construction, then, is to be preferred whenever possible. There should be no great difficulty in boring the hole of the nut at right-angles to the tongue or key.

Construction of Half Nuts

Two half nuts are shown in Fig. 164, each provided with a sliding bearing. In the illustration a disk is shown behind the two nuts which can be rotated through an arc of a circle, causing the two pins, shown is dotted lines, to operate in slots in the half nuts to bring them together or move them apart. This is rather a crude construction, as it is very difficult to make all parts so that the two half nuts will bear on the screw simultaneously and in exactly the same manner; in other words, this construction is almost sure to cause one of the two half nuts only to be in action.

Another construction which is often carried out is to have a screw with right- and left-hand thread operate on the two half nuts. This screw can be made floating, that is, it has no abutment in any part except the two parts to be moved. This will insure an even bearing of both half nuts on the screw.

On the other hand, this construction also has its drawbacks. In the one shown in Fig. 164, the two half nuts can be made in one single piece, bored and

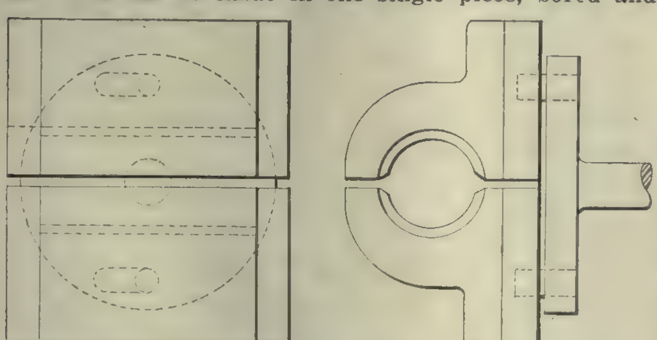


FIG. 164—CRUDE CONSTRUCTION OF HALF NUTS

threaded, and then sawed apart so that each comprises a little less than one-half of the complete nut. In the construction where a right- and left-hand screw is used for closing the nut, it is necessary either to bring the two half nuts against each other or else to provide pins or stops of some kind so that when they have gone as far as they can go, the two halves will make all or the greater part of one circle.

Introducing pins or other stops makes the fitting or assembling a rather delicate job and, on the other hand, if they are made so that they will butt against each other without such a stop, then each half nut must be the exact half of a circle so that the two parts cannot be made in one and later sawed apart. This offers no difficulties when babbitted nuts are used but requires some care if the nuts are made of some metal which has to be machined.

Nuts and screws will wear, like any other part; and many constructions have been proposed to compensate for such wear. One well-known construction is illustrated in Fig. 165 where the nut is made up of two parts, one of which can be advanced or turned through some angle and then fixed again. This, as well as practically all other suggested constructions, meets the difficulty only apparently, not really. If the wear were in the nut only, such a device might meet the problem; but wear takes place in both screw and nut.

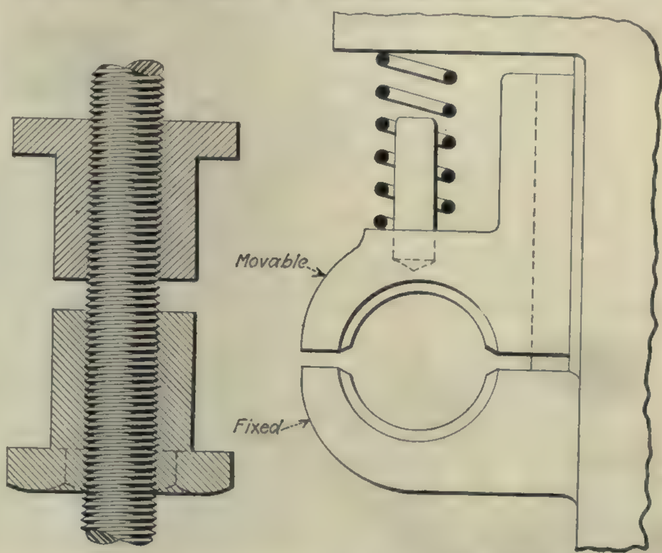


FIG. 165 AND 166—TAKE-UP DEVICES FOR HALF NUTS

Again, if the wear in the screw were perfectly even all over, this device might help us out of our trouble. But, in practically all machine tools, the location of a slide when doing work varies from day to day. It may well be that for a long time at a stretch only a short part of the screw has been used for feed and, of course, this part of the screw will then wear more than any other part. If the looseness in the nut is taken up and then a piece of work is placed in the machine which requires another part of the screw to be in action, this screw will be tight in the nut, and, in fact, it may be entirely impossible to use the nut under such conditions. Speaking from a practical standpoint we may say that it is useless to attempt to provide a take-up for the nut for any machine which must do a variety of work. It is, however, possible to utilize such a take-up for a special machine which always does the same kind of work and in the same position.

A take-up which can be used for light work requiring rather great accuracy is shown in Fig. 166. The angle of the thread of the screw is made so as to approach closely the friction angle between screw and nut. It is, in fact, supposed to exceed it by 1 or 2 deg. The half nut (only one-half nut is used here) is held in engagement by a spring, or a set of springs. These springs will force the nut into closer engagement when the screw thread is worn but permit the half nut to be

pushed back by the screw if it meets a part of the screw which is worn to a lesser extent. It will be seen from the construction that this device is not available where heavy work must be done.

Mention has been made in the previous paragraphs of the use of thrust collars or ball bearings in connection with feed screws. It is, of course, a simple matter to provide a take-up when thrust collars are used. A thrust ball bearing requires no adjustment for wear because when the balls or races are worn as little as two ten-thousandths of an inch the bearing should no longer be considered fit for use and should be replaced. For this reason as well as for the purpose of efficiency, ball bearings should be applied whenever possible. However, when very heavy loads are imposed on the screw, neither of these two constructions is entirely satisfactory. Under such conditions as were mentioned

FIG. 167—MARINE TYPE HEAVY-DUTY THRUST BEARING

in the paragraph on hydraulic feeds, ball bearings become impractical although, of course, not impossible. To provide a thrust washer of sufficient area to stand a pressure of 300,000 lb. is out of the question on account of the enormous size such washers would assume. Under these conditions, then, a different kind of thrust bearing should be constructed. The so-called marine thrust bearing lends itself very well for heavy machine tools.

In Fig. 167 is shown such a bearing in diagrammatic form. An extension of the screw is provided with a number of collars integral with the body of this extension. It rests in a capped bearing which is babbitted to fit the thrust collar. A sufficient number of collars is provided to bring the pressure per square inch down to the proper amount under the conditions of lubrication. For instance, if we should be willing to allow 200 lb. per square inch, we would need 1,500 sq.in. of thrust collar surface. If the body of the screw extension should be 7 in. and we allow a height of the collar beyond this body of 2 in., each collar would have an area of practically 50 sq.in., so that thirty of these collars would have to be provided. If this is too much for the available length of such a bearing, we would simply increase the size of the body or the height of the collar. As half of the thrust must be taken up by the bearing itself and half by the cap, provision should be made so that the bolts which hold the cap to the bearing are relieved, preferably by a cross tongue and groove or by a cross key. The box itself, too, if not cast integral with the frame of the machine, should be provided with such a cross tongue or key. Pressures as high as 300,000 lb. are not ordinarily transmitted by a screw, as was mentioned before. However, the writer has been confronted with feed screws transmitting 200,000 lb. pressure and has used the marine type of heavy-duty thrust bearing successfully in such cases.

Suggestions for Improvement in Thermit Welding

The following suggestions not previously published in instruction books on thermit welding will be of interest to welders engaged in repairs to heavy sections made by this method. In previously published directions for making plastic the yellow pattern wax to be applied between sections to be joined by means of thermit welding, it was recommended that the wax should be placed in a pan and warmed until it became plastic or else melted entirely and allowed to cool until it became plastic.

Another way of making wax plastic is to pour the melted wax in a small stream into cold water. Very shortly thereafter, it can be removed with the hands and the water squeezed out. It then will be found sufficiently plastic for use.

After hollowing out a basin in the top of a rammed up mold, a channel or trough should be cut in the top surface of the mold connecting the top of the pouring gate and the top of the riser. This will cause the first slag, overflowing on top of the mold, to quickly run across to the riser and, thus while the metal is very liquid, equalize the pressure on the pouring gate and the riser.

In order to properly preheat a section in a mold without badly burning away the preheating gate, it is necessary to use vaporized liquid fuel (gasoline or kerosene) which can be blown into the mold at such a velocity that the location of the flame can be varied at will. Thus by increasing the velocity at the end of the burner pipe, the lower part of the flame can actually be cooled down and the upper part heated. The flame at all times can be so regulated that the heating gate will be dried out but will not be burned.

This is not the case with any gaseous fuel, whether it be natural gas or illuminating gas, etc., and in all such cases the flame will either start at the end of the burner pipe, or will be blown completely out. This mass of flame passing continually through the restricted heating gate during the entire preheating operation is bound to do considerable harm, and in all cases the lower part of the mold and the section being preheated will be at considerably higher temperature than the upper parts.

Too rich a flame during the early part of preheating may not be harmful, but especially toward the end care should be taken that no excess oil be used as the lean flame will tend to burn out from the molding material any oil which may have penetrated during the early part of the preheating.

Keeping Posted

By A. L. DeVinne

The principle of seniority is not always observed in shops and factories. And for this reason, if for no other, the foreman should not only keep abreast of modern practice, but keep posted as to what is being proposed and tried out. As a result, when the time comes for promotion to be considered, he will not see some "dark horse" win against him. If there is any one man about the shop who should be up to date in his line, it is the foreman. He must be a valuable source of information and counsel and he can be that only if he keeps posted.

Manufacturing Radio-Phone Head Sets

Bending and Hardening the Magnets—Molding Poles and Pole Pieces in Earpieces—Winding the Coils for Magnets and Assembling Into Complete Head Sets

BY FRED H. COLVIN
Editor, *American Machinist*

WHILE detecting crystals or audion tubes are necessary to catch the vibrations of the air, and the various apparatus which has been shown before is needed to tune the instruments to these vibrations, the head set is really what translates the vibration so that we hear them as sounds. Head sets are, of course, telephone receivers, designed especially for radio work, and contain magnets, coils and diaphragms incased in insulating material.

In the set described herewith, the pole pieces are separate and held in contact with the magnet by the case which forms the body of the earpiece. The maker of this set, the William J. Murdock Co., Chelsea, Mass., is one of the early pioneers in this work, having made wireless or radio apparatus for 17 years before the present wave of enthusiasm swept over the country. Head sets are rated by their resistance in ohms and run from 2,000 to 4,000 ohms as a rule. In most cases this means the total resistance of both earpieces, while in some few cases it means the resistance of each earpiece. A resistance of 1,500 ohms for each earpiece is probably a fair average.

FIG. 1—BENDING AND HARDENING MAGNETS

The magnets are made from round magnet stock, which means a good steel, high enough in carbon to harden easily in water, and with a fair tungsten content. The bars are first cut off and then heated in the small gas furnace shown at *A* in Fig. 1. The heated bar is then bent to about two-thirds of a circle in the simple bending fixture shown at *B* and quenched in the tank *C* without being reheated. Two of the completed and hardened magnets are shown at *D*.

The magnets then go to the molding department where they are placed in the molds as at *A*, Fig. 2, together with the pole pieces which have been previously made from sheet steel in a simple blanking and forming operation. Two pole pieces are placed in the mold with the magnet as can be seen at *B*. These pole pieces contact with the open ends of the magnet and are held firmly in position during the molding operation.

Then a piece of insulating material, which by the way is one of the Murdock specialties as the result of years of experimenting, is placed on the mold over the magnet. The operator, through long experience, knows the amount of insulating material necessary and uses a piece about as shown at *F*. The upper part of the mold *C* is put in position, being guided by the pins *D*, and the completed mold is put in the press as at *E*. The press is of the toggle variety and forces the insulating material into the mold so as to hold the pole pieces and magnet firmly together. A space is provided for the magnet coils which are yet to go in place over the pole pieces. The mold also makes both the seat for the diaphragm and the thread by which the cap is screwed into place. It makes a particularly good thread too, which is the result of a combination of good die making and having a thoroughly suitable material as an insulator.

After a few preliminary operations the earpiece, in which the magnet and pole pieces are now firmly embedded, goes to the press, shown in Fig. 3. An earpiece body is shown in the hand of the operator and gives a better idea of the other end of the pole pieces than is obtained from Fig. 2. The ends of the pole pieces are slipped into the slots shown in the holder *A*, while the plunger *B* holds them firmly in place. The plunger is actuated by the toggle at *C*, the spring *D* being interposed to insure a uniform pressure against the block *A*. A movement of the foot now drives down the punch *E* and clips off the ends of both pole pieces to uniform length. This operation is necessary to insure the best

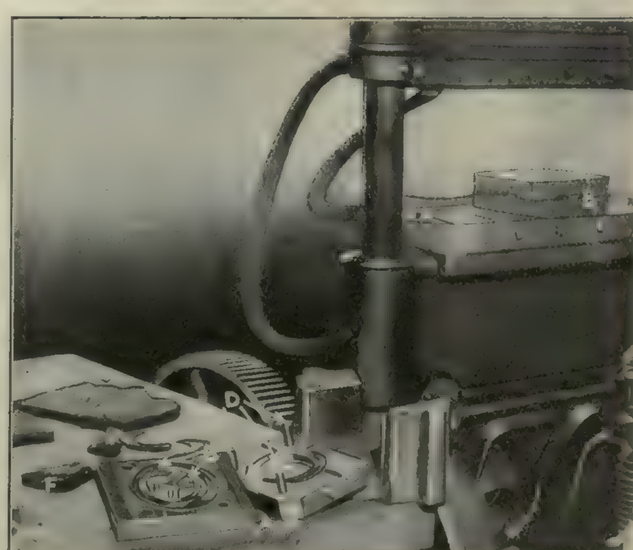


FIG. 2—MOLDING MAGNETS INTO EARPIECES

FIG. 3—TRIMMING ENDS OF POLE PIECES. FIG. 4—MAGNETIZING THE MAGNET

results and the length is carefully gaged. The important dimension is from the seat for the diaphragm to the ends of the pole pieces, the block *A* gaging it from the diaphragm seat inside the threaded rim.

The next step is to magnetize the magnet, through the pole pieces, by means of the powerful electromagnet shown in Fig. 4. Current is controlled by the switch just under the edge of the table and it only takes a momentary contact to charge the magnet. The ear piece is held so that each pole piece touches a pole piece of the electromagnet, at *A* and *B*. The magnet is then ready to receive the winding or coils.

The coils are wound on small, specially built machines, of which a battery is shown in Fig. 5. These machines have been developed and built by the Murdock company as a result of its experience in this line of work. The winding machines are run from a belt from beneath the bench, by means of a small line shaft which is motor driven. A form or hollow spool is made of two pieces of formed insulating paper as shown at *A*. Holding two of these pieces together with the raised edges outward forms them into a spool which is placed on the end of a winding spindle as at *B*. A turn of wire holds the two pieces together and the winding machine is then started by a treadle beneath the bench.

The wire is insulated by a coating of black enamel which is so thoroughly put on as not to crack in the bending and winding operations. This wire comes on spools which are mounted in frames as at *C*. The winding machine contains a counter (driven by a worm from the spindle and carrying a star wheel *D*) from which the count is easily taken. Two completed coils are shown at *E* and a box cover is fairly well filled with them at *F*. An earpiece with the two coils in place is also shown in front of the box cover.

The coils are then made up into pairs, the connecting ends of the wires soldered together, and the pair mounted over the pole pieces as in Fig. 6. The other ends of the wires are fastened to the terminals by which the coils are connected to the cords that plug in to the detecting and tuning apparatus. Electric soldering irons are used, owing to their great convenience for work of this kind.

Some idea of the extent of this business, due to the unprecedented demand for apparatus to "listen in" on the broadcasting stations all over the country, may be

FIG. 5—WINDING THE MAGNET COILS. FIG. 6—PUTTING THE COILS IN PLACE

FIG. 7—ASSEMBLING THE HEADPIECES

had from Fig. 7, which is part of the assembling room for the completed head sets. This room is in the second story of a former electric railway repair shop and has only recently been taken over by the Murdock company in its endeavor to supply the demand for its instruments. This view shows the trays of head pieces, the assembling of the headpieces, the assembling of the flexible wires or "cords" which connect them to the receiving apparatus, and all but the head frames which hold the ear pieces in a fork and keep them in position over the ears of the listener. Even though this building is old, the lighting is remarkably good, the side windows having been supplemented by several skylights of liberal dimensions.

Leaving the headpieces we find an interesting die casting job in the making of the variable condenser used in "tuning" by some makers of receiving apparatus. The condensers consist of two series of thin metal plates, evenly spaced and so mounted that one set of plates can be swung between the other for any desiderd portion of their surfaces. There are two kinds of plates as shown at *A* and *B*, Fig. 8. The required number of *A* plates are assembled in a suitable mold or fixture which spaces them the right distance apart and the mold is placed in the die-casting machine as shown at *C* and held in position by the screw *D*.

FIG. 8—DIE-CASTING CONDENSER PLATES

Below the frame is a pot of molten lead or type metal into which the plunger *E* reaches through a suitable opening. With the mold clamped in position over the opening in the table above the plunger, the lever *F* is brought down, forcing the metal up into the mold and casting it in position around the plates. Two completed sets of condenser plates are shown at *G* and *H*, the plates in *G* being held in three places and the ones in *H* only in the center. In use, the plates *G* are held stationary in the apparatus by three bolts while those at *H* are swung by means of the shaft shown so that they pass between the others. The method described is a simple and effective way of assembling the condenser plates and one that is proving very satisfactory.

Strikes and Walkouts

By R. Grimshaw

The chances are about ten to one that every factory will be visited some time or another with the strike fever. The visitation will be less likely, however, if the employees are educated to a few hard facts from labor sources. For instance, that (according to A. F. of L. figures) in 1919 there must have been collected in dues, $39,120,816, of which only $6,705,287 or about 17 per cent was paid out for union benefits (sickness, death, etc.), and only $1,391,833 or say 3.5 per cent for cost of strikes, leaving $31,623,696 or 79.5 per cent, for expenses of the unions.

It might also interest them to figure up how long it takes to make up from increased wages, even when a strike is successful, for the time when they were receiving from strike benefits only 3.5 per cent of their own money paid in as dues.

Put concretely, suppose men getting $50 a week strike for 10 per cent advance, and get it after two weeks' idleness. They lose $100 which divided by $5 gives 20 weeks before they are financially whole again. If they are out 10 weeks they lose $500 in wages, and it takes two years before the extra pay makes that up. In the meantime, instead of using all their savings to live on, they are getting only 3.5 per cent of what they had paid in, and this, no matter whether these $50 hands get $10 a week or $20 strike benefits. For every dollar that the average worker contributes to the unions, he gets back only 17 cents as sick benefits and 3.5 cents as strike pay.

Credit in the Machine Business

By H. B. Egg

It is important to know when credit should be asked for and when given, and for what purposes. In buying the daily commodities, you ordinarily exchange cash, which represents labor or other value, for something which represents labor and materials. There is no reason why the seller should wait for his money.

If you buy several objects every week or month from the same seller, the deliveries may occur at various times when it is not convenient to pay, and you can make arrangements to pay what you owe once a month, provided the seller has confidence in your willingness and ability. There is no law requiring that you be allowed thirty days, but you are given this time simply for convenience. If you want credit because you do not have the money today, you may likewise not have it thirty days hence.

Special Payment Methods

Special methods of payment are needed for articles made to order, because if the buyer fails, dies, or changes his mind before paying for the work done, the seller would suffer loss through inability to dispose of the special material. On all material made to order, including machinery, it is customary to make partial payment with the order, and often weekly or monthly payments thereafter.

Ignorance of the true uses and purposes of credit causes many young concerns to apply for credit on every purchase they make. Quite often they get it from merchants and manufacturers who ought to know better. Debts should not be incurred for the purchase of initial equipment, as a rule, because if the finances are that weak, there may not be enough cash to meet payrolls and current expenses. Sometimes it is permissible for new concerns to start under the handicap of a mortgage, but usually it is better not to. Lack of cash induces the temptation to pay thirty-day accounts in sixty or ninety days, and the business goes behind generally. Payments must be made eventually, and if they cannot be made when due, there is no especial reason why cash will be forthcoming in the hazy future, unless the firm is un-businesslike enough to permit its customers to take their own time in paying bills. If that is the case, then there is much trouble and anxiety in store.

Always Prompt Payers

If a new business is started off with enough cash to buy equipment, meet a few payrolls and other expenses, the men in charge should realize that there are plenty of prompt payers in the market without bothering with the slow or un-businesslike ones. Orders should be taken from the good payers; then it is simply a matter of keeping expenses below income to keep the business off the rocks. Competition is one of the most trifling worries in the machine business and causes a very small percentage of failures. On the other hand, slow collections and bad debts cause financial weakness.

It sometimes happens that special credit arrangements are desirable. For example, the company which employs the writer needed several machine tools to put through a large order. The business was small and lacked the necessary cash. We had never borrowed from the bank and did not know how to do it. (The machine industry is full of people just like that.) After a talk with the machine-tool builder, he found our business references and reputation satisfactory, and let us have the machines, to be paid for in six months, in six installments, without interest. His business was dull, or he might have charged us six per cent or have advised us to borrow from the bank. Long-time payments under such conditions, where everything is agreed upon in advance between both parties to the sale, are quite proper, and will not give a concern a bad name.

The size of a company has no bearing on its credit rating. Some of the smallest companies are "excellent pay," while some of the large ones are very slow and unsatisfactory. The way to build up a good credit reputation is to agree upon the terms of payment before the purchase is made, and then pay on time.

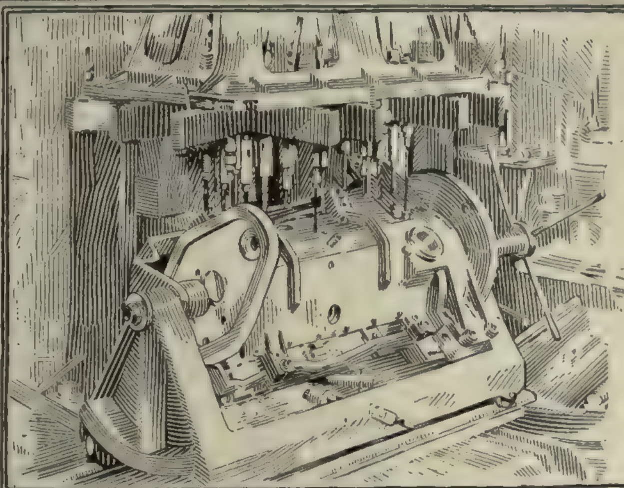
Many concerns will make purchases which should be paid for by cash upon delivery, but will ask for thirty days, knowing that they will need ninety days. The other day we received an order for some special turned and threaded shafting from a new customer. Our credit man asked for cash in advance. The customer informed him in a sarcastic manner that only one-horse concerns did business that way, and stated that they would pay in thirty days. On making inquiries from five supply houses which supplied this customer, we learned that he was very slow pay, running sixty to ninety days behind. We compromised by taking one-half cash with the order, and the balance on delivery of the material. When a customer asks for credit on a special material order, and has no account on your books, just keep the fact in mind that the payroll cannot wait thirty days or so.

Pick Customers

One time our company found itself in a peculiar condition, with all current bills paid, practically no cash in the bank, and a payroll to meet. Several thousands of dollars were owed to us on accounts. The business was over twenty-five years old, and a bank loan ought not to have been necessary. An investigation showed that about forty-five customers were in the habit of paying us when they got good and ready. Almost seven hundred others paid promptly. The few slow ones would not want it thought that they were dishonest or unbusinesslike, yet they forced us to pay the bank six per cent on money that they ought to have paid us. Of course we were at fault in allowing them to be so slow, but we were afraid that too strict an attitude would lose us trade. Then we learned that it is better to lose the order than to lose the money. An order can be gotten from some other customer, but when the money is lost, it is gone.

A new credit policy was adopted, as follows: Material made to order for customers who do not have monthly accounts, cash in advance. Sales from stock to customers who do not have monthly accounts, cash on delivery. Current sales to firms with high credit rating, thirty days net, where at least one purchase is made per month. Casual sales to firms out of the trade, cash on delivery. Any sale to customers who do not respect our thirty day terms, cash with order.

Since instituting this method, we have had very few complaints about cash payments, and the most strenuous objectors were almost without fail the ones with the worst business reputations.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Details of Design of Blanking Dies Continued — Standardization of Parts of Dies— Design of Guide Pins—Methods of Holding Punches

IT SEEMS desirable to bring up here the matter of standardization in dies, and point out its importance so that the designer will realize its utility and advantages. There are certain parts in all dies which remain the same and can be standardized. For example, the die shoe, die blank, stripper plate, punch plate, punch holder, liner pins and bushings. If these parts are designed correctly, a great many machining operations can be performed before the die opening is cut out of the blank. By using proper tools and gages these standardized parts can be produced in quantities on an interchangeable basis at much less cost than by machining one or two at a time when required. In addition to these points a new die can be made from standard parts in much less time than if the entire die must be made for each particular job.

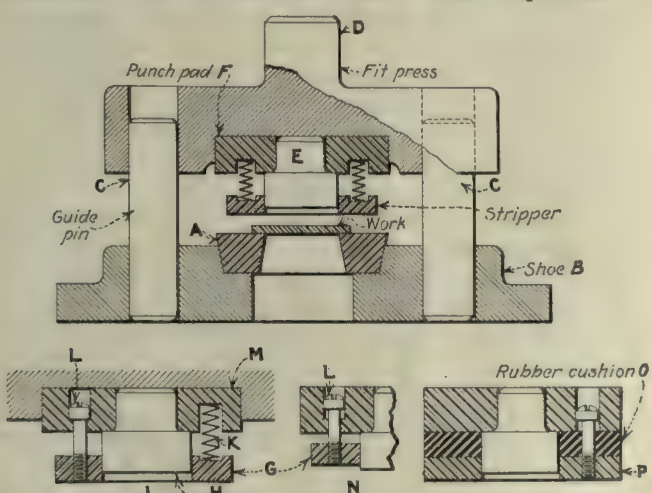
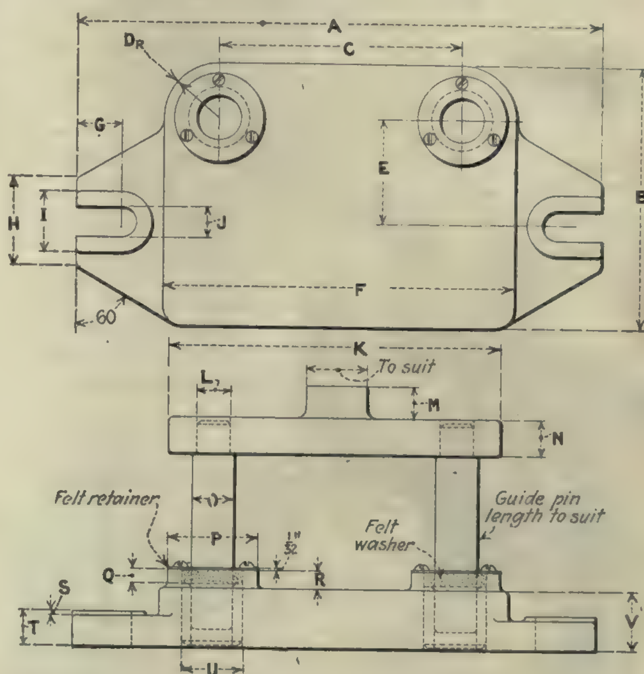


FIG. 456—DIE FOR LARGE BLANKING, SHOWING GUIDE PINS AND STRIPPER DESIGNS

Naturally, any company using punch presses covering a wide range would need to standardize their various units in accordance with the sizes of work to be produced and the presses used. The importance of this standardization cannot be over-emphasized, and its advantages are apparent to even a casual observer. A great many companies who use large quantities of dies yearly have found the process of standardization of the greatest value.

Blanking dies are frequently made with guide pins, as shown in Fig. 456. This particular design is generally used for heavy work. The die shown at *A* may be set into the shoe *B* in different ways, according to the shape of the work which is to be produced. In work of a circular form a recess can be cut in the shoe and the die forced into it, being suitably held by screws. There may be a slight taper on the sides of the die to insure concentricity, if desired. If the work is long



Shoe No.→	1	2	3	4
A	10	11	12¼	14
B	5	5½	7	10
C	4	5	6	7
D	1¼	1 5/16	1½	1½

FIG. 457—STANDARDIZED DIE SHOES AND GUIDE PINS

For the authors' forthcoming book.

or irregular in shape a slot can be cut in the shoe and the die fitted into it. In this type of die the guide pins shown at *C* align the punch and die so that they register correctly. The stem *D* fits the punch holder of the press.

It will be seen that the stripper used on this type of die is different from those which have been previously described. The punch *E* is mounted in a punch pad *F*, and the stripper remains with the punch instead of with the die. In the section shown at *J* the construction is clearly indicated. The stripper *G* is a sliding fit on the punch *H* and is forced downward by means of springs *K*. The movement is limited by the heads of the screws shown at *L*, which screws seat in the punch pad *M*. The diagram at *N* shows the position of the stripper *G* after the punch has entered the work, and it will be seen that the retaining screw *L* has moved upward in its pocket at this stage of the process.

A rubber cushion such as that shown at *O* is occasionally used in place of springs to act on the stripper *P*, but this is not generally as satisfactory as springs, although for certain classes of work the rubber cushion is used considerably. The disadvantage of it is that the rubber soon loses its elasticity under the constant pounding, so that the action of the stripper is not thoroughly efficient unless the rubber is frequently renewed.

When a die having guide pins is used it will be found profitable to standardize the sizes. Fig. 457 gives an excellent example of a method which can be used for standardizing such parts. In this case there are four die shoes, the general dimensions of which can be shown in a table placed on the drawing sheet. Additional dimensions can be given for various other parts of the die, but it has not been considered advisable to give them in the table shown at the bottom of the illustration. They can be varied according to the practice of different manufacturers. This type of die shoe and punch holder has been used considerably by the writers and has proven to be of excellent design. The guide pins in this case are fastened to the punch holder, details of which are illustrated in Fig. 458. There may be cases when it will be found necessary to change the location of the U-lugs, but the general design would not be affected, even if this were found advisable. The

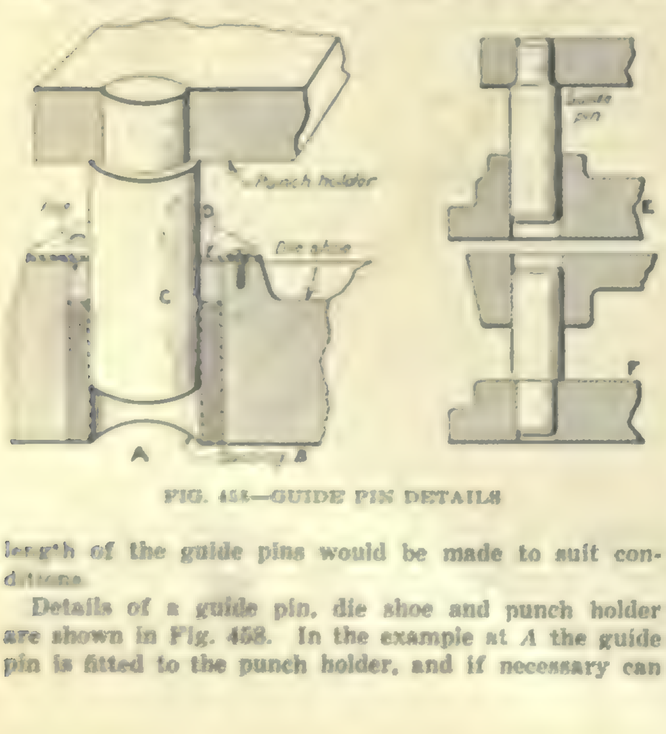


FIG. 458—GUIDE PIN DETAILS

length of the guide pins would be made to suit conditions.

Details of a guide pin, die shoe and punch holder are shown in Fig. 458. In the example at *A* the guide pin is fitted to the punch holder, and if necessary can be held in position by a setscrew or a dowel pin. The die shoe is provided with a hardened steel liner bushing *B* which has a radius at *C*. On the upper part of the bushing a felt washer is placed and is held in position by the steel washer *D*. The felt is saturated with

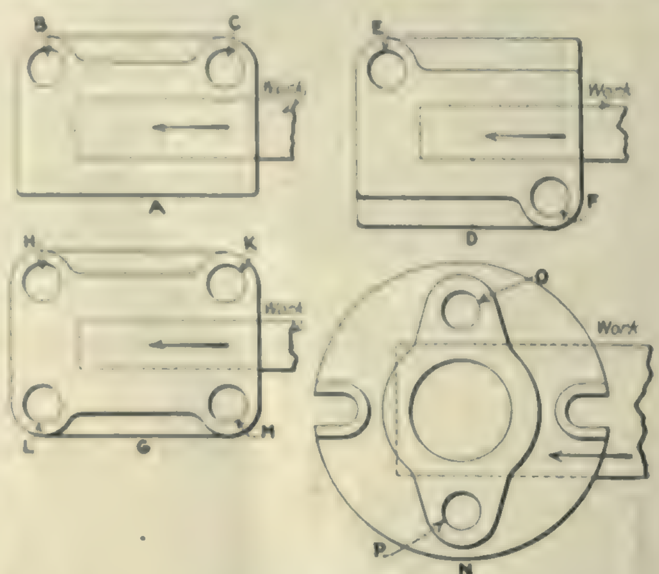


FIG. 459—STYLES OF DIE SHOES, SHOWING POSITION OF GUIDE PINS

oil, so that as the pin works up and down in the bushing it is always properly lubricated.

The use of bushings in die shoes is not always necessary, although the life and accuracy are greatly prolonged by their use. In high production work, bushings are recommended; but if the product being manufactured is produced in only small quantities the extra expenditure is not warranted, and the guide pins can be made to bear directly in the cast-iron shoes. Spiral or straight oil grooves should be cut in the guide pin to retain the oil and assist in lubrication. These oil grooves should not be deep, as their function is simply to gather and distribute the oil through the bushing, an important function, nevertheless.

The position of guide pins has been a source of argument among designers; and some believe that it is better to place the pins in the punch holder, while others contend that it is better to place them in the die shoe. The examples at *E* and *F* illustrate these two methods, but as both are often used successfully we express no preference for either type. The function of the pin in either case is to provide an accurate guide so that the punch and die will register properly; and if proper provision is made so that chips and dirt will not tend to accumulate around the punch and in the bushing, there should be no difficulty experienced with either method.

There are a number of ways of arranging guide pins and several of the methods are shown in Fig. 459. In the example *A* two pins *B* and *C* are used at the rear of the die shoe. The direction which the work takes when passing through the die is indicated by the arrow. In the example shown at *D* there are two guide pins *E* and *F*, one at the front and one at the rear of the die shoe. The work passes between the pins as indicated. A die shoe is shown at *G* having four pins *H*, *K*, *L* and *M*, two of which are at the front and the other two at the rear of the die. Another example, shown at *N*, is quite different from those previously indicated. The

pins *O* and *P* are on opposite sides of the die and central with it. The die shoe itself is circular in form.

The example at *A* is considered best for medium sized work, as the front of the die is entirely open and it is therefore somewhat more convenient of operation.

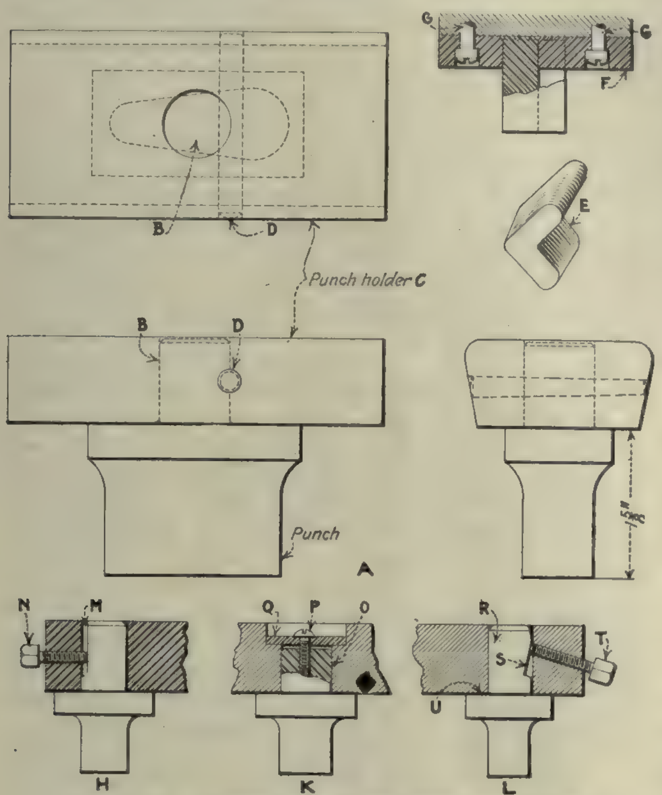


FIG. 460—METHODS OF HOLDING PUNCHES

The stock is more easily fed through and the pins are not in the way. The other styles are used from time to time, depending upon the class of work which is to be done and the size of the die.

Punch Holders

In a previous article we mentioned several general points in connection with punch holders, and we shall now take up some of the detailed matters connected with the design. Fig. 460 illustrates in detail several methods of holding punches in punch holders. In the example *A* the punch is fitted with a shank *B* which fits the punch holder *C*. As the shape of the punch is irregular, a tapered dowel pin D is used to hold it in position, and the punch drawn up against the under side of the punch holder and held in place firmly. The shape of the punch is clearly indicated by the dotted lines in the upper view.

It may be well to state here that punches for stock from 1/16 in. to 3/16 in. thick should not be less than 1 5/8 in. deep, as indicated in the diagram. When the work to be punched is thicker than 3/16 in., the height should be correspondingly increased. For work less than 1/16 in. thick, the depth of the punch can be decreased considerably according to the thickness of the stock. The purpose of using a long punch is to prolong the life of the tool and allow regrinding as it becomes dull.

Another irregular punch is shown in detail at *E*, and the method of fastening it is by using a holder *F* into which the punch is fitted as shown. This supplementary holder is screwed and doweled to the punch holder by screws shown at *G*. The upper end of the punch is left soft and the supplementary holder *F* is countersunk slightly, so that the punch can be peened over into the recess, thus holding it firmly.

In the diagram at *H*, *K* and *L* several other methods of holding punches are shown. In the example *H* a flat is machined on one side of the punch at *M*, and a plain setscrew *N* is used to hold it in position. In the example *K* the shank is turned cylindrical at *O* and tapped to receive the screw *P;* the washer *Q* acts as a retainer and prevents the punch from falling out. If this method is used for cylindrical punches no other provision is necessary, but if the punch is irregular a locating pin or dowel may be required. In the example *L* the shank *R* is milled away at one side, as shown at *S;* and the set-screw *T*, being placed at an angle, holds the punch in position and at the same time draws it up against the face *U*.

In Fig. 461 are shown several other methods which can be employed for holding punches. In the example *A* the punch *B* is quite similar to one which has been shown in the preceding illustration, except that it is considerably larger so that it requires a slightly different method of holding. It would be possible to slot the holder and make a corresponding tongue on the punch, as this would give a very excellent method of aligning. This example, however, is located on the face of the punch *C* by means of the dowels at *D* and *E* and it is held in place by the four screws at *F*, *G*, *H* and *K*. This gives a very substantial method of construction, and the punch is located with the necessary accuracy.

In another example, shown at *L*, the punch is of the form indicated so that it must be located accurately in relation to the die, yet its general shape makes it desirable to use a shank of cylindrical form as shown at *M*. In a case of this sort the location can be obtained by leaving the shank soft and placing a pin so that it acts as a key, as indicated at *N*. The same result can also be obtained by using a regular key, as at *O*.

In the example *P* a wire punch is shown that is supported in a holder *Q* into which it is driven. It is backed up by means of the adjusting screw *R*, which permits a certain amount of variation in the setting. This method is not recommended, except in cases where the thickness of the blank is less than 1/32 in. Another

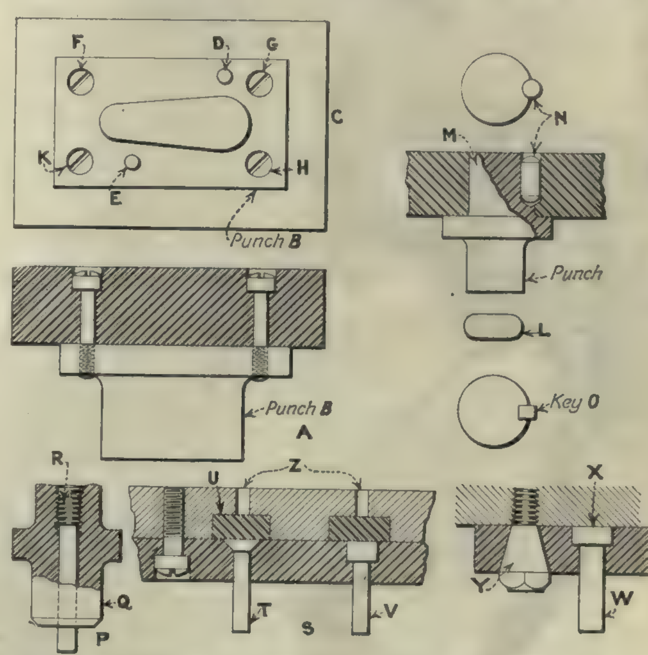


FIG. 461—OTHER METHODS OF HOLDING PUNCHES

method of holding two wire punches is shown at *S*. The punch *T* has a tapered head, and it is backed up by a steel disk shown at *U*. The other punch *V* is similar, except that the head is of larger diameter and straight instead of angular. It is backed up by a steel disk in the same manner as the first. A knock-out hole is provided at *Z* in each case.

The punch *W* is of similar form to that shown at *V*, but it is not backed up at all and comes against the cast-iron punch holder at *X*. The wear on the cast-iron holder will be so great that after the punch has been in use a short time it will lose its position and form a pocket in the punch holder, thus causing looseness and preventing accurate work. A condition of this kind might very easily result in breakage. The method of holding the punch holder is by means of a tapered screw *Y*, the taper acting as a dowel and the screw portion holding it in position.

How Stock Shortages May Be Eliminated

By R. C. Gifford

Superintendent of Production, Automatic Electric Company

High inventories and shortage of parts in assembly departments, with the resultant inefficiency, are difficulties which daily face the average factory manager. The more complicated the product, the greater the problem presented. A solution to the problem, however, has been found in the Chicago factory of the Automatic Electric Co., where 25,000 different parts are manufactured and 10,000 different raw materials used. Production meetings, which were formerly nightmares, have become a pleasure. No longer do the long list of stock shortages and the longer list of alibis take up the entire time of the meetings.

Some years ago, Henry Ford put an automobile on the market at a price that was thought to be lower than manufacturing cost. No one gave it much attention except to watch for the smash. Soon the price was lowered and manufacturers began to take notice. Another cut was made and they began to investigate. How was it done? Mr. Ford had standardized parts and also had attained large production. This standardization helped, but what was the most revolutionary of all his methods, he had mixed machine and assembling operations without discrimination. "Very well," said the wise manufacturer, "He can do that, but it would not work in our business. Besides, grandfather didn't do it that way."

When every other scheme we could think of failed to "kill the shorts," we thought of Mr. Ford. If he could mix machine operations and assembly benches, why not we? A careful study, however, revealed the fact that the chief offenders were not the standard parts used day after day, but were the specials used in varying quantities and intermittently.

It had been our plan in the past, as with most manufacturers, to group like operations together in one department. Thus, all punch press work was in a single group, all drilling in another, coil winding in a third, spring assemblies in a fourth, and so on. In this method, there is one and I may safely say, only one advantage. A minimum amount of expert supervision is required, and this benefit, in most cases has been allowed to overshadow the many disadvantages. The cost of the extra trucking and handling of parts from department to department often amounts to many times the saving in supervision. But most expensive of all losses is that due to delays in the assembly departments from a shortage of stock.

In desperation, rather than with any well defined assurance of success, we decided to experiment with Mr. Ford's scheme. Spool frames used in making magnet coils were chosen for the trial. The assembly work was done on small punch presses. A half-dozen such presses were installed in the coil winding department, and one of the diesetters was placed in charge under the coil winding foreman while the planning of the order of work was placed in the hands of the dispatcher who also planned the coil winding. From the day these presses started running, the shortage of spool frames ceased. Not only were the delays of the coil winding operators eliminated, but the inventory of spool frames was reduced over 50 per cent. This experiment was so successful that other punch press operations on parts used in this department were transferred with similar success.

An interesting case in connection with this transfer had to do with a very simple operation. A small U-shaped piece made from sheet brass was used in large and regular quantities of about 25,000 per day. This part appeared on the short list regularly about once a month. Investigation revealed that the punch and die for this work required repair at monthly intervals, and that the delay in repairing was sufficient to cause too long a break in production.

A duplicate and even a third set of tools did not stop the shortage of this part, but the reason for this was easily understood. The toolroom force was always busy and knew that one set of tools was being used, and so it let the repairs wait until all three sets were sent down. This operation was moved to the punch presses in the assembly department and the shortages ceased.

After several months, this part again appeared on the short-list at two meetings in succession. I made a quiet investigation to see if I could locate the cause of the trouble, since it seemed that our much talked of system was falling down. I found that without notice the job had been transferred back to the main press department a month before. It was again moved to the assembly department and the production meeting has not heard it mentioned since that time, over four years ago.

At first thought, there would seem to be no reason except gross mismanagement or negligence for the persistence of a case such as just outlined. In fact, I fought this problem for years with that idea in mind, continually raising the grade of employees until only technical college graduates were employed. Still the solution was not reached. But the answer now appears simple. The dispatcher or foreman, using the parts in question, knows their relative importance to his assembly department, and when the stock gets dangerously low he is in a position to bring the necessary pressure to bear to start the stock moving. On the other hand, if this same work was done by a department other than the one using it, the pressure was quite as likely to be exerted upon a part the stock for which was not so nearly exhausted, while the more important part was neglected.

Later it became necessary to enlarge the plant capacity and to rearrange all departments. The scheme here outlined was made the standard in the new layout, even where available floor space required placing the same class of assembled units in more than one department. However, two years of operation have proved it to be entirely successful.

President's Address to National Machine Tool Builders' Association

Machine Tool Builders at Fall Meeting Hear Statement of Problems Facing the Industry Evils of Price Cutting—Value of Accurate Cost Accounting

BY AUGUST H. TUECHTER

On June 12, 1902, the National Machine Tool Builders' Association was organized by 17 lathe builders. The first annual convention was held on Oct. 14, 1902, so that this convention marks the completion of our twentieth year as an organization. Of the 17 charter members only three have voluntarily resigned membership while continuing business. Three others have retired from the business and four gave up their membership through consolidations in which they have merged. This seems to me very good evidence that this Association must have meant something in all these years to those charter members who started it and who have stayed with it ever since.

Speaking for myself and my company I know that the Association has meant much to us since the day we joined it, that each year it has meant more than the year before, and as I vision the possibilities of associated effort, in each coming year this Association can and should mean increasingly more than any preceding year. You are all convinced of the cumulative value of advertising in building up the good-will factor of your businesses. I think the same cumulative value exists in associated effort.

PROPER COMPETITION

I look back to the days of cut-throat competition that existed prior to the formation of this Association, and I think of how much better things are today. All cut-throating, all unethical competition has not been removed by any means, for the strain of the last two years has revived some bad practices that we must seriously set about stamping out. But even though we have been going through, and are only just emerging from the worst slump the industry ever had, I am encouraged by noting how much rarer we have found these bad practices than they ever were before in less severe depressions.

Twenty years ago a printed price list was only the salesman's top limit in the vast majority of cases. Today this is true in very few cases indeed. That is itself a tremendous advance, but we still must work to eliminate the abuse of discriminating prices in the few cases where it still exists or where a backslide took place in ethics. Deviations from one's published price list are essentially unfair, and besides they hurt the very man who makes them. If you are quoted a confidential 5 per cent off a price list, you can never be certain that your competitor is not quoted a more confidential 10 per cent off. Any buyer buys with more confidence and respect from a seller whose price list means exactly what it says. Besides, this single price policy creates a good will and respect among competitors that is sure to improve competition.

The whole automobile industry works on a basis of openly published prices and there is no reason why ours should not. Nothing leads to reprisal and cut-throating as much as giving secret discounts and rebates; nothing gives the unscrupulous buyer a strangle hold on sellers, like the knowledge that an industry is shot through with such practices. On the other hand, nothing makes more for fair, honest, manly competition than openly announced prices that are not deviated from until replaced by other openly published prices.

An artist painting pictures not only gets his living from his efforts but he puts his heart in the work he is doing. The joy of accomplishment spurs him on. So with a constructive business man; his business is an art, and its successes satisfy his instinct of achievement, as well as furnish a means of livelihood. Just as musicians, painters, and sculptors in foregathering to discuss their art find their strongest friendships among their fellow craftsmen, it is equally true with business men.

ATTITUDE TOWARD COMPETITORS

I count it of just as much value to gain and hold the respect, the esteem, the friendship of my competitors as of my customers. Perhaps it is more valuable, because contact with a single customer is only occasional, while our competitors we have always with us. A single customer is met only "where is," but a competitor is met everywhere. The bad opinion of a single customer affects us adversely only in proportion to the size of his individual trade, but the bad opinion of a competitor hurts us everywhere.

Trade abuses are parasites that sap business of the life blood of profit. Abuses are rooted in envy and grow in hate of competitors. Only where the competitive soil is soured by suspicion can abuses take root and grow. Sweeten the soil by confidence and these noxious abuses wither and die, and the life blood of profit runs full and free. A healthy business is rooted in emulation, not envy, and it grows in respect and friendship of competitors, not in hate.

IS FRIENDLY CO-OPERATION WORTH WHILE?

How do we make friends? Only by being fair-minded, by being open and above-board in every way. Meet your competitor at least half way. Don't lie, don't cheat, don't slander his character or his product. Go out of your way to "do unto him as you would have him do unto you." Be generous with information. Cast your one bit of information on the waters and it will return to you a hundred fold, for a hundred others are doing the same with their bits of information. Enrich the soil of competition with respect for yourself, with friendship and fair play for your competitors, and you will reap a bountiful harvest.

An association can be worth while to its members only as the members put co-operation into it as well as dues. Not always have those who pay the highest dues contributed the most valuable ideas and suggestions. The Association's "Activities Chart" shows the variety of ways in which co-operation has benefited different members during the last two years. The bulletins sent out have covered a wide variety of information.

Without a central depository into which each member drops suggestions now and then, how could all this information be gathered and be made to benefit you by its variety and its careful competent presentation? Not a single bulletin has gone out but what some member or other commented on its helpfulness to him in solving some problem or in presenting some idea that had not occurred to him before.

Without an Association how could we eliminate illegitimate practices? On a single sale men have lost more than their year's dues because they took the word of a lying buyer as to a competitor's business methods. How could we strongly present the interests of the industry in matters of legislation? How could we do all the other things that modern business conditions force every industry to do by organized co-operation?

Is Our Association Practical?

Some members have resigned saying that the Association costs too much. Whether non-members realize it or not, this Association is working for their interest as well as the interest of its members, and from that aspect it is unfair for them to have the members carry the non-members' share of the industry's load as well as their own. Of course we cannot expect all men to be farsighted and realize the necessity of this work, so it remains for those who do realize its necessity to support this work and carry the "White Man's Burden." Only by education and demonstration can we hope to convert the others and get them to join with us in the work we must do for them as well as for ourselves.

Some, members and non-members, may think that the things we are proposing to do are day dreams, but I can assure you that our General Manager has not yet proposed any activity that he could not show to be in successful operation in some other association. Other industries have had more active associations than ours for many years. Our General Manager has kept in touch with as many of these as possible. He does not lack knowledge of what is worth while, nor ability to carry out any good activities that any other association has. He can and will make our Association as effective in every way as any other association. But he cannot go far if the membership do not co-operate and do not use the facilities of the Association.

The Association as a Constructive Influence

Essentially, every association is simply an information bureau. Nothing can be forced on members. They can merely be shown the facts and be asked to consider these facts in the management of their own business. When it comes to mopping up information our General Manager is a human sponge with unlimited capacity. But while he is soaking up all this information from all sorts of sources, all our members do not reach out their hands to squeeze the sponge and draw the information out of him. Those who do that know that it pays well.

Knowing what we have done and can do, I find it strange that some members do not use the Association to the fullest extent that they really can and should.

I take this occasion to record the progress to date of the broader activities that were begun at the time I entered upon the presidency. First there was the engagement of Scovell, Wellington & Co. to lay out the general principles to which the cost systems of our members should be brought to conform. This work was well done, and we have had many favorable comments on it. But unfortunately, the severity of the depression prevented us from getting much further than presentation and discussion of the report at a series of regional conferences and at the Cleveland Convention in February, 1921.

If we are now to have more active business our members should seriously set about getting their cost systems in line with the principles accepted, so that they will be better informed than they have ever been, when making prices. Only by so doing can you be sure to bring out the costs of idleness. These go on whether you directly set them forth or not. Only when you do know those idleness costs as they are can you determine which are unnecessary losses, and which are necessary costs of your business. When you actually have those costs of necessary idleness staring you out of countenance you will insist on getting a fair price for your product, one that will return those costs to you.

Unless these costs are recouped in price, this industry will stay on a low plane of remuneration unfair for all its participants, from apprentice boys up to presidents. Prices in the past have been based too much on mere hazy opinions of costs. There has been a general feeling that somehow or other we don't get out of our efforts the same reward that similar efforts bring to our neighbors and friends in other industries. If this is true, and I believe it is, it is because we have never had the facts of real costs so clearly before us as to permit of no dispute.

The Problem of Necessary Cost of Idleness

Facts are stubborn things, and convictions backed up by facts are a lot safer than hazy impressions as to costs. If you and your competitor both make unprofitable prices due to that sort of error in costs, you hurt the whole industry, and you owe it to yourselves to use better methods. Other industries find it profitable to spend much money and time on cost work, and our Association from now on should aim to do likewise. It is an investment, not an expense.

We are apt to think that the excess capacity in our industry, which has loomed so large and so idle during the last two years, is wholly a result of the war activity, but this is only partly true. The machine tool industry has always needed a maximum capacity considerably in excess of its average demand, taken over a period of years.

This is because our industry naturally suffers from what the electrical engineers term a "bad load factor" in electric light plants where a high peak load makes a large plant necessary, though the average load is low. The electrical people have given this load factor serious attention, and the peak load consumers pay rates in proportion to the expense of carrying idle equipment.

It appears to me that we could well give the same kind of consideration to the financial effect of our load factor on our pocketbooks. False bases for costs make false bases for prices. Too many of our industry use that method of dividing the total amount of expense incurred for a given period of the productive hours for that period, and calling the quotient their burden. This method has been sarcastically and truly described as a method of wasting money to give clerks simple exercise in long division to conceal costs.

Basing prices on such figures in boom times simply blinds one's eyes to the necessary cost of idleness in this industry, and leaves that cost out of the price of the product. It prevents the accumulation of a neces-

sary reserve to carry over the succeeding depression. It gives a false impression of profits during the peak load period; that makes stockholders hungry for fat dividends just when the cash should be kept in the business, and later on makes the stockholders blame the managers for weakness when receiverships occur.

That false method deludes managers in desperation during depression to sneak up back alleys with price-cutting bolos drawn on competitors who believe that honestly made goods are worth a fair price that carries a reasonable profit and should not be sold below cost. It also keeps the whole morale of the industry low; it destroys our self-respect; it prevents us from paying our employees what other industries will pay the same men; it makes our industry unattractive to the kind of men we ought to draw into it as engineers and salesmen; and it pays the industry's investors a smaller dividend than they can get on stocks bought in the open market whose earnings are not so fluctuating and whose stockholders do not run the same risks that ours do.

Frankness about Prices

If we now stamp out that kindergarten method of burden calculation, after the next boom we shall have less demoralization, and less worry. Let us openly tell the world about the demand fluctuations this industry encounters and why its bad load factor necessarily increases a burden rate to a figure much higher than one in a more stable industry. Let us study these things ourselves and see that our customers recognize these costs as necessary parts of price, and we shall have no difficulty in getting fair prices for our product. Unless we study these things our customers will not be convinced that the facts really exist.

The man who is ignorant of his true costs never has a firm basis for his price policy and can never command respect, either of his competitors or of his customers.

In the cycle we are now entering our members should so well revise their cost systems as to prevent their repeating the errors of the past. Regional accountants' meetings every three months would do wonders in that particular, and the results of such meetings would repay their cost many fold. I ask our incoming Board to well consider the advisability of such meetings.

Activities Respecting Amortization

Some buyers have put excessive pressure on our members because such buyers have a very different situation as to demand than our industry has. It is good work to make plain to all the world that we must operate our business according to the nature of its demand. Ours is a secondary demand that increases and decreases with demand for the products of our customers and is affected only slightly, if at all, by the price of our product. We all know that when our customers' shops are largely idle, no price above a free gift will induce them to buy tools that they have no reasonable prospect of using. We cannot stimulate our market when direct costs of building machines are lowered, that is, during years of depression. Our customers buy when active business requires more production, and when the buyer feels sure that a profit will inure to him out of the larger product of our machines. If and when a user cannot figure such a profit, whether times be good or bad, his ears are shut tight to the song of the machine tool salesman.

We could never gouge our customers if we tried, because they could all make machine tools in their own shops if our prices were so high that the cost and trouble would be less in making their own machines. The seller can never break through these natural limits to price that protect the buyer. Protected in this manner the buyers have never yet had to pay prices anywhere near the point where they would better make their own machines. The business struggle has gone on between the sellers, outside the buyers' breastworks rather than between buyers and sellers on the breastworks.

Even here sellers in their eagerness to reach the buyer have not protected their inventions with as many or as good patents as they could, and they have reduced their fair rewards by leaving themselves wide open to competitive attack, even though revolutionary inventions are rare in our industry. Because of the possibility of substitution of other means to produce the same results few tight patent monopolies have been possible.

Economic law protects our customers very well, but it heavily penalizes our own deficiencies. Due to all these things, very great profits have not been reaped by machine tool builders as compared to other industries, and perhaps never can be. But at least we should learn to avoid some mistakes that have reduced or even wiped out the naturally small profits that we could earn. It is constructive service to get our members to learn to make the best of a naturally bad situation. It is constructive work to make these things clear to potential competitors so that they will not rush into this industry in ignorance and make a naturally bad situation worse.

The Problem of Finance

I am convinced that if machine tool builders will pay more attention to the financial side of their business than they have in the past, they will be well repaid for the effort. Over-expansion of an industry beyond the actual requirements of its demand is almost entirely a problem for the element holding the financial control. When a man finds that by adding only a small part to his capital investment his costs per unit will be greatly reduced, it looks like a very simple problem in arithmetic to find additional profit.

The trouble is that about the time one man gets this bright idea the same very evident fact dawns on several others. They all expand, and if the total expansion is out of proportion to the market's requirements, it is very likely that a pressure to sell will arise that carries prices below the profit point and then the additional profit anticipated by the expansion vanishes into thin air and takes some of the previous profit with it.

The financial effect of excess capacity is to reduce the value of all the investment, not only in the concern that has the excess, but in the whole industry. Capital locked up in fixed investment is simply lost if it cannot be put to profitable use. A business is worth only what can be made out of it. If it cannot earn dividends on the investment, it is only worth salvage value.

The loss and gain problem in the final analysis is a problem of finance, and as it is the financial element that takes the risk and must always hold the purse-strings, it must therefore be the one to exercise the final responsibility. No business can afford to neglect this element and certainly no business subject to such irregularities as ours is safe in doing so.

Picking Them Out

By Entropy

It is reported that several large firms will pick out their employees, big and little, by psychological tests as business resumes its upward tendency. Tests of one kind or another have been before the public for several years. They have been pretty consistently laughed at and yet they persist. The Edison questionnaires met more widespread ridicule, when they were first reported, than any other, presumably because of the fame of their author. But each succeeding test has sent more men scurrying for their encyclopaedias to discover the answers and get ready to take a similar test if it should come their turn to do so. From these tests down to plain intelligence tests and trade tests of the simplest nature is only a moderate step and one that is very likely to follow.

It is pretty generally conceded, among employment managers, that selecting the right man for the job is comparatively easy as long as they can personally attend to it, but that, as soon as the plant needs men fast enough to keep several subordinates at work, there is no uniformity in their work. Consequently they would all like to discover some way to standardize the work so that all assistants in the hiring office will send about the same kind of men for each different kind of job. The general manager is concerned about this too because he realizes that he is not to have a perfect selection of men, no matter what his plan. He cannot expect to attract all the best machinists or pattern makers to his shop, realizing that others can play that game as well as he. He is better off with a fairly uniform selection if his tools, methods of manufacture and foremanship are adapted to that type than he will with a few high-grade men and some at the other extreme.

Methods of Selection

There are two ways of looking at the selection of men. One is to try to find the man best adapted by experience and training to go right ahead and do the work in the shop, while the other is to try to find the men who, when trained, will make the best men.

The first plan discovers the men whose experience comes the nearest to that which they will have in the new shop. It attracts the wanderers who, by virtue of much travel from shop to shop, can pass any kind of a trade test except a test for stability. It works well in a manufacturing machine shop where no great effort is made to keep men, where new men are wanted who will work for a while, leave all their good ideas for the superintendent to use, and, when their oranges are squeezed dry, will move on to some other place. They make for a high labor turnover but a low cost of replacement.

The second plan attracts young men whose ambitions are stirred by the promised chance to learn a trade or a profession. It is expensive in first cost because the cost of training is high regardless of whether it is concealed in the cost accounts or made the subject of a special ledger account of its own. It does produce a low labor turnover and undoubtedly in that way repays the first high cost as soon as it is running in full swing. Moreover, it makes a strong organization of men loyal to the shop, whereas the first plan makes a loose organization in which every man sees only a stepping stone to another job.

For the first plan, trade tests which show the technical skill of the applicant are all that is necessary. These tests, however, cannot be entirely verbal, the veriest manual training school boy could pass many of them verbally, but should be operative. The man should have certain jobs to set up and do before the eye of the examiner and he should be marked not alone on what he accomplishes but by the way he goes at it. For this purpose, it is essential that the examiner be broad minded enough to give the man full credit for successfully doing, in his own way, a job which he never saw before provided it is a workmanlike way and can be made efficient. Under the second scheme of tests, the intelligence test plays a great part, plus sufficient additional to show that the man has the special aptitudes that the trade requires. For example, the machinist trade is based very largely on ability to measure.

Must Distinguish Measures

A man on lathe, planer or milling machine works as close as he can measure and no closer. If the candidate shows inability to close a micrometer alike on two pieces of the same size he should be looked upon with question. If he cannot distinguish measurements with a rule as fine as 32ds he can hardly be expected to learn to read thousandths. Mathematical tests will also disclose the kind of men who can think in figures. Estimating tests, in which men are given short pieces of one, two and three inch bars to estimate without any means of measurement, will help, but the general intelligence test, with care to make sure of the man's general reasoning power and his imagination for things seen, gives the basis for a decision which will probably be at least as good as that of the employment manager himself.

The free use of tests is likely to bring about one condition that has not hitherto been met, except in connection with the civil service. Men will take many of these examinations with the idea of laying an anchor to windward. They may have no intention of accepting the job but they want to know how they stand. Men are just as curious, regarding their actual ability relative to others in the same line, as employers are. They may take a test at the Jones shop without the slightest thought of leaving Smith but if they rank high and an immediate job is available at a higher rate they are quite likely at least to ask Smith for more recognition in the pay envelope. This, however, is not an unmitigated blessing. If Smith finds several of his men making these shifts, he will jack up his psychometrist, or whatever he may call him, and get his tests up to the Jones standard.

Safety Appliances

By C. E. Jenson

In many instances safety appliances are called for by law or ordinance. But the law is too seldom enforced. Some builders rather pride themselves on their machines and even tools being fool proof, but even after the law has demanded safety appliances for elevator hatches, gears, in fact, almost everything about the place, and the inspector has come around, which I am sorry to say is often only in the hopes of graft, danger areas and danger appliances still exist. It is up to the foreman to report them, over and over again if necessary, to his employer. No workman can reasonably be expected to give his best effort when he is constantly aware that his surroundings are unsafe.

Machining Gas Engine Pistons

Rough Turning in Automatic Machine—Trouble Due to Expansion Chuck Overcome by a Chuck of Special Design—A Special Grinding Mandrel

BY A. W. FREEMAN

IN MACHINING pistons at the Cushman Motor Works, Lincoln, Neb., the castings are first annealed and the open ends faced by grinding on an 18-in. disk grinding-machine. The work is held by hand square against the disk, removing just enough stock to allow the piston to set flat on this surface, which is used as a clamping surface in subsequent operations.

Rough-reaming the open end is done on a Cincinnati-Bickford drilling machine, using a lathe chuck to hold the work, as shown in Fig. 1. Very little stock is removed, not more than $\frac{1}{32}$ in. For this operation we use an expansion shell reamer with a pilot at *A* approximately fitting the cored hole. The limits to which we hold this hole are plus or minus 0.0015 inches.

Rough-turning is done on a 2-in. Cleveland automatic piston machine, supplied with air equipment for operating the chuck, which is a distinctive feature in the operation. After an unsuccessful attempt to use a chuck of the expansion pin type, the chuck shown in Fig. 2 was developed.

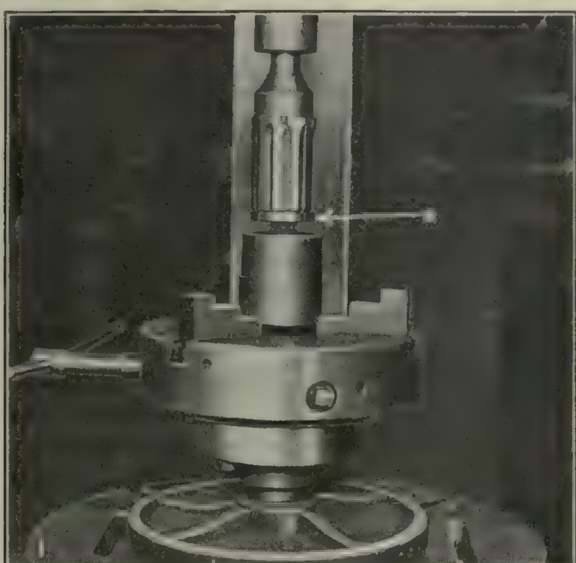


FIG. 1. ROUGH-REAMING THE OPEN END

One trouble we had with the expansion type of chuck was that the pressure would crack the piston after the roughing cut was about completed. If we reduced the pressure, the piston would wobble or run out of true when the grooving tools started to cut. Worst of all the pistons would come out of round from 0.1010 to 0.050 in. These troubles have been overcome by using the chuck shown.

The chuck holds the piston the same as it would be held by a draw bar and pin through the wristpin hole, except that it grips over the outside of the wristpin bosses, thus eliminating the necessity of drilling the wristpin holes until after the piston has been finish-turned. It also ends the troublesome job of machining across the drilled holes in the turning operation.

To chuck a piston it is only necessary to slip it over the chuck and turn on the air. There is no outward pressure against the wall of the piston, all of the pull being straight back.

The two dogs *A* when spread by the spreader block *C* will grip the wristpin bosses. The spreader block and its rod *G* are connected direct to the piston rod of the chuck. Springs at *D* collapse the chuck when the air is released. The main member *E* has a heavy coil spring behind it to force it out when air is released.

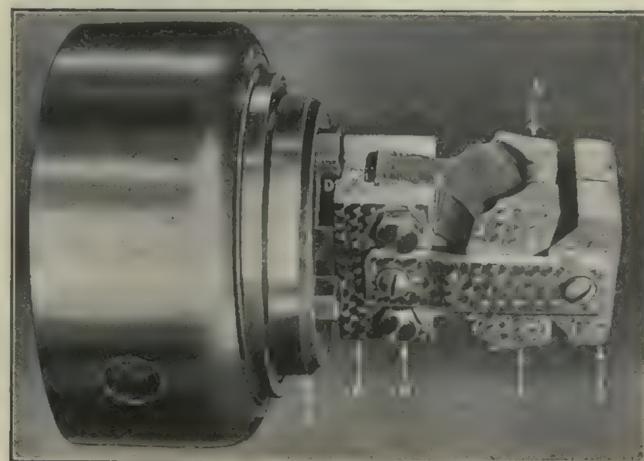
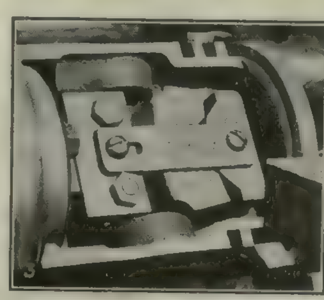


FIG. 2. A SPECIAL CHUCK

When the air is turned on, the spreader block first spreads the boss dogs to their extreme position, catching over the wristpin bosses and then the whole chuck together with the piston is drawn back against the shoulder of mandrel *F*.

All of the pull is directly over the ends of the boss dogs *A*. The spreader block and rod have swivel joints, and the holes where bolts *H* go through are slotted to take care of any variation in the wristpin bosses, giving equal pressure on each boss.

A section of a piston slipped over the chuck is shown in Fig. 3 while Fig. 4 shows the piston tightened on the chuck. Note the difference in the positions of the boss dogs in each illustration. The wall of this piston is $\frac{8}{32}$ in. thick and the first operation, which includes rough-turning the diameter, roughing the ring grooves and facing the head end, leaves it to within 0.002 to 0.004 in. of round.



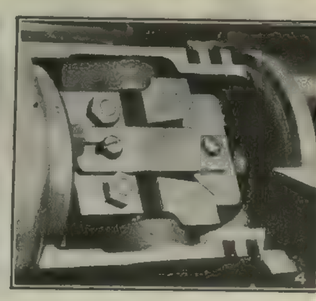


FIG. 3 PISTON IN PLACE, CHUCK NOT TIGHTENED.
FIG. 4. PISTON IN PLACE, CHUCK TIGHTENED

Boring and facing the open end is done on a No. 4 Warner & Swasey universal turret lathe. The work is held in a collet as shown in Fig. 5. The hole is bored with a two-bladed adjustable tool and reamed with an adjustable shell reamer. The diameter over the ring grooves is finish-turned with a second tool, allowing no stock for grinding.

In testing for leaks, the piston is placed in a fixture and a pressure of 50 lb. applied to the inside to determine if there are any leaks or porous places.

Boring the wristpin hole is done on a Cincinnati-

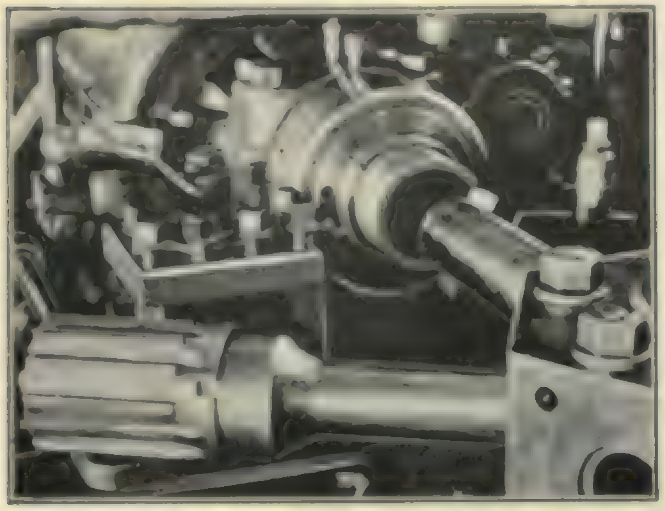


FIG. 5. BORING AND FACING THE OPEN END

Bickford 4-spindle gang drilling machine, using three spindles for the work as shown in Fig. 6. There are four fixtures. Three hold work in operation, leaving one ready to load. The hole is first drilled from both sides, turning the jig over to accomplish this. The fixture is then passed along the track to the next spindle and rough-reamed in the same manner. The finish reamer in the third spindle, however, is run through both holes from one side to insure perfect alignment. The holes are reamed to within 0.005 to 0.0015 in. of finished size. This amount is removed by hand reaming when the wristpins are fitted. Two gages are used, a limit gage and a gage to check alignment of holes. The illustration shows the locating arrangement. The yoke *A* straddles one wristpin boss. The plate *B* is hardened and ground and has a pilot to fit the open end of the piston. Screw *C* holds the piston squarely against the plate and over the pilot.

In finish grinding the diameter, the work is placed on the hardened and ground mandrel shown in Fig. 7.

FIG. 6. DRILLING AND REAMING THE PIN HOLE

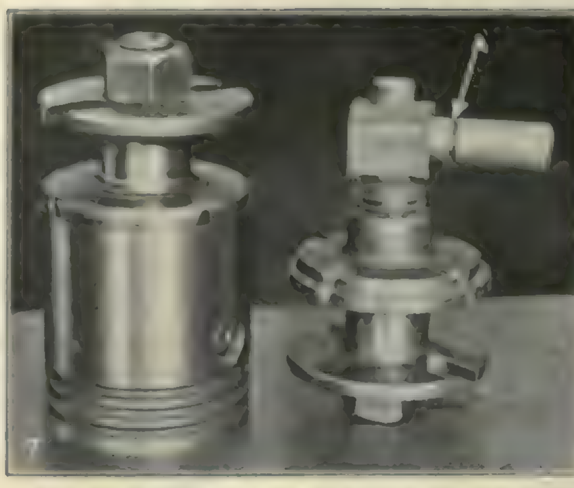


FIG. 7. MANDREL FOR HOLDING PISTON IN GRINDING MACHINE

The groove to be seen in the center of the pin at *A* is used to hold it centrally. A small ball with a spring behind it drops into the groove when the pin is in position. The four grooves shown in the mandrel will allow the grinding compound to run out. To remove the piston from the mandrel, the nut is clamped in a vise and it is only necessary to grip the piston by the hands to tighten or loosen it. A Norton 20 x 2½-in. 36-L Crystolon wheel is used, removing 0.008 to 0.012 in. of stock while feeding straight in and finishing in one operation to 3.247 or 3.245 inches.

Dimensions of Tapper Taps

The accompanying table gives dimensions of tapper taps as recently adopted by the Tap and Die Institute. It is published for the information of those interested.

DIMENSIONS OF TAPPER TAPS AS ADOPTED BY THE TAP AND DIE INSTITUTE

Diam. of Tap, Inches A	Length Overall, Inches,	No. of Threads, Per Inch			Length of a Thread Inches, B	
		U.S. Std.	S.A.E. Std.	Whit. Std.	U. S. Std. Whit. Std.	S.A.E. Std.
1/4	12 and 15	20	[illegible]	20	1 5/8	1 1/4
5/16	12 and 15	18	24	18	1 13/16	1 3/8
3/8	12 and 15	16	24	16	2	1 1/2
7/16	12 and 15	14	20	14	2 1/4	1 11/16
1/2	12 and 15	13	20	12	2 1/4	1 11/16
9/16	12 and 15	12	18	12	2 1/2	1 7/8
5/8	12 and 15	11	18	11	2 1/2	1 7/8
11/16	12 and 15	11	16	11	2 1/2	1 7/8
3/4	12 and 15	10	16	10	2 3/4	2
13/16	12 and 15	10	....	10	2 3/4	....
7/8	12 and 15	9	14, 18	9	3	2
15/16	12 and 15	9	....	9	3	....
1	12 and 15	8	14	8	3 1/2	2 5/8
1 1/8	15	7	12	7	3 1/2	2 5/8
1 1/4	15	7	12	7	3 1/2	2 5/8
1 3/8	15	6	12	6	4	3
1 1/2	15	6	12	6	4	3
1 5/8	15	5 1/2	....	5	4	....
1 3/4	15	5	....	5	4 1/2	....
1 7/8	15	5	....	4 1/2	4 1/2	....
2	15	4 1/2	....	4 1/2	4 1/2	....

Ideas from Practical Men

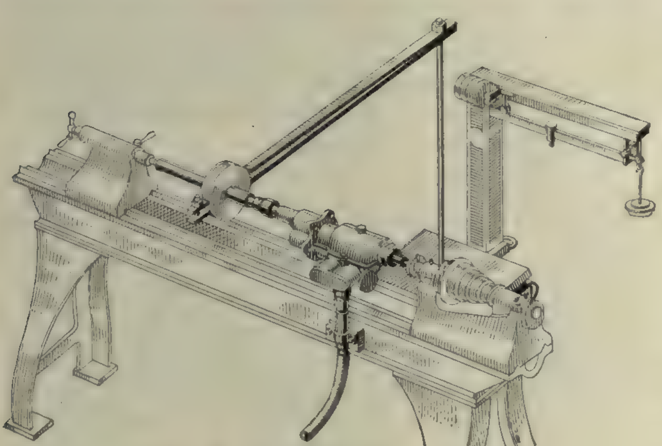
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Simple Device for Testing Power of Air Drill

By Juvenal Grignolo

On pages 875 and 951, Vol. 56, of *American Machinist*, S. Ashton Hand describes devices for testing the efficiency of air drills. These suggestions are all right for the purpose provided there are a sufficient number of drills in operation around the plant to warrant the expense of the installation. The sketch accompanying this article shows a device used by the writer while repairing drills around a small shipyard that has at least the merit of low cost.

A short shaft was made with a tapered shank to fit the socket of the drill and to it was keyed a flanged pulley, or brake wheel, about 8 in. in diameter. A forged brake band was made, as the sketch shows, and was lined with leather to fit the brake wheel. To test a drill, the shaft and brake wheel should be put into the drill and the whole placed between the centers of a lathe. The brake band should then be separated and placed over the wheel, being then drawn tight by means of the bolt at the short end. When in position, the long end of the brake band lever extended horizontally over the front shears of the lathe and was supported in this position by a long rod, the lower end of which rested upon the platform of a scale placed in front of the lathe.



DEVICE FOR TESTING AIR DRILLS

Turning on the air and tightening the bolt gradually, at the same time increasing the weight on the scale beam to correspond, the resistance necessary at the end of the lever to stall the drill was thus determined in terms of weight. This device would not, of course, measure the efficiency of the drill in the matter of air consumption with respect to the amount of work done but it does measure the power a drill was capable of delivering and tells us immediately whether or not a repair drill is up to the standard. This is the really important matter.

Another Way to Catch the Thread—Discussion

By Jesse B. King

In an article on pages 352 of the *American Machinist*, Vol. 57, under the above title, H. O. Turnbull gives a scheme for catching the thread with a pointer. The idea is very good, but I dont think Mr. Turnbull carried it quite far enough. He neglected to tell us what would happen should the thread extend up close to a flange or shoulder, in which case his thread pointer would receive some rough usage as it is in advance of the thread tool.

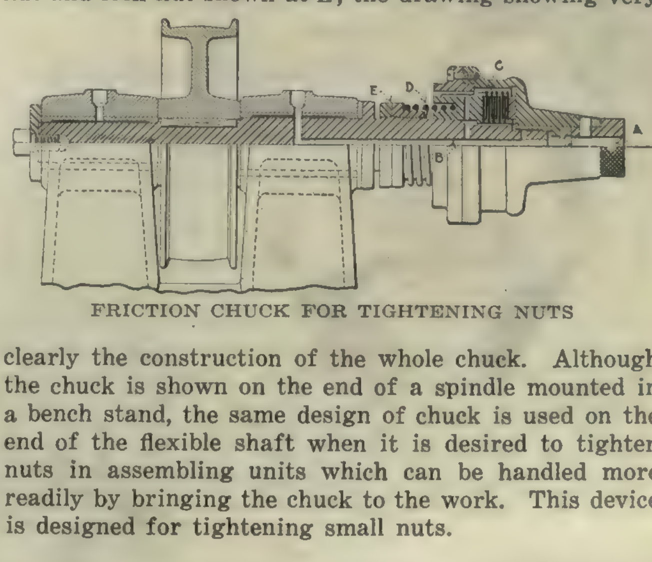
I had a similar device in use at one time on a lathe minus a thread dial and, as the work was of $1\frac{3}{4}$ in. diameter and to be threaded close up to a 4-in. flange, the rigid pointer would not do. I hit upon the scheme of hinging the pointer about $\frac{3}{8}$ in. from the tool post. When the operator is sure the tool will follow correctly, he can swing the pointer up where it will not cause trouble and set it down again before starting the next cut.

Friction Chuck for Tightening Nuts

By Herbert Crawford

The illustration shows a friction chuck used by the Ford Motor Co. for screwing up nuts to any desired tightness. Without going into unnecessary details of construction, it will be seen that the device consists primarily of the chuck *A* and the driving spindle *B*. These members are connected by the friction plates *C* in the same way as the friction clutches in automobile drives. Part of the disks are connected to *A* and the remaining disks to the drive shaft *B*, normal friction being secured by means of the helical spring *D*.

This friction can be readily adjusted by means of the nut and lock nut shown at *E*, the drawing showing very clearly the construction of the whole chuck. Although the chuck is shown on the end of a spindle mounted in a bench stand, the same design of chuck is used on the end of the flexible shaft when it is desired to tighten nuts in assembling units which can be handled more readily by bringing the chuck to the work. This device is designed for tightening small nuts.



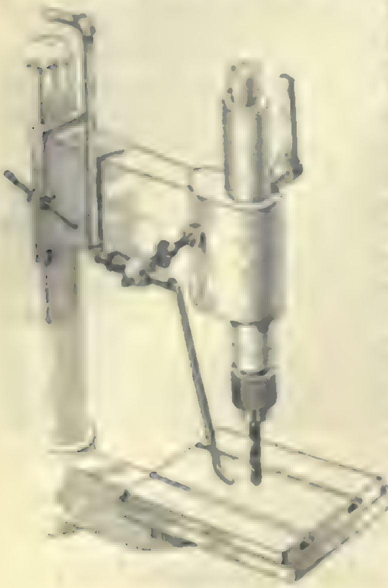
FRICTION CHUCK FOR TIGHTENING NUTS

Automatic Air Valve to Blow Away the Chips

By W. L. Kaufman

On small drill-presses used in connection with manufacturing operations, we found that it took altogether too much of the operator's time to keep the chips away from the table or fixture where the work was to go. Each time a piece was changed it would be necessary to brush or blow away the chips to make sure that none of them would get under the following piece and cause it to be drilled incorrectly.

To remedy this difficulty we piped air at 60 lb. pressure to each of the drill-presses and closed each pipe with an ordinary gas cock from the plug of which the pin had been removed so that the plug would turn all the way around. We then tapped into the end of the pinion shaft of the drill-press a large fillister head screw, the slot of which had been enlarged sufficiently to fit over the thumb piece of the gas plug and attached it to the plug by drilling through and setting in a pin, as shown in the sketch. A lock nut on the body of the screw kept it from turning in the thread and gave us an adjustment in the matter of the angle at which the slot stood. A small copper tube was fitted to the outlet end of the gas cock and bent down close to the table or fixture where the jet of air would do the most good.



AUTOMATIC AIR JET FOR SMALL DRILL-PRESS

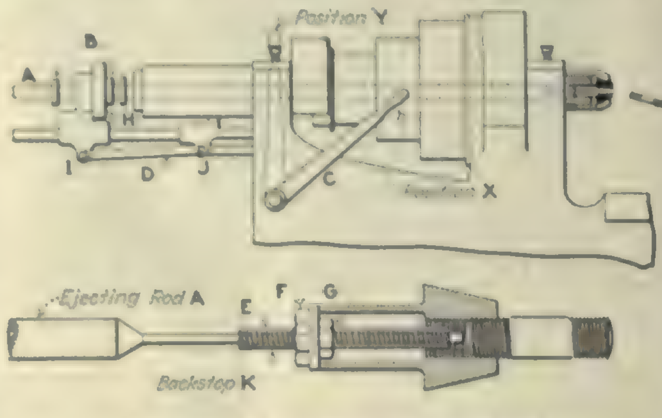
With a drill-press equipped in this way, the operator need pay no attention to the chips. When he starts to raise the drill from the work the air will automatically be turned on, while, if the lever is thrown away back, as when changing pieces, the air will be shut off again. By loosening the lock nut on the body of the screw, the valve can be set in position to deliver a jet of air at any desired rise of the drill.

A Backstop and Ejector Combination

By M. W. Taylor

The use of an ejector for the removal of work from the collets on small hand screw machines, when figured in dollars and cents, will in a year more than cover the depreciation of the machines themselves. This is especially true when the operation requires only a small amount of time, such as a second operation on work that has been partly machined on an automatic. For example, if a stud requires a ten-second threading operation (the opposite end having been previously threaded) and the time required to remove the work from the chuck is two seconds, the use of an ejector means a saving of 20 per cent of the total time. Obviously, the shorter the machining operation, the greater the saving.

The type of combination backstop and ejector illustrated in the accompanying sketch has a wider range than the so-called "spring type," generally used on the hand screw machines as there is no sticking of the spring to contend with. An adjustable backstop *K*, an ejector rod *A*, two feeding collars *B* and connecting strap *D* are necessary. The backstop and collars are equipment to be found in practically any shop. Stud *E* is a piece of steel tubing threaded and the stop can be adjusted to the length desired by moving the nuts *F* and *G*. The ejector rod is made of cold-rolled steel with one of the ends turned down so as to make it a sliding fit in the hole in the backstop. The feeding collars *B* are adjusted with setscrews.



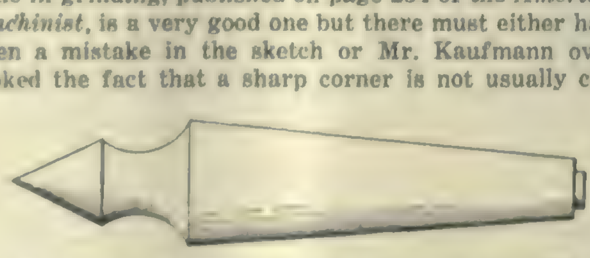
COMBINED BACKSTOP AND EJECTOR

When the lever *C* is in position *X*, the collet is open. The piece of work is placed in the chuck until it touches the backstop and further movement causes the ejector to slide back in the hole. When the lever *C* is moved to position *Y*, the collet is closed. After the operation has been performed, and the lever moved to open the collet, the simultaneous movement of *H* starts the ejector rod through the backstop and ejects the work instantly. Connecting strap *D*, secured at *I* and *J*, causes movement of *H* in the direction in which lever *C* is moved. Casehardening of all parts adds to the life of the apparatus.

Saving Time in Grinding Centers —Discussion

By A. Chester

Charles Kaufmann's suggestion for a center to save time in grinding, published on page 284 of the *American Machinist*, is a very good one but there must either have been a mistake in the sketch or Mr. Kaufmann overlooked the fact that a sharp corner is not usually considered good design. The same idea, but with a generous round, as shown in the sketch herewith, would be much more in accordance with the general conception of good mechanical practice. Moreover, it certainly would save a lot of trouble in trying to harden such pieces.



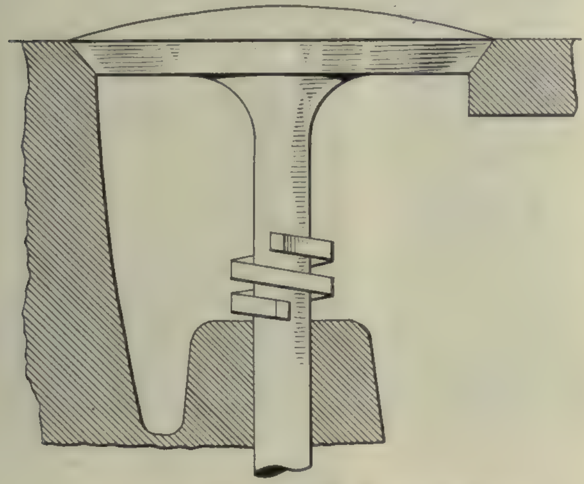
TIME-SAVING CENTER WITH ROUNDED CORNER

Rings to Keep Valves from Sticking

By G. A. Luers

Valves sticking, due to carbon collecting about the stems, is a common fault in some motors. It is necessary in some cases to remove the cylinder head and disassemble the parts to scrape the carbon from the stems. One motorist devised the simple method for scraping off the carbon as rapidly as it collects, by placing a scraper ring about the stem of each valve, as indicated in the sketch.

These rings are made from heavy square wire wound to about the size of the stems and cut off to leave two turns in each ring. Another method is to use one or more lock washers about the size of the valve stem, which will effect the same purpose. The movement of the valve affords the loose ring an opportunity to reach the bearing surface each time the valve raises. Since installing these rings the owner claims not to have had a reoccurrence of valve-sticking troubles.



RINGS TO KEEP VALVES FROM STICKING

Slip Bushings

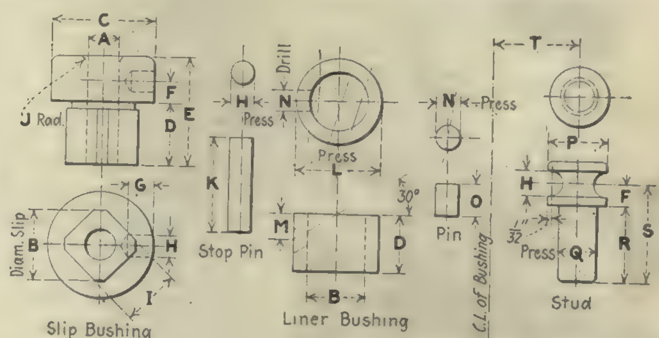
By Edward Heller

The slip bushings described by Raymond Beckman on page 152, Vol. 57, of *American Machinist* are certainly a step away from the ordinary kind and there are quite a few objections to be raised against them. In the first place, they are rather expensive to make. Secondly, the handle is pretty large (the smallest one is 2⅛ in. spread) and at times other things around the jig would interfere with it. Lastly, the chief objection to slip bushings, that of sticking, is not eliminated. Mr. Beckman only provides a big handle with which to pry them loose.

A slip bushing that does away with the chief trouble is shown in the accompanying drawing. The principal feature of the bushing is the relief milled on the part that enters the liner bushing. No matter how much dirt or grease there is in the liner bushing, the slip bushing acts as a reamer and cleans everything out. Another feature of this bushing outfit is the method by which the liner bushing is held in place. A small hole is drilled in the liner bushing a distance *M* from the top and at 30 deg. with the horizontal. After the bushing is pressed into the jig body, the small hole *N* is continued through the liner bushing, into the casting of the jig. A small pin is then forced into the hole. The hole for the pin is always drilled deeper than necessary.

If for any reason it becomes necessary to remove the liner bushing, the pin can be driven in deep enough to clear the bushing, which can then be forced out. When another bushing is inserted, it is set to miss the old hole, and a new hole is drilled for the pin. It is not often that a liner bushing has to be replaced, so the extra holes that might have to be drilled in the jig casting are negligible. This method does away with a flange on the liner bushing and it also permits the bushing to be driven in or out in any direction.

These bushings were developed and used in a shop manufacturing automobile motors and transmissions. The sizes shown in the table are the principal sizes used up to one inch. For any intermediate sizes, the dimensions of the next larger size were used. The parts for the more common sizes were usually made in quantities, kept in stock and when a drill jig was designed the bushings and accessories were drawn in but no dimensions given. The parts were then called for in the bill of material. It will be interesting to note that we even designed a universal drill jig to drill that little hole in the liner bushing.



A SLIP BUSHING THAT WILL NOT STICK

SIZES OF BUSHINGS AND PARTS

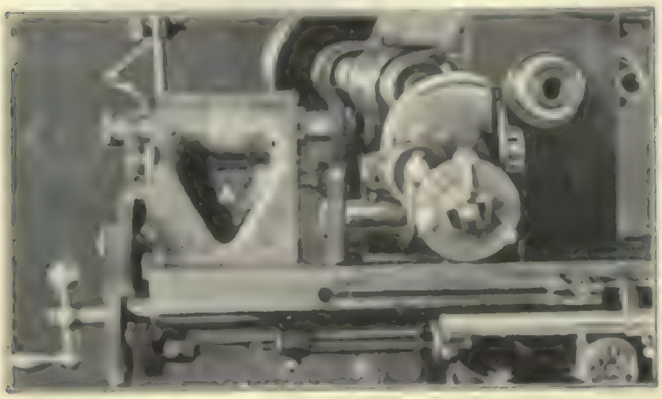
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1/16	3/16	3/8	1/2	3/4	1/8	3/32	1/16	11/64	1/32	7/16	3/8	3/32	1/16	3/16	1/4	3/16	3/8	5/8	15/32
3/32	1/4	3/8	1/2	3/4	1/8	1/8	1/16	7/32	1/32	7/16	7/16	1/8	3/32	3/16	1/4	3/16	3/8	5/8	7/16
1/8	5/16	7/16	5/8	7/8	1/8	1/8	1/16	9/32	1/32	1/2	1/2	5/32	3/32	3/16	1/4	3/16	3/8	5/8	17/32
5/32	3/8	7/16	5/8	7/8	1/8	1/8	1/16	11/32	1/32	1/2	9/16	3/16	3/32	7/32	1/4	3/16	3/8	5/8	17/32
3/16	3/8	9/16	5/8	7/8	1/8	1/8	3/32	11/32	3/64	5/8	9/16	7/32	3/32	7/32	5/16	1/4	15/32	23/32	23/32
1/4	1/2	3/4	5/8	7/8	1/8	1/8	3/32	13/32	3/64	3/4	11/16	1/4	3/32	7/32	5/16	1/4	15/32	23/32	15/16
5/16	9/16	13/16	5/8	15/16	5/32	3/16	1/8	15/32	1/16	13/16	13/16	1/4	1/8	7/32	3/8	5/16	15/32	25/32	31/32
3/8	11/16	7/8	3/4	1 1/8	3/16	3/16	1/8	19/32	1/16	13/16	15/16	1/4	1/8	1/4	3/8	5/16	1/2	7/8	1
7/16	3/4	15/16	13/16	1 3/16	3/16	3/16	1/8	21/32	1/16	13/16	1	1/4	1/8	1/4	3/8	5/16	1/2	7/8	1 1/32
1/2	27/32	1	7/8	1 5/16	7/32	3/16	1/8	11/16	3/32	13/16	1 3/32	1/4	1/8	1/4	3/8	5/16	1/2	15/16	1 1/16
9/16	29/32	1 1/8	1	1 1/2	1/4	7/32	1/8	25/32	3/32	13/16	1 5/32	9/32	1/8	1/4	3/8	5/16	1/2	1	1 3/32
5/8	1	1 1/4	1 1/8	1 5/8	1/4	7/32	1/8	27/32	3/32	13/16	1 3/8	9/32	1/8	5/16	3/8	5/16	1/2	1	1 5/32
11/16	1 1/16	1 5/16	1 1/8	1 5/8	1/4	1/4	1/8	29/32	3/32	7/8	1 7/16	5/16	1/8	5/16	3/8	5/16	1/2	1	1 3/16
3/4	1 1/8	1 3/8	1 1/8	1 5/8	1/4	1/4	5/32	31/32	1/8	7/8	1 1/2	5/16	1/8	5/16	7/16	3/8	17/32	1 1/32	1 7/32
13/16	1 1/4	1 1/2	1 1/4	1 7/8	5/16	1/4	5/32	1 3/32	1/8	7/8	1 5/8	5/16	1/8	5/16	7/16	3/8	17/32	1 5/32	1 9/32
7/8	1 5/16	1 9/16	1 1/4	1 7/8	5/16	1/4	5/32	1 1/8	5/32	7/8	1 11/16	5/16	1/8	5/16	7/16	3/8	9/16	1 3/16	1 5/16
15/16	1 3/8	1 5/8	1 3/8	2 1/8	3/8	1/4	5/32	1 3/16	5/32	7/8	1 3/4	5/16	1/8	5/16	7/16	3/8	9/16	1 5/16	1 11/32
1	1 3/8	1 5/8	1 3/8	2 1/8	3/8	1/4	5/32	1 3/16	5/32	7/8	1 3/4	5/16	1/8	5/16	7/16	3/8	9/16	1 5/16	1 11/32

Cutting Spirals of Extreme Lead

By A. B. Seaman

At times it is necessary to cut spirals having leads beyond the range provided for by the gearing of the universal milling machine.

The accompanying illustration shows a device *A* in use at the works of the Pratt & Whitney Co., Hartford,



DEVICE FOR CUTTING SPIRALS OF EXTREME LEAD

Conn., by which the range in the leads of spirals that can be cut with the regular gears can be increased or decreased by as much as ten.

As can be seen, the device is simply an arrangement for compounding the gears between the driving gear on the table screw and the driven gear on the worm of the dividing head, behind which it is placed.

Testing Push Fits by Spring Tension

By Herbert Crawford

Nothing is more exasperating than to have a gear come loose on its shaft, especially when it is part of a gear train and repairing it means dis-assembling the whole gear train. To avoid this the Neptune Meter Company, Long Island City, New York, has a very ingenious method of testing the fit of small gear wheels on their shafts, after they have been forced in place.

Two examples of their method are shown in Figs. 1 and 2. In Fig. 1 the wheel shaft is clamped in the

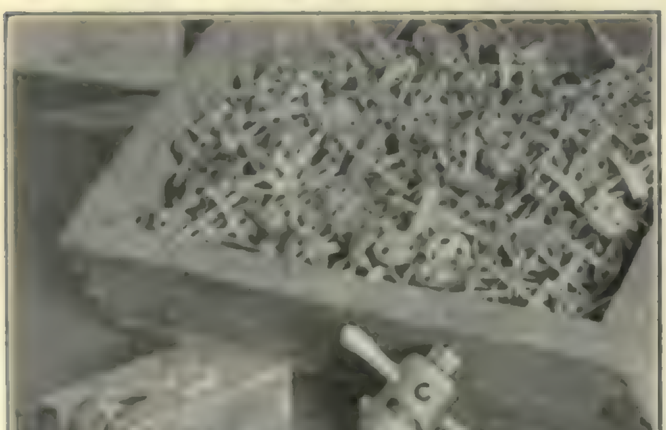


FIG. 1—TESTING FIT OF WHEEL ON SHAFT

quick acting vise *A* by the lever shown. Then the two prongs *B* of the tool *C* are placed between the spokes of the wheel and the tool turned until the screw *D* touches the other end of the slot. The two parts of the tool are connected by a helical spring. This puts the desired spring tension on the wheel, and if it does not turn on the shaft, it will stand any load that will be thrown on it in the gear train.

Another method of doing the same thing is shown in Fig. 2, except that this method tests the wheel on

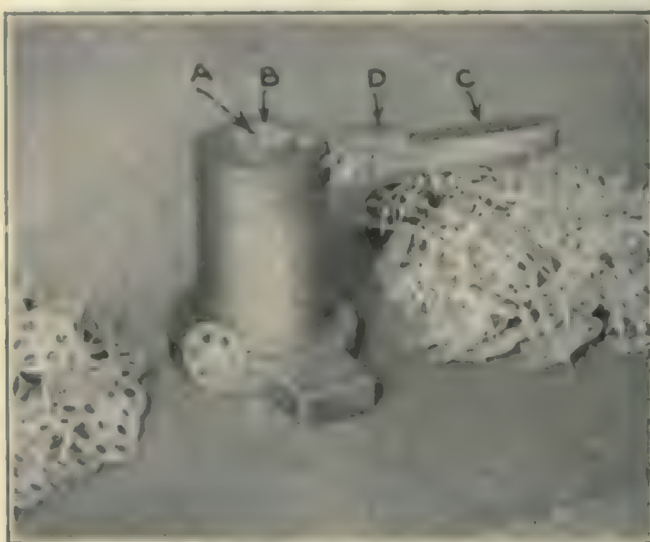


FIG. 2—ANOTHER METHOD OF TESTING HOLDING POWER OF FIT

the pinion shaft. The pinion drops into a toothed hole at *A* while one of the holes between the spokes in the wheel fits over the pin *B*. By moving the handle *C* the tension is shown by the pointer *D*. Both of these methods practically weigh the twisting load which the fit of the two pieces will stand, and prove that they will not loosen under the load exerted in service. These tests have practically eliminated the difficulties from this source.

Utilizing Fixtures on Different Machines —Discussion

By C. L. Henry
Beeston, Notts, England

The writer has read with interest the article under the above title on page 27, Vol. 57, of the *American Machinist* by Frank C. Hudson. It is true that the lack of uniform dimensions in the T-slots of machine tool tables has increased the cost of toolmaking considerably and decreased the number of production hours. It is, therefore, pleasing to know the American Society of Mechanical Engineers is considering their standardization.

The novel way of using interchangeable tongues for fixtures, as illustrated and used by the Lucas Machine Tool Company, Cleveland, Ohio, to get over the different widths of T-slots is of interest. As is customary in our plant, week by week, the contents of the *American Machinist* is read with eagerness, and the various articles discussed by the boys. After discussing this article we wondered if the cost of equipping fixtures with interchangeable tongues was worth while and we wish to explain our own method to get over the difficulty.

It was our practice to make interchangeable tongues of the plain pattern for our fixtures until about 3 years ago. Then we discovered that fixtures with narrow tongues were being used on machines with wide T-slots with satisfactory results. Since that time all our fixtures have been made with tongues to suit the narrowest T-slots and no difficulty has been experienced, while much time and material have been saved. When setting a fixture on a machine in wide T-slots it is only necessary to hold the fixture against the front or back face of T-slot and clamp it in position.

This method is undoubtedly open to criticism and we naturally conclude that, owing to the narrow tongues not being a good fit in the slots, the fixture is liable to move out of position while in use. But as tongues on fixtures are only put there to align or position them, the clamps and bolts should take all the strain and prevent them from moving.

To illustrate this, very heavy milling jobs are done in our plant using Brown & Sharpe No. 3 and No. 4 plain milling machine vices. They are not equipped with tongues to align them as the clamps and bolts hold them in position so firmly that they do not move out of alignment even under severe cutting strains.

Gage for Locating Holes from a Periphery

By C. J. Dorer

Very often after several holes have been drilled and reamed in a part, it is desirable to know the relationship between these holes and the outside edge of the part. The gage shown in the accompanying illustration was designed for the purpose of checking the relations of two holes with the outside of the disk in which they were drilled.

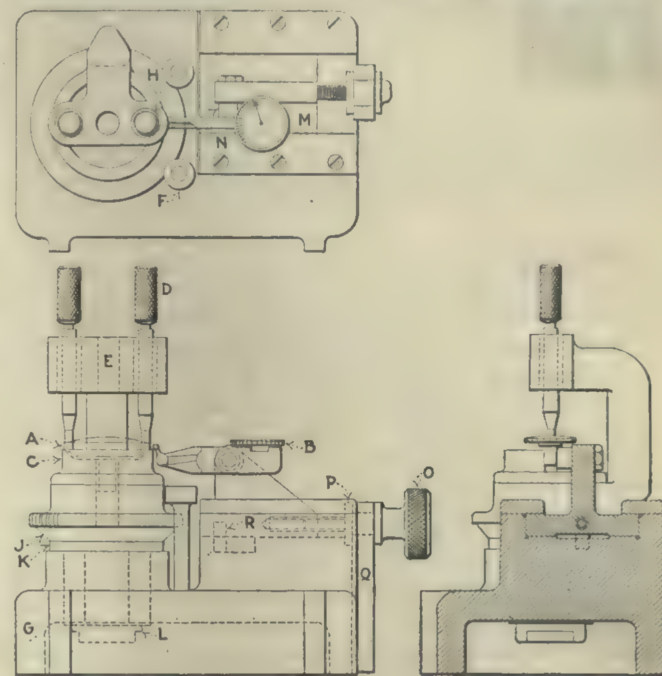
The holes in this case were drilled and reamed to a limit of plus or minus 0.00025 in. The center distance between the holes was held to a limit of plus or minus 0.0000 in. and the relation of the holes to the outside diameter was limited to a limit of plus or minus 0.0015 inch.

In checking the piece of work *A* is laid on the locating block *C*. The two plungers *D* are then pushed downward through the holes in part *A*, in which they are a close fit, and thus the piece is held tight in relation to the holes. The "Last Word" indicator *B* is moved into position, until the pointer registers on some convenient figure.

The piece *A* is now ready to be checked. This checking is accomplished by revolving the bracket *E*, which causes the periphery of the piece *A* to pass the indicator ball. The indicator pointer will register the amount of the variation in the distance from the holes to the periphery of the piece. It is not necessary to revolve the piece much over half the way around, as the opposite side of the disk will register the same amount of variation in the opposite direction; that is, minus instead of plus, or vice versa, as the case may be. The two stop pins *F* limit the motion of bracket *E* and protect the indicator against a blow from the arm of the bracket. It can be readily seen that the direction and amount of variation can be quickly determined, and, if necessary, the jig which drills the holes may be corrected.

The gage is built on a cast iron base *G*. The locating block *C* is a hardened tool steel block mounted on a bracket *E*. The plungers *D* slide freely up and down in the hardened bushings *H* which are pressed in the bracket E. The bracket E has a bearing plug J of as large a diameter as convenient, and revolves in and rests on hardened bushing *K*. The larger the bearing, the greater the degree of accuracy that can be maintained, and the more firm the bracket *E* will be. Lock nut *L* serves to keep bearing plug *J* from rising up out of place.

The indicator *B* is mounted on bracket *M* by means of stud *N*. Bracket *M* slides back and forth in ways



ASSEMBLED PARTS OF GAGE FOR LOCATING HOLES FROM A CIRCUMFERENCE

in base *G*. This bracket is moved forward and backward by revolving knob *O* which is securely fastened to screw *P*. Screw *P* has a collar which engages plate *Q* on one side and knob *O* serves as the collar on the other side, thus holding the screw in place as it revolves, and causing the bracket *M* to move.

Pin *R* is a stop pin which prevents the indicator from being jammed against locating block *C* in case bracket *M* is moved forward too far.

In order to get as accurate a reading as possible the ball of indicator *B* should move against the part *A* along a line coincident with the diameter of the part.

Soliloquies of Old Mac

When turning shouldered work in the lathe, upon which the shoulders must be accurately located with respect to each other, a scale is a very unsatisfactory tool to use for measuring the length, for the reason that it is always too short or too long, and in any event the hot chips from the tool have a tendency to curl around the operator's fingers in a way that is anything but comfortable.

To eliminate the discomfort and uncertainty, set an hermaphrodite caliper to the required dimension and then, with the caliper leg against the shoulder from which the measurement is to be taken and the hand away from possible contact with hot chips, the divider point will indicate the exact place at which to stop the tool from further cutting. More accurate work with less trouble and discomfort will be the result of using the caliper.

Editorial

A MACHINE is merely canned human intelligence. Like other canned goods it is well to examine the stuff very carefully before using, especially when it is old. It may be stale, or, worse yet, it may be spoiled and unfit for consumption. The kind of ptomaines it may stir up in your shop will not be noticed as quickly as the kind of ptomaines that wreck your inner works but the effects are none the less deadly.

A Significant Race Meet

NEAR DETROIT this week an event of unusual significance to machinery manufacturers is taking place. A race meet is being held in which the contestants in the various classes are heavier-than-air flying machines. Perhaps the connection betweeen airplanes and machinery builders seems remote, but just think back a few years.

In the early nineties there was some little interest and a good deal of derision over the first automobile race between what were really motorized carriages. Very few could see any connection between those noisy contrivances that could barely struggle through a twenty-five mile run without falling to pieces and the old and well-established machine tool industry. But what a difference a few years made! Within ten years speeds of a mile a minute were no longer unusual and then began the commercial development which revolutionized not only our methods of transportation but our methods of manufacture and our machine design as well. And what a machinery market was opened up!

Some people make the mistake of considering the airplane a competitor of the automobile. It is not and probably never can be. As a means of transportation it begins where the automobile leaves off. Its speed in a generation of men which places so much emphasis on time, counterbalances its greater cost of operation. Its size precludes its widespread use in congested districts. But who can foretell the direction or extent of its development? What prophet, twenty years ago, would have been rash enough to predict that two decades later the factories of the United States would be turning out more than two million motor cars in a single year?

The aëronautical pioneers have a harder job before them in their endeavor to educate the people to a comprehension of the possibilities of their product than the automobile men had, but they are turning to account the greater knowledge of transportation problems that twenty years of experience have given us. Where automobile races have always been speed, endurance or climbing contests for passenger carrying cars, this year's airplane meet includes events for light and heavy freight carrying machines as well as pure speed races like that for the Pulitzer Trophy. There is also an event for seaplanes.

The Detroit meet is only an incident in the development of aërial transportation but it is significant as an indication of how far and with what speed the art of flying has progressed.

Might and Right in Industrial Relations

PROGRESS OF civilization has been in a large measure a struggle between might and right. When might and right were combined in one man and one nation progress was rapid, but as a rule they were opposed to each other and progress was slow and halting, or negative. The fact that civilization has progressed is proof that right wins in the long run. Nor is this surprising, for we call that right or moral which is best for society, or at least for many, as against the desires of the few. This struggle takes place in many localities, under many different circumstances and between many different parties. Often he who is on the side of right in one issue is on the side of might in another.

There was a time when the struggle between employer and employee impressed us as if it were between might and right because the employer was only one and his employees many, and so we were instinctively inclined to take sides with the many. As the unions fought this fight we were inclined to be with them because their victory meant the greatest good to the greatest number. If the public suffered occasionally, it was willing to take its discomfort good naturedly. Where wood is hewn, chips must fly and neither one of the warring parties tried deliberately to hurt the public.

Things have changed. The coal strike was not an attempt to obtain the greatest good for the greatest number but was a display of might. The head of the miners' union did not claim that the miners were right, but that they had the power to enforce their demands. Whether the miners were right or not did not seem to interest him and was not mentioned, at least not in his public utterances.

That might has won for the present is neither surprising nor discouraging. An organized minority can always beat an unorganized majority. But such victories do not last. When the masses begin to feel the hurt and the injustice of it, they too organize and gather unto themselves the weapon of their oppressors, —Might. When might and right together combat might alone, right wins.

Progress of Uniform Cost Accounting

A CHART WORTH studying has been prepared by the Fabricated Production Department of the United States Chamber of Commerce. It shows the progress made in various commodity lines where uniform cost accounting has been achieved or attempted. The encouraging feature of the chart is the number of industries marked as being aroused to the importance of uniform cost accounting and actively engaged in pushing it. Only a few, however, have actually reached the point where a satisfactory system has been installed, although there are many more that have completed systems adapted to their respective needs.

In the statement accompanying the chart are some general truths, so-called, which may be worth emphasiz-

ing. One of them is that cost accounting uniformity is a plant of slow growth and one that requires constant encouragement. Another is that a cost system may be devised by an outside expert but that its adoption, modification to meet individual needs, and improvement must be accomplished by men of the different plants.

The Fabricated Production Department is to be congratulated for the success that has attended its efforts to stimulate interest in so vital a subject as uniform cost methods. It has a big job on its hands and needs all the support the Chamber can give it. Uniform cost accounting is a form of standardization that can be secured without great sacrifice on the part of the average manufacturer and one that will repay him and his industry many times for the effort expended.

Something About General Rules

NO GENERAL RULE should be applied with the eyes closed, not even this one. This warning is not new but it bears repeating, for there is nothing the average human being takes so gladly to his heart as a general rule. It relieves him of all responsibility in the matter at hand, gives him a weapon with which to put all critics to shame and makes unnecessary that most onerous task of all: individual thinking.

When a general rule is old enough it becomes venerable, something which cannot be said of all humans. To doubt its accuracy or investigate its merits is considered disrespectful. When still older, a general rule changes into a fetish. It then becomes sacrilege to so much as think about it in any other terms than those of submission and adoration.

In industry we find quite a number of these sainted general rules. So long as they are standing on their pedestals like idols, and are worshipped as such, they do no harm. But when they are consulted, they, like the oracle of Delphi are liable to start a lot of trouble. The courageous man asks them for advice which he follows only when his own mind tells him that it is proper.

Take, for instance, the general rule that the product should move through the shop in a straight (meaning continuous) line. Any other system is inefficient. We wonder how many millions of dollars have been sacrificed on the altar of this idol.

This rule looks good, in fact, is good if—. And this is exactly what we should say whenever we quote a general rule: If all other conditions are the same, and, if it does not cost more to apply the rule than to leave it alone, this rule, like all others, has its merits.

Some time ago we were in a very well conducted shop. The buildings, however, were old. The place had just grown and all departments were not exactly where they might have been. The general manager apologized for the lack of continuity in the line of movement of his product. He pointed out that a trucker had to move his stuff 300 ft. and back again, just because the buildings were as they were, and not as they should be.

A few questions brought out the fact that this happened five times a day, that the amount of unnecessary travel was 3,000 ft. per day for one man with a truck. We asked the G. M. how much money, he thought, could properly be spent to correct this evil and he smiled and grew more satisfied with himself and his shop. There are many cases where thousands of dollars have been spent for less cause than we saw in that shop. But then, there was a general rule which had to be obeyed.

The Increasing Use of Aerial Transport

OCCASIONALLY we run across a man who doesn't think that aviation will ever amount to much because he can't see that it has developed much since the early days. The facts are that flying has become so common that we read of very little in the daily papers except an occasional accident.

We are apt to forget that it was only twelve years ago that Hamilton flew from New York to Philadelphia and it was hailed as a remarkable feat. Yet when Lieut. Doolittle flew from Jacksonville, Fla., to San Diego, Cal., the other day in about 19 hours and with only one stop, in Texas, the papers hardly put it on the front page. Then too, we have had a twice-a-day service from Detroit to Cleveland, on schedule time, during the past summer, making the trip in 90 minutes as against 5½ hours by rail.

Perhaps the most striking instance of airplane utilization is that of Gen. Wm. Mitchell, assistant chief of air service, who has only used the railroad twice since he came back from France after the war. But this doesn't mean that he hasn't traveled, for he has flown approximately 200,000 miles during that time, visiting the various aviation centers. Railroad strikes mean nothing to him.

Aircraft development is going on in a fairly healthy fashion, and with the trend toward metal construction in place of wood, there is more and more likelihood of its being a factor in the machine building field. It is an industry to be encouraged in every legitimate manner, and machine builders should be among its boosters. Every aviation landing field is a potential market for more or less machinery, small tools and other equipment.

Just Suppose

JUST SUPPOSE all of the union railroad employees had been paying their dues regularly for the last ten years, and suppose this money had been honestly and intelligently administered, with as small an expenditure as possible for maintaining the union organization and other legitimate work. And suppose every time a union thought fit to strike it had refrained from doing so, but had made the would-be strikers contribute the amount they would have lost if they had struck a reasonable length of time.

Suppose further that all this money had been spent for railroad bonds and stocks, how many roads would now be under complete control of the railroad workers? Think of it. All the net income going to the men either as wages or as dividends. The Labor Board might reduce wages to the vanishing point and it would make no difference. And think of the beautiful chance of a union leader becoming a railroad president and riding around in his private car. Wages, working conditions, everything as the worker wants and dividends at the end of the year; a yearly vacation of not less than one month—with pay—instead of the annual strike of six weeks without pay and . . .

Of course, this is only a dream, it is not practical. There might be no dividends; the men might not be willing to pay their imaginary strike losses and besides why should a union want to do a thing like this when it would be almost certain to reduce the number of men required to run it. You cannot expect a man to kill his own job. No, it could not be done, but—

Just suppose.

Shop Equipment News

Holmes Tilted Threading Machine No. 3

A threading machine in which the spindles are tilted and which can be adapted to both internal and external threading has recently been placed on the market by the Holmes Engineering Co., Oshkosh, Wis. The machine, which is designated as the No. 3, has a capacity when cutting internal threads for taps up to ¾ in. in diameter on U. S. S. threads and 1 in. in diameter on S. A. E. threads. In Fig. 1 it is illustrated as equipped for tapping, with both forward and reverse movements for the spindles. Its particular adaptability is for work such as yokes, turnbuckles and other parts used in the manufacture of automobiles and farm machinery.

The six spindles are placed at an angle of 30 deg. from the vertical to permit of the proper lubrication of the cut when tapping, and also to allow the use of self-clamping jigs. The taps are chucked in spring collets. Four changes of speed are provided by means of change pinions and either right- or left-hand threads may be cut. Reversal of the taps at twice the cutting speed is performed automatically when the desired depth of thread is reached.

The arrangement of the work-holding jigs is such as to aid continuous tapping. Twelve jigs are employed, six of which are brought simultaneously up to the taps while the six idle jigs are being loaded. A treadle is used to move the jigs to the cutting tools, so that the operator can use both hands while unloading

FIG. 1—HOLMES TILTED THREADING MACHINE NO. 3 EQUIPPED FOR TAPPING

and loading the idle jigs. The bedplate on which the jigs are mounted can be moved laterally on its supporting member so as to bring the proper jigs under the spindles. Feed is provided by pressure on the pedal.

The tilted arrangement of the jigs and spindles can be seen in the end view in Fig. 2. This view shows

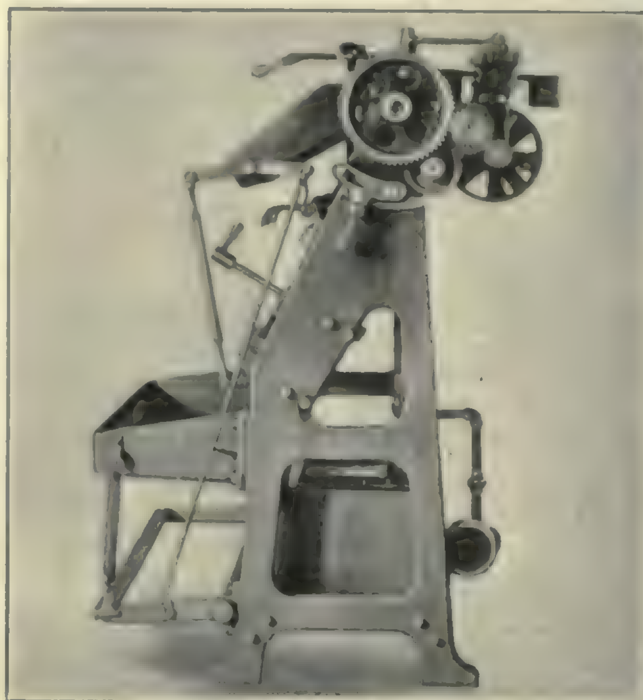


FIG. 2—END VIEW OF HOLMES THREADING MACHINE

also the arrangement of the pipes for bringing lubricant to the taps. The rotary pump forces oil to each individual spindle. A work shelf large enough to accommodate two tote boxes full of parts is located just above the spindles. It is inclined downward so that the parts are within easy reach of the operator. A trough below the jig is arranged to drain the lubricant into the tank at the rear. The arrangement of both the shelf and the trough is shown in the end view.

The machine is driven from a countershaft. Large bronze bearings are employed throughout and all thrust

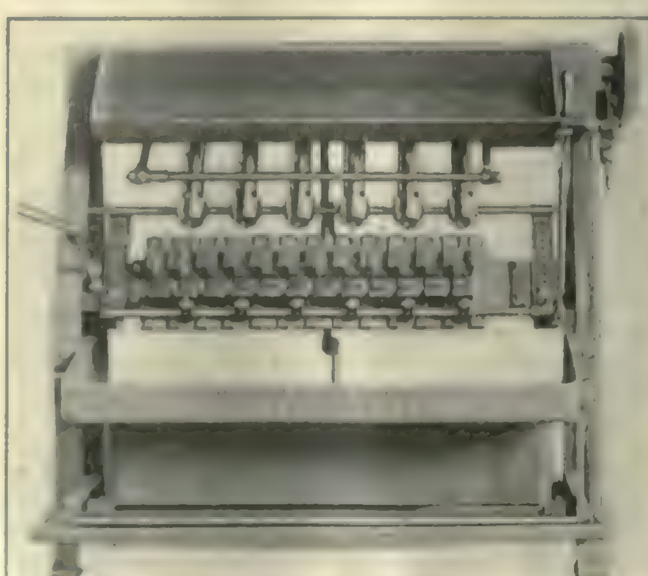


FIG. 3—HOLMES MACHINE FOR EXTERNAL THREADING

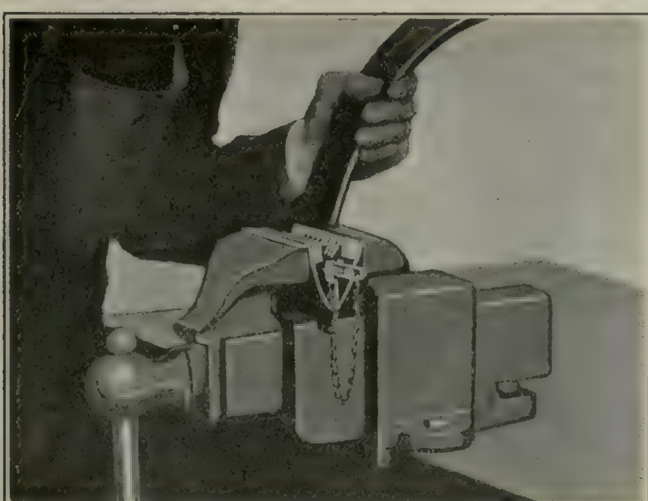
points are fitted with ball thrust bearings. It is stated that the machine is capable of production of 1,000 to 1,500 pieces per hour on average work.

When employed for external threading, the machine has a capacity up to 1 in. U. S. S. or 1¼ in. S. A. E. threads, and can be employed when threading such pieces as cap screws, king bolts, spring clips and similar parts where large production is required. It is stated that a production of 1,000 to 2,000 pieces per hour can be maintained.

In Fig. 3 is shown the non-reversing threading machine, equipped with self-opening dies. As in the previous case, four changes in speed are obtained and either right- or left-hand threads may be cut. The inclined position of the spindles prevents the lodging of chips in the dieheads, which might occur if the spindles were horizontal. The arrangement of the work-ho'ding jigs, the shelves and the lubricating system is the same as when the machine is equipped for internal threading. The machine requires a floor space of 66 x 41 in., and the height over the gear cover is 65 in.

Detroit Belt-Lace Closing Tool for Use in a Vise

A device has recently been placed on the market by the Detroit Belt Lacer Co., Detroit, Mich., by which its wire belt lacing can be applied to belting without the use of the regular bench-type closing machine made by the concern. To operate this small closing machine, a vise is necessary, as shown in the accompanying illustration. The device is normally held open by means of a spring so that it retains its position on the vise jaws. When the vise is closed, the jaws always come to the proper position to shape the lacing. The device is made of steel, while the magazine is bronze, the same as in the large standard machine. The outfit should be of use particularly in the small shop, garage or mill where belting is employed.



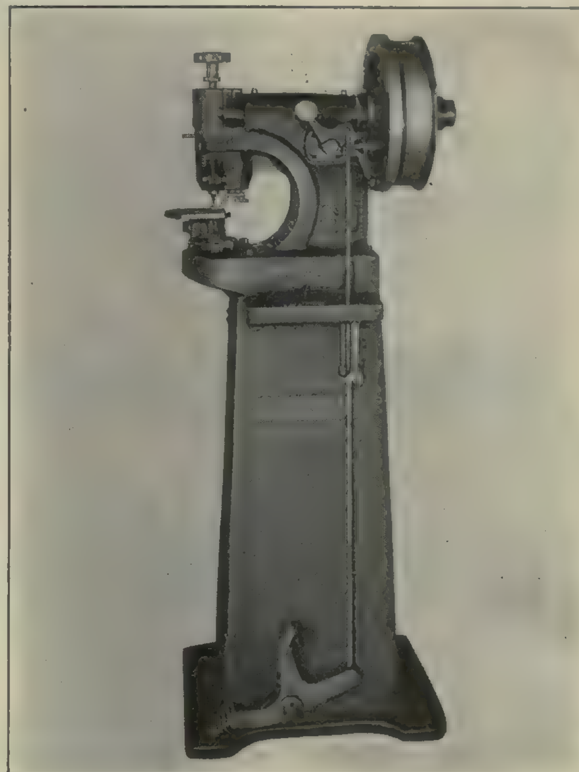
DETROIT SMALL BELT-LACE CLOSING TOOL

The standard staggered type of Detroit wire belt lacing is employed. The hooks mounted on cards can be placed in the closing device, the belt held in position by the operator with one hand and the vise handle operated with the other. Pressure is used to sink the hooks into the belt and flatten the lacing. Rawhide pins are employed to connect the lacing on the two ends of the belt.

Campbell Nibbling Machine

A machine known as a "nibbling machine," for cutting irregular forms from sheet metal, celluloid, fiber or other material that can be worked with punch and die, has recently been placed on the market by A. C. Campbell, Inc., Waterbury, Conn. It will handle sheets of any thickness up to 3/8 inch.

The machine, which is herewith illustrated, is in effect a small punch press and does its cutting by means of a small cylindrical punch and die. It runs very rapidly, and the work may be pushed or pulled in any direction by hand, following an outline marked upon the surface much as one would cut out a wooden pattern upon a jig saw, and at about the same speed. An average speed of 18 in. per minute is claimed.



CAMPBELL NIBBLING MACHINE

The punch has a central pilot and the ram is so set that this pilot does not at any time come above the surface of the work. Thus the amount of stock that is cut out at each stroke, or the rate of feed, is governed by the difference in diameter between the punch and the pilot.

Closed outlines, as strippers for blanking dies, may be cut as readily as open ones by first drilling a small hole anywhere within the contour to be cut out. The movement of a small lever in the ram withdraws the pilot and allows the sheet to be entered under the punch without disturbing the adjustment of the ram. To start the work this lever is thrown down, entering the pilot in the drilled hole.

When used for repetition work a templet is first made to the desired contour, and with this attached to the sheet the machine will reproduce it without the necessity for the operator to watch a line. An attachment enables the machine to cut circles of any size up to 28 in. in diameter.

The punches are about 3/16 in. in diameter and are made from a special alloy steel. They are double ended and may be reversed and replaced in a minute's time.

Morris Toolholder and Interchangeable Cutters

A toolholder and interchangeable cutters of different styles that adapt the device to practically all types of work for which a toolholder can be used is a recent product of the Morris Tool Co., Inc., 30 Church St., New York, N. Y. The illustration shows both the straight and the offset holders, as well as a number of the blades or cutters that can be fastened to these holders.

The holders are made of chrome-nickel steel and have two projecting arms at the cutting end in which bolts holding the cutters are secured. The holes are offset unequally from the center of the shank. By turning the holder over and fastening the blade on the other side of it, it is possible to change the height of the cutting edge.

MORRIS TOOLHOLDERS AND CUTTERS

The construction of the high-speed steel blades is probably the most interesting feature of the equipment. Each blade has two cutting edges, and can be turned so as to employ either one of them. It should be noted that the cutting edge is very well supported, so that there is less danger of breaking the cutter than when tool bits of small section are placed in standard toolholders. The tools are made for turning, cutting-off, threading and facing, the method of fastening to the holder being the same in each case so that the blades are interchangeable.

The side and front angles of the cutters are always kept correct, because they are formed in the manufacture of the cutter. When sharpening, it is necessary merely to grind the top slope. Regrinding may be carried to such an extent that only a small lip remains at the bottom. Thus only a very small piece of tool steel need be discarded when the blade is worn out.

Two chrome-nickel steel bolts fasten the cutter to the holder. A bifurcated hole in the blade rests on the bottom bolt, but the top bolt passes through a hole in the upper part of the cutter. The blade is thus both supported and suspended. The construction is stated to be so firm that very heavy cuts can be taken with practically the same rigidity that results when using a solid forged tool. Because of the intimate connection of the two members and the large cross-sectional area of them, the heat of the cut is conducted from the cutting edge so that there is little liability of overheating the blade.

The tool can be applied to lathes, planers, shapers, boring mills and slotters, and is adaptable to practically any operation of cutting on these machines. A set of tools will be readily interchangeable as regards both the cutters themselves and other machines. A complete set of the tools consists of one straight, one right off-set and one left off-set toolholder, three left-hand roughing tools, three right-hand roughing tools, two 60-deg. U. S. F. or V thread tools, two cut-off tools, one right-hand and one left-hand side tool. The use of this equipment is stated to enable a large saving in weight and number of tools as compared with the forged tools and special tools required for the same work. The tools are adapted particularly to the heavy-duty work such as axle and wheel turning that is encountered in railroad shops.

At the top of the accompanying illustration, reading from left to right, are shown a double cutting-off tool, a double threading tool, a right and left side tool, and a right and left roughing tool. The great depth of the cutting-off tool gives it rigidity. With the double threading tool, one side can be used for roughing and the other side for finishing, without moving the holder. The tool is merely turned around, and the proper angle thus maintained throughout the whole operation.

Twelve sizes numbered from 2 to 18-B are made. The holders vary from $\frac{1}{2}$ x $\frac{5}{8}$ x 4 in. in the smallest size to $2\frac{1}{2}$ x 3 x 24 in. in the largest size, and the blade thicknesses vary from $\frac{1}{8}$ to $1\frac{1}{8}$ in. The tools are normally kept in stock up to the No. 12 size, which carries a blade $\frac{3}{4}$ in. thick and has a holder $1\frac{1}{4}$ x 2 x 13 in. in size.

Pneumatic Vibrator for Foundry Use

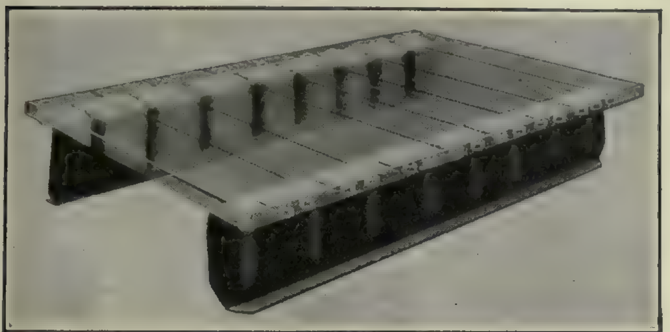
On page 121 of *American Machinist* there was described a pneumatic vibrator for foundry use, made by the Malleable Iron Fittings Co., Branford, Conn. The clamping arrangement of the device has been changed somewhat, so that it appears as in the accompanying illustration. It was erroneously stated in the previous description that the vibrator was intended to be used for the purpose of jarring the flask when removing a cope from the pattern.

The real field of usefulness for the device is, however, in the core-room, where it is used for rapping core driers or core boxes when removing the cores, to avoid danger of breakage of them. The vibrator should be attached to the air line by a sufficient length of flexible tube to enable the operator to reach any position desired. Air pressure of 20 lb. per square inch or upward is required.

PNEUMATIC VIBRATOR FOR FOUNDRY

Barrett "Steeleg" Truck Platform

A lift-truck platform that combines both wood and steel in its construction has recently been placed on the market by the Barrett-Cravens Co., 1328 W. Monroe St., Chicago, Ill. The construction of this "steeleg" platform, as it is called, is well shown by the phantom view in the accompanying illustration. The top of the platform is made of wood and can be from 1½ to 2 in.



BARRETT "STEELEG" TRUCK PLATFORM

in thickness, depending upon the class of work for which it is intended. Flat-head bolts fasten the boards to the steel legs or skids; they are countersunk so that they do not project above the wood.

The legs are made of heavy-gage flanged steel plate and have vertical ribs to prevent buckling. The lower flange rests on the floor and is wide enough so as not to injure or cut the floor. The upper flange has a wide bearing for the top, and its turned-up edge protects the ends of the boards. The construction is such as to make a very rigid and durable platform that is capable of continuous service under heavy loads.

The legs do not wear or shrink as wooden skids do, so that the truck can always be run under the platform, even after long use. The fact that the top of the platform overhangs the skids at the sides gives greater load-carrying capacity for the same thickness of the top boards.

"Nitrol" Casehardening Compound

The American Kreuger & Toll Corporation, 522 Fifth Ave., New York, N. Y., has just placed on the market a casehardening compound designated as "Nitrol." The compound is a nitrogenous powder that can be employed for surface-hardening iron and steel under practically any conditions. Rusty objects can be hardened as well as polished ones. A surface hardened with Nitrol is stated to be practically rustproof.

The compound is furnished in two grades, Grade A being used for surface hardening and Grade E for pack hardening to depths up to 3/16 in. The Grade A or sprinkling powder melts at 1,200 deg. F., and does not give off poisonous or obnoxious fumes. Cast steel or alloy pots similar to those employed for cyanide may be used, but the life of the pot is much longer than when cyanide is employed. Ordinarily, the articles to be hardened are immersed in a molten bath of the cyanide at a temperature from 1,375 to 1,400 deg. F. After being in the bath for from 5 to 20 min., the pieces are quenched in brine. The surface obtained is stated to be bright and free from scale.

When carburizing in pots, the parts are packed with the Grade E Nitrol and then heated in the usual manner up to 1,475 to 1,550 deg. F. for from three to eight hours. The parts are removed and quenched in the usual manner, either directly from the box or reheated to 1,425 deg. F. and quenched. The depth of the case is stated to vary from 1/64 in. for a two or three hour treatment, to 1/16 in. for from seven to eight hours. The surface obtained is smooth and free from deposit or marking. The moderate temperature required does not seriously injure the grain size of the core and thus weaken the work. Economy in the use of fuel and the longer life of the furnace resulting from the moderate temperature are also advantages of the compound. The material can be re-used repeatedly.

Whitney Roller Bearing

A roller bearing in which the rolling action is obtained by means of cylindrical disks, as shown in Fig. 1, has been developed by the Whitney Bearing Corporation, 467 East Ontario St., Chicago, Ill. The periphery of each disk is parallel with the axis, and the diameter is twice the thickness, regardless of size. Both conical surfaces of the bearing have the same angle.

The rollers operate between parallel surfaces, as

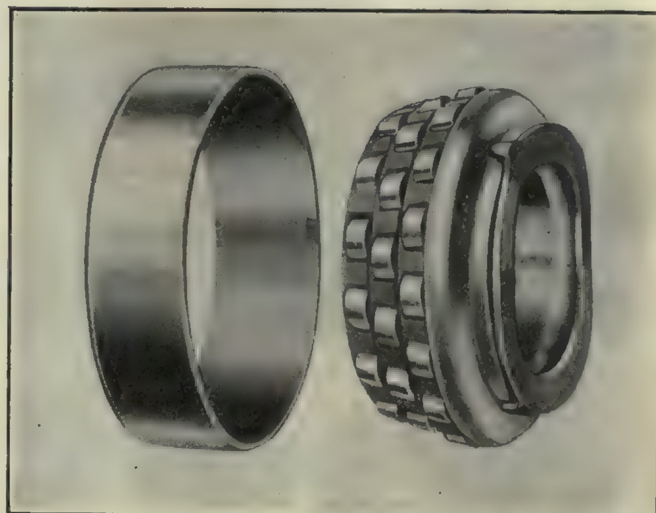


FIG. 1—WHITNEY ROLLER BEARING

shown in Fig. 2, which construction is intended to eliminate end thrust and the accompanying friction, which occur when tapered rollers are used, and to transmit the load to the face of the roller only in a direction perpendicular to the axis of the roller. The several series or rollers are carried in separate ring cages, as the rollers nearer the apex of the cone travel faster than those nearer the base.

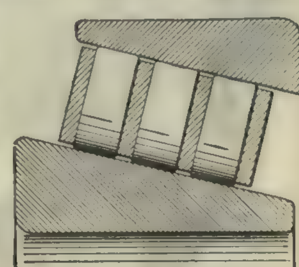


FIG. 2—CROSS-SECTION OF ROLLERS

Another feature of the bearing is the adjusting spring, which, it is said, exerts just the right pressure to keep the bearings in complete contact. The adjustment is automatic and the pressure on the bearing is uniform, assuring that all the rollers are in contact with the cone surfaces at all times. The bearings are made in all sizes, so as to fit them for a wide range of work where both radial and thrust loads must be carried.

News Section

Important Discussion Features Convention of Machine Tool Builders

An innovation in connection with the 21st annual convention of the National Machine Tool Builders' Association was its being held in an out-of-the-way place, Lenox, Mass. The topics to be discussed were of so much importance that the members felt justified in getting off to themselves where they would not risk interruption, and the comments of the large number present indicated that such procedure was entirely satisfactory and the meeting a success in every respect.

E. J. KEARNEY

WINSLOW BLANCHARD

O. B. ILES

JAMES N. HEALD

The new officers elected are: E. J. Kearney, Kearney & Trecker Corporation, Milwaukee, Wis., president; Winslow Blanchard, Blanchard Machine Company, Cambridge, Mass., first vice president; O. B. Iles, International Machine Tool Company, Indianapolis, Ind., second vice president; James N. Heald, Heald Machine Company, Worcester, Mass., treasurer; Ernest F. DuBrul continues as secretary and general manager with offices in Cincinnati, Ohio.

Directors are: A. H. Tuechter, Cincinnati Bickford Tool Co., Cincinnati, Ohio; C. Wood Walter, Cincinnati Milling Machine Co., Cincinnati, Ohio; E. J. Kearney, Kearney & Trecker Corporation, Milwaukee, Wis.; Winslow Blanchard, Blanchard Machine Co., Cambridge, Mass.; Howard Dunbar, Norton Company, Worcester, Mass.; Frank N. MacLeod, Abrasive Machine Tool Co., East Providence, R. I.; Edward P. Welles, Charles H. Besly & Co., Chicago, Ill.; O. B. Iles, International Machine Tool Co., Indianapolis, Ind.; James N. Heald, Heald Machine Co., Worcester, Mass.

Three days, Tuesday, Oct. 3 to and including Thursday, Oct. 5, were given over to the meeting beginning with the usual registration and business session during which the address of President Tuechter, printed in another section of this issue, was delivered. During the same session William A. Viall, secretary, Brown & Sharpe Mfg. Co., spoke on "Self Respect of the Machine Tool Trade" and there was a general discussion on the ethics of the machine tool industry.

The second session was devoted to a consideration of administrative subjects, being closed with a round table discussion. Addresses were delivered by O. B. Iles, president of the International Machine Tool Co., on "Conditions that Create Unprofitable Prices," Frank N. MacLeod, president, Abrasive Machine Tool Co., on "Improving the Sales Outlet" and Paul E. Thomas, president, Kempsmith Mfg. Co., on "Dealers' Problems."

Committee meetings were held on the second day, both morning and afternoon. In the evening Joseph K. Schofield, Chief of Patent Department, Niles-Bement-Pond Company, spoke on "What Patents Are Worth to the Machine Tool Industry." The session ended with a round table discussion on technical topics.

All of Thursday, the third day, was devoted to association affairs, including the receiving of reports and the election of officers.

Discussion throughout the convention was earnest and thorough. How much ground was covered may be seen from the following list of topics:

Administrative Subjects

1. What is a fair return on capital invested in business?
2. Do machine tool investors get fair returns compared to other industries?
3. What rate of turnover of total capital must a machine tool business have to produce a fair return?
4. What ratio should plant investment bear to working capital in the machine tool business?
5. What rate of turnover of working assets must a machine tool business have?
6. What is a fair percentage of idleness to figure on in overhead costs due to depressions?
7. How shall we get cost accounting generally in line with Scovell Wellington report?
8. What are the prospective conditions of cost-labor-material-expense?
9. On what basis should the cost and selling price of repair parts be based?
10. Can a code of ethics be drawn to advantage?
11. Elimination of everything savoring of unfair competition.
12. Would it be well to exchange experience and information as to the men who are using unfair methods?
13. How can various statistics be used in guiding financial policies?

Technical Subjects

1. Are patents in the Machine Tool Industry not good?
2. How do you get sales departments to co-operate with the engineering departments on standardization?
3. What research work would it be

well for the association to undertake?

4. What standardization is common to various types of machines?

5. How far can we go in the elimination of unnecessary sizes?

SALES SUBJECTS

1. What are the best prospective foreign markets at this time?

2. How can we secure complete information covering new developments in the machine tool line as made by leading European machine tool builders, and the specifications and prices thereof?

3. Does it pay to furnish automobiles for salesmen? Under what conditions are these furnished and what is cost of upkeep?

4. How can we raise the standard of machine tool salesmanship?

5. What percentage of gross sales is best spent on free engineering service of various kinds?

6. How far should the machine tool builders be called on to send factory representatives to close sales for which the dealer agent draws a commission?

7. What percentage of gross sales is best spent on salesmen's expense?

8. How prevalent is the demand for long time credits, and how is it best met?

9. Can we establish a uniform basis of cash discounts and standard sales terms, i. e., time?

10. What would be considered fair credit and sales terms for special machinery sold direct to purchasers and machines sold through dealers?

11. What is the best method of handling matters of credit on extended terms?

12. What is a fair term of credit to be accorded to machine tool buyers?

13. Is there any abuse of standard 30-day terms by excessive credit extension?

14. How far is free engineering service abused? (Designs, time studies, data sheets, production studies, etc.)

15. How can the duplication of engineering work be avoided, that nowadays often involves more total expense than any possible profit to the one who gets the order?

16. How can the buyer be kept from unfairly working one competitor against the other?

17. Asking sales departments to create an unnatural demand for tools.

18. Has a liquidated damage clause stopped cancellations?

19. Attitude of some purchasers in attempting unwarranted pressure on machine tool builders.

20. Exchange the best arguments and develop methods of combating unfair practices of purchasers.

21. The buyer worries about the machine tool builder's cost of production, instead of figuring the utility of the machine to himself against the price asked.

22. How can we educate the buyer on value of machines, to buy production, not pounds?

23. How long should we furnish repairs for old types of machines?

24. Credit and sales information regarding dealers and agents.

25. How does present sales organization of the industry compare with prewar conditions and how can we improve it?

26. What is fair practice when changing agents, as to taking back stock that is considered necessary to carry if the line is to be properly represented?

27. What is an equitable arrangement for division of commission between selling agents where purchases are made in one territory for shipment to another?

28. What provisions ought to be put in agency contracts?

29. What is a proper commission for agents?

30. How to get dealers to notify manufacturers of all pending deals and report progress made on same from time to time?

DEALER PROBLEMS

1. Overstocking—especially on prices guaranteed against decline.

2. Pressure of dealers for cancellations.

3. Status of dealer contracts in view of recent court decisions.

4. What is a contract of agency and one of sale? Are exclusive sales contracts valid—or binding?

Ordnance Officers and Engineers Meet at Aberdeen

This year's meeting of the Army Ordnance Association, the fourth annual gathering, was held at the Aberdeen Proving Grounds on Oct. 6 in conjunction with the Society of Automotive Engineers and the American Society of Mechanical Engineers. Great credit is due those responsible for the smoothness with which everything ran. About 500 were present to witness demonstrations of the latest developments in guns, projectiles and automotive ground and aerial equipment.

Guns of all sizes were seen in action from sub-caliber machine guns to 16-inch railroad mounts. Tanks, tractors and trucks were maneuvered about the field, bombs were dropped from airplanes and plenty of time was allowed for inspection of every type of equipment from a non-rigid dirigible balloon to an automatic pistol.

Perhaps the most spectacular event was the controlling of a whippet tank by means of orders given over a radio sending set. It was almost uncanny to watch the little tank turn and twist at commands spoken in an ordinary tone by an officer half a mile away.

Almost equally spectacular was the tracer ammunition firing both by daylight and after dark and the firing of phosphorus rifle grenades, but the most impressive exhibition was that of smokeless, flashless powder in the 75 and 155 mm. guns. Rounds of two different kinds of flashless powder were mixed in between rounds of service powder and the contrast between the two on the dark "main front" drew forth applause from the visitors.

Large Mexican Machine Tool Order

The National Mexican Railways have placed an order for machine tools with Jos. T. Ryerson & Son, Chicago, Ill., amounting to $308,000.

Steel Treating Convention Draws Big Crowd

The convention of the American Society for Steel Treating held in conjunction with the annual meeting of the American Drop Forging Institute which was brought to a close last week in Detroit was regarded by all present to have been the most successful in the history of both bodies.

The total attendance upon the convention was estimated at between eighteen and twenty thousand persons. Of the membership in both bodies, there were thirteen hundred present or approximately 50 per cent of the total.

The chief feature of the convention was the number of executives present and interest was centered chiefly in the exhibit which was considered to be the most successful ever held, fully one hundred more companies displaying their products than in previous years. Nearly all the machinery displayed on the floor was sold during the convention.

Tuesday and Wednesday evenings, Oct. 3 and 4 were given up to smoker and carnival frolic. On Thursday, Oct. 5 the annual banquet was held at which the chief speakers were: President Burton, University of Michigan and Frank Hook Alfred, president of the Pere Marquette Railway. T. E. Barker and W. P. Woodside, both of whom have been instrumental in establishing and furthering the interests of the American Society for Steel Treating were the recipients of founder memberships in recognition of their work.

On Thursday afternoon a bronze tablet was unveiled at Wyandotte, Mich., to William Kelly who was the first to use the Bessemer process in America.

Among the papers read during the sessions of the convention were the following: Furnace Atmospheres and their Relation to the Formation of Scale by G. C. McCormick; The Effect of Structure upon the Machining of Tool Steel by J. V. Emmons; Case Hardening by A. H. d'Arcambal; Lathe Breakdown Tests of Some Modern High Speed Tool Steels by H. J. French and Jerome Strauss; Heat Treating in Lead by R. B. Schenck; Irregularities in Case Hardened Work caused by Improperly Made Steel by E. W. Ehn; Study of Some Failures in Aircraft and Engine Parts by J. B. Johnson and Samuel Daniels; and Carburizing and Decarburizing in Case Hardening by H. B. Knowlton.

Officers elected for the ensuing year were: T. B. Lynch, Westinghouse Electric and Manufacturing Co., president; W. S. Bidle, of the W. S. Bidle Co., Cleveland, second vice president and W. H. Eisman, secretary.

Iron and Steel Men Will Meet October 27

The twenty-second general meeting of the American Iron and Steel Institute will be held in this city at the Hotel Commodore on Friday, October 27. The opening address will be made by Judge Elbert H. Gary, chairman of the board of the United States Steel Corporation. Many papers covering the different phases of the iron and steel industries are to be presented.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

AT THE annual meeting of the American Bankers' Association held in New York last week some 7,500 bank officers from all over the country were present, and with every authority from Secretary Mellon down telling them that "good times have come again" a nationwide boom should commence as soon as they get home, provided they believe what they heard.

But while the bankers may, from force of habit, discount what they were told, it is true nevertheless that an expectation of active business and good trade is general all the way from the Atlantic to the Pacific. Sales and prices are commencing to reflect it.

In their circular of last week Marshall Field & Co. of Chicago is definitely optimistic, especially in regard to cotton goods, and "customers are advised to cover their requirements up to the end of next January." John V. Farwell & Co. write in the same strain and say that "there is no reason why retailers should not feel safe in purchasing merchandise according to their normal needs." These two pronouncements from practical and successful merchants find academic confirmation in an address before the National Association of Cotton Manufacturers, in which Professor Copeland of the Harvard Bureau of Business Research predicts an unexampled expansion in the cotton manufacturing industry in the near future.

With optimism so general it is not surprising that almost everything but coal is firm or higher, and the decline in coal is regarded as a blessing by everyone but the coal dealers for whom, rightly or wrongly, no sympathy is felt. Regarding the commodity markets it is hardly necessary to particularize. The advancing tendency noticeable in wheat is probably the most important item in the week's commercial news as it implies an increase in the purchasing power of the agricultural West. But the strength of cotton in the face of a ginning report that is somewhat inconsistent with extremely small crop estimates is another significant straw in the business current of the week.

The long excepted advance in rubber has also started. Woolen goods, silk, paper, hides, kerosene, metals and sugar are all likewise firmer or higher, and making allowance for technical influences in the case of each commodity it is reasonable to expect that higher wages and the tariff will gradually lift the level of commercial values until there is another buyers' strike, of which there is no indication at present.

The National Association of Credit Men is about the only important authority that is not optimistic. In convention at Atlantic City it passed a resolution declaring that "there is no ground for believing that a business boom is in sight," and cautioning merchants against overbuying.

Most merchants are, however, inclined to think that the Credit Men are premature in their warning, for there is a general belief that stocks are unusually low and that there is less commodity speculation than for years.

The principal if not the only bad spot in the domestic situation is the increasing railroad congestion. There is a serious shortage of cars. The traffic awaiting shipment and on the tracks is enormous. Many roads have declared embargoes and there is every probability that the money market will be tightened and distributive trade blocked by the delay in the delivery of goods. The railroad managers are, however, working hard to relieve the blockade and they promise better service if consignees will but co-operate in unloading cars promptly.

> **From the Atlantic to the Pacific, sales and prices reflect an expectation of active business and good trade, making the domestic situation one of promise. The biggest obstacle to a return of general prosperity is unquestionably embraced in the economic unsettlement in Europe, demanding the formulation of some definite plan of action on the part of this country with respect to war debts and a European policy.**

The big railroad earnings that are expected during the last months of the year are already reflected in a firmer market for railway shares on the Stock Exchange, but I see nothing to change my previously expressed opinion that bonds and industrial securities will fluctuate hereafter inversely in relation to the money market. If interest rates go up securities will go down and vice versa. But there is no present indication that rates will go lower and the Federal Reserve Bank of New York says that they "have grown firmer and have risen fractionally" because of the increased demand for commercial accommodation.

The weekly statement of the Federal Reserve System confirms this view, for it discloses a decline of 1 per cent in the reserve ratio, which now stands at 77.4 per cent despite an increase of over $12,000,000 in the gold held.

The political as well as the financial news from Europe is encouraging. Kemal Pasha has evinced a willingness to parley that is inconsistent with an eagerness for war. Some cynics suggest that "English Sovereigns" may have brought him to a recognition of English sovereignty in the Levant, but whatever the facts it is plain that the crisis has passed for the London markets are strong and sterling exchange is higher. Marks are, however, slipping out of sight. An additional 26 billion were issued during the week ending Oct. 5 and last Friday they sold at 4½ cents a hundred in New York. This is the lowest price yet touched. The New York World estimates that Americans have lost nearly a billion dollars in buying marks and German mark bonds.

There would seem to be but little chance of any advance in the value of the mark unless an Allied loan to Germany, in which the United States shall participate, can be arranged. Of this there is little hope, although Thomas W. Lamont of the Morgan firm and Reginald McKenna, now chairman of the biggest bank in England and formerly Chancellor of the British Exchequer, both made addresses before the American Bankers Association that might be construed as intended to pave the way for some such program.

Mr. Lamont suggested waiving our claim for that portion of the debt due us by the Allies that was incurred before we commenced sending men to Europe in 1918, and Mr. McKenna very tactfully intimated that it would be good business for us to write off the sums due us by those nations who were too impoverished to pay.

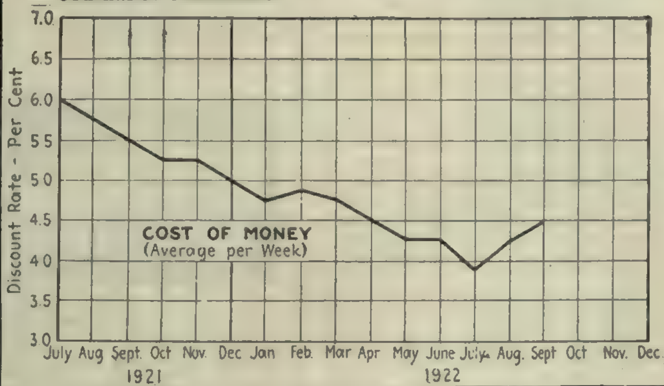
From this group he specifically excluded Great Britain, who could and would, he asserted, honor her obligations. It remains to be seen whether American public opinion will be much changed by these speeches.

The only other sensation at the Bankers' Conference was the vociferous adoption of a resolution opposing the establishment of branches by National Banks in those states in which branch banks were permitted by the state laws. The resolution was in fact a condemnation of branch banking in general upon the theory that it would ultimately bring the credit reservoirs of the people under the control of a few men. It is an old issue in a new form. Much may be said on both sides.

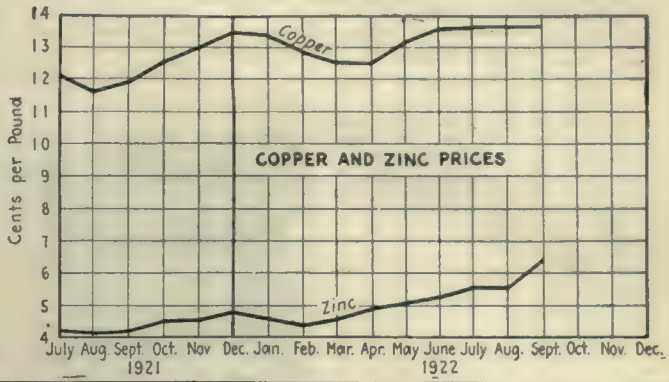
It is estimated that the expenses and expenditures of the 7,500 bankers and their wives who attended the New York meeting will exceed $2,500,000 and the fact that they were willing to leave home and spend this sum is in itself encouraging in the light it sheds on financial conditions throughout the country.

They are sound, and until credit becomes scarcer and restricted the optimism that now extends from ocean to ocean seems justified.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



COST of money showed no marked change during the month of September as compared with August. Prime commercial paper ruled at 4 to 4¼ per cent with a slight upward tendency. Call money showed a higher tendency. Time money was in fairly active demand, 60 day maturities ruling around 4¼ per cent with longer maturities quoted at 4½ per cent. The tendency during the latter part of September has been for the rates to harden with the increased demand for funds resulting from the West for crop movement purposes.

Copper and zinc prices, on the average, show but fractional changes during September. The average price on the New York market for the former was 13.748 cents as against 13.723 cents in August. Zinc averaged 6.110, a decline from 6.212 cents. Surplus stocks of copper are reported as being practically exhausted with Germany a heavy buyer. With an increasing demand for domestic construction and a steady export demand, producers are now asking from 14 to 14½ cents. The price of zinc appears to have softened as a result of a decrease in demand caused by the effect of freight embargoes, fuel shortage and labor scarcity on consumers.

Equipment shares advanced during September, the average price for 10 representative issues being $110.40 as compared with $104.60 in August. The high point was reached about the middle of September. Since that time there has been but a slight recession, adverse foreign news having but little effect. The car and locomotive building firms all show healthy financial statements and reports indicate a considerable volume of business booked from the railroads during September. Locomotive builders have also booked a fair volume of foreign business with numerous inquiries reported pending.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

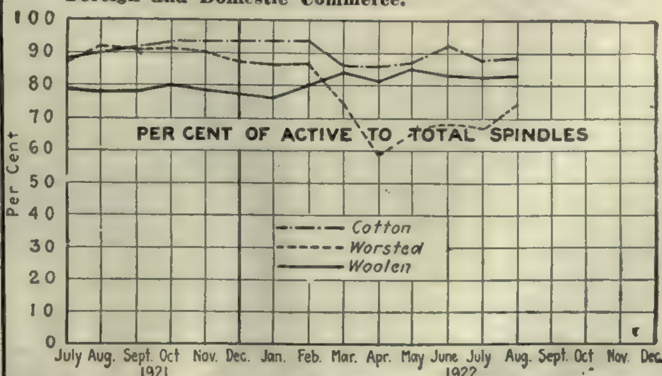
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb......	$0.0292	$0.0285	$0.0273
Cold finished shafting......	per lb......	0.0378	0.0365	0.0384
Brass rods.....	per lb......	0.165	0.1700	0.135
Solder (½ and ½)	per lb......	0.22	0.225	0.20
Cotton waste..	per lb......	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	3.83	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.575	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list......	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list......	55% @60%	50%@ 65–10%	50%@ 60–10%

Textile industrial activity in the United States during the month of August compares favorably with the July period, September figures not yet being available. Cotton spindleage active amounted to 87.9 per cent of the total in place as compared with 86.5 per cent in July. In the woolen industry there was a fractional decline from 83.7 per cent to 82.9 per cent. Worsted conditions, on the other hand were better, active machinery amounting to 74.8 per cent of the total in place as compared with 68 per cent in July. Settlement of textile labor troubles, with a strong domestic and export demand has improved conditions.

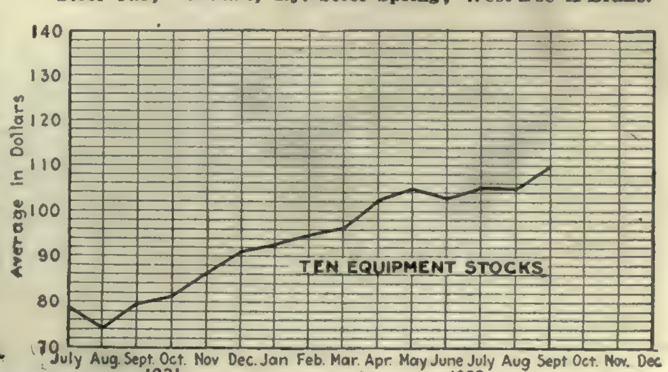
Employment in industries, according to the Department of Labor, shows that in August as compared with July, there was an increase of 0.7 per cent in foundry and machine shops. Per capita earnings in these same industries show an increase of 2.9 per cent over the July period.

Wholesale prices in the United States during August, according to the Federal Reserve Board's index, show but little, if any change over July. Using 100 as the index for 1913, August stands at 165, the same as in the month of July.

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.

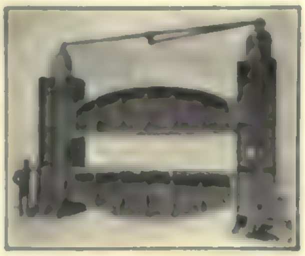


Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Flanging, Hydraulic, Large
Hydraulic Press Manufacturing Co., Mount Gilead, Ohio
"American Machinist," August 3, 1922

The machine is used for flanging the plates for Murphy car ends and will flange cold steel ⅜ in. thick by 14 ft. long. The press is equipped with two [illegible]-in. diameter rams. Two auxiliary 1½-in. diameter cylinders are used for returning the platen to the upper position. The press is capable of exerting a pressure of [illegible] tons. A three-way, poppet-type, high-pressure valve controls all the movements of the press, being operated by one hand lever. Stroke, 24 in. Maximum distance between platens, 36 in. Weight, 63 tons.

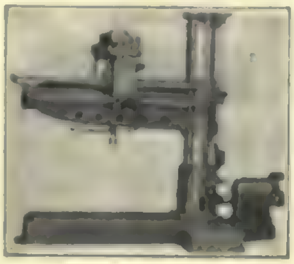


Calculator, Dimension, Rapid, "Rotex"
W. Leinert, 410 West 23rd St., New York, N. Y.
"American Machinist," August 3, 1922

The device is for mechanically adding and subtracting fractions of an inch, inches and feet when checking a series of dimensions on a drawing. It consists of a front plate carrying two circular scales, one divided into forty-eight equal parts and the other into sixty-four parts. The former scale is used for operations involving integers of feet and inches, and the latter scale for those involving fractions of an inch. When reading the results, the number of feet is indicated on the upper gear on the left-hand side, the integers of inches on the lower disk on the left-hand side and on the upper gear on the right-hand side, while the fractions of inches are read on the lower disk at the right.

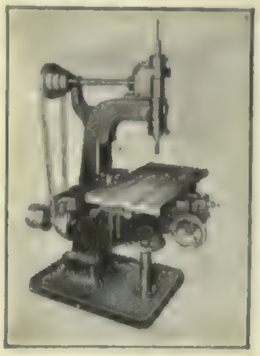
Clamping Device, Power, for Radial Drilling Machine Column
Dreses Machine Tool Co., Cincinnati, Ohio
"American Machinist," August 10, 1922

The device is for tightening the column carrying the swinging arm at each shift of the drill and is controlled from the head. No air pressure is required. The drive for the clamp is from the main vertical driving shaft which extends through the small oval box at the rear of the column. Two friction clutches in the box are incorporated in the drive so that the screw below the box can be run either right- or left-handed for operating the binding screw. They are self-releasing and slip at either end of the movement of the tightening lever, preventing injury to the parts by over-straining.



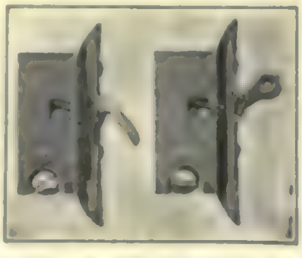
Profiling and Milling Machine, Vertical Spindle
Robbins Machine Co., 42 Lagrange St., Worcester, Mass.
"American Machinist," August 10, 1922

The machine has a crossfeed screw operated through helical gears from a handwheel that stands in the same plane as the traverse handle. The $1\frac{1}{16}$-in. diameter spindle takes a No. 3 Morse taper shank. A through hole provides for the use of a knock-out rod. The spindle runs in three parallel bronze bearings and is driven through generated bevel gears from a shaft having a four-step cone for speed changes. Work table, 16 x 30 in. Throat depth from spindle center to column face, 14 in. Table traverse, 12 in. Cross movement, 7 in. Vertical movement: knee, 6 in., spindle, 2⅞ in. Floor space, 36 x 45 in. Weight, 1,100 pounds.



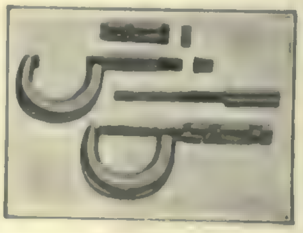
Switches, Tool-Handle, Electric
Cutler-Hammer Manufacturing Co., Milwaukee, Wis.
"American Machinist," August 10, 1922

The two types of compact electric switches are for use on small tools and appliances. The momentary-contact type of switch, at the left, is for installation in the handles of such tools as portable drills. When the operator grips the tool, his forefinger rests on the trigger, thus turning on the current. The switch at the right is provided with an operating lever but with no spring to return the lever. It is used in appliances where the switch should remain in either the off or the on position until the lever is moved to the other position. Both devices have long phosphor-bronze contacts which engage with a wiping motion.



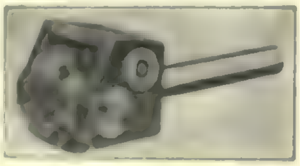
Micrometer, "Jaques Special"
Central Tool Co., Auburn, R. I.
"American Machinist," August 10, 1922

The frame of the micrometer is of oval section and is one piece with the barrel. The outer end of the barrel is split to provide a means of compensating for wear of the thread. The adjustment in diameter is made by the spring nut adjacent to the barrel. The thimble is a tight push fit over the sleeve of the measuring spindle. It is also split and provided with a knurled ring nut so that it may be clamped to the sleeve. The micrometer may be easily taken apart and adjusted.



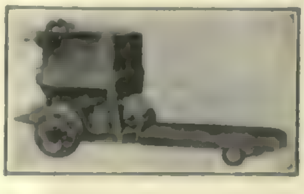
Dresser, Grinding-Wheel, Roller Bearing, Rotary Type
Desmond-Stephan Manufacturing Co., Urbana, Ohio
"American Machinist," August 10, 1922

The two steel disks of the device are carried on roller bearings. A stud ¾ in. in diameter carries a cage holding the rollers of the bearing, which in turn support a bushing on which the cutters are securely fastened. The cutters are replaceable, have a corrugated form, and are 2⅜ in. in diameter. The body of the device may be used either in a toolpost or on a magnetic chuck. The shank is employed to hold the dresser in a toolpost. Used on a chuck, the device is turned over so that both the top of the body and the end of the shank rest on the chuck table.



Truck, Lifting-Platform, Electric-Driven, Industrial, 3-Ton
Automatic Transportation Co., 2933 Main St., Buffalo, N. Y.
"American Machinist," August 10, 1922

In this truck structural steel, hot-riveted in place, provides a rigid and durable, as well as a light, construction. The truck has a lifting capacity of three tons. The battery, the motor, the drive mechanism and the control mechanism are similar to those employed on previous models. Steel covers enclose the batteries and all of the auxiliary mechanism.



Clip, paste on 3 x 5-in. cards and file as desired

Business Items

Davis, Hoy and Stumpf, Singer Building, New York, N. Y., have recently been organized as dealers and distributors of metal-working machinery. The firm consists of Wm. F. Davis. L. J. Hoy and Charles O. Stumpf, all of whom were formerly connected with the Wm. F. Davis Machine Tool Co., New York. The concern specializes in used machinery.

The Triangle Tool and Die Co., advises that, in the future, inquiries regarding the Superlative Sash Cord Coupler and the Triangle Rapid Bench Saw should be sent to that company at 211 Smith St., Rochester, N. Y.

The Morse Chain Co., Ithaca, N. Y., has changed its Philadelphia headquarters to Franklin Trust Building, 18 South 15th St.

The Henry Furnace and Foundry Co. of Medina, Ohio, has declared the regular quarterly dividend of 1¾ per cent on the preferred stock.

The Atlantic Elevator Co. and the Albro-Clem Elevator Co. announce a consolidation under the name of the Atlantic Elevator Co. with headquarters in Philadelphia.

The C. F. Davis Machine Co., Inc., Rochester, N. Y., has moved into a new factory at 150 N. Water St., that city.

The Wilde Drop Forge and Tool Company has filed incorporation papers with the secretary of the state, showing a capital stock of $50,000 and 1,000 shares of no par value. The company will manufacture, buy and sell tools, machinery of various kinds, act as manufacturer's agents and brokers. The shareholders are Mary Wilde, Goldie Wilde and Paul Froeschl.

The Flexo Supply Co., St. Louis, Mo., has been incorporated with a capital stock of $10,000. The company will manufacture, buy and sell flexible pipe joint, known by trade mark as flex-o-kant leak, joints, piping, valves, pipe fittings, steam fittings and accessories. The incorporators are M. L. Evans, B. M. Brownell and Santon Fitzgerald, of St. Louis.

The American Radiator Co., has moved its Southern headquarters from Birmingham, Ala., to Atlanta, serving the group of six southeastern states and part of Arkansas. Thirty salesmen travel out of the Atlanta office, which is located at 232 Peachtree St., and is under the management of A. F. Westerfield.

The Turner Machine Co. has been organized and incorporated in Atlanta with $100,000 capital as machinery dealers in the southeastern territory, to handle all kinds of machinery, parts, tools, etc. The incorporators are J. T. Turner, 34 East 12th St., Atlanta, and Dr. A. M. Williamson, 24 Cooper St., Atlanta.

The P. H. Palmer Co., incorporated with $5,000 capital at Jacksonville, Fla., according to its application for charter, plans the establishment of a machine shop for marine machinery. P. H. Palmer is president, and Charles Atkins is vice-president and treasurer.

The Cincinnati Planer Co., Cincinnati, Ohio, announces a 10 per cent increase in prices on its vertical boring and turning mills, effective October 1.

The L-M Axle Co., Cleveland, Ohio, has purchased the plant of the Jones Gear Co., on Wayside Road and commenced the production of the L-M automobile axle, the invention of Leo Melanowski. Officers of the company are: George B. Durell, president; Warren H. Cowdery, chairman of the board and J. L. Vaughan, secretary.

Williams, White & Co., of Moline, Ill., have taken over the entire business of manufacturing and marketing the Osterholm automatic surface grinding machine, in addition to their present line.

The Brown Instrument Co., announces the opening on Sept. 1, of its Southern Branch, 619 Brown-Marx Building, Birmingham, Ala., with Charles L. Saunders in charge.

The Bonnot Co., Canton, Ohio, manufacturer of coal pulverizing and clay making machinery, has announced that its directors have declared the regular quarterly dividend of 1¾ per cent on the preferred stock payable Oct. 1, to stock holders of record Sept. 20.

The Rockwood Manufacturing Co., 1801 English Ave., Indianapolis, has awarded the contract for the construction of a new machine shop and the work has been started. The building will be brick, heavy mill fire proof construction, with a traveling crane.

The American Art Textile Co., Ft. Wayne, Ind., is planning a new factory addition, and will install much new equipment.

The Dudio Manufacturing Co., Ft. Wayne, Ind., will install in its new wire enameling plant, now nearing completion, equipment costing approximately $100,000. G. A. Jacobs is general manager.

The Commercial Shearing and Stamping Co., Youngstown, Ohio, has been reorganized with the following officers and directors elected: President, W. A. Beecher; vice president, G. F. Aledrice; treasurer, Nathan Folsom; secretary, Guy Ohl. The directors include the foregoing with the addition of C. B. Cushwa and George Donaldson. At a recent meeting the purchase of $30,000 worth of additional equipment was authorized.

The Seaboard Air Line has applied to the Interstate Commerce Commission for authority to create an equipment trust under which $2,560,000 of certificates, with interest of 5.5 per cent annually, will be issued. The money is to be used in acquiring three large special type Mikado engines, 2,150 rebuilt box cars, 850 rebuilt gondolas, and 100 rebuilt phosphate rock cars.

The Seybold Machine Co. directors at a recent meeting in Dayton, declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Oct. 1, 1922, to stockholders of record Sept. 20.

The George T. Trundle, Jr. Engineering Co., 118 St. Clair Ave., Cleveland, Ohio, makes the announcement that John F. Price has been appointed its vice president. Mr. Price was formerly comptroller of the Brown Hoisting Machinery Co., Cleveland.

Frostholm Brothers, Syracuse, N. Y., manufacturers of tools and cylinder grinders have purchased a new daylight factory at 1009 S. Clinton St., in that city. New equipment is to be installed and arrangements are being made for an expansion of the business.

The Home Accessories Corporation, recently incorporated in Worcester, Mass., to manufacture bathroom fixtures and kitchen accessories, has purchased the property at the corner of Gardner and Tainter Sts., that city, where it will begin operations in the near future.

The Hartley Clock Co., Boston, which was incorporated recently with a capital of $1,300,000, will build a three-story factory in Attleboro, Mass.

The Harris Automatic Press Co. directors at their meeting in Cleveland have declared the regular 1¾ per cent quarterly dividend on the preferred stock, payable Oct. 1.

The Angle Steel Stool Co., established about eleven years ago at Otsego, Mich., moved recently to its new daylight factory at Plainwell, Mich., the steady growth of its business necessitating larger quarters. C. E. Pipp is the president and manager of the company.

The Houghton Elevator and Machine Co. directors at a recent meeting in Toledo, have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Oct. 1.

The Computing-Tabulating-Recording Co. has announced the purchase of a factory by the company at Villengen, Germany, for the manufacture of its products for European consumption.

The Western Pacific Railroad Co. plans to add 2,000 refrigerator cars and 100 automobile cars to its equipment, according to an application made to the Railroad Commission to issue and sell $5,000,000 for this purpose.

The Bureau of Foreign and Domestic Commerce has opened a branch office in the Witherspoon Building, Philadelphia, Pa.

The Machinery Supply Corporation is the name of a new consolidation formed in Joplin, Mo., of the Joplin Machinery Exchange and the Machinery and Supply Corporation. R. M. Clark is manager and office headquarters have been established at 211 East Fourth St. D. C. Morrow of Kansas City is president and L. G. Lebow of the United Iron Works of Joplin is vice-president.

The Mott Southern Co., Peters St. Viaduct, Atlanta, distributor of plumbing and heating supplies and fixtures in the southern territory, is amending its charter, increasing its capital stock by an additional issue of $100,000, according to Charles B. Wilson, secretary.

The Standard Sanitary Manufacturing Co. opened in Atlanta the latter part of September a southern showroom for the display of plumbing fixtures and brass goods manufactured by this concern. The Atlanta address is 281 Peachtree St.

The Nashville Bridge Co., Nashville, Tenn., has acquired a site at Bessemer, Ala., and will shortly establish a branch plant there for the manufacture of steel parts for bridges, an official of the company advises.

The Director of Sales of the War Department announces that award has been made to the Republic of Poland of 7,504 European type railway cars, consisting of 75 Guerite box cars with cabs, 529 flat cars, 1,850 low side gon-

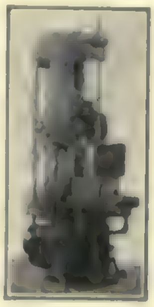
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Gage, End, Test, "Everwear"
Central Tool Co., Auburn, R. I.
"American Machinist," August 10, 1922

The end gage is for testing mi- [illegible] or for use in quantity [illegible] of work requiring the accurate gaging of internal diameters. The central part, or stem, is cupped at both ends to receive a [illegible] steel ball which is retained in place by a [illegible] or cup threaded to screw on the stem. As round balls give the actual measuring contacts, the gage may be adjusted to compensate for wear by loosening the [illegible] and turning the balls slightly to expose the unused [illegible] of their surfaces. After several such adjustments the balls may be discarded and new ones substituted. The gage can be [illegible] in any desired length above 1 inch.

Countersinking Machine, Automatic, No. 12
[illegible] Machine Co., Jackson, Mich.
"American Machinist," August 10, 1922



This single purpose machine is for counter- [illegible] clutch plate holes. Arranged for [illegible] the fifty-two holes in Hudson clutch plates, it is a three-station, rotary-table machine with twenty-six spindles in each of two groups mounted in a single head. The [illegible] on the top of the column is similar to others of the same make. The feed box has but one fixed movement. A geared pump located in the head furnishes forced lubrication for the spindle bearings and the spindle head gears. [illegible] drive is through an automobile-type dry-disk clutch at the top of the column and controlled by a foot lever at the base of the pedestal. Weight, [illegible] pounds.

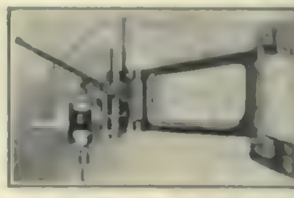
Gage and Stand, Inspection, Internal
John Bath & Co., Inc., Worcester, Mass.
"American Machinist," August 10, 1922

The gage is for accurately calibrating internal diameters in hardened and ground work. It is a modification of the Bath internal [illegible] that measures diameters by means of a [illegible] screw and sliding wedges. The tool measures variations of 0.0001 in., each mark on the [illegible] representing this amount. The stand grips the measuring tool by the knurled handle, which has no movement with relation to the body. Its [illegible] surfaces are faced with soft metal. Measuring tools can be supplied for any diameter above 1 in., and the change from one size to another can be easily made.

Saw, Bench, Portable, Patternmaker's
A. C. [illegible], 41 Bayley St., Pawtucket, R. I.
"American Machinist," August 10, 1922

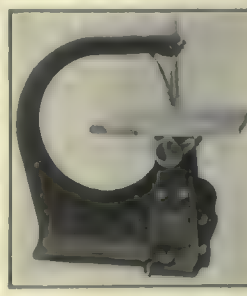
The machine is for patternmaker and [illegible] and may be used in [illegible] shops where woodworking is being done. It is entirely self-contained. The arbor is belt driven from a motor that can be attached to any lamp socket. A rip fence may be set at any angle for bevel sawing, and a cut-off slide is adjustable for miters up to 45 deg. An [illegible] to the cut-off slide for [illegible] lengths. The arbor will carry a [illegible] saw and runs at [illegible] r.p.m. The table may be tilted to any angle or swung up out of the way. Table height, 30 in.; surface, 16½ x 21½ in. Weight, 134 pounds.

Drill, Radial-Arm, Electric, for Millwrights
Van Dorn Electric Tool Co., Cleveland, Ohio
"American Machinist," August 10, 1922



The electric drill is especially adapted to the needs of millwrights and maintenance men, and has a universal motor. The chuck holds twist drills up to ⅝ in. in diameter for work in iron and steel, while larger bits can be carried for boring wood. Two brackets bolted to the wall or column carry the pivots that support the arm. At the outer end of the arm is a second pivoted joint on which the short forearm swings. The drill bracket or vertical sliding members can be operated by means of the long hand lever. The cutting tool swings within a circle having a radius of 31½ in. from the wall pivots. The auxiliary forearm provides a secondary radius of 10½ inches.

Saw, Jig, Self-Contained, No. 173
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," August 10, 1922

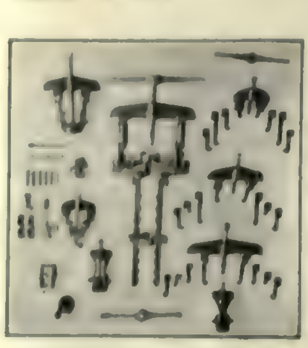


The machine is for interior and exterior scroll work in wood or other easily machined substances. No moving parts are exposed except the saw. An automatic clamping device below the table operates in conjunction with the sliding block above. The saw guides may be rotated 90 deg. in their bearings. The foot control can be operated from either position. A continuous air blast directed at the front of the saw carries away the dust. Belt drive can be provided. One dozen saws and the necessary wrenches are furnished with the machine. Table, 30 x 34 in.; tilted 30 deg. right or left. Saw stroke, 3 in. Capacity, saws up to 18 in. in length.

Molding Machine, Jolt, Stripper
Arcade Manufacturing Co., Freeport, Ill.
"American Machinist," August 10, 1922

The machine has a 6-in. jolting motion operated by compressed air in the usual manner, and can be furnished with either an 8- or 12-in. length of stripping stroke. The 12-in. strip machine is placed half below the floor, but the 8-in. strip machine is placed entirely above. The flask containing the sand can be lifted straight up from the pattern, requiring only a small amount of draft. The lifting pins engaging the stripping plate or the flask are adjustable. The machine may be made with a hand-operated stripping device for small jolt cylinders. Several stripping cylinders for long flasks may be furnished.

Press, Combination Hand and Puller
Geo. W. Dover, Inc., Providence, R. I.
"American Machinist," August 10, 1922



The combination hand press and puller is for removing wheels, gears and bushings from their shafts and also for pressing them in place. Its base can be attached to the work bench. With the yoke, spreaders and anvil plate in place, it becomes an arbor press, for handling round pieces up to 18 in. in diameter. Three yokes of different lengths are supplied, each having a set of hook arms for pulling off the refractory wheels or for extracting bushings. The arms are reversible. Special hook arms remove gears and bushings from parts for certain makes of automobiles that cannot be reached with the regular equipment.

Clip, paste on 3 x 5-in. cards and file as desired

dola cars, 1,450 high side gondola cars with tarpaulin frames, and 3,600 high side gondola cars without tarpaulin frames

The F. S. Pearson Engineering Corporation, Fisk Bldg., 57th St. and Broadway, New York City, has re-established its department for industrial management and technical auditing of industries and public utilities. This department will be carried on together with the usual work of financing, developing, design and construction of engineering projects and industrial plants.

Personals

ROBERT B. GERHARDT, electrical superintendent of the Maryland plant of the Bethlehem Steel Co., Sparrows Point, was elected president of the Association of Iron and Steel Electrical Engineers at its recent convention in Cleveland.

WALTER ENOCH, formerly head of the domestic goods department of the Wickwire-Spencer Steel Corporation, Worcester, Mass., has become president and general manager of the new Home Accessories Corporation, manufacturers of bath room fixtures, of Worcester.

DAVID JULIAN, formerly connected with the E. J. Manville Machine Co., Waterbury, Conn., is now associated with the Columbus Bolt Works Co., Columbus, Ohio, as factory manager.

B. S. LEWIS of the Stanley Works, New Britain, Conn., has been elected president of the New Britain branch of the Connecticut section of the A. S. M. E.

H. I. MARKEY, associated with the sales department of the Diamond Chain and Manufacturing Co., has been appointed manager of the company's newly opened office in the *Leader-News* Building, Cleveland, Ohio.

ALBERT J. WOODRUFF, head of the Woodruff Machinery Co., Atlanta, Ga., jobber of machinery, tools and machine parts, was nominated as a member of the house of representatives from DeKalb county in the recent Georgia primary.

PHIL CARR, who spent the past year in Honolulu, Hawaiian Islands, as a representative of machine tool interests in this country, has returned to the United States and taken up work as sales manager of the Davenport Machine Tool Co., Inc., Rochester, N. Y.

W. LA COSTE NEILSON, vice-president and general sales manager of the Norton Co., Worcester, Mass., has just returned from a European trip.

ERNEST R. LLEWELLYN, of the sales department of the Greenfield Tap and Die Corporation resigned his position with that company on October 1. He has not as yet formulated plans for the future.

WILLIAM BREEDEN, sales manager of the Lackawanna Steel Co. for the past three years, has resigned. He has been with the company both at Philadelphia and Buffalo.

JOSEPH W. ROE, president of the American Society of Industrial Engineers and professor of industrial engineering in the University of New York, addressed a meeting in Springfield, Mass., Sept. 29, held in the interest of the plan to form a local body of industrial engineers to be affiliated with the national society. The purpose and advantages of the organization were explained and progress made in the arrangements, which are now in charge of a membership committee.

CHARLES U. SMITH of St. Joseph, Mich., has been appointed superintendent of the American Malleable Castings Co. plant in Marion, Ohio. Mr. Smith was formerly foundry superintendent for the Auto Specialties Manufacturing Co., in St. Joseph.

JAMES A. BUELL, assistant general manager of the United Alloy Steel Corporation, has resigned his position to become general superintendent of the Donner Steel Co., Buffalo, N. Y.

Obituary

Herbert C. Follinger, manager of the Chicago Office of the Chain Belt Co., died of pneumonia at his home in Chicago, September 27, following an illness of but a few days. Mr. Follinger was 38 years of age at the time of his death, and was born at Fort Wayne, Indiana. In 1902 he graduated from the Chicago Manual Training School, and entered the employ of the Otis Elevator Company. He became associated with the Chain Belt Co. in 1914, and in 1916 was appointed district manager for the Chicago territory.

Book Reviews

Six-Place Tables. A pocket-size (4 x 7 in.) book of 124 pages, flexible cloth covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $1.25.

The small volume contains in convenient form, seven sets of tables, including those on squares, cubes, square roots, cube roots, circumferences, areas, fifth roots, fifth powers, logarithms (six places) logarithmic sines, cosines, tangents and cotangents, natural tangents and cotangents and trigonometric formulas. For those who are using the tables enumerated constantly or even frequently, the book will be worth much. In addition to the value of its contents, it is well arranged and clearly printed.

Elements of Industrial Heating. By the engineers of the W. S. Rockwell Company, New York City. 44 pages, illustrated with numerous line drawings, charts and tables. Published by the W. S. Rockwell Co., 50 Church St., New York City.

"The influence of heat upon the quality and cost of practically all manufactured products, and the comparatively inefficient methods in general use, indicate the necessity of developing a broader view of the industrial heating problem. The demand for better and cheaper products can only be met with better methods of heating and handling, better equipment, and above all, men better qualified to understand and properly apply in practice the simple principles of one of the oldest and most important, though indifferently practiced, industrial arts."

There is no doubt of the tremendous importance of the problems thus outlined in the preface of this book and furthermore there is no doubt that the engineers who have prepared it has done much for industry in furnishing this well-illustrated, effective summary of important considerations in fuel application. Much of the material in this book has appeared in pamphlets previously issued, but when this material is brought together under one cover, it again emphasizes the complexity as well as the importance of the fundamental problems as these problems are seldom stressed.

One of the purposes of this new book is to bring together in convenient form for the use of chemical and mechanical engineering teachers material that may be employed as a "supplementary text book for shop training classes, vocational schools, colleges, etc., as well as for the man in the shop and others interested in the subject." Several institutions have already announced that they expect their engineering students to use this pamphlet. If this practice is extended widely, as it well may be, we may look forward to the time when engineers will think not alone of cost of fuel per ton or the relative cost of various fuels per million heat units, but rather of that important over-all efficiency, the fuel cost per unit of quality product. In bringing out the importance of that feature, this book gives attention not alone to the selection of the fuel, but also to the selection of the furnace, the placing of the material in the furnace, and the time factor in heating.

The book does not in any way argue for any single type of equipment or any particular fuel; it affords an unusually well-balanced and impartial review of the various types of heating furnaces, annealing equipment, automatic and continuous methods and the many variations of heat-applying devices that modern technology furnishes. It will be well worth while for experienced engineers as well as those beginning their studies in engineering to look through this booklet.

Machinists' and Draftsmen's Handbook. By Peder Lobben. Third edition. Four hundred eighty $4\frac{3}{4}$ x $7\frac{1}{2}$ in. pages, flexible board covers. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price $3.00.

A handbook is judged by its contents and by the method of their presentation. The contents in this volume include notes on mathematics, arithmetic, notes on algebra, logarithms, weights and measures, geometry, mensuration, strength of materials, mechanics, belts, rope transmission, pulleys, fly wheels, shafting, bearings, gear teeth, screws, pipes, notes on hydraulics, notes on steam, notes on copper wire, notes on electrical terms, shop notes, blue printing. In presenting the work the author has avoided the use of abstruse theories and complicated formulas. Definitions are clear and examples are well chosen. Logarithmic tables are six-place.

Factory Storekeeping—The Control and Storage of Materials. By Henry H. Farquhar. Cloth; one hundred and seventy-six 6 x 9-in. pages, illustrated. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York, N. Y. Price, $2.50.

The author, who is assistant professor of industrial management at the Harvard Graduate School of Business Administration, and is thus well qualified to write on the subject, describes a method that is practical and well worth following. He starts off with a discussion of the functions of a manufacturing plant and emphasizes the dependence of production upon material control. He ends this discussion with a summary of material losses which he claims are due to the lack of standards of variety and quality, to excessive supply, to insufficient supply and to misplaced responsibility and faulty routine.

In the chapter on material replenishment, the author gives three excellent plans for controlling supplies by the amount on hand, by the amount available or by schedule. In the next chapter are described and illustrated the balance sheets for these three plans and the information necessary for each. The duties of the purchasing department in both speculative and routine purchasing and the procedure of the receiving and inspection departments finish the discussion of material control.

The author then undertakes a description of the storeroom, dealing with the layout, equipment and storage of materials. He shows the advantages and disadvantages of a centralized storeroom, gives the details to be considered in selecting a location for the storeroom and outlines a system for indexing supplies. Several drawings of interchangeable racks and bins are shown to bring out the author's theory of double binning. His method for securing a turnover of stock is well thought out and in practice should give an efficient system of storing in regard to saving space and labor. The classification of materials and a description of material accounting, inventories and statistics finish the book.

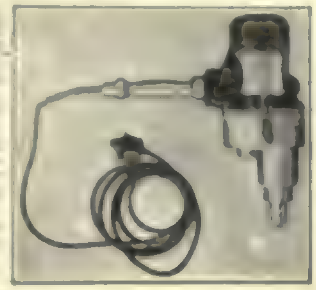
Business Analysis of United States Made by Counties. In two volumes, each consisting of an I. P. No. 2710 flexible leather binder with loose leaf index and contents. Leaves are $5\frac{1}{2}$ x $8\frac{1}{2}$ inches. Published by Wm. H. Rankin Co., 180 North Wabash Ave., Chicago, Ill. Price $200.

Statistics covering the following items are given by county, and by total for state: Total farm value, total crop value, total income tax, total white population, total

Condensed-Clipping Index of Equipment

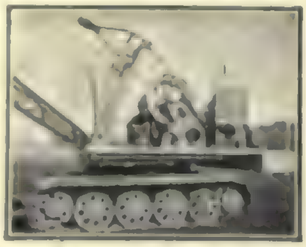
Patented Aug. 20, 1918

Screw and Nut Setting Tools, Portable and Stationary
Electrive Manufacturing Co., Inc., Syracuse, N. Y.
"American Machinist," August 17, 1922



The tools are used in driving and setting screws, studs and nuts, and are made in two sizes of the portable and one size of the stationary type. Motors for both types run on 110-volt d.c. or a.c. providing the a.c. is not more than [illegible]. The portable model operates from an electric light socket, but unless the light wiring has a large enough safety factor the stationary one should be operated from a power line. Hardened, tapered wrenches are furnished for picking up the nuts while the spindle is running at full speed. Portable tool: capacities, [illegible] to [illegible] in. and [illegible] to [illegible] in. respectively; weights, 11 and 13 lb. Stationary tool capacity, [illegible] to 1 inch.

Crane, Crawler, Heavy-Duty, Motor-Driven
Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.
"American Machinist," August 17, 1922



The crane, operated by a heavy-duty, 4-cylinder traction engine running at 800 r.p.m., is equipped with an automatic governor, gear-driven fan, centrifugal pump, high tension magneto with impulse starter, and force feed lubrication to all bearings. The boom-hoisting mechanism is automatically self locking. The clutches for swinging, traveling and hoisting the boom, and for hoisting and lowering the drums are of the expanding type. The operator can set the brakes either before or while hoisting. A 40-hp. electric motor for any standard current can be supplied to operate the crane in place of the gasoline engine. Height, 11 ft. [illegible] inches.

Transformer, Electric Arc, Rivet Cutter
Electric Arc Cutting and Welding Co., 152 Jelliff Ave., Newark, N. J.
"American Machinist," August 17, 1922

The machine is adapted primarily to rivet cutting, although it can be used also for cutting cast iron, brass or bronze. It is made in three sizes. The type CW, 300-amp. machine is intended for both welding and cutting, the 600-amp machine for rivet cutting and carbon arc welding, and the 1,000-amp. for cutting alone. A magnetically operated switch is provided in the primary, so that the circuit remains open at all times when the electrode is not in contact with the work or when the arc is not being drawn. The small pilot transformer of 100 watts capacity makes the operation automatic and positive.

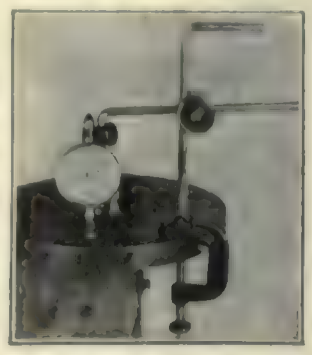
Threading Machine, Automatic, Double-Ended
Cleveland Automatic Machine Co., Cleveland, Ohio
"American Machinist," August 24, 1922

The machine is fully automatic, has two heads and is adapted to high-speed threading. It can thread simultaneously both ends of a forged or rolled staybolt, so that both threaded ends are in line and the lead is continuous from one threaded portion to the other. The machine consists [illegible] of a [illegible], a [illegible] mechanism, a pair of [illegible] jaws which hold the [illegible], two [illegible] carrying the [illegible], and a [illegible]. It is [illegible] for all [illegible] and threading work on [illegible] and [illegible]. Capacity, staybolts up to 1[illegible] in. in diameter, [illegible] in. long.

Grinding Attachment, Combination External and Internal
United States Electrical Tool Co., Cincinnati, Ohio
"American Machinist," August 17, 1922

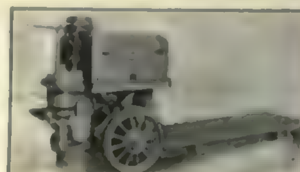
The attachment can be used on lathes with a swing as small as 10 in. The universal type motor can be operated by either d.c. or a.c. where the latter has a frequency of 60 cycles or less, and is pivoted to the angle plate. The spindle has an angle adjustment and also a vertical adjustment of 4 in., and is used for both external and internal grinding, the speed being changed by transposing the pulleys. Different lengths of wheel arbors can be inserted in the spindle. Regular equipment: three pulleys, grinding wheels for internal and external work, a wheel arbor 3 in. long, and two woven belts.

Attachment, Gage, Universal
B. C. Ames Co., Waltham, Mass.
"American Machinist," August 17, 1922



The attachment can be applied to any object within the range of the clamp and can be set so as to bring the dial gage to almost any position or angle. It can be used for testing the straightness of crankshafts, camshafts and valve cams; checking lifts of valves and valve cams; gaging thickness of piston rings, shims, bearing liners and diameters of pistons. It can be purchased without the dial gage if desired.

Truck, Platform, Elevating, 5-Ton
Atlas Car and Manufacturing Co., Cleveland, Ohio
"American Machinist," August 17, 1922



The truck is used especially in handling large core racks into and out of core ovens. The platform can be elevated 4 in. in 10 seconds. The truck may be operated by either Edison or lead batteries, the latter being standard equipment. A limit switch is operated automatically at each end of the platform travel so that the motor is stopped and the platform held in position. The brake is applied whenever pressure is released from the pedal. Three speeds are provided in each direction and steering is applied to all four wheels. The machine can be operated through intersecting aisles 8 ft. wide, while carrying a core rack 5 ft. 1 in. wide and 7 ft. long.

Grinder, Bench, Motor-Driven, "Duwell"
J. A. Finley Co., 20 Braintree St., Allston, Mass.
"American Machinist," August 24, 1922

The grinder is designed for service in machine shops and garages, for tool grinding, polishing, and wire-brushing. It carries two grinding wheels of 5-in. diameter by [illegible]-in. face and runs at 4,500 r.p.m. Power is supplied by a universal motor of special construction running on either d.c. or a.c. and wound for 110 or 220 volts. The wheel spindle is mounted well toward the front. The machine is provided with cord, switch and attachment plug, ready for connecting to a lamp socket. Detachable wheel guards and tool rests for each wheel are also furnished. Height from base to wheel center, 8 in. Distance between wheels, 9[illegible] in. Weight, 25 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

manufacturing value, total state auto registration, total mileage of all roads, total surfaced roads, and certain information on climatology.

A preface lists the sources from which the data were obtained. For example, the data for the manufacturing values were taken from the 1919 Manufacturers' Bulletin, Department of Commerce, Bureau of Census. Manufacturing value is defined as the value of manufactured products, i. e., cost of material plus value added by manufacture.

Graphic Charts in Business. By Allan C. Haskell. Two hundred forty-six pages, 6 x 9 in., cloth boards. Published by Codex Book Co., Inc., 119 Broad St., New York, N. Y. Price $4.00.

Beginning with a well written chapter on the necessity for and the use of charts in business, the book progresses by gradual, easily followed steps through the definition of graphic charts and an explanation of their functions to a study of the simplest kinds of charts. The more complicated charts are then taken up, after which more than half of the book is devoted to showing how graphic charts are used in the various departments of businesses and factories, including the departments of accounting, advertising, collection, cost, credit, personnel, purchasing, sales, scheduling and production.

The kinds of charts treated are line, plain and ratio ruling, bar, circular, percentage, organization, tri-linear, probability. There is an undisputed value to graphic charts when properly executed and applied. How they may be prepared and where applied are subjects thoroughly covered and the book as a whole should be of real value in the analytical problems connected with the conducting of a business.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Iron and steel pipes of all diameters and lengths of good quality—Italy. Agency desired. Quotations, c. i. f. Italian port. Correspondence and catalogs should be in Italian or French. Reference No. 3639.

Chamotte, silica, and magnesite—Norway. Purchase desired. Quotations, c. i. f. Norwegian port. Terms, cash against documents. Reference No. 3640.

Hardware such as wood screws, wire nails, rose nails, annealed wire, and barbed and other wires; steel of every kind, anvils, etc.; railway materials; machinery; boiler fittings; electrical goods; cotton mill and gin requisites; plain and corrugated iron sheets; plain galvanized sheets; brass and copper sheets, etc.—India. Reference No. 3644.

Iron and steel bars, sheets, pipes, wire, and metals, tin plates, building forgings, tools of all kinds, engine fittings, screws, nails, tacks, rivets, and general hardware; oils and greases; varnishes and paints; leather and balata belting; cotton waste.—Finland. Purchase and agency desired. Quotations, c. i. f. Helsingfors. Terms, payment against documents. Reference No. 3665.

Sawmill machinery and accessories—Spain. Purchase desired. Quotations, c. i. f. Ferrol. Correspondence, Spanish. Reference No. 3714.

Machinery and equipment for the manufacture of candies, crackers, and biscuits—Italy. Purchase desired. Quotations, c. i. f. Genoa or Savona. Terms, cash against documents. Correspondence, French or Italian. Reference No. 3718.

Printing machinery and supplies—Italy. Purchase desired. Quotations, c. i. f. Genoa, Correspondence, Italian or French. Reference No. 3752.

Pneumatic drilling machines for mining operations—Spain. Purchase desired. Quotations, f. o. b. New York. Reference No. 3753.

Machinery for compressing calcium carbide dissolved in acetone—Spain. Purchase desired. Quotations, c. i. f. Barcelona. Payment, cash against documents. Correspondence, Spanish. Reference No. 3757.

Zinc, copper and sulphate of ammonia—Italy. Agency and purchase desired. Quotations, c. i. f. Italian port. Payment, cash against documents. Reference No. 3758.

Corrugated sheets—India. Purchase desired. Quotations, c. i. f. Karachi. Terms, cash. Reference No. 3762.

Iron kegs or drums suitable for packing stiff and liquid paints. Kegs to hold 28, 56 and 112 pounds, and drums 3, 5 and 10 gallons (imperial measure), medium-quality goods—Wales. Purchase desired. Quotations, c. i. f. Swansea or Bristol Channel port. Reference No. 3764.

Glazers' lead for vitrifying drainage pipes —Cuba. Purchase desired. Quotations, c. i. f. Caibarien. Terms, cash against draft. Correspondence, Spanish. Reference No. 3774.

Trade Catalogs

Baker Air Units. The Baker-Hansen Manufacturing Co., 1900 Park St., Alameda, Calif. This company has just issued a circular, known as Bulletin No. 201 in which is described in a comprehensive way, the Baker ball-bearing two-stage air units for oil stations, garages, tire shops, machine shops, and paint spraying machines. The publication contains illustrations of the unit with full illustrations as to its operation and maintenance.

The Tilted Turret. The Wood Turret Machine Co., Brazil, Ind. This company has just issued an instructive pamphlet on the subject of the tilted turret. The publication takes the form of questions and answers in which the many advantages of this type of turret are set forth in a clear and concise manner. Questions with their answers are also given on the precision index, the turret lock mechanism, the turret slide and saddle, spindle and bearings and automatic chuck and feed.

Portable Electric Drills. The A. F. Way Co., Inc., Hartford, Conn. This company has recently issued a new folder describing their portable electric drills. The publication contains illustrations showing construction features and a full description of the product.

Line Shafting Equipment. The Medart Co., St. Louis, Mo. This company has just issued a new condensed catalog of 192 pages with a complete index. The publication is made up in an attractive manner with numerous illustrations and line drawings and presents facts about the most generally used line shafting equipment. The aim has been to state dimensions, construction details and list prices in a way to enable engineers and designers, mechanics and power users—to plan installations and purchase the necessary requirements. The catalog forms a useful handbook with its many useful tables and is noteworthy in that no attempt is made in its pages to exploit the Medart products.

Pamphlets Received

Industrial Conditions in China. Trade Information Bulletin No. 61, prepared by the Far Eastern Division, Department of Commerce, on the present state of industrial conditions within the Chinese Empire. Distributed by the Department of Commerce, Washington, D. C.

Plan for Industrial Development of Szechwan Province, China. Trade information bulletin No. 62, prepared by the Far Eastern Division, Department of Commerce, on the state of conditions in the Chinese province of Szechwan. Distributed by the Department of Commerce, Washington, D. C.

International Association of Industrial Accident Boards and Commissions. Proceedings of the eighth annual meeting of the association, held in Chicago, September 19 to 23. This publication is known as Bulletin No. 304 of the U. S. Dept. of Labor, Bureau of Labor Statistics, from which department copies may be secured.

Foreign Trade of the United States. Trade information Bulletin No. 59 of the Department of Commerce. The bulletin is a review of the U. S. foreign trade for the fiscal year, 1921-1922. Distributed by the Department of Commerce, Washington, D. C.

Training for Foreign Service. Bulletin No. 27 of the Bureau of Education, Department of the Interior. This useful and valuable publication has been compiled by Glen Levin Swiggett and is divided into four parts as follows: Part 1, Economics; Part 2, Government; Part 3, Modern Foreign Languages and Part 4, Periodical Literature. Under each part are found numerous chapters on special phases of the subjects. Of particular value are the bibliographies to be found in the book furnishing a guide to the best works on the entire aspect of foreign service and the training therefor.

Notes on the Efficiency of Various Systems of Air Conditioning in a Munition Factory. U. S. Public Haelth Service, Treasury Department, Reprint No. 729. This pamphlet has been prepared by C. E. A. Winslow, professor of Public Health, Yale School of Medicine and Leonard Greenburg, assistant sanitary engineer of the U. S. Public Health Service.

Statistical Record of the British Iron and Steel Industry. Trade information bulletin No. 66 of the Iron and Steel Division of the Department of Commerce. The bulletin contains numerous statistical tables on the state of the industry which are of considerable interest at the present time. Distributed by the Department of Commerce, Washington, D. C.

Engineering Education After The War. By Arthur M. Greene, Jr., of Rensselaer Polytechnic Institute, Troy, N. Y. This publication is known as Bulletin No. 50, Department of Interior, Bureau of Education, and contains a review of engineering study courses with changes made therein during and since the late world war.

Forthcoming Meetings

American Mining Congress, twenty-fifth annual convention, new auditorium, Cleveland, Ohio, October 9 to 14. Secretary, J. F. Callbreath, 84 Munsey Building, Washington, D. C.

Second National Aero Congress and National Airplane Races, Detroit, Mich., October 7 to 14, 1922.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

Automobile Accessories Branch of the National Hardware Association of the United States. Convention and Exhibition, Atlantic City, N. J., Oct. 16, 17, 1922. Headquarters, Hotel Ambassador, T. James Fernley, secretary-treasurer, 505 Arch St., Philadelphia, Pa.

National Hardware Association of the United States. Convention, Atlantic City, N. J. Oct. 17, 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. T. James Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa.

American Hardware Manufacturers' Association. Convention, Atlantic City, N. J., Oct. 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances.—Bulk of steel buying being done by railroads; 113,000 cars purchased thus far this year as against 28,000, last year. Shapes, plates and bars, $2@$2.25 f.o.b. Pittsburgh, on ordinary business, for indefinite deliveries; $2.50 per 100 lb. on plates, however, where deliveries are specified at earliest possible time consistent with rail embargoes, now holding up all but food and fuel shipments. Connellsville foundry coke up 50c. per ton.

Tin, 33c. as against 32½c. per lb. at New York warehouses. Lead, 6¼c. as compared with 6.15c., f.o.b. East St. Louis, last week. Aluminum ingots up ½c. per lb. in New York.

Raw linseed oil, 93c. as against 91c. per gal. (5 bbl. lots) f.o.b. New York. Market firmer; tendency upward with continued scarcity of spot oil. Lard oil market stronger; prices unchanged.

Declines—Pig-iron showing downward tendency despite higher coke prices, with increased production and falling off in demand.

Zinc, 6.7c. as against 6.86c.@6.9c. per lb., East St. Louis; 7½c. as compared with 7¾c. at New York warehouses.

Lubricating oils show sluggish market, with large stocks on hand.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	28.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	36.64
Virginia No. 2	37.17
Basic	32.00
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	33.00
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	8.0	6.0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	[illegible]	4.29	3.80	4.10
No. 16	[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	[illegible]	4.70	4.20	4.70
Nos. 22 and 24	[illegible]	4.75	4.25	4.70
Nos. 25 and 26	[illegible]	4.80	4.30	4.75
No. 28	[illegible]	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.15	5.30	4.80	....
Nos. 22 and 24	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	34	19
LAP WELD					
2	61	49½	2	29	15
2½ to 6	65	53½	2½ to 4	32½	19
7 to 8	62	49½	4½ to 6	32½	19
9 to 12	61	48½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	34	20
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	30	17
2½ to 4	63	52½	2½ to 4	33	21
4½ to 6	62	51½	4½ to 6	32	20
7 to 8	58	45½	7 to 8	25	13
9 to 12	52	39½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	[illegible]	[illegible]
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	[illegible]	[illegible]

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	2.92½
Soft steel bars (base)	3.04	2.91	2.82½
Soft steel bar shapes (base)	3.04	2.91	2.82½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	2.92½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{16}$	8.00		12@13
⅛	6.50		11@12
$\frac{5}{32}$ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	33.00
Lead (up to carlots), St. Louis.... 6.25; New York.	6.75@6.87½
Zinc (up to carlots), St. Louis..... 6.70; New York.	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	21.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.25	10.25	.....
Solder (½ and ½), (caselots)	25.00	23.50	20.00
Babbitt metal (83% tin)	34.00	42.25	36.00
Babbitt metal (35% tin)	25.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11 50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.00	7.25
IC, 14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¾x13¾, per lb.	.075	.06	.10
Wiping cloths, 13¾x20¾, per lb.	.08	.096	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton 11.50@12.50		
Coke, prompt foundry, Connellsville	per net ton 13.50@14.50		

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ¼ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$5.00	\$3.90	\$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply., 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1 24	1.40
Cloth	3.02	2 67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Hamler Boiler Tank Co., [illegible] West [illegible] St.—one horizontal pyramid type plate bending roll, 12 ft. between housings, drop housings with power lift, 1 in. [illegible] capacity, arranged for motor drive, also [illegible] machine, 16 ft. between housings.

Ill., Chicago—J. Hess, 1219 South Western Ave. [illegible]—one double crank geared [illegible] press.

Ind., Indianapolis—Indiana Battery Service Co., [illegible] North Meridian St., H. Churchman, Pres.—electrical machinery, tools and equipment for 1 story service and repair shop for electrical automobiles and automotive equipment.

Ind., Michigan City—The Super Range Co., R. L. Poe, Purch. Agt.—machine tools and foundry equipment for the manufacture of stoves and ranges.

Ia., Ottumwa—Hardsocg Mfg. Co. (manufacturer of mining tools)—one press for forging pick eyes, about 60 in. between uprights, die space approximately 20 x 40 in., distance between slide and bed with stroke down and adjustment up, 20 in., stroke 6 to 8 in., diameter crank 8 in., press shearing attachment preferred.

Md., Baltimore — Beckerly-Trusler Co., 304 Stewart Bldg.—one 20 in. metal lathe.

Mich., Detroit—Base-O-Lite Products Co., [illegible] Woodbridge St., E.—bench, tap and drill, motor driven, vertical and reversible.

Mo., St. Louis — The Modern Specialty Co., [illegible] North 16th St. (machine shop)—spring making machinery and spring winding machine, power equipment.

N. Y., New York—McCall Co., 236 West 37th St. (publishing plant) A. Dudley, Purch. Agt.—one 24 x 12 in. engine lathe, 9 ft. between centers.

O., Cleveland—Star Machine & Tool Co., [illegible] Champlain St.—one small punch press.

O., Columbus—Columbus Auto Parts Co., [illegible] East Russell St., [illegible] Klages, Pres.—automatic milling machine and screw machine.

O., Columbus—Jaeger Machine Co., 520 [illegible] Ave. (manufacturer of machines and concrete mixers) G. Jaeger, Pres.—one [illegible] in. vertical boring machine and one 21 or 24 in. turret lathe.

O., Uhrichsville—Gallagher Bros.—additional machine shop equipment.

Pa., Palmerton — Horlachers Garage — machine and repair shop equipment for new garage.

Pa., Pittsburgh—The Fairmont Creamery Co., 301 Ferry St.—garage and repair shop equipment, also mechanical equipment for proposed $150,000 garage and warehouse on 24th and Smallman Sts.

R. I., Providence—The Hope St. Garage Co., [illegible] Hope St.—machinery and equipment for proposed garage and service station.

Tenn., Chattanooga — Hamilton Mchy. Co., 101-103 Market St.—one 72 in. open side planer, having 12 to 16 ft. bed, (used).

W. Va., Wheeling—Centre Fdry. & Machine Co., [illegible] Main St.—foundry and machine shop equipment.

Wis., Appleton—P. Rademacher, 801 Superior St.—automobile repair machinery for proposed garage.

Wis., Colby—Colby Buick Co., H. J. Cornelius, Mgr.—automobile repair machinery for proposed garage.

Wis., Eau Claire—W. A. Craig, 110 Galloway St.—automobile repair machinery.

Wis., Janesville—The Bower City Machine Co., [illegible]—machinery and equipment for proposed machine shop.

Wis., Marinette—C. Anderson & Son, [illegible] and [illegible] Sts. (manufacturers of [illegible])—additional machine tools for proposed factory and machine shop.

Wis., Milwaukee—The Radio Garage, [illegible] E. Fleming, [illegible] St.—repair shop machinery, including lathe, etc.

Wis., Milwaukee—The Uecke Motor Car Co., c/o E. Uecke, 1412 9th St.—repair shop equipment including drill press.

Wis., Slinger — L. A. Burg—automobile repair machinery for proposed garage.

Wis., West Bend—Amer. Service Garage Co., M. A. Johannes, Mgr.—automobile repair machinery.

Ont., Delhi—J. E. Stedelbauer—complete equipment for proposed garage and automobile repair shop.

Ont., Petrolea—Peninsular Sugar Co.—complete machine shop equipment.

Ont., St. Thomas—Lorne Tractors, Ltd., H. Carmichael, Mgr.—tools and metal working equipment for plant at Tillsonburg.

Que., Montreal—J. Linssen, 600 Dorchester St., W.—one 12 in. engine lathe and one swing and drill press.

Machinery Wanted

Ark., Mountain Home—W. Wolf—machinery and equipment for proposed cold storage and refrigeration plant.

Conn., Middletown—Burns Lace Mfg. Co. —two 54 x 60 in. extractors and two starch mangles.

Ga., Atlanta—Hightower Box and Tank Co., T. H. Trent, 40 Queen St., Secy.—special machines for the manufacture of bottle boxes and other lock corner boxes; also other general woodworking machines, total cost $30,000.

Ga., Gainesville—W. Taffar—machinery and equipment for show case manufacturing plant at Athens.

Ill., Chicago—E. M. Heller & Co., 144 West Kinzie St.—hydraulic lard press, meat cutter, copper kettles and belting.

Ill., Chicago—Western Newspaper Union, 210 South Desplaines St.—one Cox duplex, 8 page printing press.

Ill., Joliet—J. Argo, 405 Grant Ave. (iron company)—compressor and pressure tank.

Ind., Logansport—The Universal Burner Co. (manufacturer of liquid fuel burning equipment)—air compressors and steam pumps.

Ind., Plymouth—Bd. Educ.—vocational equipment for proposed high school.

Ky., Louisville—Axton-Fisher Co., 811 South 20th St.—machinery and equipment for proposed addition to tobacco factory.

Ky., Louisville—R. C. Wayne Supply Co., 608 West Jefferson St.—one 20 ton, 8 wheel locomotive crane with reversible engine.

Md., Salisbury—Salisbury Ice Co., J. Price, Pres.—machinery and equipment for 6,000 ton ice handling plant.

Mass., Boston—Advance Printing Service Co., 78 Portland St.—hand press, card cutter, also lever pipe cutter (used).

Mass., Boston—The Amer. Net & Twine Co., 575 Atlantic Ave.—machinery for proposed factory at Wes. Kennebunk, Me.

Mass., Cambridge—American Oil Co. (oil refiners)—used rubber mill and vulcanizing press for experimental purposes.

Mass., Malden—G. O. Smith—knitting machines for the manufacture of men's neckties.

Mass., Ware—Ware River News—remelting furnace, about 300 lbs., ingot molds.

Mich., Detroit—The Gray Motor Co., Mack Ave.—miscellaneous equipment for manufacturing and assembling automobiles.

Mich., Laingsburg—Press (newspaper)—linotype.

Mo., Kansas City—C. P. Shipley, 1627 Genessee St. (machine shop)—air compressor and a Deming duplex power pump for oil burner.

N. J., Newark—Kreuter & Co., 563 18th Ave. (machinists)—exhauster having 16 in. inlet.

N. J., Newark—The Newark Umbrella Frame Co., 359 Ogden Ave.—automatic machine for the manufacture of 7 and 8 notch umbrella parts.

N. Y., Buffalo—Buffalo Pattern Wks., 1445-1447 Niagara St.—machinery and equipment for pattern works to replace that which was destroyed by fire.

N. Y., Buffalo—C. J. Heimerle, 37 Orange St.—machinery for light manufacturing and for the manufacture of automobile parts.

N. Y., Buffalo—King Electric Mfg. Co., 1681 Fillmore Ave.—one 25 cycle, 110 volt, not less than 5 kw. spot welder.

N. Y., Buffalo—A. Leising, 19 Greenfield St.—bakeshop equipment.

N. Y., Buffalo—M. E. Lamkin, 586 Masten St.—equipment for tinsmith shop.

N. Y., Buffalo—G. V. Patrick, 514 Elmwood Ave.—equipment for proposed wholesale and retail bakery.

N. Y., Buffalo—W. A. Schneggenberger, 212 Hertel Ave.—cutting machinery and equipment for proposed junk and iron metal scrap plant.

N. Y., Gouverneur—Aldrich Paper Co., N. R. Caswell, Pres.—machinery and equipment for proposed $40,000 addition to paper factory.

N. Y., Jamestown—The Alliance Furniture Co., 615 Allen St.—machinery and equipment for proposed addition to factory.

N. Y., Jamestown — Jamestown Lounge Co., 40 Winsor St.—machinery and equipment for proposed addition to factory.

N. Y., Jamestown—Liberty Upholstery Co., Inc., Martyn Bldg., F. R. Nelson, 6 Seneca St., Pres.—woodworking machinery and equipment for the manufacture of living room furniture.

N. Y., New York—J. C. Bossong Co., 88 Franklin St. (manufacturer of hosiery)—several Scott and Williams machines, 176-200-220 needle gauge.

N. Y., New York—Hickman Mfg. Co., 70 Cortlandt St., A. W. Bell, Purch. Agt.—small stone crusher and road scraper.

N. Y., Rochester—A. T. Crapsey Co., Atlas Bldg., Elm St., E. G. Starry, Secy. and Treas.—machinery and equipment for proposed addition to clothing manufacturing plant.

N. Y., Syracuse—The United States Hoffman Mchy. Co., 729 Temple St. (manufacturer of clothes pressing machines, etc.)—complete machinery and equipment for addition to factory.

N. Y., Tonawanda—National Roofing Co., Fillmore St.—machinery and equipment for proposed $250,000 plant, for the manufacture of roofing at Chattanooga, Tenn.

N. C., Marion—Marion Knitting Mills—sixty 176 needle Scott & Williams knitting machines, models B-3 or B-5.

O., Asheville—Asheville Fireproof Co., J. Dum, Pres.—machinery and equipment for proposed plant for the manufacture of hollow tile and brick.

O., Cleveland—Lyons Bros., 983 East 152nd St.—power hammer, 300 or 400 lb. capacity, (used).

O., Cleveland — Western Newspaper Union, 1279 West 3rd St.—one 10 x 15 in. and one 12 x 18 in. job press, also paper cutter for power equipment.

O., Columbus—Grumman & Moyer Co., 286 South Greenwood Ave. (manufacturer of furniture, boxes, crates, etc.) — wood working machinery, saws, planers and shapers.

O., Columbus—O. Harmon, 528 Carpenter St., (printer)—8 x 12 in. and 10 x 15 in. printing press, 22 in. paper cutter for power equipment.

O., Columbus—Weinman Pump Mfg. Co., 284 Spruce St., W. N. Weinman, Pres.—machinery for addition to plant (new).

O., Fremont—Fremont Metal Body Co.—machinery and equipment for proposed factory, for the manufacture of metal automobile bodies, etc.

O., Lima—Vapo Stove Co.—machinery and equipment for proposed stove factory.

O., Ravenna—F. H. Phillips & associates, c/o Chamber of Commerce—machinery and equipment for automobile body plant.

O., Warren—Clark Knitting Co., 37 Walnut St., E. E. Clark, Secy. and Gen. Mgr.—machinery for hosiery knitting mill.

Okla., Bartlesville—Black, Sivalls & Bryson, Inc., J. A. Sivalls, Secy.—machinery and equipment for proposed addition to tank erecting shop in Rocky Mountain section.

Okla., Henryetta—O'Neil Petroleum Co., Box 548—pumping power outfit suitable for pumping number of wells on a 40 acre site.

Pa., Bath—Bd. of Educ.—vocational equipment for proposed school.

Pa., East Smethport—Smethport Aceton Co.—machinery and equipment for acid chemical works, to replace that which was destroyed by fire and explosion.

Pa., Natrona — School Districts of the Boro. of Brackenridge, and Twp. of Harrison, c/o F. M. Hathaway, 54 Garfield St.—equipment for manual training department.

Pa., Packerton—Packer Silk Mills—machinery and equipment for branch silk factory at Leighton.

Pa., Pittsburgh—Jones & Laughlin Steel Co., 3rd Ave. and Ross St.—one 50 ton crane with 10 ton auxiliary, for power house, Eliza furnace, two 5 ton and one 15 ton cranes for South Side Wks.; cranes, ladles and other equipment for Aliquippa Wks.

Pa., Pittsburgh — Meyers Printing Co., 6309 Broad St.—saw trimmer and other printing equipment.

Pa., Pittsburgh—Open-Hearth Fire Brick Co., 1407 Keenan Bldg. (manufacturer of sleeves, runners, nozzles, runner brick and silicia brick), H. O. Williams, Purch. Agt.—machinery and equipment for plant at Freeport.

Pa., Pittsburgh—The Union R.R. Co., Carnegie Bldg.—600 ton wheel press.

Pa., Pittston—Hillside Coal & Iron Co.—special machinery for equipping new coal colliery with wet jig process of separating coal and slate.

Pa., Reading—The Reading Rubber Co.—$20,000 worth of machinery and equipment for tire and rubber plant at Kutztown.

S. C., Rock Hill—The Anderson Motor Co.—two Rabbit No. 4 planers.

Tenn., Maryville—Ideal Hosiery Mills—several 220 needle, 3½ cylinder Banner machines, also ribbers and loopers.

Tex., Deweyville—Peavy-Moore Lumber Co.—sawmill machinery and power house equipment.

Tex., Winfield—Lignite Coal Co.—second motion hoisting engine, with a 10 x 12 cylinder.

Va., Lynchburg—C. M. Guggenheimer (newspaper publisher)—one 12 x 18 in. Gordon press.

Va., Richmond—News-Leader Publishing Co. (newspaper)—2 super special Howe printing presses and 15 linotype machines.

Va., Richmond—Richmond, Fredericksburg & Potomac R.R., Union Sta., R. J. Rouse, Purch. Agt.—washout system for coaling plant, requiring pump and tanks, also complete outfit for blacksmith shop, including forges, air compressors, engine boiler, drill and lathe.

W. Va., New Martinsville — Universal Concrete Products Co.—air compressor.

Wis., Appleton—Traas Candy Co., 865 College Ave.—candy making machinery and equipment.

Wis., Green Bay—Fort Howard Paper Co., South State St.—special paper finishing machinery.

Wis., La Crosse—E. D. Hunt, 909 State St.—laundry machinery.

Wis., Marinette—C. Anderson & Sons, Cook and Merryman Sts.—special tools, power machinery and machines for the manufacture of brick conveyors.

Wis., Milwaukee—Ideal Shoe Mfg. Co., 1115 4th St., C. Ortgiesen, Purch. Agt.—shoe working machinery, individual motors.

Wis., Milwaukee—O. J. Koch Co., 2825 Grand Ave.—machinery for candy making.

Wis., Milwaukee—F. Kraning, 1147 Forest Home Ave.—gas storage tanks and pump for proposed addition to garage.

Wis., Milwaukee—I. Lecy, 946 26th Ave., (woodworker)—medium sized planer.

Wis., Neenah—The Valley Paper Mills, 145 West Wisconsin Ave.—machinery for proposed paper mill.

Ont., Brantford—The city, F. P. Adams, City Engr.—concrete mixer and material unloading equipment.

Ont., Burford—Burford Knitting Mills, W. Burgess, Mgr.—special knitting mill equipment for proposed plant at Simcoe.

Ont., Hanover—The Peninsular Cord Tire Co., W. A. Oakley, Mgr.—special tire and rubber manufacturing equipment.

Ont., Night Hawk Lake (Timmins P. O.) The Peninsular Mines—equipment for 200 ton mill (gold mining).

Ont., Tavistock—Ratz & Sons—machinery and equipment for flour mills, to replace that which was destroyed by fire.

Que., Montreal—J. A. Ritchie & Co., 140 Clarke St., A. James, Purch. Agt.—pulverizer, high speed, for grinding.

Mex., Tampico—Mexican Petroleum Co.—machinery and equipment for gasoline manufacturing plants in the Cerro Azul and Chapopote petroleum fields.

Metal Working Shops

Calif., Oakland—A. Kahn. Archt., 1000 Marquette Bldg., Detroit, Mich., is receiving bids for the construction of a 2 story, 80 x 684 ft. factory, on Hillside Ave. and 72nd St., here, for the Chevrolet Automobile Co., Foothill Blvd. and 69th Ave. Estimated cost $250,000. Noted Sept. 28.

Calif., San Francisco—The Bothin Real Estate Co., 604 Mission St., awarded the contract for the construction of a 3 story garage on Natoma, Hunter and Sherwood Sts. Estimated cost $45,000. Noted Sept. 14.

Calif., San Francisco — The Brumfield Electric Sign Co., 18 7th St., awarded the contract for the construction of a 1 story, 75 x 85 ft. and 25' x 80 ft. electric sign manufacturing plant, on Folsom St. near 6th St. Estimated cost $12,000. Noted May 18.

Calif., San Francisco—Crest View Apartments, Inc., c/o J. L. Stewart, Archt., Claus Spreckels Bldg., is having preliminary plans prepared for the construction of a 1 story garage on Washington St., near Gough St.

Calif., San Francisco—L. Skerl, 298 11th St., will build a 2 story factory for heavy sheet metal work, on Folsom St. near 11th St. Estimated cost $5,000. Private plans.

Calif., Watsonville — Watsonville High School District has had preliminary plans prepared for the construction of a machine shop building on the high school grounds. Wyckoff & White, Growers Bank Bldg., San Jose, Archts.

Conn., Norwalk—Meeker Union Fdry., 34 Smith St., awarded the contract for the construction of a 1 story addition to its plant. Estimated cost $10,000. Noted July 6.

Ill., Chicago—F. G. Arnold Co., c/o Z. E. Smith, Archt., 304 East 55th St., awarded the contract for the construction of a 1 story, 75 x 160 ft. garage at 3725-29 Ogden Ave. Estimated cost $50,000.

Ill., Chicago—F. Gustafson, 5724 Kenmore Ave., awarded the contract for the construction of a 1 story, 109 x 200 ft. garage, at 405-423 East Erie St. Estimated cost $80,000.

Ill., Chicago—The Pullman Co., 101st St. and Corliss Ave., awarded the contract for the construction of a 1 story, 200 x 250 ft. foundry addition. Estimated cost $600,000.

Ill., Oak Park—Davis & Kramer, Archts., 400 North Michigan Ave., Chicago, are receiving bids for the construction of a 1 story, 100 x 122 ft. garage, on Madison St. and East Ave., here, for J. F. Stacey, c/o architects. Estimated cost $50,000.

Ind., Evansville — The Fellwock Motor Co., 3 U 4th St., is having plans prepared for the construction of a 2 story service station. Estimated cost $60,000. C. Shopbell, Furniture Bldg., Archt.

Ind., Fort Wayne—The General Electric Co., Bway. and Wall St., plans to build a 1 story, 100 x 150 ft. tank shop and garage. Estimated cost $30,000. Private plans.

Ind., Indianapolis—The Indiana Battery Service Co., 1007 North Meridian St., awarded the contract for the construction of a 1 story, 60 x 200 ft. automobile service station. Estimated cost $30,000. Noted Oct. 5.

Ind., Indianapolis—The Rockwood Mfg. Co., 1801 English Ave., awarded the contract for the construction of a 1 story, 75 x 100 ft. machine shop. Estimated cost $40,000. Noted Oct. 5.

Ind., Richmond—The Automotive Gear Co. will build a 1 story, 400 x 600 ft. gear factory. Estimated cost $35,000. Noted Sept. 7.

Mass., Springfield—G. H. Chaplin, 374 Main St., awarded the contract for the construction of a 3 story, 80 x 120 ft. garage on Harrison Ave. Estimated cost $100,000.

Mass., Worcester—The Home Accessories Corp., Gardner and Tainter Sts., will soon award the contract for the construction of a 2 story, 45 x 112 ft. addition to its factory, for the manufacture of bath room fixtures. Estimated cost $35,000. Private plans.

Mich., Dearborn—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, will soon award the contract for the construction of a 1 story, 202 x 804 ft. and a 2 story, 51 x 235 ft. engineering laboratory, on Oakwood Blvd., here, for Ford Motor Co., Highland Park. Estimated cost $250,000. Noted Oct. 5.

Mich., Detroit—Gray Motor Co., Mack Ave. and Railroad St., awarded the contract for the construction of a 1 story, 200 x 550 ft. automobile factory. Estimated cost $200,000.

Mich., Detroit—The Maxwell Motor Co., 12200 East Jefferson St., awarded the contract for the construction of a 1 story, 80 x 440 ft. factory. Estimated cost $200,000.

Minn., Minneapolis—T. R. McKenzie, 1050 Plymouth Bldg., has had plans prepared and will soon receive bids for the construction of a 1 story, 154 x 164 ft. garage and store building, at 2628 Hennepin Ave. Estimated cost $50,000. P. O. Moe, 1037 Plymouth Bldg., Archt.

N. J., Trenton—The Mercer County Board of Freeholders awarded the contract for the construction of a 2 story garage and warehouse. Estimated cost $31,000. Noted Sept. 21.

N. Y., Brooklyn — The Court Heights Realty Co., c/o J. Lubroth, Archt., 44 Court St., awarded the contract for the construction of a 2 story, 55 x 205 ft. garage at 22 Concord St. Estimated cost $75,000.

N. Y., Jamestown—The Watson Mfg. Co., 63 Taylor St., manufacturer of window and door screens, awarded the contract for the construction of a 4 story addition to its factory. Estimated cost $25,000. Noted Aug. 29.

N. Y., Mount Kisco—The Westchester Lighting Co., 1st Ave., Mount Vernon, awarded the contract for the construction of a 1 story automobile service and repair building, here. Estimated cost $50,000.

N. Y., Tonawanda—The National Roofing Co. plans to rebuild portion of its factory which was recently destroyed by fire. Estimated cost $5,000. Architect not announced.

N. Y., White Plains—The New York Telephone Co., 15 Dey St., New York City, is having plans prepared for the construction of a 2 story, 155 x 205 ft. automobile service and repair building, on White Plains Rd., here. Estimated cost $200,000. McKenzie, Voorhees & Gmelin, 342 Madison Ave., New York City, Engrs. and Archts.

Pa., Phila.—T. Bardaro, 57 East Vine St., will soon receive bids for the construction of a 2 story, 32 x 90 ft. and 18 x 24 ft. garage, at 5611 Vine St. Estimated cost $50,000. F. N. Greisler, 1035 Walnut St., Archt.

Pa., Phila.—Osmond & Keene, 1619 Sansom St., awarded the contract for the construction of a 1 story, 89 x 125 ft. and 25 x 29 ft. garage, on Greene St. and Queen Lane. Estimated cost $70,000.

Pa., Pittsburgh—The Equitable Gas Co., Phila. Co. Bldg., awarded the contract for the construction of a 1 story, 50 x 164 ft., 50 x 140 ft. and 15 x 20 ft. repair and machine shop on Reedsdale St.

Pa., Pittsburgh—Hubbard & Co., Granite Bldg., manufacturer of shovels, is having plans prepared for the construction of a 1 story addition to its plant on 63rd and Butler Sts. Private plans.

Pa., Pittsburgh—The Neely Nut & Bolt Co., 26 South 22nd St., is having plans prepared for the construction of a 1 story, 120 x 150 x 173 x 210 ft. addition to its plant. Private plans.

Pa., Pittsburgh—The Stroh Steel Hardening Process Co., Westinghouse Bldg., will build a 1 story, 68 x 100 ft. steel foundry and machine shop on Chateau and Ridge Sts. Estimated cost $250,000. V. S. Cruze, c/o owner, Engr. Noted Sept. 7.

Pa., Sharpsburg—L. Z. Hodil, 88 Bridge St., awarded the contract for the construction of a 1 story, 95 x 140 ft. garage, on Main St. Estimated cost $40,000.

R. I., Providence—The Hope St. Garage Co., Inc., 825 Hope St., awarded the contract for the construction of a 1 story garage and service station on 4th and Hope Sts. Estimated cots $50,000. Noted Sept. 21.

Tex., Dallas—The Southern Wire & Iron Mfg. Co., Harwood and Santa Fe Sts., plans to build a wire factory consisting of 4 units, that will exceed $[illegible]. Architect not announced.

W. Va., Clarksburg — The Carmichael Motor Co. is having preliminary plans prepared for the construction of a 2 story, 33 x 126 ft. garage on 6th St. Estimated cost $45,000. E. J. Wood & Son, Lowndes Bldg., Archts.

W. Va., Weirton—The Weirton Steel Co. awarded the contract for the construction of eight 1 and 2 story steel sheet mills. Estimated cost $1,[illegible].

Wis., Janesville—The Bower City Machine Co., [illegible] McKey Blvd., awarded the contract for the construction of a 1 story, [illegible] x [illegible] ft. machine shop. Estimated cost $[illegible].

Wis., Marinette — C. Anderson & Son, [illegible] and Merryman Sts., manufacturer of [illegible], will build a 2 story, 36 x [illegible] ft. factory and machine shop on Main St. Estimated cost $10,000. Private plans.

Wis., Milwaukee—A. G. Wolff, Archt., 453 [illegible] St., is receiving bids for the construction of a 2 story, [illegible] x [illegible] ft. addition to garage, for F. Kraning, 1147 Forest Home Ave. Estimated cost $40,000.

Wis., New Diggings—The Imperial Mining Co. will build a 2 story, 75 x 190 ft. zinc mill.

Wis., Slinger—L. A. Burg is receiving bids for the construction of a 1 story, 60 x [illegible] ft. garage. Estimated cost $40,000. Private plans.

Ont., Delhi—J. E. Stedelbauer plans to rebuild his garage and automobile repair shop which was destroyed by fire. Estimated cost $[illegible].

Ont., Niagara Falls — Davidson & Williams [illegible], awarded the contract for the construction of a 2 story, 40 x 100 ft. garage. Estimated cost $25,000. Noted Sept. 21.

General Manufacturing

Ariz., Phoenix—The Southwest Portland Cement Co., 1[illegible] South Spring St., Los Angeles, is having plans prepared for the construction of a cement plant here. Estimated cost $1,500,000. Private plans.

Colo., Denver—The Denver Custom Garment Co., 1517 Lawrence St., is having plans prepared for the construction of a 3 story, 60 x 125 ft. office and factory building. Estimated cost $75,000. H. W. J. [illegible], Colorado Theatre Bldg., Archt.

Ill., Chicago—A. S. Alschuler, Archt., 28 East Jackson Blvd., is receiving bids for the construction of a 4 story furniture factory, on George St. near Crawford St., for the Valentine-Seaver Co. Estimated cost $400,000. Noted Sept. 14.

Ill., Chicago—Olson Rug Co., 32 Laflin St., is having plans prepared for the construction of a 6 story, 84 x 187 ft. factory. Davidson & Weiss, 53 West Jackson Blvd., Archts.

Ill., Chicago—The Purity Packing Co., 3247 West 47th St., awarded the contract for the construction of a 2 story, 100 x 125 ft. canning factory. Estimated cost $100,000.

Ind., Elkhart—The Curtain Supply Co. is having plans prepared for the construction of a 1 story, 172 x 400 ft. curtain factory. Estimated cost $100,000. Muncie & Jensen, 38 South La Salle St., Chicago, Archts.

Ind., Ft. Wayne—The American Art Textile Co. plans to build a 2 story addition to its textile plant. Estimated cost $27,000. Architect not selected.

Ind., Fort Wayne—The Wayne Oil Tank & Pump Co., Anthony Hotel, is having plans prepared for the construction of a 1 story, [illegible] x 100 ft. paint factory. Estimated cost $10,000. Austin Co., 208 South La Salle St., Chicago, Archts.

Ind., Hammond — The Hammond Dairy Co. is receiving bids for the construction of a [illegible] story, [illegible] x [illegible] ft. creamery at [illegible] Ave. Estimated cost $[illegible]. [illegible] & Co., [illegible] Bldg., Archts. Noted Oct. 5.

Ind., Hammond—The [illegible] Co., [illegible] St. and [illegible] Park Ave., Chicago, is having plans prepared for the construction of a 3 story ice cream plant on Hohman St., here. Estimated cost $100,000. The McCormick Co., Inc., Century Bldg., Pittsburgh, Pa., Archts.

Ind., Hammond—H. J. Postlewaite, c/o M. Turner, Archt., 633 Hohman St., is receiving bids for the construction of a 2 story, 45 x 100 ft. printing plant. Estimated cost $25,000. Noted Sept. 14.

Ind., Indianapolis — Fra-Rose-Cleaners, 30th St. and Central Ave., are having plans prepared for the construction of a 2 story, 41 x 111 ft. cleaning plant. Estimated cost $35,000. T. A. Winterrowd, American Central Life Bldg., Archt.

Ind., Indianapolis—The United States Encaustic Tile Wks., 349 West 16th St., is having plans prepared for the construction of a 2 story, 90 x 100 ft. factory. Estimated cost $30,000. S. A. Hastings, c/o owner, Archt.

Ind., Jasper—The Hoosier Desk Co. is having plans prepared for the construction of a 3 story, 60 x 200 ft. addition to its furniture factory. Estimated cost $40,000. C. A. Shopbell, Furniture Bldg., Evansville, Archt.

Ind., South Bend—The Ward Baking Co., 3655 South La Salle St., Chicago, plans to build a 4 story bakery on South Main St., here. Estimated cost $175,000. Architect not selected.

Me., West Kennebunk—The Amer. Net & Twine Co., 575 Atlantic Ave., Boston, is building a 75 x 100 ft. factory, here.

Mass., Allston (Boston P. O.)—The Atlantic Refining Co., 248 Boylston St., Boston, awarded the contract for the construction of a 3 story, 100 x 200 ft. warehouse and plant on Cambridge St., here. Estimated cost $85,000.

Mass., Salem—Baker & Kimball, 38 South St., Boston, manufacturers of leather, will soon award the contract for the construction of a 3 story, 70 x 175 ft. factory, here. Estimated cost $50,000. Private plans.

Mich., Detroit—Dept. of Street Railways, Shoemaker and St. Jean Aves., plans to build a 1 story, paint shop, on Woodward Ave. Estimated cost $100,000. W. C. Markham, 312 Marquette Bldg., Engr.

Mich., Grand Rapids — Valley City Creamery Co., 666 Lake Dr. S. E., plans to build a 2 story, 40 x 100 ft. creamery. Estimated cost $40,000. H. L. Mead, Grand Rapids, Archt.

Minn., Minneapolis—The Lavoris Chemical Co., 52 Western Ave., is having plans prepared for the construction of a 3 story, 45 x 110 x 143 ft. office and factory building on 3rd St. and 10th Ave., N. Estimated cost $125,000. W. H. Levings, Secy., Long & Thorshov, 1028 Andrus Bldg., Archts

N. Y., Buffalo—The Niagara Gas Corp., 179 Baraga St., plans to build an addition to its compressor plant. Estimated cost $5,000. Architect not announced.

N. Y., Geneva—The Link Mfg. Co., Canandaigua, awarded the contract for the construction of a 160 x 280 ft. enamel ware factory, here. Estimated cost $1,000,000. Noted Sept. 21.

N. Y., Jamestown—The Alliance Furniture Co., 615 Allen St., plans to build a 4 story addition to its factory, to contain 20,000 sq.ft. floor space. Cost will exceed $50,000. Architect not announced.

N. Y., Jamestown—The Empire Case Goods Co., 142 Foote Ave., plans to build a 2 story addition, containing 7,000 sq.ft. of floor space, to its dining room and bedroom furniture factory. Cost will exceed $25,000. Architect not announced.

N. Y., Jamestown—The Jamestown Chair Co., 20 Winsor St., awarded the contract for the construction of a 4 story, 50 x 62 ft. addition to its chair factory. Estimated cost $20,000. Noted Oct. 5.

N. Y., Jamestown — Jamestown Lounge Co., 40 Winsor St., plans to build a 4 story, 102 x 104 ft. addition to its factory. Architect not announced.

N. Y., Long Island City — The Perry Candy Co., 408 West Bway., New York City, awarded the contract for the construction of a factory on Wilbur Ave., here. Estimated cost $75,000. Noted Sept. 21.

N. Y., Randolph—A. and D. Harris, Penfield, plan to rebuild their apple evaporator plant, here, which was recently destroyed by fire. Estimated cost $7,500. Architect not announced.

N. C., Gastonia—Arkray Mills is building a 2 story, 126 x 471 ft. manufacturing plant, to house 20,000 spindles.

N. C., Gastonia — The Flint Mfg. Co., manufacturer of yarns, is building a 2 story, 126 x 285 ft. manufacturing plant, to house 1,200 spindles.

O., Cleveland—The Ferro Enameling Co., 4150 East 56th St., awarded the contract for the construction of a 2 story, 36 x 74 ft. addition to its factory. Estimated cost $25,000.

Pa., Bellefonte—G. Kelley, Port Matilda, R. D., plans to build an ice making plant, here. Estimated cost $18,000.

Pa., Castle Shannon—The Pittsburgh Art Stone Co., 807 Jones Law Bldg., Pittsburgh, is having plans prepared for the construction of a 1 story, 40 x 60 ft. manufacturing plant, here. Estimated cost $25,000. Private plans.

Pa., Jeannette — The American Window Glass Co., Farmers' Bank Bldg., Pittsburgh, awarded the contract for the construction of a 1 story addition to its glass plant, including machine tank buildings, furnace producer plant, boiler and power houses, and addition to cutting room. Estimated cost $1,500,000. Noted Sept. 14.

Pa., Phila.—The Manyunk Plush Co., 108 Levering St., awarded the contract for the construction of a textile factory on Gay and Main Sts. Estimated cost $20,000.

Pa., Phila.—C. Wunder, Archt., 1415 Locust St., will soon receive bids for the construction of a 5 story, 80 x 122 ft. paper factory, on 5th St. and Willow Ave., for Paper Mfg. Co., c/o F. A. O'Neil, 526 Cherry St. Estimated cost $200,000.

Pa., Pottstown—R. A. Reiff, 62 Hanover St., will soon receive bids for the construction of a 2 story, 60 x 190 ft. and 60 x 125 ft. knitting mill. Estimated cost $75,000. J. V. Pooley, 162 2nd Ave., Royersford, Archt.

Pa., Williamsport—The Demarest Silk Co., 607 Railway St., plans to build a 3 story addition to its silk mill. Estimated cost $100,000.

R. I., Pawtucket—J. and P. Coats, Inc., 366 Pine St., awarded the contract for the construction of an addition to its plant, consisting of two 2 and 3 story, 95 x 370 ft. and 95 x 270 ft. buildings, for the manufacture of thread. Estimated cost $400,000. Noted Oct. 5.

R. I., Pawtucket—The Prescott Corp., North Main and Bates Sts., awarded the contract for the construction of a 1 story, 75 x 120 ft. addition to its textile mill. Estimated cost $40,000.

Tenn., Knoxville — The Hall-Tate Co., North Gay St., plans to build a men's clothing factory and wholesale distribution building, 75 x 125 ft., on West Jackson Ave. Estimated cost $150,000. Architect not selected.

W. Va., Clarksburg—The Clarksburg Ice & Storage Co. plans to build a 1 story, 50 x 120 ft. ice plant. Estimated cost $50,000.

Wis., Clyman—The Reeseville Canning Co., Reeseville, plans to build a 3 story factory and warehouse, here. Private plans.

Wis., Milwaukee—A. C. Beck Co., 1 East St., plans to build a 2 or 3 story box factory, to replace one which was recently destroyed by fire. Architect not selected.

Wis., Neenah—The Valley Paper Mills, 145 West Wisconsin Ave., will soon receive bids for the construction of a 1 and 2 story, 80 x 627 ft. mill and a 112 x 144 ft. warehouse. E. A. Wettengel, 578 Pierce Ave., Appleton, Archt. Noted Sept. 29, 1921.

Wis., Stevens Point—Stevens Point Cleaning & Dye Wks., 446 Clark St., awarded the contract for the construction of a 1 story, 30 x 60 ft. cleaning and dyeing plant. Estimated cost $15,000.

Wis., Waukesha—Waukesha Lime & Stone Co. will build a 2 story, 50 x 120 ft. pulverizing plant, to replace the one which was destroyed by fire. Estimated cost $50,000. Private plans.

Wis., Wittenberg—The Holman Mfg. Co., 1910 North 13th St., Sheboygan, plans to build a 2 story, 60 x 95 ft. clothing factory, here. Estimated cost $50,000. H. Holman, Pres. Architect not selected.

B. C., Vancouver—The Seaman Paper Mills, 208 South La Salle St., Chicago, plan to build a paper mill here. Estimated cost $3,000,000. V. D. Simons, 39 South La Salle St., Chicago, Engr.

Ont., Niagara Falls—Dominion Canners, Ltd., c/o Chamber of Commerce, plans to build a large canning and packing factory on a five acre site. Cost will exceed $50,000.

Ont., Paris — Penmans, Ltd., manufacturer of woolen underwear, is having plans prepared for the construction of an addition to its factory. Estimated cost $50,000.

Que., Montreal, East—The Red Star Refineries Co., Ltd., Canada Cement Bldg., Montreal, plans to build a refinery, 1,000 bbl. per day capacity. Estimated cost $250,000.

American Machinist

Volume 57 NEW YORK, OCTOBER 19, 1922 Number 16

577

Design of Herringbone Gears

Methods of Cutting—Involute and Cycloidal Tooth Forms—Determination of Strength and Wear Factors—Care of Herringbone Gears

By N. LEERBERG

Works Engineer, Mesta Machine Co.

THE rapid progress in the use of cut herringbone gears calls for more general information among mill engineers on the principles and practical points of their design. Nearly all writers on the subject, excepting the recent work of the Gear Manufacturers Association, have had a particular system or type of gear to advocate. This has resulted in a great deal of confusion and lack of general knowledge. Many times a gear has come to our attention which might have been produced much more cheaply if the designer had been familiar with the practice and methods for cutting such gears. It is the intention of this article to place such information before the reader in a clear, concise manner and to enlarge somewhat on theory.

To avoid confusion, let it be clearly understood that in its elements a herringbone gear is similar to a spur gear. Both have rolling action in the same plane, a plane normal to the axes of the gears; both have the same circumferential pitch for the same pitch diameter and the same number of teeth. A good tooth form for the spur gear is generally also a good tooth form for the herringbone gear, although, as will be shown later, the exact reproduction of the correct tooth curve is vastly more essential for the best operation of the herringbone gear.

In earlier days double or triple staggered spur gears were used, thereby obtaining a strong, heavy tooth with a comparatively smooth action. If this principle is now carried to its limit we obtain a helical gear. The

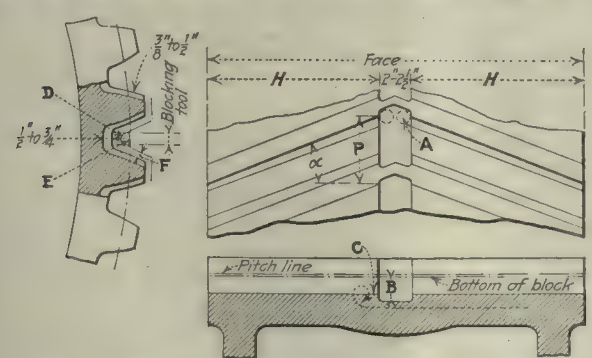


FIG. 1—DIAGRAM TO SHOW CLEARANCE POCKET IN PLANED GEAR

tooth profile on one side of the gear has been twisted ahead so as to occupy the former position of the tooth profile of the next tooth. Beyond this amount of twist nothing is gained so far as continuity of action is concerned. The herringbone gear is virtually two helical gears placed alongside each other, one having a right-hand helix and the other a left-hand helix.

In helical or herringbone gears it requires a right-hand helix to mesh with a left-hand helix. Therefore, if the ends of the pinion shaft or the hubs of the gear are not symmetrical, care must be exercised that the apex of the "V" be made in the proper direction. It

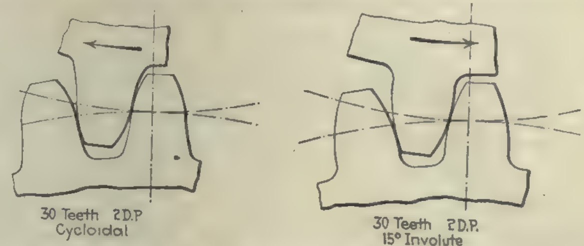


FIG. 2—OUTLINE OF INVOLUTE AND CYCLOIDAL TEETH

is customary to run molded herringbone gears with the apex of the "V" leading. This is not necessary with cut herringbone gears. They will run equally well in both directions but sometimes to prevent sideways splash of oil it is advantageous to run them in the opposite direction.

A knowledge of the different methods of cutting herringbone gears is essential, as that system of cutting or type of gear may then be selected which is the most economical for the case under consideration. Such gears are usually applied in the following cases:

I. Slow speeds and very heavy loads where strength and absence of shocks are of prime importance.
II. Smooth and noiseless operation.
III. Extremely high speeds.
IV. Very high gear ratios.

In the first class are all heavy rolling mill pinions. These may have up to 8 in. circular pitch. The smoother action resulting from the use of these pinions tends greatly to reduce breakage of all the machinery driven through them. The second class comprises nearly all cases of gear drives, such as mill drives, pump drives, mine hoist drives, and machine tool drives. In the latter application they are found to be a great aid in overcoming chatter in the machine. They have thus been applied particularly to planer drives. Spur gears become noisy at pitch speeds of 1,200 ft. per minute and should not be used at pitch speeds greater than 2,000 ft. per minute, if avoidable. The use of herringbone gears will then be found preferable. If a herringbone pinion is desired for the first reduction in connection with a motor, it should never be mounted on the armature shaft, but on an independent shaft connected to the motor through a flexible coupling. The other mounting may cause destructive end whip-

ping of the armature if the load should happen to set up a suitable period of vibration.

The third class consists mainly of turbine drives. High pitch speeds, 3,000 to 5,000 ft. per minute, should not be attempted except with generated gear teeth. The slight inaccuracies due to any other method will render them very noisy and inefficient. Generated herringbone gears have been run at 10,000 ft. per minute. A good oil spray should always be provided at the point where the teeth enter into mesh.

The pitch of herringbone gears may always be made finer than for spur gears for equivalent strength. It is thus possible to obtain smaller pinions, and consequently higher gear ratios. Also, because of the continuous action of such gears, it is possible to use a fewer number of teeth in the pinion. Such pinions have now been made to work successfully with only one tooth.

The preceding classification largely determines the method to be followed in the cutting of the gears. With particular reference to the method of machining the classification will be as shown in the table.

Method of Machining	Type of Gear
A. Planing by templet principle.	1. for slow speed and heavy loads.
	2. for smooth and noiseless operation.
	4. for high gear ratios.
B. Hobbing—Generating.	2. for smooth and noiseless operation.
	3. for high pitch speed.
	4. for high gear ratios.
C. End Milling.	2. for smooth and noiseless operation.
	4. for high gear ratios.
D. Shaping—Generating.	2. for smooth and noiseless operation.
	3. for high pitch speeds.
	4. for high gear ratios.

The different methods with their specific characteristics will now be considered in this order.

Usually all gears having pitches greater than 1 D.P. are planed in gear planers working on the templet principle. Planing is an economical method for removing great quantities of metal. The tools are heavy, rigid, and inexpensive, and need therefore not be used with much consideration for their safety. But as the pitch becomes smaller, about 2.5 in. C.P., the method ceases to be economical.

Planing by Templet Principle

There are generally few limitations to planing, fewer than for any other method. The machines are broadly divided into two classes, those carrying one tool and those carrying two tools. Either class requires a clearance pocket at the center of the face 2 in. to 2.5 in. wide. In order to make the casting equally adaptable for both classes, this pocket should be made as shown in Fig. 1. In case the pinion is made of forge steel the pockets may be drilled as indicated at a, after which the block is chipped out. For the best work this pocket should then be milled so as to leave no sharp corners. A pinion of small pitch diameter and wide face will have its stiffness greatly augmented by the retention of this bridge. But for cast-steel gears or pinions with less than 4 in. C.P. the bridge becomes so thin that it is a source of weakness rather than of strength.

The stock F, left for finishing, should not be less than ½ in. and sometimes as much as ¾ in. to take care of uneven shrinkage of the casting. If the "block" is carried down, as indicated at D, there are apt to be "draws" formed at the root and the sand will burn in, thus making it difficult to clean the casting. It is better, therefore, to "block" as indicated at E, especially

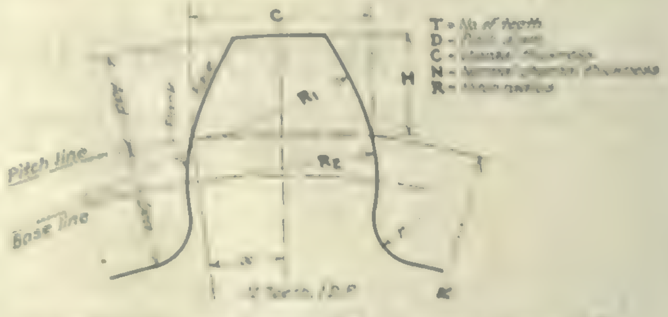


FIG. 3—DIAGRAM FOR CALCULATING CHORDAL THICKNESS

since it will not take any more time for planing. For small pitches the depth B of the pocket is a very bad feature in the mold. The hot steel rising in the mold forms eddies at C, forming blowholes and dirt which seldom become visible until the gear is rough planed. It is well, therefore, simply to blank all gears with pitches up to 4 in. inclusive, and to cut a groove from the solid to a depth of $\frac{3}{16}$ in. below the root of the tooth.

The helix angle should not be less than such that

$$\tan a = \frac{P}{H}$$

as shown in Fig. 1.

But it should, as a rule, not exceed 23 deg., which is the standard for hobbed gears. Any greater helix angle will cause the normal section of the tooth to become rather thin. Mill pinions, due to their hard service, may be thrown out of alignment. The load may therefore at some instant be thrown entirely on one end of the tooth, breaking out that end because of the weakened normal section.

The face of the gear will be found to be from 6 to 10 times the circular pitch. In our practice a 17-deg. helix angle has been adopted as standard for mill drives. For this case the minimum face becomes

$$F_{min.} = 6.541 \times \text{C.P.} + \text{clearance pocket.}$$

Since a slight amount of overlap is desirable it is convenient to use the formula

$$F_{min.}(17\text{ deg.}) = 7 \times \text{C.P.} + \text{Clearance pocket} \quad (1)$$

The 20-deg. involute stub tooth is the most desirable tooth form. But exception may be taken in the case of heavy mill pinions taking an extreme tooth load. By reference to Fig. 2 it is seen that the involute system places two convex surfaces together, while the cycloidal system brings a convex and a concave surface together. Due to the elasticity of the metal, a certain bearing surface will be obtained, and this bearing surface will be much greater for the cycloidal tooth. But in selecting a cycloidal tooth form regard should be had for the fact that cycloidal gears run correctly only at fixed center distances. Their use where bearing wear cannot be kept within reasonable limits may therefore be inadvisable.

The tooth profile and tooth thickness dimensions are required for the pattern and for cutting the gear and should therefore be given fully on the drawing. The former dimensions may be taken from a good odontograph table or may be determined by an actual

layout. In involute gears there can be no action below the base line and the part of the tooth which extends below is ordinarily made with a radial flank. But this method sometimes leaves a tooth which requires a slight additional rounding at the base line to satisfy appearance. It will be found better to continue the flank radius and to draw the radial line tangent to this arc. The tooth should then be joined to the root circle with a fillet radius equal to about $\frac{1}{10}$ of the circular pitch.

In order to calculate the chordal thickness of the tooth it is convenient to consider the gear as having no backlash. Then

$$a = \frac{90}{T}$$

as shown in Fig. 3 and

$$C = D \sin a. \qquad (2)$$

Similarly,

$$H = \text{Addendum} + R(1 - \cos a). \qquad (3)$$

The dimension H is used for the depth of the gage, but the width of the gage must be made to suit the normal tooth section. Disregarding the slight change in curvature on the normal section, we have

$$N = C \times \cos(\text{helix angle}). \qquad (4)$$

The gage being made to this dimension, the amount of backlash will be determined by the shake of the gage. This amount depends entirely upon the degree of accuracy to which the gears are planed. The friction and inertia in indexing large, heavy gears makes it unsafe to rely entirely on the index wheel, as the resulting errors in tooth spacing may be excessive. Consequently, it is well to finish the upper side of the teeth, after which the variation from the true tooth spacing is gaged. In our practice not more than 0.005 in. variation in the spacing is permitted, and several teeth may have to be replaned to come within this limit. Since it is possible that two such teeth will come in mesh the minimum backlash is 0.010 in., and the total backlash may be given as

$$\text{Backlash} = 0.010 + 0.001 \times \text{C.P.} \qquad (5)$$

Hobbing Herringbone Gears

Nearly all the smaller gears used in mill work may be cut by the hobbing process. Hobbing is a very economical method for gears not exceeding 1 D.P., and such gears should therefore preferably be designed with this method in view. The method employs a hob having an axial section similar to that of a rack, and this hob will automatically generate any gear of a similar pitch. Due to the expensive hob equipment, it has been necessary to standardize the tooth elements. We find, therefore, the following standards fairly well adopted:

Tooth form = 20 deg. involute,
Helix angle = 23 deg.,
Pitch = diametral, with 1 D.P. as maximum,

$$\text{Addendum} = \frac{0.8}{\text{D.P.}}, \qquad (6)$$

$$\text{Dedendum} = \frac{1}{\text{D.P.}}, \qquad (7)$$

$$\text{Minimum face about } 6 \times \text{C.P.} \qquad (8)$$

To avoid interference, and partly to give freer cutting action to the hob, the outside diameter for pinions of 17 teeth or less is given a slight increase.

$$\text{Enlargement} = \frac{2(1 - 0.0585\,N)}{\text{D.P.}},$$

$$\text{where } N = \text{number of teeth in pinion.} \qquad (9)$$

Usually the gear blank is reduced a corresponding amount, thus maintaining the correct center distance. Regardless of this change in the blank diameter, the tooth is cut to the standard depth. The gear requires a clearance space in the center of the blank approximately equal to the circular pitch and of a depth slightly greater than the addendum of the tooth. (These standards were published on pages 329 and 589, Vol. 56 of *American Machinist*.)

Hobs are made with single or with multiple threads. If multiple threaded hobs are used, it may be advisable to have a number of teeth in the gear not divisible by the number of threads in the hob. A distorted hob tooth will then not be able to cut continuously in the same tooth space. The resulting tooth spacing will be more uniform and the gear action correspondingly more smooth and noiseless. As an example, a pinion of 13 or 17 teeth will run very well with gears of 101, 103, or 107 teeth.

End Milling and Shaping

End milling, though much used on the continent, has found little favor in this country. The end mill is a small tool, incapable of standing up against heavy cuts, or of carrying the heat incidental to taking such cuts. The maximum pitch which so far is being milled is about 5 in. circular, and the mean diameter of the mill is therefore only 2½ in. The shape of the mill must be made to suit the normal section of the tooth space. Now, this shape varies for every different pitch, and for every different number of teeth in that pitch. It will require a series of 25 end mills of each pitch to get a fairly close approximation to the correct tooth curve.

One outstanding advantage of the end milling process is that it is able to produce a tooth that is seemingly continuous across the face of the gear. There can, however, be no tooth action at the point of reversal of the helix angle and the radius is, therefore, relieved to avoid interference. Another advantage, which must be shared with planed gears, is the ability to retain a shroud on the faces of the pinions.

Shaping by the molding-generating method or by the shaping-generating method is only used for smaller gears. One machine of the former type, not in use in this country, is able to cut a gear having the teeth meet in a sharp apex. Another machine of the latter type is now being used for gears in machine tool construction. These gears are not being built to a universal standard, and will therefore not be covered in this article.

Standard Tooth Proportions

The involute curve has many advantages over any other tooth curve. It may be generated by a rack with straight sides, and this generated tooth curve may also as readily be ground if required. The 20 deg. pressure angle has now been universally adopted for all classes of work. Since hobbing is the standard process for gears up to 1¼ D.P. or 1 D.P., gears of these pitches will have tooth standards as previously given. Gears with pitches greater than these are principally planed, and it is therefore this class which remains to be considered. Since the heavier pitches are always given in terms of circular pitch, the tooth standards should be given on that basis.

$$\frac{0.8}{\text{D.P.}} = 0.2546 \text{ C.P., and } \frac{1}{\text{D.P.}} = 0.3183 \text{ C.P.}$$

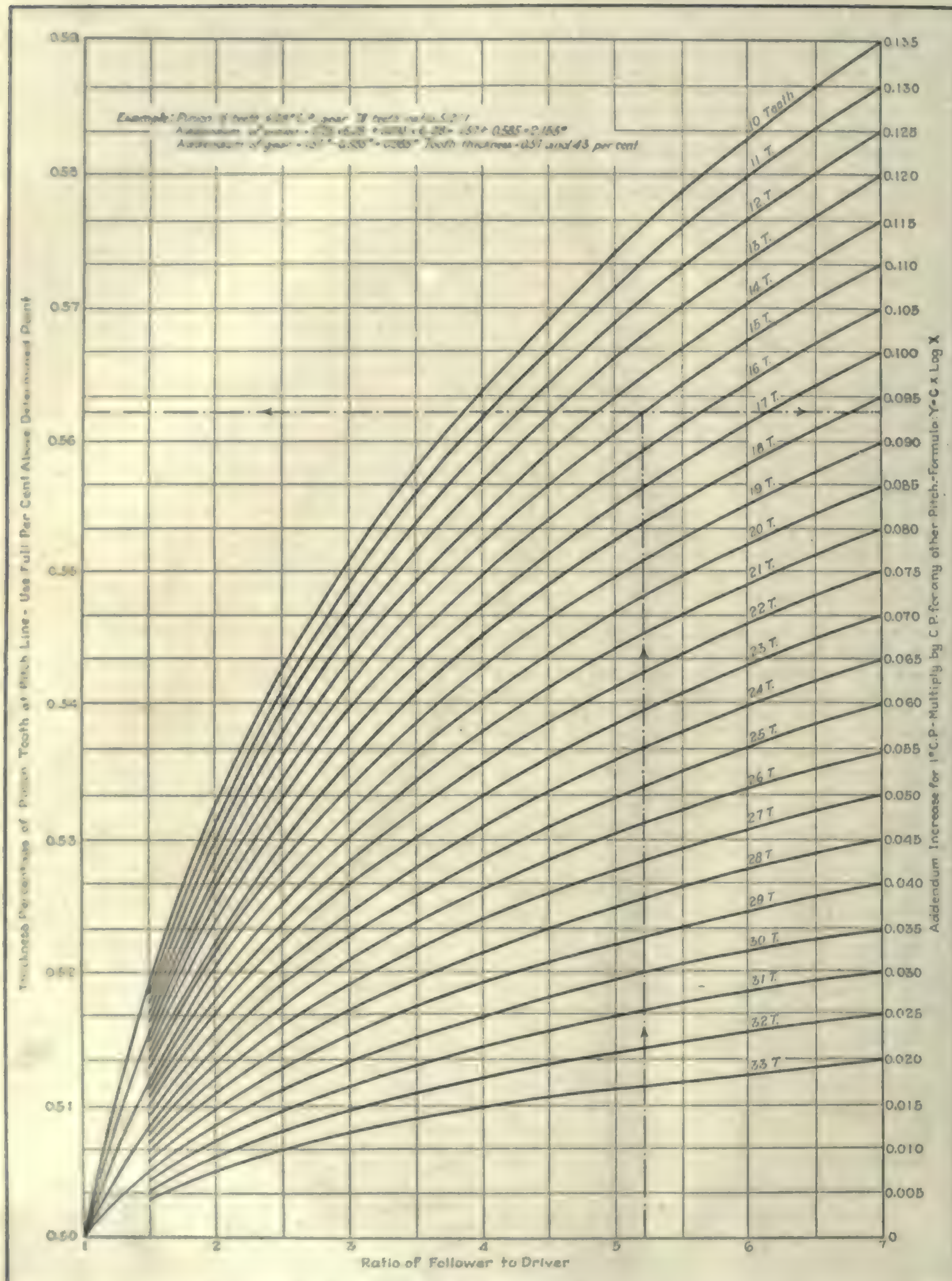


FIG. 4—ADDENDUM INCREMENTS AND TOOTH THICKNESS OF PINIONS

For the sake of simplicity we shall change these to the commonly accepted standards

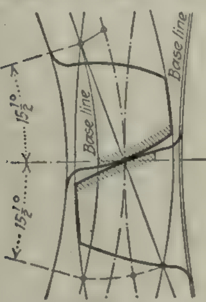
$$\text{Addendum} = 0.25 \text{ C.P.} \qquad (10)$$
$$\text{Dedendum} = 0.30 \text{ C.P.} \qquad (11)$$

In heavy gearing there is no need of an interchangeable system. The freedom from restrictions of the "planing by templet process" should therefore be taken into account. It is well known that the tooth action is more destructive on the arc of approach than on the arc of recess. The remedy is to increase the addendum of the pinion, as was done for hobbed gears. But the method used for hobbed gears if applied to a set of three high mill pinions of 10 and 17 teeth respectively would give very bad tooth action, as the dedendum of the 17 tooth pinion would be entirely too deep. Any system, to be workable, must take account of the number of teeth in the pinion, the gear ratio, the position of the base circles in relation to the action of the gears, and the arc of action. The arc of action should be greater than the circular pitch, preferably about 1¼ C.P. Appearance demands that the tooth thicknesses be made approximately equal on the apparent pitch diameters, and the resulting pinion tooth will be much stronger than would otherwise be the case. The amount which the pinion addendum should be increased is rather arbitrary, but it has a three-fold purpose:

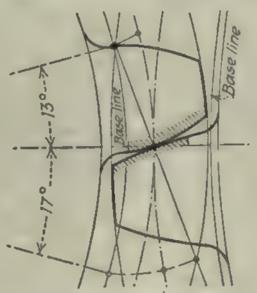
(1) To eliminate undercut of the teeth;

(2) To insure contact along the entire face of the gear addenda;

(3) To reduce the arc of approach and increase the arc of recess.



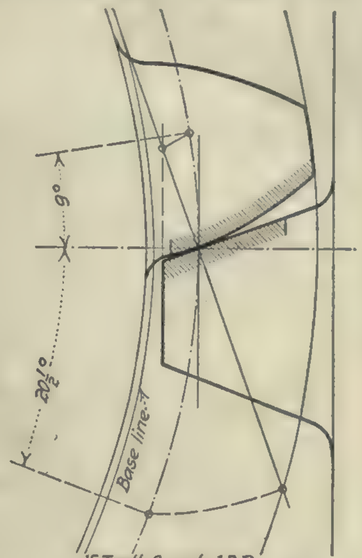
Pitch = 1 D.P. - 20° Involute
Pinion 15 teeth Gear 30 teeth
Add. = 0.785 Add. = 0.785
Ded. = 0.943 Ded. = 0.943
Tooth thickness = 0.50
Arc of action = 1.295 C.P.
FIG. 5



Pitch = 1 D.P. - 20° Involute
Pinion 15 teeth Gear 30 teeth
Add. = 0.785+0.1065 = 0.8919 Add. = 0.785-0.1065 = 0.6789
Ded. = 0.943-0.1065 = 0.8365 Ded. = 0.943+0.1065 = 1.0495
Tooth thickness = 0.53 Tooth thickness = 0.47
Arc of action = 1.23 C.P.
FIG. 6

FIGS. 5 AND 6—ACTIONS OF NORMAL AND MODIFIED TEETH CONTRASTED

As long as the pinion and the gear each have less than 30 teeth the conditions are fulfilled by the first two factors. The gears may therefore be so proportioned that their base circles are equidistant from their respective root circles, and a straight line formula will satisfy the amount of addendum increase. The necessity for the first two conditions disappears, however, as the pinion gets a greater number of teeth. Now, for gear ratios of one to one interchangeability of position is generally required. We find then by trial that the addendum increment is satisfactorily governed by the formula, $y = C \times \log X$, in which y = addendum increment and X = gear ratio. The constant C is determined by trial. Ten teeth may safely be assumed as being the minimum. For hobbed gears the addendum increment would in that case be 0.420 in. for a pitch of 1 D.P., or 0.1337 in. per inch of pitch. For convenience in plotting the curve we will use 0.135 in., making the increment 0.005 in. less for each additional tooth in the pinion. The results are plotted in Fig. 4, which is self-explanatory. A contrasting example is given in Figs. 5 and 6, in which the shaded portions represent the parts acting upon each other. It is seen that the arc of approach has been decreased with a consequent improvement in the relative sliding action. Likewise, the arc of recess has been increased. Due to the small ratio of these gears the improvement is not as noticeable as it would be for a greater gear ratio. A 15-tooth, 1 D.P. piston meshing with a rack is shown in Fig. 7. Here the relative slip has been nearly eliminated on the angle of approach, and the tooth has the stubby profile giving maximum strength.



15 Teeth & rack, 1 D.P.
Add. = 0.7854+0.425 = 1.2104 Add. = 0.785-0.425 = 0.360
Ded. = 0.9430-0.425 = 0.518 Ded. = 0.943+0.425 = 1.368
Tooth thickness = 0.57% & 0.43%
Arc of action = 1.2 C.P.

FIG. 7—MODIFIED RACK AND PINION

The strength of herringbone gears is affected by several conditions which are beyond the control of the designer, and which are dependent mainly on the accuracy of the teeth and the alignment of the gears in operation. There are, however, several other conditions which may be determined to a nicety. The formula for strength of gear teeth according to Lewis is

$$W = S P F Y K,$$

in which W = load, S = safe stress, P = circular pitch, F = face, Y = tooth form constant, and K = speed factor. Evidently S remains unchanged. Likewise, remembering that the rolling action is in the same plane as for a spur gear, P remains unaffected. The tooth load W, acting tangentially to the pitch line, is accompanied by the side thrust T, giving a resultant force N normal to the helix angle. Now,

$N = \dfrac{W}{\cos a.}$, and the gear face measured along the helix $= \dfrac{h}{\cos a.}$

Therefore, the load per inch of face $= \dfrac{W}{\cos a.} \div \dfrac{h}{\cos a.}, = \dfrac{W}{h}$, which shows that the face F is also unaffected. (See Fig. 8.)

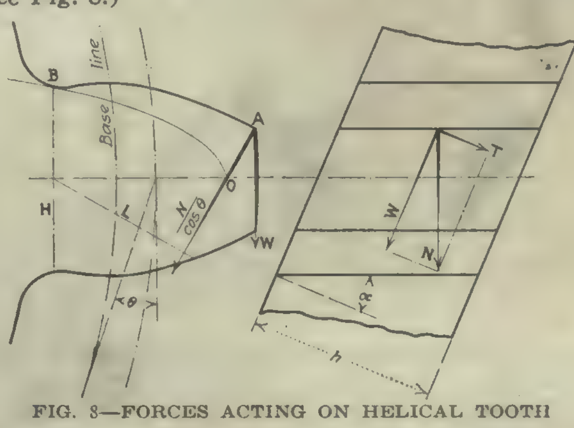
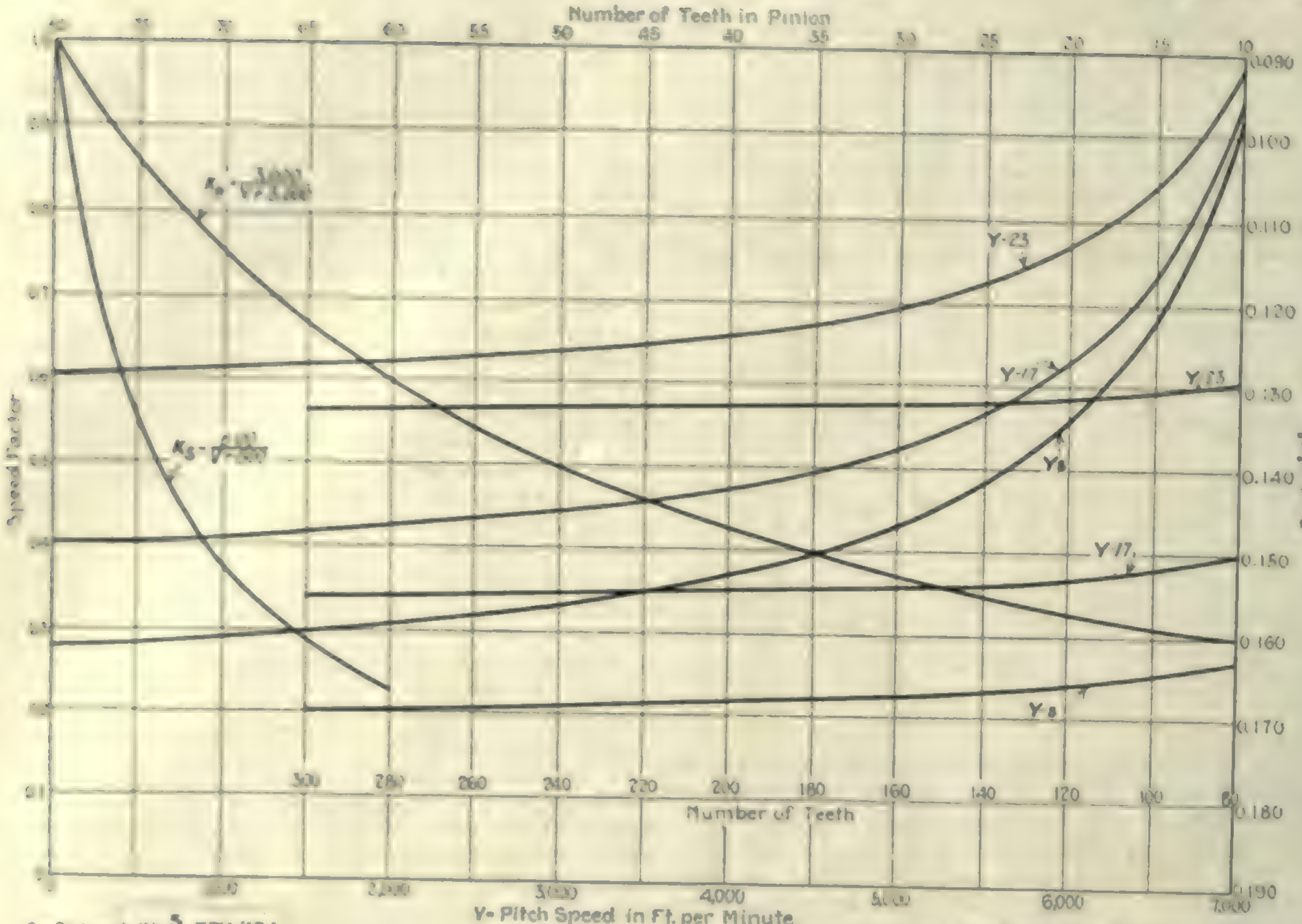


FIG. 8—FORCES ACTING ON HELICAL TOOTH



Safe load $W = \frac{S}{2}$ PFY KOI
S - Safe stress at no speed - see table
P - Circular pitch
F - Total overall face of gear in inches
Ys - Tooth factor for spur gear
Y17 - Tooth factor for 17 deg. herringbone gears
Y23 - Tooth factor for 25 deg. herringbone gears
K_s - Speed factor for spur gears
K_h - Speed factor for herringbone gears
O - Lubricant factor
1.0 for well oiled gears
0.6 to 0.8 for grease lubrication
I - Addendum increment factor - see S-197
= (2 x tooth thickness percentage)^2 thus $(2 \times .56)^2 = 1.254$
Example: Pin 15 T - 4" P - 30" F. - 17 deg. helix - 50 C. F. St. - 1830 Ft. per min. - gear 93 T
$W = 12,500 \times 4 \times 30 \times 0.1165 \times 0.62 \times 1 \times 1.142 = 140,000$ lb., $\frac{140,000 \times 1830}{33,000} = 7,750$ hp.

VALUES OF S

METAL	S	ULT. T. ST.
Nickel steel heat treated	30,000	120,000
Forge " 50 C	25,000	100,000
Forge " 30 C	20,000	80,000
Cast " 50 C	20,000	80,000
Cast " 40 C	17,500	70,000
Cast " 30 C	15,000	60,000
Cast iron	10,000	32,000
Cast "	8,000	24,000
Bronze 88-10-2	8,000	30,000
Rawhide	5,000	
Fabric	5,000	

FIG. 9—STRENGTH OF CUT SPUR AND HERRINGBONE GEARS

The speed factor K depends entirely on the accuracy of the teeth. If we assume that spur gears become noisy at 1,200 ft. per minute, ordinary planed or end milled gears at 3,000 ft. per minute, and closely generated gears at 6,000 ft. per minute, we may further assume that the constant K is identical for these cases. We have then,

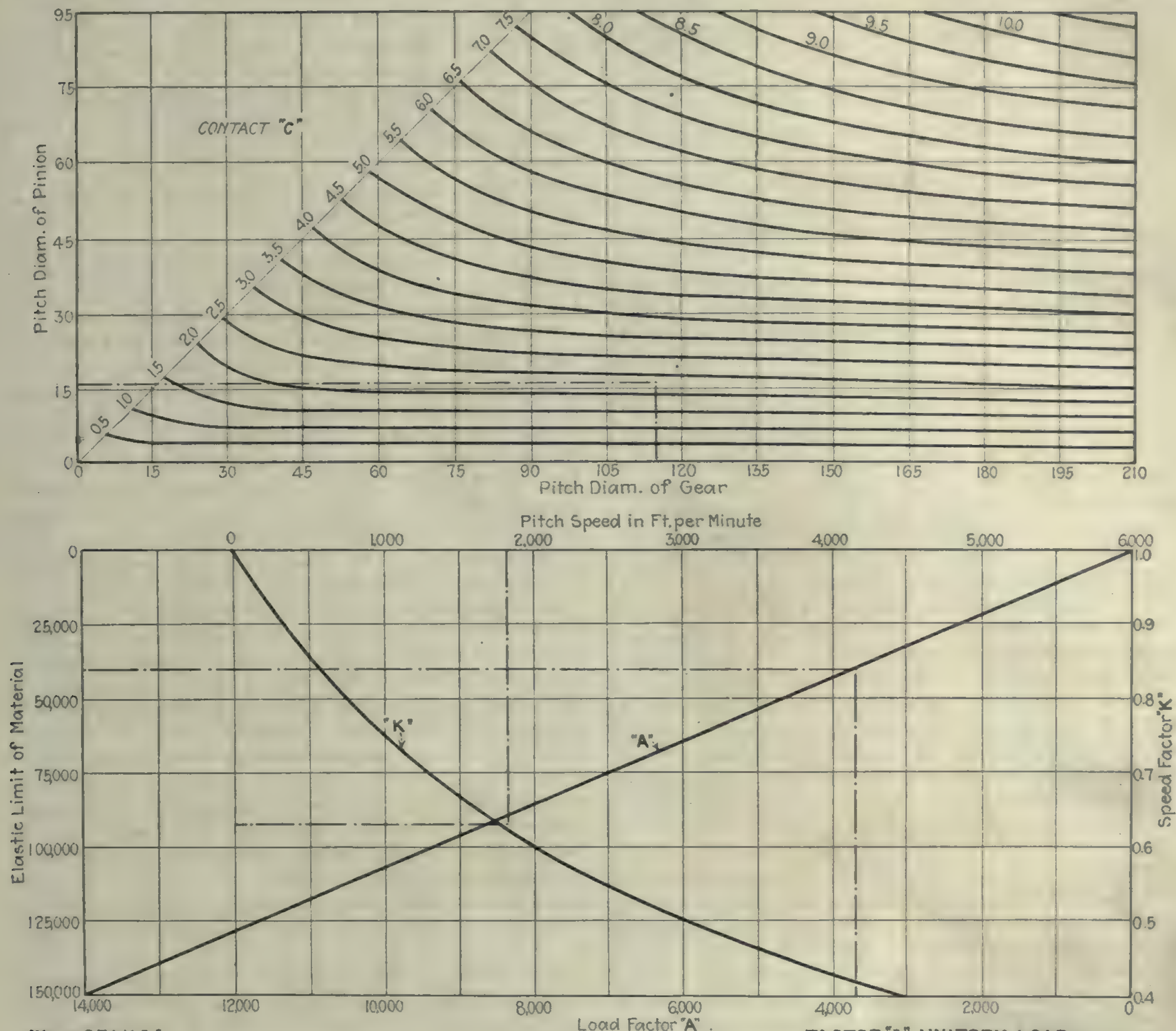
$$K_s = \frac{600}{V + 600} \text{ for spur gears;}$$

$$K_l = \frac{1,500}{V + 1,500} \text{ for ordinary planed or end milled gears;}$$

$$K_g = \frac{3,000}{V + 3,000} \text{ for closely generated herringbone gears.}$$

Now, by painstaking methods, gears may be planed so accurately as regards tooth spacing, true involute, and helix angle that they will show full bearing when run together. For such gears the constant Kg may well be used to the limit of about 8,500 ft. per minute.

The values for the constant Y are not readily solved. In the Lewis method for spur gear teeth it is assumed that a force $\frac{W}{\cos \theta}$, passes through the outer edge of the tooth. Commonly this assumption is incorrect for herringbone gears, in which the load is always concentrated nearer to the pitch line. Observation shows that the wear is usually greatest from the pitch line and out towards the end of the tooth. If we therefore assume that the maximum load occurs at a point half way out the face of the tooth, we shall have shortened the arm L, Fig. 8, about 25 per cent. But the loss of tooth due to the clearance groove is about 17 per cent, leaving 8 per cent still to be considered. The danger from misalignment is a very uncertain element, and is, of course, greater because of the greater ratio of face to pitch. On the other hand, such gears usually receive



Wc - CFAKOI
Wc - Safe load for wear or crushing
C - Contact factor from curve
F - Active face of gear
A - Load factor from curve
K - Speed factor from curve
O - Lubrication factor 1.0 for gears running in oil
0.8-0.62 for grease Lubrication
I - Service factor 1.0 for 10 hrs. per day for 2 years
and from table for other periods
Example: Pin. 15 T.-4" P.-30" F. 50 C.-F.S.-1830 ft./min.
el. limit = 40.000 - service 1 Yr. cont.-gear 93 T.
Wc - 2.8 x 27.5 x 3.700 x 0.625 x 1 x 0.75 = 134.000 lb.

FACTOR "I" UNIFORM LOAD

SERVICE	CONTINUOUS	10 HRS. DAILY	5 HRS. DAILY
3 Months	3.00	8.00	18.00
6 "	1.50	4.00	9.00
9 "	1.00	2.67	6.00
1 Year	0.75	2.00	4.50
2 "	0.38	1.00	2.25
3 "	0.25	0.67	1.50
4 "	0.19	0.50	1.13
5 "	0.15	0.40	0.90
6 "	0.13	0.33	0.75
7 "	0.11	0.29	0.65
8 "	0.10	0.25	0.56
9 "	0.09	0.22	0.50
10 "	0.08	0.20	0.45

FIG. 10—WEAR OF SPUR AND HERRINGBONE GEARS. CLASSIFICATION OF GEAR CUTTING METHODS

better attention. If we therefore charge the remaining 8 per cent to this factor we shall have simplified the calculations in that the face is to be taken as the total overall face. The layouts for Y will therefore be made by the method previously mentioned. But since the forces are acting normal to the tooth it will be necessary to use the normal tooth section for the determinations. Using the formulas developed by A. B. Cox on page 104, Vol. 56 of *American Machinist*, we find that the pitch diameter for the normal section $= D \sec^2 \alpha$. The tooth thickness $= 0.5 \cos \alpha$, and the pressure angle is altered so that

$$\tan \theta = \frac{\tan \theta'}{\sec \alpha}.$$

The force $\frac{N}{\cos \theta}$ is drawn normal to the involute at A, and the parabola constructed from O tangent to the tooth flank indicates B as the point of weakness. The moment tending to break the tooth is therefore $\frac{NL}{\cos \theta}$ with the section along line H resisting breakage. Sub-

stituting for N the values corresponding to W in the Lewis formula we have

$$Y = \frac{W' \cos \alpha}{6\ PL}.$$

For $\alpha = O$, that is for spur gears, $Y = 0.172 - \frac{0.76}{N}$

for $\alpha = 17$ deg., $Y = 0.158 - \frac{0.62}{N}$

and for $\alpha = 23$ deg., $Y = 0.135 - \frac{0.44}{N}$.

These values have been plotted in Fig. 9, which gives all the necessary data for the calculations.

The formula for the safe load on herringbone gears is then:

$$W = \frac{S}{2}\ P F Y K O I \qquad (12)$$

The factor I in the formula is based on the fact that the strength of the tooth varies as the square of the thickness along the line of weakness. The addendum increment has, however, a disturbing influence which renders it very difficult to establish a correct factor for all different ratios. But within the limits of Fig. 4, that is 33 teeth, the factor is practically correct. Any error is in all cases on the safe side. It might be thought that the teeth in the gear meshing with a pinion would have its strength impaired at the same rate. But this is not the case as the decrease of addendum more than balances the loss of tooth thickness. It is sufficient therefore to consider I only for pinions having up to 33 teeth. The gain in tooth strength may be as high as 30 per cent, depending on the number of teeth in the pinion and the gear ratio.

Wear of Herringbone Gears

If gears were designed for strength alone they would soon fail from abrasion. Accordingly the safe stress S has been halved. The result will very closely approximate any formula based on wear. The factor O, in formula 12, although not affecting the strength of the teeth, is of great importance when wear is considered. For most cases it is sufficient to calculate the gears from formula 12. But if we want to be more careful, we shall have to approach the subject from an entirely different angle.

Herringbone gears, having correct involute curves, will bear along diagonal lines across the tooth. These lines will travel across the tooth from one end to the other. If the helix angle is such as to advance one tooth there will be one diagonal line passing clear across the tooth. If the advance of the helix angle is in multiples of one tooth there will be a corresponding series of shorter lines. But the total length of bearing line is the same in each case and will not vary much in extent from the straight bearing line of a spur gear.

Should the gear not have true involute teeth the bearing lines would be very much shortened, giving bearing close to the pitch line only. The consequent bearing pressure will then be great enough to crush the material and the result is a deep groove along the pitch line on both gear and pinion. Such conditions may be partly relieved by "running in" under light load. But the amount of "running in" should be moderate. If the gears do not show a fair bearing across the teeth after a few hours run it is due to the helix angles not meshing properly. Any great amount of "running in" tends to destroy the proper tooth profile and is therefore harmful. The object of "running in" should be only to take away toolmarks and waves transmitted from the gearing in the machine so as to eliminate all local bearing surfaces.

In our discussion for wear we shall therefore consider that the tooth is made practically perfect. Since the only point having true rolling action is at the pitch line, it will be the place of greatest tooth load. All other points will be partly relieved through abrasion. Wear takes place principally when surfaces are loaded beyond a certain amount, and, as the unit load depends largely on the curvature of the two tooth curves bearing on each other, we shall have to consider this curvature as well as the elasticity of the metals.

The subject of contact has been well treated by C. H. Logue in the "American Machinist Gear Book" for 14½-deg. spur gears. With a few modifications the same data is applicable to herringbone gears. The writer has therefore taken the liberty of altering these curves to suit the 20-deg. involute herringbone gear, as shown in Fig. 10. The contact C has been calculated for 20 deg. involute curves, the radius of the curvature being taken as 0.5 D sin 20 deg. Since herringbone gears nearly always run in oil the value of A has been increased 50 per cent so as to make the lubrication factor unity in such cases. Also, the curve for A has been based on the elasticity rather than the hardness of the metal. The curves for the relative hardness of gear and pinion have been left out. The normal run of gears used in mill work do not receive any heat treatment after they are cut. The gears may be made from 30 to 40 carbon cast steel and the pinions from 50 to 60 carbon forged steel. This is about as hard as it is practical to make such pinions, and they will consequently wear much faster than the gears. But being the cheaper part to replace, and as spare pinions are usually kept on hand, this is entirely satisfactory.

The formula will then be written as shown in Fig. 10,

$$Wc = C\ F A K O I \qquad (13)$$

The notations and explanations may all be obtained from the figure. The example there given is the same as was used in Fig. 9 for the strength calculations. It will be noticed that the agreement is fairly close. We shall have to accept the values of the service factor I until better experimental data is obtained.

Conclusion

The technical press has recently shown an intense interest in gears of all kinds. But much is yet to be learned, especially of herringbone gears. Where, in earlier days, such gears were made to ample dimensions, greater competition and efficiency will now demand a much smaller gear for the same capacity, and this can only be done with great attention to details. The user of machine cut herringbone gears should therefore assure himself of obtaining gears having a minimum error in tooth spacing, a minimum backlash, a tooth profile as true to the theoretical curve as it can practically be made, a tooth bearing clear across the face of the gear without excessive grinding together, a tooth bearing which is not only localized at the pitch line, but extends well out along the tooth profile. And, having such gears, he should see that they receive proper attention, that the lubricant is of sufficient body to carry the load without being sticky or gummy, that the shafts are kept in proper alignment and the bearings well adjusted. Good gears may be ruined in a short time by lack of attention to these details.

Hot Galvanizing

Methods Employed—Design and Construction of the Plant with Suggested Layout—Selection and Care of Equipment

BY CLAUDE O. KELL

EXPOSURE of iron and steel to the atmosphere without protection invariably causes corrosion. By coating these metals, protection can be given in two general ways, non-metallic and metallic. The non-metallic method consists in covering the material with some organic matter, such as paint, varnish or oil. In the metallic method of plating, the iron or steel is covered with some other metal, usually zinc or tin.

Galvanizing is the trade name of coating metals, most commonly steel and iron, with zinc. Three methods of accomplishing this are, (1) electroplating; (2) sherardizing or dry galvanizing; and (3) hot galvanizing. The last of these methods is the one here treated in detail.

The method of hot galvanizing can best be divided into the following operations: cleaning, fluxing, and dipping or galvanizing.

Before either iron or steel can receive an adherent coat of zinc, the article must be absolutely clean and free from all sand, rust, paint, or other foreign matter. This cleaning process may be accomplished either by tumbling, sand blasting, burning, or pickling, that is, by treatment with acids.

CLEANING BY TUMBLING

Malleable castings and small forgings can be freed from sand and scale by the wet or the dry tumbling process. In wet rolling, a tumbling barrel is packed with the material to be cleaned, sand, water, and a small amount of either muriatic or sulphuric acid. In the dry rolling process, the barrel is packed alternately with the articles to be cleaned and small cast shapes known as "shot." Great precaution must be taken in packing the barrel that too much space is not left empty, thus allowing excessive play within the barrel. This may result in fracture to fragile castings. Tumbling has the great advantage of producing a smooth, polished surface on articles and at the same time removing sand from sand pits or castings, or scale from forgings. This polished surface cannot be obtained by pickling in acids. Although the tumbling barrel is a very highly desirable part of the equipment of a galvanizing plant, it is not altogether necessary because cleaning can be done satisfactorily by pickling in acid and by sand blasting.

Sand blasting is a very efficient but comparatively slow method of cleaning sand from castings or slight scale and rust from forgings and plate work. A very cheaply constructed, but efficient sand blast, consists of a piece of ½-in. steel pipe about 12 in. long with a T-connection at one end. One lead is taken to a source of air of about 75 to 100 lb. pressure, while the other is connected to a container of fine sand. Sand blasting produces a polished and smooth clean surface, but has the disadvantage of being expensive, due to labor cost.

Paint is easily removed by burning it off either with a torch or in a furnace. In either case care must be taken not to subject the material to temperatures that will change its chemical and physical properties.

Pickling, which is the treatment of material with acid, is the most common method of cleaning material in small plants. Sand is readily removed by a warm, weak solution of hydrofluoric acid, about one part acid and twenty parts water by volume. There is a danger involved in the use of hydrofluoric acid, however, in the formation of the silicate of the acid. This is a very poisonous gas, but it can be guarded against by suitable equipment and ample ventilation of the plant.

CLEANING BY PICKLING

Material is most commonly pickled in sulphuric acid. A solution of one part acid and twenty parts water by weight is strong enough. The solution will be more effective if heated to a temperature of about 150 deg. F. and kept agitated. This can be done easily by a blast of air from the bottom of the tank along its length. A lead pipe, 1 in. in diameter, with holes ⅛ in. in diameter drilled on 1-in. centers is suitable for such a blast in a tank of about 500 gal. capacity. Muriatic acid may be used for pickling but it is not preferred since it is not as cheap as sulphuric acid. If the pickling solution is not heated and is not agitated, a stronger solution will be necessary to accomplish results. In the interest of economy and to prevent pitting of the metal by a stronger solution, the weaker is recommended.

To prevent over-pickling of the less corroded parts, it may be necessary to remove the heavier rust and scale with a scraper. The length of time necessary for for pickling is, of course, dependent upon the condition of the material and is best governed by experience. Overpickling must be guarded against. Seams and pits in the material are indications of this. Upon removal from the sulphuric acid bath, the material should not be exposed to the air, but should be washed in fresh water preparatory to entering the muriatic bath for fluxing.

FLUXING AND GALVANIZING

Fluxing is the treatment of material in a weak solution of muriatic acid after it has been cleaned. The chloride salt which remains on the iron after it has dried, upon removal from the muriatic acid bath, acts as a very efficient flux. The consistency of one part commercial muriatic acid and fifteen parts water by weight is recommended for fluxing. To heat this mixture produces a very nauseating gas, and the advantage gained by heating is not considered great enough to warrant this disadvantage. If work is thoroughly cleaned, treatment for four hours in the muriatic acid bath is considered ample. After the material is dry it should not remain in the atmosphere long before dipping as this will allow a slight coating of rust to form.

Before material can be dipped into the zinc bath, it must be thoroughly dried, after being removed from the muriatic bath. Drying can best be done on a hot plate, heated either by gas or by a coke fire. It is not necessary to keep this plate at a high temperature,

about 200 deg. F. being sufficient. In small plants where a drying plate or oven is not available, the plates over the fire boxes around the kettle serve very well.

The temperature of zinc is a great factor in the success and effectiveness of the coating obtained. The melting point of pure spelter is 419 deg. C., or 786 deg. F. (Smithsonian Physical Tables, 1916). For galvanizing small work handled in baskets, such as small stampings and castings, the temperature should be higher, say, about 90 deg. F.; while for plate work the zinc should be about 950 deg. F. The temperature of the zinc should be recorded constantly and this can be done best by a pyrometer fitted with base metal thermocouples.

Before an article is dipped, the surface of the zinc should be cleaned with a scraper and covered with gray salammoniac, which acts as a flux. Gray salammoniac is preferred to white salammoniac, since it is cheaper and does not vaporize as readily. A few drops of glycerine will make the salammoniac adhere as a mass on the surface of the zinc. In dipping, pass the article through the salammoniac slowly, until it is entirely submerged. This operation must be done slowly, to prevent sputtering of the zinc which might injure the workmen. Allow the article to remain in the zinc entirely submerged until it has reached the temperature of the zinc, which is indicated by the ceasing of the bubbling action. Withdraw the article slowly through the salammoniac and examine it to see that every part of the surface is coated. If not, apply salammoniac freely to those parts not covered and lower again into the zinc. Examine again before preparing to withdraw the article finally. Before hoisting the article from the zinc for the last time, brush the salammoniac clear, leaving a clean surface on the zinc. Allow all surplus metal to drip into the kettle.

Large castings can be cooled by dipping in warm water covered with oil. Small castings should not be dipped into water to cool, but allowed to cool in the air as dipping these in water may cause cracking. Plate work should be sprinkled with water and allowed to cool in air. This produces the spangled appearance of such pieces.

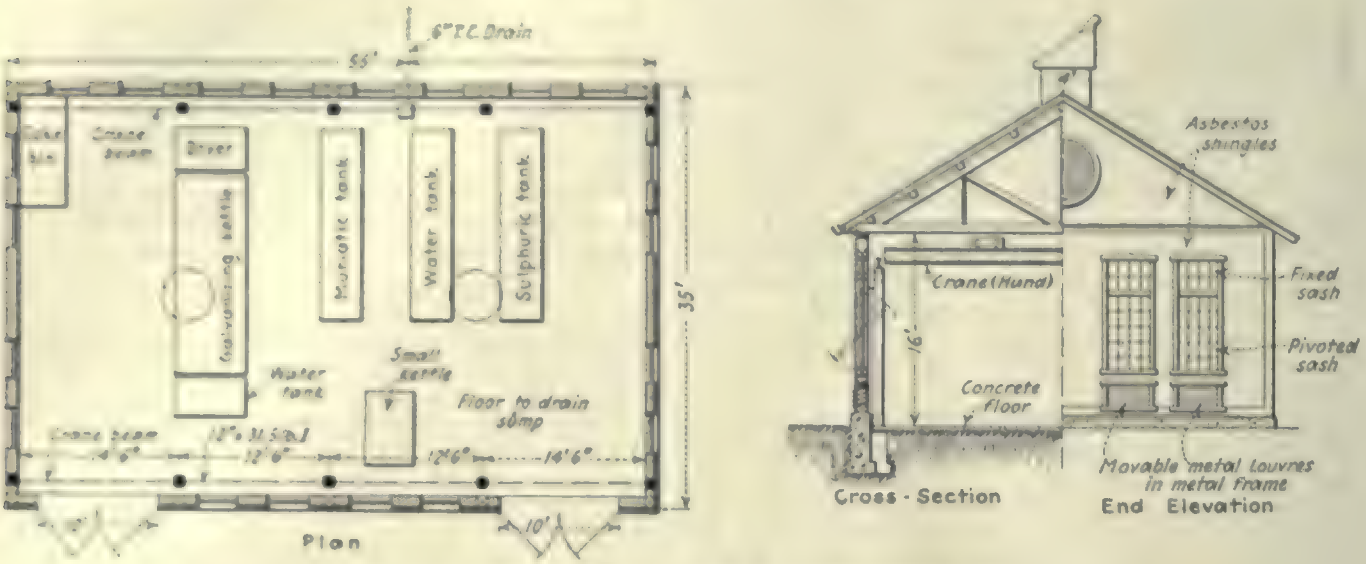


FIG. 1—PLAN AND ELEVATION OF GALVANIZING PLANT

The quality of work in galvanizing is governed to a large extent by the purity of the zinc. The kettle must always be kept free from dross, which is a compound formed by iron and its impurities passing into solution with the zinc. Sources of dross are mill scale on material galvanized and the iron from the kettle itself. For this reason it is most important that the kettle be constructed with suitable material.

Plant Construction and Equipment

It is most important that the building in which a galvanizing plant is housed, be designed to give a maximum amount of ventilation, in order to insure the expulsion of all fumes arising from pickling tanks and the kettle.

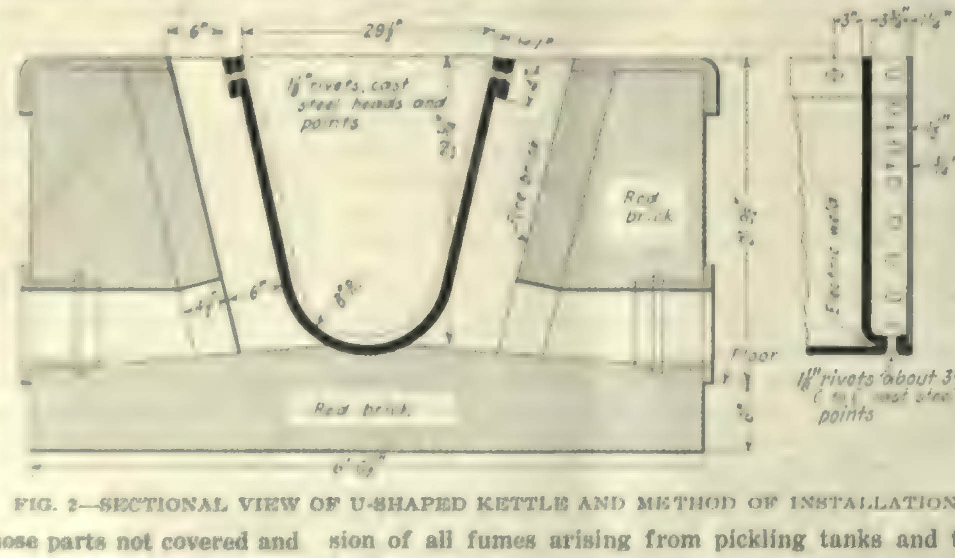


FIG. 2—SECTIONAL VIEW OF U-SHAPED KETTLE AND METHOD OF INSTALLATION

In Fig. 1 is shown the plan and elevation in section of a building designed to house a plant of about 3 tons per day capacity. The long windows are spaced closely together and are pivoted, enabling them to be opened

wide. Below the windows are louvres which act to create a draft upward through the ventilators when weather conditions make it necessary to keep the large windows closed. Natural ventilation is preferable because a forced draft blower is liable to act to keep the fumes low within the plant. Hoods may be designed to cover the pickling tanks and kettle but these have the disadvantage of interfering with work. A concrete floor is desirable because it is not materially affected by acids and can be cleaned readily. The plan view gives the logical layout of tanks and kettle designed to minimize transportation within the plant and should be rolled from a single plate. Riveted joints except at the ends should be avoided. To facilitate drossing the kettle and to prevent the dross adhering to the bottom of the kettle, it is good practice to keep about 8 to 10 in. of lead in the bottom of the kettle.

The life of a kettle depends to a great extent upon the care in firing. Precaution should be taken not to allow the zinc to solidify and to prevent excessive temperatures with the danger of burning the kettle. This can be done with little attention by using oil or gas fuel. If coke is used, uniformly clean fires about 6 in. thick and in depth equal to the height of the zinc in

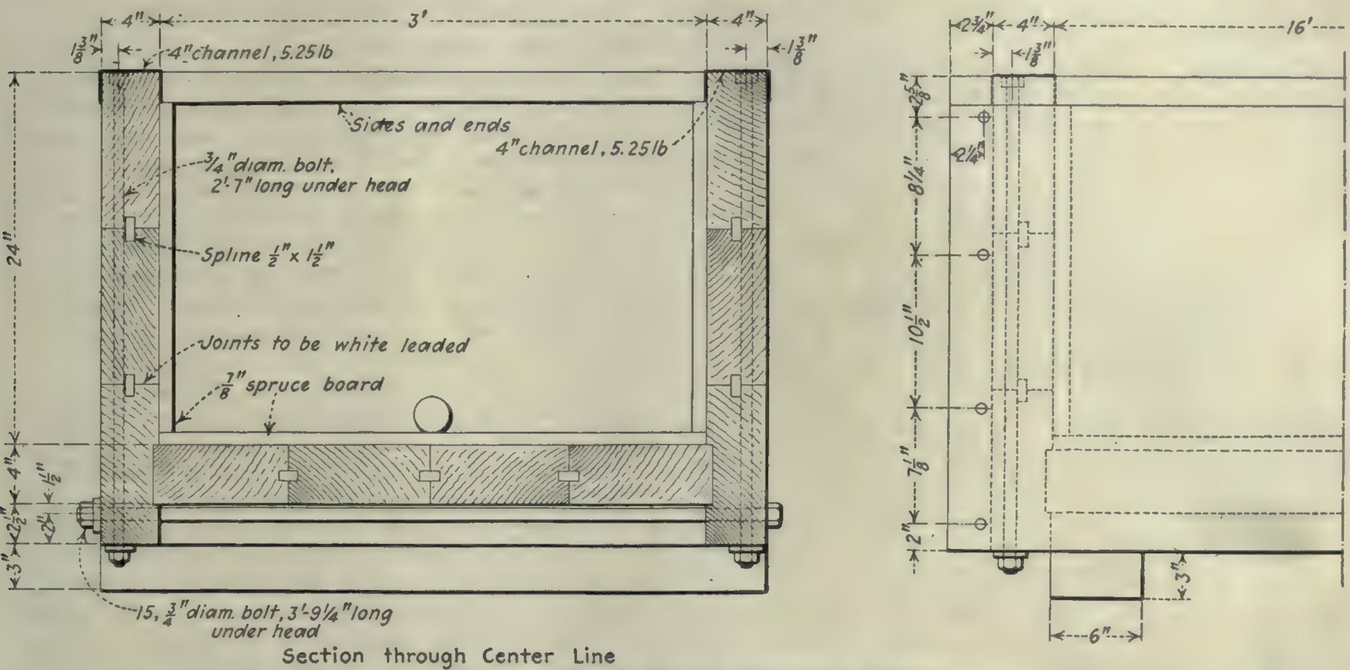


FIG. 3—DESIGN DETAILS OF PICKLING TANKS

facilitate handling of materials. For transportation an overhead traveling air hoist is most satisfactory where compressed air is available foı power. This type has two advantages, viz., its atmospheric exhaust works no hardship upon operators; and its ruggedness minimizes repair and upkeep costs.

To determine the most satisfactory grade of iron with which to manufacture galvanizing kettles, extensive experiments have been made. These have shown, conclusively, that the resistant qualities of iron to the molten zinc are nearly in proportion to the degree of purity of the iron. Carbon and nickel, as impurities, particularly, should be avoided. Specifications for a satisfactory iron should allow no greater percentages of impurities than the following:

Carbon	0.12 of 1 per cent or less
Manganese	0.2 of 1 per cent or less
Phosphorus	0.01 of 1 per cent or less
Nickel	None.

The U-shaped kettle as illustrated in Fig. 2 in section is the most satisfactory design. This design has advantages over the rectangular shaped kettle in that it permits a more even heat distribution through the volume of zinc and is more easily drossed and kept clean. In the rectangular kettle dross collects and remains in corners and along the edges. This causes overheating in these parts and thereby accelerates the destruction of the kettle by burning. Plate at least 1 in. thick should be used, and if possible the kettle the kettle, should be kept. Large coke is best since this gives a greater percentage of voids which allows better circulation of air throughout the fire.

In firing a new kettle, it is of greatest importance that the operation be slow and that no part of the kettle be subjected to concentrated heat. Before lighting the fires, the kettle should be packed carefully with enough ordinary pig lead which, when melted, will have a depth of at least 8 in. On top of this, slab spelter should be packed making sure that all of the surface of the kettle is in contact with the zinc. When possible, it is well to pour melted zinc down the sides of the kettle to insure its surface being covered. No less than forty-eight hours should be required to melt down a kettle of zinc and bring it up to temperature ready for use. It is believed to be economical to use only first-class virgin spelter marketed by a reliable firm rather than use the remelt spelter which may be obtained at a much lower price. In the latter case it has been found that a great percentage of the spelter is lost as dross.

Details of design of suitable pickling tanks are shown in Fig. 3. Either long leaf pine or spruce are preferred as material with which to build them, in view of economy and the resistant qualities of the woods to acids. The edges of the tanks should be protected by inverted channel bars as shown. To protect the bottom and sides of the tank against cutting and pricking by plate edges, a thin lining of spruce should be used. This can be easily and cheaply renewed and prolongs the life of a tank greatly.

P. A.—Discussion

By C. J. Morrison

The remarks of Charles W. Lee on page 337 regarding purchasing agents are very much to the point and treat an important subject—one so important in fact that more should be said until a large number of purchasing agents are reformed.

In too many cases the thought seems to be that any dub can do the purchasing, and totally incompetent and inexperienced men are made purchasing agents. Before being made purchasing agent, a man should have at least some experience in both manufacturing and selling, and the broader the experience, the better will he fill the position.

This thing of keeping salesmen waiting for long periods, of haggling over prices, of knocking the firms they represent, and of generally treating them as something different from human beings is not only all wrong, but is costing an awful lot of money. Purchasing agents and salesmen should be good friends and work together for their mutual interest. That this is possible is illustrated by a number of cases, but particularly by the purchasing agent of a very large concern which, in fact, is the largest of its kind in the world.

This man has a large corps of assistants, but they handle the details and he personally sees every salesman who calls. Moreover, he tries to keep no one waiting for more than a few minutes and if there is to be an unavoidable delay, he goes out to the salesman, tells him the probable length of time before he can be seen, and either gives him a definite appointment or allows him to wait, just as the salesman may elect.

Rules for the Purchasing Agent

A very successful general manager wrote instructions for a man he had just promoted to purchasing agent, and the ones which apply to business in general are given below:

See every salesman who calls.

Treat a salesman as courteously as you would a customer.

Do not keep a salesman waiting. If a delay is unavoidable, go out to him and offer a definite appointment.

Tell no salesman from whom you are purchasing.

Tell no salesman the prices you are paying.

Be truthful to the salesmen.

Do no haggling over prices and do not tell a salesman at what price you will buy. It is the salesman's duty to name his price. We do not buy from a house that names a price and then lowers it to make a sale. Our competitors might buy from the same house at a still lower price.

Do no knocking. If you are not satisfied with the service or merchandise of any concern, tell the salesman of that concern, in a courteous manner, the trouble. Talk to no salesman about any company except his own and yours and be sure to advertise your company.

Study the markets, the political situation, the financial conditions, and the agricultural prospects—all of these for both this country and abroad. Your department is supplied with the best trade and technical journals, with a daily financial and a daily market report paper, and with one of the leading newspapers and you are supposed to study them.

On a falling market, buy only enough at a time to keep the plant running and allow the stock on hand to fall to a minimum, but on a rising market buy in large quantities and increase the stock to the maximum. Never be in a hurry to buy. Few buy actually at the bottom and it is far safer to buy a few points above the bottom, when prices have turned definitely upward, than to buy at what you think is the bottom only to find that prices are still falling.

Study the scrap and spoilage reports from the plant, and if they are rising above normal, find out whether or not the fault lies with something you are purchasing.

Make frequent trips through the plant so as to familiarize yourself with the uses made of the things you purchase. Perhaps you can suggest some change to reduce costs, but no change should be made until after the factory manager has been consulted and the consent of the general manager secured.

Be sure that prices, discounts, terms, quantities, delivery dates, f.o.b. point, etc., are clearly stated.

Specifications are provided for nearly all of the regular items that you purchase and with each purchase order should be included the specifications for the items on that order. When specifications are not provided, be sure that the goods ordered are so specifically described that no misunderstanding can arise.

A Case of Expensive Ignorance

These paragraphs from the instructions apply to almost any business and this would make a good place to stop, but I feel inclined to tell a personal experience which illustrates the ignorance of some purchasing agents and also shows that the management does not always do its part. Some time ago our salesmen who were calling on a company to whom we were anxious to sell reported that the purchasing agent could not be seen as he seemed to have duties more important than interviewing salesmen and that the assistant to whom they were referred was "impossible," so I decided to make a call.

Although my card was sent to the purchasing agent it was the office of the assistant to which I was admitted. After delivering a long talk on prices and trying to impress me with the idea that he always bought at a lower price than anyone else, the assistant consented to allow me to tell him what I had to sell. He then told me what I already knew, that they made the article themselves. I explained to him that the manufacture of this article was entirely foreign to their regular work, and this fact, combined with the fact that they made the article only in small quantities, would make the cost higher than our selling price, as the article was a specialty with us and was made in very large quantities on special patented machines of our own design which were far more efficient than any machine they could purchase. Moreover, the fabrication of this article gave a very large waste of raw material for which they had no use, while we used it for other purposes. As this sounded reasonable, he consented to receive a quotation and I asked for specifications, to which he replied, "We have no specifications, but I will give you samples."

He sent for samples, and after receiving them I said, "Now if you will tell me the limits, you will receive a rock bottom quotation in the morning's mail."

He replied, "We have no limits. Your goods must be exactly like the sample, without any variation whatever." When I tried to explain, he said, "Limits would have nothing to do with the costs. If you cannot make the article, say so, while if you can, submit a price; but remember that your articles must be exact duplicates of the sample or they will not be accepted."

As argument availed nothing, I left and the next day submitted a very low price for the article "to be made similar to sample within the usual commercial limits for this article which are —," giving the limits we used for other customers. We did not get the order and, as far as I know, that company is still making the article at a much higher price than it could be purchased because no one will make it for them "exactly like sample." I wonder how many others are in the same boat.

Methods of Machine Tool Design

Fourth Installment of Section on Feed Mechanisms—Rack Feeds and Their Limitations Cam Feeds—Intermittent and Uniform Motion Cams

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

FEW REMARKS need to be made about the main elements of a rack feed mechanism. As a rule, a rack feed is not used where accurate distances must be obtained. A high degree of accuracy would not be obtainable with racks and pinions as ordinarily made in the machine shop. Nevertheless, there are cases where it is desirable to lay off distances by means of rack and pinion. In such cases one should make the pinion with circular and not with diametral pitch so as to be able to say that one revolution of the pinion corresponds to four, five, six inches, or whatever it may be. As a rule, a rack feed is not used for the heaviest kind of work so that the very heavy pitches need not be used. If the work is moderately heavy, the rack should be fastened to the frame of the machine by screws and heavy dowels, or preferably by screws and cross keys.

LARGE REDUCTION ADVISABLE

One should keep in mind, when designing a rack feed, that the rod or shaft which comes from the driving end and goes to the rack feed mechanism should run at relatively high speed; that is, it should make a great many revolutions for one revolution of the pinion. There are two reasons why this is necessary. In the first place, the feed shaft is, as a rule, of considerable length and must be kept limited in diameter to meet the conditions of the feed mechanism—let us say in the apron of a lathe. Therefore it is impossible to avoid excessive twist and perhaps breakage of the rod unless it runs at much higher speed than the feed pinion. In the second place, such a rod transmits the power by means of a spline, and the coefficient of friction between rod and key is necessarily great, partly because neither the spline nor the key has the best kind of finish nor could this be maintained if they had it, and partly because the conditions of lubrication are necessarily of the poorest for a splined rod.

HOW A DIRECT DRIVE WOULD ACT

Suppose the splined rod should be keyed directly to the rack pinion. Let us suppose this rack pinion to be of 3 in. pitch diameter and the splined rod to be 1 in. in diameter. Then for one revolution of the splined shaft the key must travel in an axial direction as much as is the circumference of a section of the rod. The result is the same as if the load were pushed in a horizontal direction and had to climb an incline of 45 deg. Besides, there is to be considered the large friction angle which may cause the same result as if this load had to climb at an angle of 45 plus the friction angle. This angle may be so considerable that the device becomes self-locking. If, on the other hand, the splined shaft were so geared to the rack pinion that twenty revolutions of the shaft were required for one revolution of the pinion, then the key would have traveled only $\frac{1}{20}$ of the previous distance per revolution of the shaft. Thus the load would have been pushed up a gentle incline. Another reason why this large reduction is necessary is that otherwise the pressure of the spline against the key would be several times the load on the rack pinion and would cause excessive wear. If the lathe carriage had been working for some time over a certain region of the lathe bed, the spline would have been worn to a shoulder, causing trouble when later on we want the carriage to work in some different region.

It is always possible to give the feed rod the necessary speed but it is more difficult to arrange this matter properly when a feed screw is used also as feed rod. Let us assume that we have a medium sized lathe upon which threads can be cut from one to twenty-four to the inch and in which the smallest rack feed is 0.01 in. or, practically, one-fourth of the finest lead. If the gearing at the head-stock end is so arranged that we will get $\frac{1}{24}$ pitch, this same gearing will also make a 0.01 in. feed. If the gearing is set for the largest possible lead, namely 1 in., we shall obtain with the same arrangement a $\frac{1}{4}$ in. feed. If this screw had a lead of 1 in. which, as we found, was desirable for screw feed, we would have the condition that one revolution of the screw would cause $\frac{1}{4}$ in. feed when it is used as a feed rod. This small reduction, though it would not lead to self-lock, is undesirable, causing excessive wear and producing a hard and irregular action of the feed.

CAM DRIVEN FEED MECHANISMS

Books might be written about cam feeds and many excellent articles and treatises have been written on the action of cams. We shall have to confine ourselves here to those properties of cams and those requirements of cam feeds which are directly applicable to the design of machine tools. Cams are almost exclusively used in automatic machines because they are necessarily limited in their range and, at a first glance, do not seem to lend themselves to variations in the requirements of the machine. As a matter of fact, such variations are not possible if we consider the cam alone. A cam, however, considered in combination with its driving mechanism, may lend itself to many variations in the duty it has to perform.

The simplest kind of cam and cam arrangement has a constant lead, advances the machine element the same amount at all times, and has provision for returning that element as quickly as possible. Change gears or any other speed variator in the driving mechanism of that cam may permit of changing the amount of time required for a complete cycle. The requirements for such a cam are that its slope should be as gentle as possible and that in order to obtain the greatest economy of time the return should be as steep as practical.

There are two distinct ways of utilizing cams in a mechanism. The cam may either be used for one definite function or it may be arranged to take care of one complete cycle of the machine. To illustrate: The cam used for the shifting of the belt on a Brown

For the author's forthcoming book.

and Sharpe screw machine belongs to the first class. It has one function only, it shifts the belt and does nothing else, and moves only at the moment when the belt must be shifted. A cam of the second kind is the one used on the Spencer Hartford screw machine, on which there are all the elements required for the various advances and retreats of all the turret tools as well as for the indexing. Idle spaces on this cam permit another cam on the same shaft to attend to the chucking, stock feed, etc., between the feeds of the turret and cross slide tools. If the arrangement of the machine would permit, it might be possible to have these two cams consolidated into one. The full revolution of these two cams completes an entire cycle of the machine.

Functioning of a Typical Cam

There are other cams on such machines, but they are all mounted on the same shaft. The effect is the same as if they were all built into one member. Though we say that one cam takes care of the advances of the various turret tools, the truth is, each turret tool has its own cam but all cams are mounted on a single drum. This mounting of a number of cams on a single drum serves the purpose of assuring a proper sequence of operations and a proper proportioning of the rapidity of feed and the amount of advance of each tool. There is no possibility of the machine getting out of time. Operations cannot be mixed up if once properly set. To analyze better the functioning of such a cam we will take a concrete example, selecting some imaginary screw machine with four turret tools, one cross slide tool, and so arranged that the indexing of the turret is accomplished by a cam and not by the mere backward movement of the turret. Starting with the first tool, we will have the following sequence of operations:

a — quick traverse forward of first tool,
also quick traverse forward of cross slide tool,
b — feed of first tool and cross slide tool,
c — quick return of first turret tool and cross slide tool,
d — dwell of first tool and cross slide tool, and
d-1 — unlocking of the turret,
d-2 — indexing of the turret,
d-3 — locking of the turret,
e — rapid advance of second tool,
f — feed of second tool,
g — quick return of second tool,
h — dwell and, at the same time,
h-1 — unlocking of the turret,
h-2 — indexing of the turret,
h-3 — locking of the turret,
i — rapid advance of third turret tool,
j — feed of third turret tool,
k — quick return of third turret tool,
l — dwell of third turret tool and, at the same time,
l-1 — unlocking turret,
l-2 — indexing turret,
l-3 — locking turret,
m — rapid advance of fourth turret tool,
n — feed of fourth turret tool,
o — quick return of fourth turret tool and, while these operations have gone on, there may have been,
p — shifting of the belt for the purpose of tapping, and
q — shifting back of the tapping belt,
r — dwell of fourth turret tool and, at the same time,
r-1 — unlocking turret,
r-2 — indexing turret,
r-3 — locking turret,
s — dwell for first turret tool and, at the same time,
t-1 — opening chuck,
t-2 — feeding chuck,
t-3 — closing chuck,
t-4 — returning feed shell.

This completes the entire cycle. To a certain extent some of these elements may overlap each other.

Such a cam may be run either at a uniform speed or it may have a slow and fast motion. We will assume that in the imaginary machine we have under consideration the cam will sometimes move slow and sometimes fast, the slow motions being used only for feeding. Then we find that all the movements except for *b*, *f*, *j*, and *n* are fast movements of the turret. Thus, only a relatively small fraction of the circumference of the

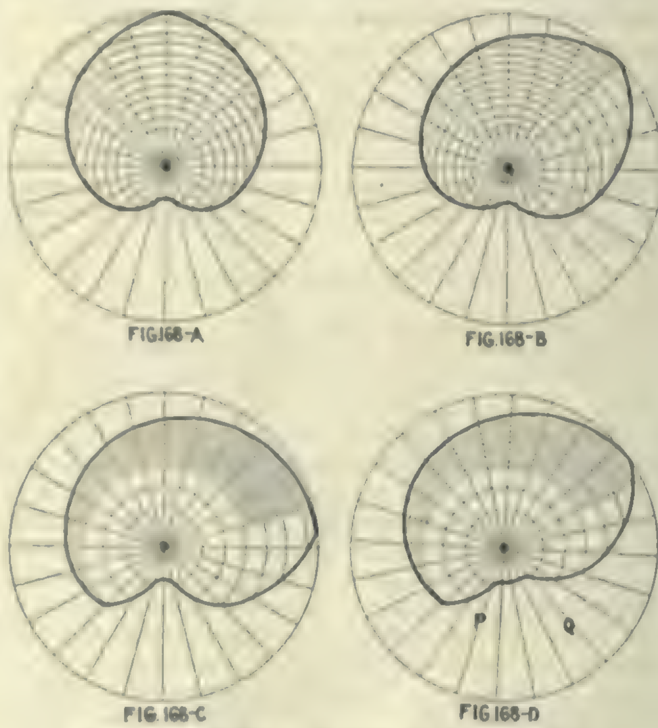


FIG. 168. SEVERAL FORMS OF FEED CAMS.

drum is used for the purpose of feeding whereas all the rest is used for what might be called "non-productive movements." As a result, such a cam must be made of large diameter, though the amount of feed and the number of tools to be fed may be small.

There is another difficulty in connection with the camming of such a machine. To set up a new job requires a complete analysis of all the detail operations and a careful calculation of the parts of the cam drum available for each function. We will go further into this matter later on and first consider the various other arrangements in existence or possible arrangements which might be made.

Perhaps the simplest arrangement of all is the cam which turns at uniform speed, has a uniform advance, a uniform return which may be at the same or different speed as the advance, and no idle space to permit some other function to take place. Such cams might be used for a variety of machines, as for example filing machines. A modification of this arrangement would permit a machine to stop at the end of every cycle by the throwing out of a clutch or a drop-worm. Cams of this description are quite commonly used in special

machines. They become more generally useful if the advance is not uniform.

Fig. 168-A shows a cam with the uniform and equal advance and return. Fig 168-B shows the cam modified with a uniform advance and rapid return and Fig. 168-C shows the same type of cam for rapid advance, slow feed, and rapid return. Fig. 168-D, finally, shows a cam which has the same characteristics as Fig. 168-C, except that it has idle spaces left for other operations. This idle space is a concentric part, *PQ*.

The cams are shown in the illustration as disk cams, though there is no reason why they should not be constructed as drum cams. As the diagram shows them, no provision is made for the return and this would have to be accomplished by a weight or spring whereas it might be accomplished by having a groove act on the roller instead of depending on the outside of the cam disk. The shape of the return branch of the cam, 168-C, is not objectionable when a spring or weight brings the slide back but if such a cam were provided with a groove, so that the cam becomes active instead of passive, there might be danger that the device would become self-locking, and it might be necessary to make the return less rapid. As a compromise, the cam might be made with a groove and, in addition, a weight or spring might be provided to bring the slide back so that the return side of the cam only works if, for some reason or other, the spring or weight should not be sufficient.

Keeping Operations in Synchronism

When a cam is constructed on the principles of Fig. 168-D—that is, with idle space for some other operations—it becomes necessary to connect the two functions in such a manner that they cannot get out of time with one another. The simplest way of accomplishing this is to have the other functions also controlled by a cam and then place the two cams on the same shaft and in the proper relation to each other. If, for instance, a slide at the righthand end of the machine had to be advanced and returned, after which a similar slide at the lefthand end of the machine had to go through the same movements, it would be natural to use two cams on the same shaft, each one occupying about one-half of the circumference. If the two slides to be moved were close together, the two cams would be consolidated into one, each function requiring about one-half of the circumference. We see, then, that whether we use one or two cams their size is not changed and must be as large as if only one cam were used for both operations. When there are a great many different operations to

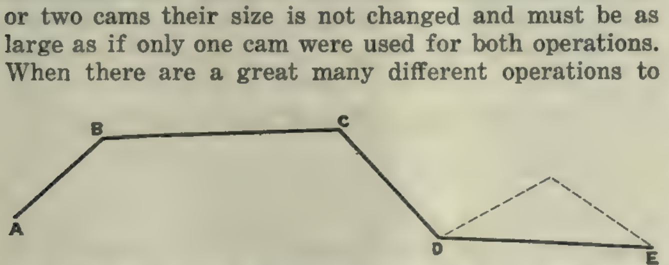


FIG. 169. DIAGRAM TO SHOW DURATION AND SPEED OF VARIOUS MACHINE FUNCTIONS.

be performed on the machine, the cams naturally take on very large proportions.

It might be thought that the size of such cams could be reduced by performing part of the operations at a high speed but as a matter of fact this has a tendency to increase, rather than to decrease, the final size of the cam. To illustrate how this may happen we will take a concrete example. In Fig. 169, the full line from *A* to *B* shows the rapid advance of the slide, from *B* to *C* feed, from *C* to *D* return, and from *D* to *E* dwell, during which another operation takes place. The cam intended for that other operation is indicated by dotted lines. This second operation is not a feed for a tool and the steepest permissible slope for the cam might be used here. This steepest slope we will assume to be 45 deg. and this angle is actually used on the advance and return of the main cam (shown in full lines).

It will be noticed that the dotted line is not shown at this angle of 45 deg. The reason is that in our device the member to be moved by the dotted line cam is very heavy and does not permit of the same rapidity of movement as that member which was shown by the full line cam. If the two cams had been separate and without any connection with one another, the dotted line might have been drawn at an angle of 45 deg. and we would have given this cam a speed which was proper for the heavy member to be advanced. In that case the dotted line cam would have occupied less space than it does now. Under such conditions, then, we have the choice either of making the dotted line cam at an angle of 45 deg., reducing the fast speed of the entire mechanism and thus lose time, or of making the dotted line cam of gentler slope and thereby increasing the size of the entire cam.

Electrolytic Deposition of Iron for Building Up Worn or Undersized Parts

By David R. Kellogg

The electrodeposition of iron has been practiced for many years. During the war, the British army repair shops developed a method for building up worn parts of automotive machinery, aero engines, etc., using the cold sulfate bath and low-current density method. The method has been used successfully in commercial work for the production of about 6,000 repaired parts, therefore experiments along the same lines have since been made at the Westinghouse research laboratory.

Current used for cleaning was obtained from a $\frac{3}{4}$-kw. 60-volt, house-lighting generator, direct connected to a 2-hp., 870-r.p.m., 440-volt, three-phase, type CS induction motor; while the plating current was taken from the storage batteries at any desired voltage. The anodes were made from 0.036-in. Armco iron made into cylinders 5 in. long by 8 in. in diameter with a disk of $\frac{1}{8}$-in. micarta, having a 2-in. hole in the center field at each end of the cylinder for stirring. The anodes were hung on a wooden rocker frame driven by a wooden connecting rod directly connected to a small reducing gear, such as is sold by most of the apparatus supply firms; three-gallon stoneware crocks were used as containers.

Uncertain Behavior

A solution used by Thomas, 75 g. of the crystallized ferrous ammonium sulfate per liter, was tried, using the current density recommended by him; namely, 0.33 amp. per sq.dm. Under these conditions the deposit on a $\frac{1}{2}$-in. (12.7 mm.) rod of cold-rolled steel was smooth, bright, and adherent; it withstood bending and refused to chip off even when attacked at the junction of coating and parent metal with a cold chisel. A current efficiency of

Extract from a paper presented at the February meeting of the American Institute of Mining and Metallurgical Engineers, in New York.

about 75 per cent was obtained, the rate of deposit being about 0.000197 in. per hour.

Baths thus prepared were rather uncertain in their behavior, being especially likely to oxidize when used with small pieces. Adding ferrous-carbonate "mud," kept under water after preparation, somewhat reduced this tendency to oxidize and hence increase in acidity. Powdered charcoal helped to secure a good deposit, and was used in all subsequent work.

After the work had been cleaned with gasoline or benzine, it was made the cathode in an alkaline bath containing about 5 per cent commercial lye and about the same amount of sodium carbonate, the exact amount being immaterial. A current density of 3 to 5 amp. per square inch was used. The work was treated in this bath for 3 min. Then it was washed in running city water and made the anode with approximately the same current density in 20 to 30 per cent commercial sulfuric acid for an equal length of time. As a matter of fact, the current in the acid cleaning bath was always adjusted more with respect to the free gassing of the anode than with respect to the actual current density.

When for any reason the cleaning current was too low to make the work passive, cleaning was unsuccessful, the piece came from the bath dark colored, and a good coating could not be produced. If the work were moved about during the anode cleaning it rapidly became active but again became passive on cessation of the motion. When this condition was very noticeable, it was a good indication that the cleaning current was close to the lower limit. With a current density of 5 amp. per square inch this effect was not so noticeable. After cleaning in this manner, the work was well washed and immediately transferred to the plating bath. With the plating solutions at room temperature, it was possible to deposit at the rate of 1 amp. per sq.dm., which is three times the rate given by Thomas.

Durability of the Deposit

This process gave smooth, tough, adherent coats which, when deposited on a carefully ground rod 0.485 in. in diameter and then ground to a thickness of 0.001 in. could be pressed through a hole in 1-in. cold-rolled steel 0.0005 in. smaller than the finished size of the rod, and then pressed back again with no signs of stripping. These test rods could be bent and mishandled in various ways with no damage to the coat.

A motor shaft having bearings ½ in. in diameter by 1½ in. long was purposely finished 0.002 in. small in diameter, plated oversize, reground to proper dimensions, and then assembled and run in bronze bearings for 1,000 hr. with a load of 50 lb. per square inch projected area, using a short stiff belt with a clipper joint in order to give a pounding effect as well as friction. At the end of the run it was found that the wear was 0.0002 in., which is just a trifle less than the original material shows in factory life tests.

Plug and thread gages have been repaired by this means and have given good satisfaction although they are not as hard as heat-treated tool steel. It is, of course, possible to carburize such pieces, when they will compare favorably with the original gages.

Resistance to Cutting

Another interesting job done by this method was on the throw bearing of a crankshaft of an experimental gasoline engine where the maximum pressure was about 650 lb. per square inch. This was given about 100 hr. intermittent running and then 400 hr. continuous running. During the first period, two "freeze ups" occurred, as a result of experiments with various bearing metals; yet when the engine was taken down for inspection the bearing surfaces were in perfect condition and showed a wear of 0.00025 in. Many press fits and running fits have been repaired for shop use and no case of failure has occurred. Coatings obtained by this method are much harder than pure iron; they are usually about 220 Brinell.

Some work of N. B. Pilling, of the Westinghouse laboratory, as yet unpublished, has shown that the brittleness due to occluded hydrogen may be completely removed by heating for ½ hr. at 300 to 400 deg. C.

When cast iron is put through the electrolytic cleaning process, it emerges from the acid with a coating of graphite. A piece was dipped in arsenic-chloride solution and then copper plated in an acid copper-sulfate bath. Iron coatings deposited on this base were fairly adherent.

Acidity of Bath

In connection with all this work a rather close watch of the acidity has been maintained. It now appears, that this is unnecessary as the hot concentrated bath produces such complete anode corrosion that oxidation is practically negligible. The addition of small amounts of ferrous-carbonate mud is still practiced, but the amount used is very small. These baths may be left for weeks when not in use, without any serious oxidation. They have also been worked for weeks at a time, most of the work being done during the daytime, as the rapid rate of deposit, 0.004 to 0.005 in. per hour, makes it possible to do almost any job in one working day.

In addition to a large number of test pieces, between seventy to eighty salvage jobs have been done for the shop, running all the way from the badly scored end of a 1/20-hp. motor to an experimental airplane propeller hub. For the electrolytic cleaning of the larger pieces, we used a 300-amp. arc welding M-G set, with the series field coils short-circuited and with a potentiometer rheostat across 110-volt direct current for the shunt field. This arrangement, together with the regular field rheostat, gives a fine adjustment of current, so that the set may be used for small work, or for work requiring up to 450 amp. for cleaning.

Great credit is due to Leon McCullouch, J. P. Thomas, and J. D. Alleg who carefully handled the experimental part of this work and contributed many valuable ideas to its development.

The Welding Torch and Cast Iron

We are informed by a correspondent that the statement contained in the article on the "Application of the Welding Torch to Railroad Repairs," published on page 444 of our Sept. 21 issue, to the effect that the oxy-acetylene torch would not cut cast iron, is no longer correct. He states that the Oxweld-Acetylene Co. of Chicago has perfected a torch that will do this work.

In making the statement that the torch would not cut cast iron the writer of the article had no intention of conveying the impression that the oxy-acetylene flame would have no effect upon this metal. The reason that the torch has hitherto been considered impractical for this purpose is that the cast iron yields too readily, leaving a ragged, uneven edge instead of the clean knife-like cut produced upon steel.

Taking the Air in England

Present State of the British Airplane Industry—Post-War Stagnation in Bristol Plant 400 Hp. Radial Engine and Ten-Passenger Plane

By HENRY OBERMEYER and ARTHUR L. GREENE

A GREAT deal has been written about the impoverished condition of the American aircraft industry, the failure of Congress to lend a helping hand, and the indifference of army and navy officials to the future development of the Air Service. One hears the same sort of thing in England. Parliament is appropriating little or nothing and the British aircraft factories are living on the crumbs that fall from the London to Paris commercial and passenger lines and from certain distant principalities which are engaged in wars at present or expect to be so occupied in time.

Admiral Sir Percy Scott, a leading exponent of a more extensive British Air Force, in a recent article contributed to the London *Times*, notes that the British Government is preparing to spend only £11,000,000 on its air defences. This sum he terms "ridiculous."

"The size of our Naval Air Service to-day is simply absurd," he adds. "During the war it was found necessary to equip every light cruiser with a fighting aeroplane. Today we have six fighting aeroplanes for the whole Navy, less than one per fleet."

The general situation described by Admiral Scott is fully confirmed by a visit to Great Britain's greatest airplane factory by the writers. The machines of this concern, the Bristol Aeroplane Company, Ltd., are recognized as the official standard in use by the British Government. The 400 hp. Bristol "Jupiter," a nine cylinder air-cooled radial engine, virtually every part of which is manufactured and assembled in the company's shops, is said to be the only airplane engine that has ever passed both the French and British official tests. It weighs only 698 lb. or 1,745 lb. per hp., an unusually low proportion.

Industry in Peace

The factory today is a graphic example of the transition from war to peace in the airplane industry of the country. It is their ready adaptation to the new conditions that has enabled the British builders to advance to their present position and not any paternal assistance. The necessities of the war enabled British manufacturers to indulge in practical experimentation on a scale impossible for American firms whose planes were never put to actual use at the front. Many of the improvements developed in English factories during the war period have been lasting and have proved as important to the development of commercial flying as to that of scouting. This circumstance has brought England well to the fore and it is the general impression among manufacturers there that America is only marking time.

The wartime spurt, then, is the chief reason why British manufacturers have advanced in the face of discouragements as real as those in America. In some cases they have even advanced further than the market. In anticipation of extensive passenger-carrying operations on the Continent, the Bristol factory some time ago turned out an air limousine capable of carrying sixteen persons in addition to the pilot and mechanic. The cabin of the machine represented the *n*th degree of twentieth century luxuriousness. There was but one thing the matter with it. There were no passengers. Only on rare occasions was it possible to collect sixteen passengers at the same time who wanted to make the trip.

For the time being, therefore, Bristol is compelled to concentrate on the ten-passenger machine, shown in Fig. 3, which is amply spacious to meet the demands of the immediate future. This temporary check has left the inventive faculty free to experiment with new types of engines, which has now reached its culmination in the huge air cooled static radial, the "Jupiter."

American Development Slow

The manufacturers of the Bristol machines are so confident that they have left our own manufacturers behind that they are beginning to ask: "What is the matter with the United States?" They assert that there has been little, if any, new development in aircraft manufacture in America since the collaborative Liberty motor. It might be here mentioned that the British experience with the Liberty motor has left an impression that America is more given to quantitative than to qualitative production. They admit that the principle of the American engine was excellent, but, in a majority of cases, it had to be taken apart and reassembled before it would work up to standard.

British headway in the development of aircraft engines is far in advance of progress in the construction of planes, partly, of course, owing to lack of support from the Government and the general public. The fact is, the type of planes now in flight is considered quite satisfactory for the uses to which they are being put. Except for minor details, it is practically the same as that used by the British air forces during the last few months of the war. From the Bristol "Fighter," which is being used by Spain against the Moors, as well as by other governments, Bristol has developed a three seated touring plane for the Western Australia Mail Service. This machine is scarcely different in principle from the machines of 1917.

Engines Further Developed Than Planes

Active development of aircraft engines by Bristol is comparatively recent, dating back scarcely more than two years. Before that time, Bristol planes were equipped variously with the 110 hp. Le Rhone, the 275 hp. Rolls-Royce, the 240 hp. Siddeley Puma, and the 300 hp. Mercury. In beginning the construction of its own engines, Bristol took over the entire business of the Cosmos Engineering Company, Ltd., located on the Filton training field near the outskirts of Bristol proper, together with all patents, designs and rights in connection with the various engines previously manufactured by that organization.

Bristol devoted its attention from the start to the radial type of engine as likely to develop the greatest power with a minimum of weight, always the great de-

sideratum in aircraft design. The additional advantages of the air-cooled engine influenced the trend of subsequent experiments.

The reasons which decided the Bristol company to devote its attention to the radial engine are possibly obvious. Experimentation proved that the grouping of many cylinders around a single throw crankshaft would permit the use of the smallest possible shaft and crankcase, and, as these are two of the heaviest single parts in an aero engine, the saving thus effected in motors of radial design is considerable. Another important feature is the short stiff crankshaft in which periodic vibration is cut to a minimum.

Reasons for Use of Radial Engine

The advantages of a radial air-cooled engine over power units of other types were so apparent that the Bristol company early in its experiments devoted nearly all its time to the development of this type of engine. It represented a feature of commercial airplane engine design even more important than that of the military plane. It meant that the possibility of decreased weight implied a proportionate increase in the revenue producing cargo which could be carried.

Another factor taken into consideration was the increased reliability arising from the absence of possible leakage in the water connections, pipes, jackets or radiators; the impossibility of freezing either at high altitudes or in cold weather, and the freedom from trouble arising from the overheating of the water during flight.

The nine cylinders of the Bristol engine as now assembled are in a single plane and have a bore of 5¾ in. with a stroke of 7½ in. The engine is made in two types, the first ungeared and the second fitted with an epicyclic geared reduction of 0.656 to 1. The reduction gearing is interposed betwen the crankshaft and the propeller, and with the engine running at 1,600 revolutions per minute and developing 400 B.H.P., the propeller turns at 1,050 revolutions per minute.

Unique Mixture Distribution

The cylinder heads are of aluminum with two inlet and two exhaust valves, and take care of the distribution of the major portion of the heat. The single induction pipe branches at the entry into the cylinder head while the exhaust is conducted away through two separate heads, thus obtaining a smooth flow of mixture to the cylinders and allowing a free passage of air across the cylinder head. See Figs. 1 and 2. The crankcase is an aluminum casting of two parts, the joint being in a vertical plane.

One of the most interesting features of the "Jupiter" engine is the induction chamber, shown in Fig. 6, an aluminum spiral casting constituting a three-start spiral. The annular cover of the induction chamber carries three Claudel carburetors, each of which feeds a separate convolution. One carburetor supplies mixture to the second, eighth and fifth cylinders, the second carburetor supplies the third, ninth and sixth cylinders, while the third supplies the fourth, first and seventh. This arrangement, it is claimed, allows the mixture a clean sweep from the carburetor to the induction pipe. It further isolates the cylinders into three perfectly balanced groups so that, should one or even two carburetors fail to act properly, a sufficient number of cylinders will remain in action to carry the plane.

The entire engine is supported on a removable framework of thin wire struts, as shown in Fig. 4, almost spidery in appearance but actually capable of bearing a tension many times over that required. The engine may thus easily be removed and changed in case of trouble, with little loss of time which is an obvious advantage in the carrying of mail.

In many cases the manufacture and assembling of the Bristol "Jupiter" in the shop is a reversion to the days of hand labor. Quantity production is frowned upon. With a force of 160 men, the Bristol Company will consider itself well satisfied to turn out as many as sixty engines during the next year. That, at least, is the production quota it has set for itself, although at this writing the shop is more than one machine behind schedule. Views of the shop are given in Figs. 5 and 7.

Hand Labor in Vogue

Hand labor here, moreover, is hand labor in every sense of the word. Some parts, such as the induction spiral, are so complicated that no machine has been made that can fashion them. Not even a filing machine is used on the spiral, the work of filing it down by hand requiring many hours of painstaking endeavor.

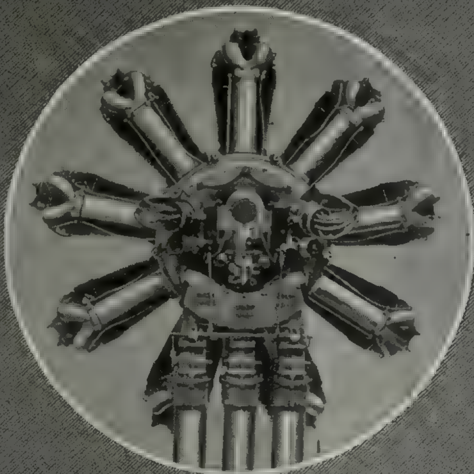
As a matter of fact, the British have had almost no experience with quantitative production in engines. Something in that direction was attempted during the war, but the project lapsed with the fulfillment of wartime contracts. In the automobile field the Rover stands virtually alone as a product of quantity output, but even the Rover total, 300 cars a week, is little compared with the sausage machine production of Henry Ford. From the standpoint of the airplane, day work and handwork are more than sufficient to meet the needs of the moment when even the slowest factories are turning out more planes than they can dispose of. If the prophets are right, however, the time is not far distant when the practical importance of the airplane in commercial life will be more universally recognized. Then a way will have to be found to speed up production; and it is a way that American manufacturers have known for years.

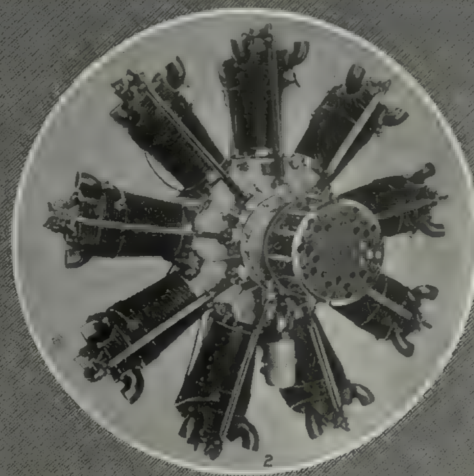
French Manufacturers Get Government Aid

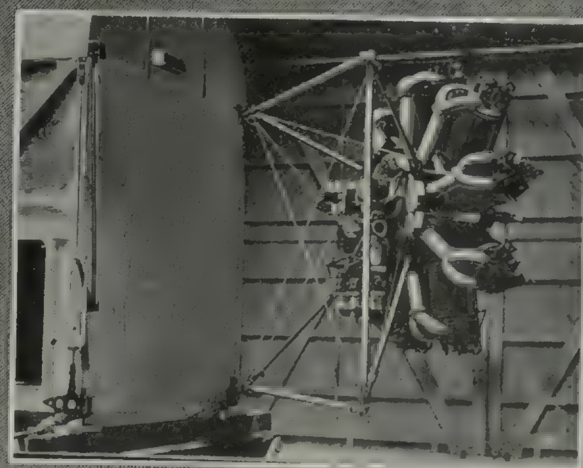
Despite a very real achievement, therefore, British airplane manufacturers may be considered as having gone as far as they can for the present. The air ministry has not given them the support they had hoped for after the war, certainly nothing commensurate with the financial nourishment provided by the French Government for its native industries. This advantage of the French is a bitter pill for British airmen to swallow because of the fact that France is paying practically no interest on her debt to Great Britain, while the money expended in developing her own aircraft industry is approximately equal to the interest she would otherwise have to pay.

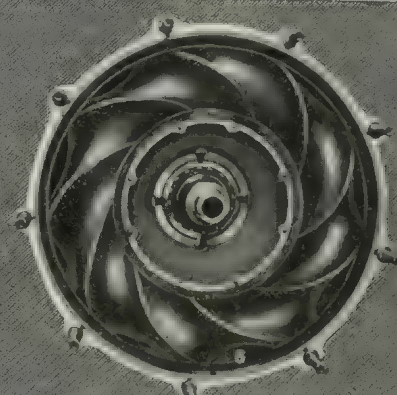
The English position in airplane production was given by Mr. Douglas Vickers, M.P., chairman of Vickers, Ltd., at the fifty-fifth annual general meeting of the company in Sheffield during the latter part of July.

"We are getting our share of such airplane orders as are being placed," he said, "and our type of machines are very successful. But orders come for such small quantities that the cost of designing and experiments bears much too high a proportion to the works' costs of a machine. The position of an airplane manufacturer here contrasts very unfavorably with that of the French manufacturer who gets orders for large series









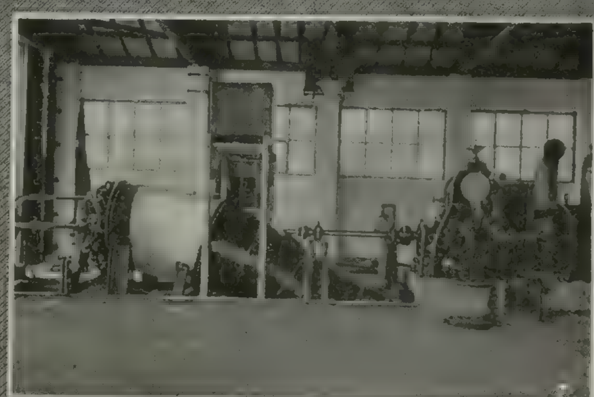


FIG. 1—REAR VIEW OF "JUPITER" RADIAL ENGINE. FIG. 2—PROPELLER SIDE OF "JUPITER" 400-HP. ENGINE. FIG. 3—INTERIOR OF TEN-PASSENGER LIMOUSINE. FIG. 4—ACCESSIBLE FUSELAGE MOUNTING OF RADIAL ENGINE. FIG. 5—RADIAL ENGINES ON ASSEMBLING STANDS. FIG. 6—THREE-START SPIRAL INDUCTION CHAMBER. FIG. 7—TEST BLOCK WITH DEVICE FOR COOLING ENGINE.

of machines and works with much reduced charges and all advantages of repetition work."

The British frankly hope that the next step will be taken by America, which is considered far behind in the manufacture of passenger and cargo-carrying machines. For this reason no little attention was attracted in England by the recent decision of A.H.G. Fokker, the Dutch airplane expert, to abandon Europe and devote his talent to the development of American aviation. If Mr. Fokker's project of establishing a network of aerial lines along the Atlantic seaboard is realized and a sufficient number of Americans are educated to use them, much will be done to overcome the handicap under which the airplane industry of America is laboring.

Incidentally, many British experts, seeming to resent the fact that Americans have ideas of their own in airplane construction, have suggested that American manufacturers can do little better than to import a number of the most recent European models, adopt them "in principle" and continue their experiments from that footing.

The Value of Calculation in Machine Shop

By W. H. Kellogg

The following case may serve to show how a little calculation in the making of a tool or any simple device, is a profitable investment in time.

A jig was wanted, low in cost and high in weight. At the same time, the requirements of its use made it somewhat difficult to devise, and it took about two days to work out the design that would cover these points. When the layout was made it was found that the casting for the frame looked rather heavy, so the designer roughly figured its weight by writing all of the dimensions of each rectangular element, and with a slide rule determined the volumes, writing them down opposite each set of dimensions in one column tc be added, the whole operating taking about ten minutes.

Then looking at the design again from another angle, a different form of casting was conceived which could be made without changing the principle of the mechanism. In thirty minutes more a rough drawing was made, which was true in outline and fairly close to scale, and from it another calculation was made, the result of which was 43 lb., as against 92 lb. in the first design.

As no detailing work had been done, no loss of time for additional work was necessary in making the change except the forty minutes that was already consumed for the two calculations and the rough drawing. The saving in the cost of the casting more than paid for the time of considering this change, and the result of the work was much more satisfactory as the reduced weight made the tool so much easier to handle.

While such simple facts may seem commonplace, the writer thinks that in calling attention to this circumstance, many other cases will be brought to mind in which no drawing or even a sketch was used. In many such cases it may be remembered that some parts of the mechanism were made that could not be used, as certain points in the design could not well be foreseen, also that considerable time was spent in making these parts as well as trying various ways of doing the work without a definite outline to go by. Probably a few hours at the drawing board and a few additional sheets of paper would have cost considerably less than the time and material used in this way.

There are few machine shops large enough to employ twenty-five men or more, that could not profitably use a good designer for the purpose of looking into many little problems such as these, even though very little original work is needed. The placing of machines to save floor space, the arranging of the room in the shop or office to save unnecessary movements, the improvement of belt drives to save belting and eliminate friction, the saving of material by changing the design of manufactured parts, and numberless other things of varied kinds can be improved in a profitable way by the simple application of careful thought and calculation.

Laying a Corner Stone 50 Years After

When Henry Disston, founder of Henry Disston & Sons, Inc., needed a new plant in Tacony, Phila., 50 years ago there was no time for ceremonies and ground was broken by Henry Disston, Samuel Bevan, chief engineer, and William Smith, who succeeded Mr. Bevan. Fifty years later, September 27, 1922, the corner stone was laid as shown herewith, by Jacob Disston, Sr. (the only surviving son of the founder), and William Smith, who assisted in breaking ground 50 years before.

Of equal interest, and even more unusual, was the witnessing of the ceremonies by 54 Disston employees who were working for the firm when the Tacony plant was started. The Disston saws date back to 1840 when Henry Disston began, alone and by hand, to make them in a cellar on Bread Street, near Second, in Philadelphia.

The corner stone was dedicated not only to the starting of the new plant but to the veterans whose service had helped to make a success possible, as stated by William D. Disston, grandson of the founder. It speaks volumes for the kindly relations existing in this plant that the number of veterans is increasing year by year. There is something worth while about a plant when men stick to the job year after year.

LAYING THE CORNERSTONE

Building Axles for the Franklin

Some of the Special Tools and Methods Used in Making a Tubular Front Axle and a Combination Steel and Aluminum Rear Axle

BY FRED H. COLVIN
Editor, *American Machinist*

ALTHOUGH nearly all builders of automobiles have adopted forged axles of the I-beam type, the Franklin designers still believe that the tubular front axle presents the best answer to the many demands made upon it by the various stresses and road shocks. It is retained even though its cost is probably higher. Methods used in making such an axle are of special interest.

The bending of the tube and the drilling of the spring pads are done by usual methods but the special machines used in drilling for the forks which carry the steering pin are unusual, as shown in Fig. 1. The axle is located by the spring pad at *A* and the forked end is positioned by the steering pin hole at *B*.

The drilling head carries four spindles all driven by a single belt and the drills are fed into the work by means of the pilot wheel *C* acting through the rack and pinion at *D* and transmitting the feed by means of the levers and bell cranks as at *E*. After the drilling, the locating rivets are put in place and the forked ends brazed to the front axle tube. The riveting is shown in Fig. 2. where the tube is held in special vise jaws and the rivets driven by the air hammer *A*, while the plugs *B* act as holders-on.

The assembling of the front axle requires considerable care if good results are to be secured. The assembling fixture, shown in Fig. 3, is very complete and takes care of the steering knuckles as well as the spring mounting. The forked ends are located by the plug *A*, which represents the steering pin and holds the knuckle in place. The full elliptical springs are posi-

FIG. 2—RIVETING FORK BEFORE BRAZING

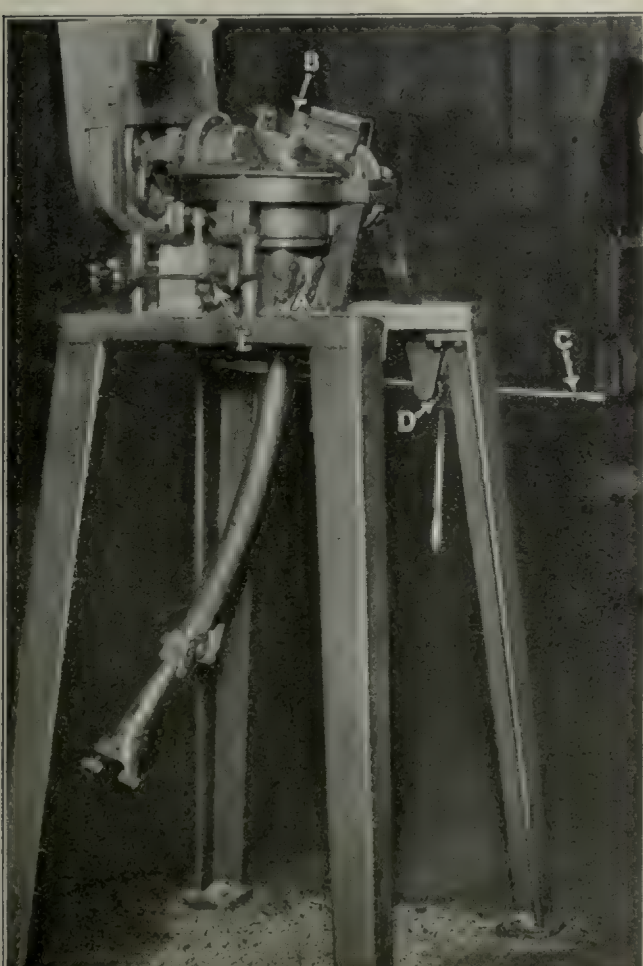


FIG. 1—DRILLING FRONT AXLE FORK

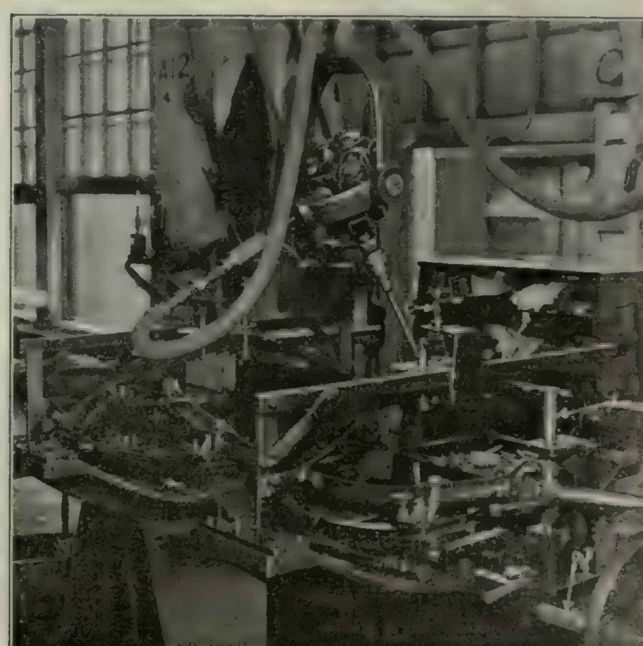


FIG. 3—ASSEMBLING THE FRONT AXLE

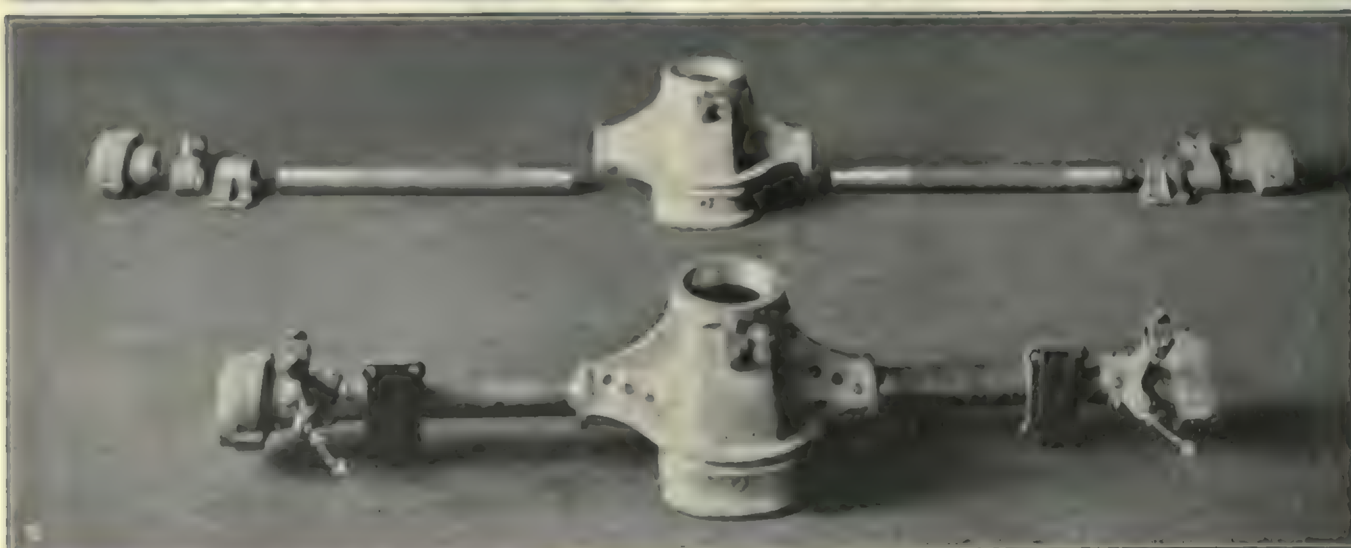


FIG. 4—FORCING REAR AXLE HOUSING PARTS TOGETHER. FIG. 5—REAR AXLE PARTS AND AN ASSEMBLED AXLE.
FIG. 6—ASSEMBLING THE REAR AXLE

tioned by the framework *B*. This fixture allows the easy assembling of the top and bottom spring clips, the lower connection being underslung, as can be seen. The upper spring connections are located by the spring plunger at *C*. The projections above the spring are for fastening the springs to the wooden frame which connects the two axles and on which the body rests. The whole fixture is trunnioned on two pedestals so that it can be turned in any convenient position. The indexing pin is shown at *D*. The nuts are screwed into place by an air drill provided with a friction chuck.

The Rear Axle

The Franklin rear axle is also out of the ordinary, as can be seen from its construction in Fig. 4. It is one of the few rear axles made with an aluminum differential case in order to reduce unsprung weight. Into each end of this central casting a steel tube is forced before the final assembly. The press, Fig. 4, forces on the spring pads and the outer castings which carry the rear wheel bearings.

The differential aluminum casting with the tubes already riveted in is first put in the press and a spacing piece, *A*, put in between the walls of the case to prevent distortion while the tubes are being pressed into position. Screw flanges adjust this spacing block and allow it to be easily put in and removed.

The spring pads are placed over dowels *B* and *C* in the fixture and the end pieces located in the two rams at the ends. The valve *D* controls the hydraulic pressure which forces the heads toward the center and with them the various parts which go to make up the rear axle housing. The completed housing is shown at *E* and also very clearly in Fig. 5, including the leather cushions riveted to the spring pads.

The complete rear axle assembly is shown in Fig. 6. Here the drive shaft pinion is in place as well as the brake rigging. The upper spring connection for the frame is shown at the bottom, the axle being upside down with the frame plates resting on blocks on the bench. The tray on the bench contains all necessary nuts, bolts and cotter pins. A small pile of the springs used to keep the brake band away from the drum may be seen at *A* and in place at *B*. This view also shows the truss rod which runs under the differential case and which is anchored at *A* and *B*, Fig. 5.

Personal Records

By A. W. Brown

A card index "Who's Who" should be kept by every manufacturing establishment, giving information concerning each member of the working force from the Grand Panjandrum down. The index should give not merely the usual memos about age, family circumstances, etc., but data concerning temperament, and physical, mental and moral qualities. In other words, the worker should be "sized up" so that if the time comes for laying off men on the one hand, or transferring or promoting on the other, the man's record as to what he can do and cannot do, and what he probably could do and could not do, will enable sane and mutually satisfactory action without great delay. Wages from the beginning of employment, through successive increases or decreases should be entered, with the reason for each change.

Needless to remark, these records should be open for inspection only to certain duly appointed persons, in no case to any of the workers.

A Trial Drill that Made Good

By I. B. Rich

A local salesman had left a new kind of drill for trial in a shop on his "beat" and in due course of time he dropped in to see how it was working out. It wasn't one of these "red-tapy" shops where the salesman sees only the P. A. and the P. A. tells the super and the super tells the general foreman, etc. It was a direct action shop, and the salesman had the confidence of the management to the extent of being able to go straight to the man using the drill.

But the man saw him coming—made a few mysterious passes at the drill spindle and beat it. Pretty soon he came back empty handed.

"How's the drill working, Bill?"

"Fine, don't see how it could be better. Have you come after it?"

"No, Bill, just wanted to see how it worked."

"S'all right then—I'll go get it. Saw you coming, so I hid it—thought you wanted it."

The salesman didn't need to be told how to use this recommendation for his drill.

Sauce for the Goose Is Sauce for the Gander

By Entropy

Draw a circle with a radius of five hundred miles with the office of *American Machinist* as a center, and it will just about pass through a shop that I saw a few days ago where awnings were hung alike over shop windows and office windows. It was such an odd circumstance that I was quite amazed. It has long been the custom to assume that the office force needed awnings on the sunny side and that the shop force did not. From my personal acquaintance I have judged that from a purely physical point of view it may be that the average office worker is less able to withstand heat and cold than the average shop worker, but as a matter of profit and loss to the company I have wondered if there would not be more profit per awning if they were put over shop windows than over office windows.

Of course an awning does not do much good in the middle of the day because then the sun is nearly overhead during the awning season, but on the east side in the morning and on the west toward night there is a good deal of superfluous sunlight coming in. This is either when men are starting the day's work and need to conserve their strength to get through the day, or when they are finishing the day's work and will soldier on the job to get through it with the least effort if they are already tired.

Awnings on the south side, where most put them, are more ornamental than useful. Shop men get tired, they are affected by the heat and they have just as many ways of appearing to keep busy without working hard as do office workers. The profits of the company are much more affected by this slowing down of a shop man than they are by the corresponding slowing down of the office, moreover the shop usually starts work earlier and quits later than the office.

I have sometimes wondered if the managers of these shops did not put up awnings for the offices because they were so ashamed of the rates they pay their clerks that they felt that they must do something to make up this deficiency to them. Perhaps like the fleas on David Harum's dog, the awnings help to keep their minds off their being clerks.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Small Heating Furnace from Scrap Material

By Milton Wright

A furnace in which to heat small dies and other tools for hardening, to melt small quantities of babbitt, for soldering or any of the numerous purposes for which such a furnace is needed about the average machine shop, is here shown. It is made from scrap materials. The body of the furnace is a 4-in. pipe tee that had been discarded because of a crack. A flange and short nipple furnish the base, the nipple being filled with fire clay up to the level of the side outlet of the tee. A plug which is tapped for the burner, closes the top of the tee, and the burner is made from such odd fittings as may always be found around a shop where pipe is used.

The construction of the burner is apparent from the picture. The gas is admitted to the side outlet of the $\frac{3}{4}$-in. tee while the upper outlet or "run" of the tee is reduced to take the $\frac{3}{8}$-in. air jet pipe. The whole outfit can be put together in a few minutes in most any

A HOME-MADE SMALL FURNACE

general machine jobbing shop from material that would otherwise be considered as scrap. None of the joints need be tight and therefore fittings that are distorted or have damaged threads may be used. The size of the air jet would depend somewhat upon the pressure of the supply. The illustration shows the furnace under fire with a ladle of babbitt being melted.

A Handy Boring Machine Attachment

By W. J. Winston

The use of the fixture shown in the photograph, Fig. 1, on the faceplate of a Landis horizontal boring machine, makes it possible to perform several operations that formerly required the services of a planer, lathe and radial drilling machine and has eliminated

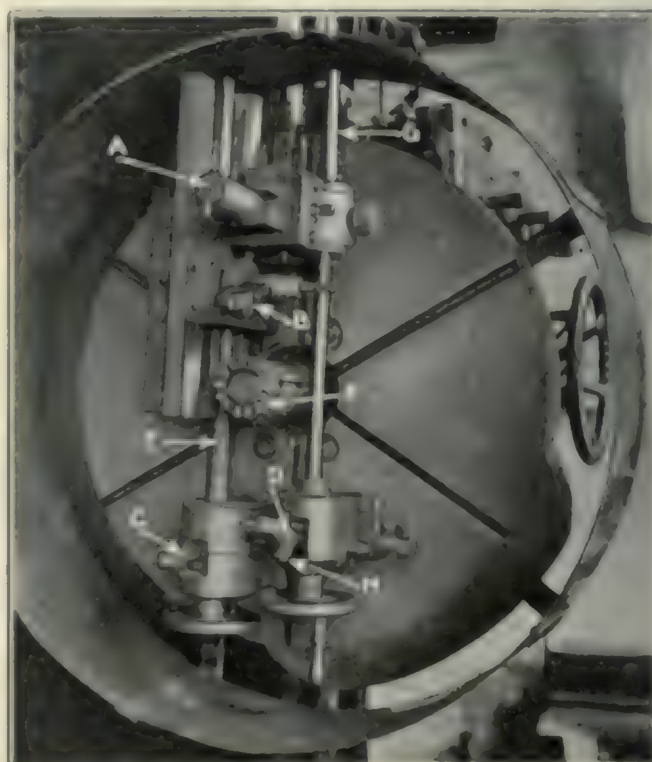


FIG. 1—ATTACHMENT ON BORING MACHINE FACEPLATE

the time and cost of handling the casting between operations.

The casting, a machine frame, is shown in Fig. 2 in the position in which it is placed on the table of

FIG. 2—MACHINE FRAME

the machine. In the first operation, the machine-table is turned so that the side of the frame faces the head of the machine and the inner faces of the bearings *A* are milled off, using a four-inch cutter, shown at *F*, Fig. 1. Then the table is turned to bring the top of

the casting to the head of the machine and the six-inch hole is machined, using a cutter in the spindle F, while at the same time the tool A is turning the outside of the hub. Then the face of the square and the end of the hub are faced simultaneously, using the cutters A and B.

When used for turning, the feeding of tool A is effected as follows: Shaft G passes through a worm that meshes with worm-gear which has a square thread cut through the hub. The tool-bar A has a corresponding thread cut on the outside and thus serves as a shaft for the gear. When shaft G is turned, the worm gear is revolved and the bar is fed forward. A keyway, cut the whole length of the bar, slides on keys in the worm gear housing and keeps the bar from turning.

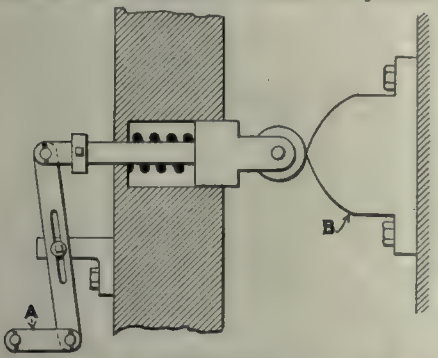


FIG. 3—AUTOMATIC FEED MECHANISM

When ready to perform the facing operation, tool A is set the correct distance from tool B, and the two tools are fed across the work by the operation of the screw E, which passes through a nut on the bottom of each of the tool posts.

Screw E and shaft G each passes through a gear located at the lower end of the shaft, just above the hand wheel, and connected with each gear is a ratchet of the usual design. Attached to the ratchet at point H is the connection A, Fig. 3. Through an intermediate lever, this connection operates a push-rod which carries a hardened and ground steel roller. The push-rod operates through a hole in the face plate of the machine, as shown in Fig. 3. A hardened steel block, B, is bolted to the column of the machine in such a position that the roller passes over it with every revolution of the face plate, thus operating the ratchet and feeding the tool. The intermediate lever is slotted so that it can be shifted to change the feed.

Formula for Tap Drill Size—Discussion

By Wm. S. Rowell

I wish to refer to recent contributions in the *American Machinist* under the above head by J. R. Owens, on page 935, Vol. 56, and H. W. Bearce on page 310, Vol. 57. Possibly a little further consideration of this subject may not be overdoing it. The rule: Tap drill = Nominal tap size — $2d$, (d = depth of thread) may be departed from only where less than a full thread is permissible. Doubtless modesty prevented the editor from pointing out that Mr. Owens' variant has appeared in more than one edition of the *American Machinists'* Handbook, and may be found on page 62 of the third and current edition, where it appears with a caution. It is only a rough approximation, giving about 76 per cent of a full thread. Though reasons may be given for the use of such threads, it is well to understand their limitations, and especially to know when we are producing them. The percentage of full thread permissible or advisable in any specific case depends on many factors, including not only service required, but material used, length of thread in relation to diameter, and so forth.

A little examination of the subject will show that the rule under consideration: Tap drill = nominal size $-\frac{1}{p}$, (p = number of threads per inch), would be right if $2d = \frac{1}{p}$; but even in the shortened U.S.F., and similar threads, $2d = \frac{1+0.3}{p}$, very nearly. To be more exact $2d = \frac{1 + 0.2990375}{p}$. For convenience the less than 0.001 may be neglected, and double the depth of U.S.F. threads ($2d$) may be considered, $\frac{1.3}{p}$. Those who are especially interested in reducing power consumption and breakage in tapping operations are inclined to urge the advantages of a shallow thread; but so mony considerations enter into the problem of proper thread depth that most designers and users of taps prefer to decide each case on its own needs.

A rule for quickly and easily approximating tap drill sizes for any U.S.F. tap is: Tap drill = nominal tap size less $\frac{1.3}{p}$. This rule is submitted after use extending over many years. It also "has never been seen in print" nor has it been found in use by the writer. It may appear to some that 1.3 is an inconvenient mixed-number to use as a dividend; but most of that disappears when reduced to $\frac{1,300}{1,000}$. It is always considered either $\frac{13}{10}$, $\frac{130}{100}$ or $\frac{1,300}{1,000}$; usually the latter, as most of our dimensions are in thousandths. A pencil is never used in the calculation, the mental process being something like this: Take a $\frac{3}{4}$-in. 10-thread tap drill:

$$1,300 \div 10 = 0.130$$

Nominal size = 0.750 in. — 0.130 in. = 0.620 in. = aproximately $\frac{5}{8}$ in.

It is instantly seen that $\frac{5}{8}$ in. is slightly large but as generally agreed we rarely need a *full* thread. This is an easy one. Now for one that may look less so. A one-inch 8-thread tap drill = 1,300 ÷ 8 = 0.1625

Nominal size 1 in. — 0.1625 in. = 0.8375 in. = [illegible] in. approximately.

Here again in selecting a $\frac{27}{32}$-in. drill we are sacrificing a small amount of thread depth.

Even in the case of a fractional thread a pencil is scarcely needed in the simple calculation

Example, 5 in. $2\frac{1}{2}$ threads.

$$1,300 \div 2\tfrac{1}{2} = 0.520$$

Nominal size 5 in. — 0.520 in. = 4.480 in.

It is readily seen that the only noval feature of this rule is considering the constant 1.2990375 as 1.3 and this as thirteen-tenths or a hundred and thirty hundredths or thirteen hundred thousandths, preferably the latter as so much of our work is dimensioned in thousandths that we all become more or less familiar with that tiresome translation of binary and other vulgar fractions into their nearest equivalents in three places of decimals. The burden of ten as a radix is one that man may never escape. May it be considered evidence of a slight oversight in the original design, starting him out with ten digits instead of eight, or better, twelve?

String Board Graphics—Discussion

By H. E. Taylor
Chief Engineer, Hotchkiss & Co., Coventry, England

The contribution of Percy S. Brown on string board graphics which appeared on page 483, Vol. 56, of *American Machinist*, has been read with interest.

Visual recording in its works has been adopted successfully by Hotchkiss & Co. As the string graphs have been in operation for nearly three years, a few remarks on the details of their application to the progress section may be of timely interest.

The boards used, a sample of which is shown in Fig. 1, are of simple, cheap construction, standard as to size and painted black. The titles and borders are carried out in white enamel, and light green paint is used in dividing the board into squares.

The names of the components with their corresponding drawing numbers are painted on black enameled strip plates. Each plate is drilled at the ends and can be hung on two nails provided on the board for this purpose. These plates were adopted to enable alterations to be made quickly. In the center of each square, a short brass nail is driven, and around these pegs the string is carried as shown in the illustration.

Various colored strings are used. A red string stretched from the top to the bottom of the board, shown by the dash line, is used to indicate the nominal stock which should be carried. The actual stock in the stores is indicated by a white string. A yellow string is used to show the number of parts actually passing through the shops at the time the boards were last made up.

To the extreme left of each board, a strip of paper is carried on "bulldog" clips. Upon this strip of paper, each time the boards are made up, is entered the number or quantity by which any component falls short of the nominal stock quantity previously arranged. In the case

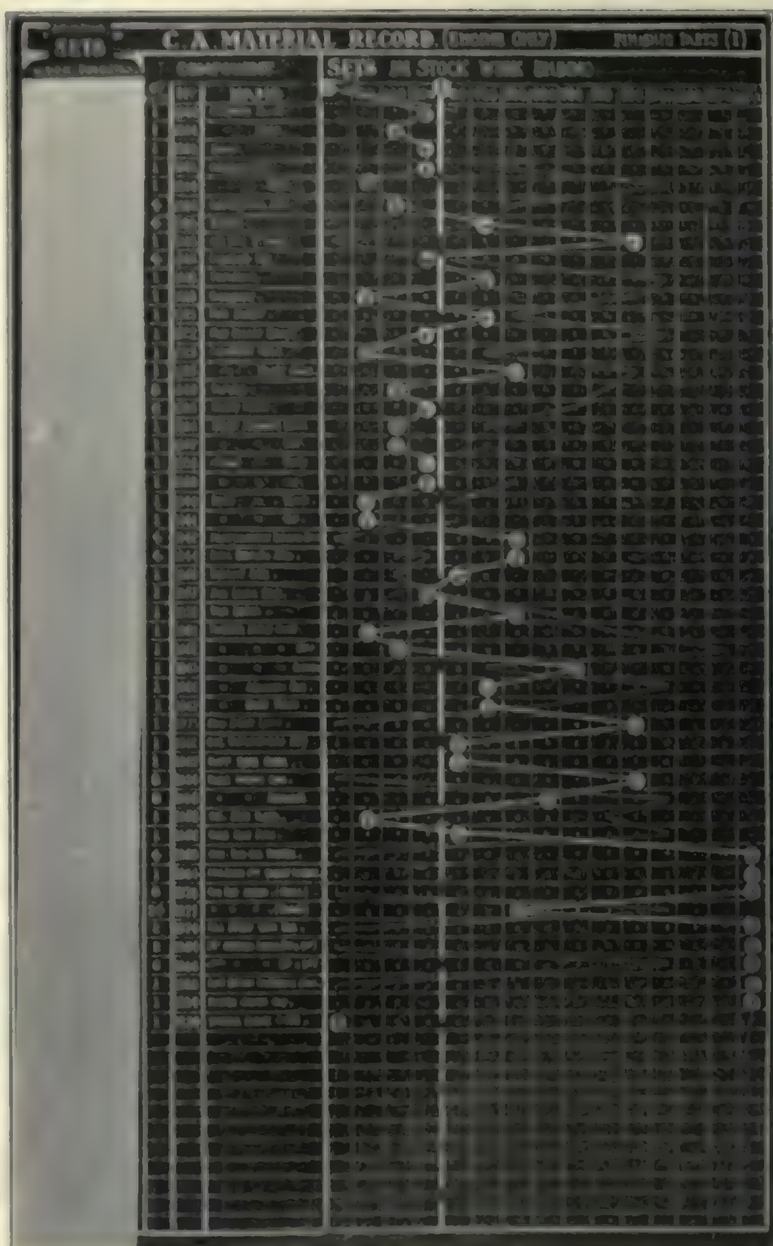


FIG. 1—STYLE OF BOARD USED, STRING GRAPHS IN POSITION

FIG. 2—STRING BOARDS IN OPERATION IN FINISHED STOCKROOM

of a shortage, therefore, the department concerned understands that it should endeavor to make up the quantity lacking before the boards are brought up to date again.

Three sets of boards are used. One gives the position of the raw material stock. The second board shows the parts purchased from outside sources in a completely finished condition; and the third board, by means of different colored strings, indicates not only the quantity of finished parts actually on hand in stores, but shows details pertaining to the progress of parts in manufacture in the shops.

The boards are brought up to date weekly. The "rough storekeeper" is responsible for the raw material records, and the progress department for parts passing through the shop. The "finished storekeeper" is responsible for parts bought outside, as well as finished stock. In cases where any component or part requires special attention, metal stars are used, and these are hung on the pins around which the strings are carried. In Fig. 2 a number of the boards are shown in operation in the finished stores department.

Automatic Machines for Small Brass Gear Blanks

By Herbert Crawford

The Neptune Meter Co. uses many small brass gears in the recording mechanism of its meters, and the two machines shown herewith have been rigged up especially for machining the blanks. The first is a small, special automatic machine, shown in Fig. 1, for turning the outsides. The castings are dumped into the hopper and slide down against the feeding disk *A*, which revolves slowly. The slots in the face pick up the castings and the outer piece in each slot drops through a chute at *B* to the feeding plunger *C*. The two holes to be seen in the gear blanks fit over corresponding pins on the plunger which hold them against turning, while the plunger feeds the blanks into a hollow mill which turns the outside. With the withdrawal of the plunger the finished piece drops out of the way and another takes its place. The machine requires no attention except to fill the hopper.

The second operation is performed on a Brown & Sharpe automatic screw machine, as shown in Fig. 2. The turned blanks are fed into the S-shaped magazine and roll down into the receiving head *A*. The tool *B* pushes them into the chuck by means of the plunger *C*. While the turret is turning, the rear cross slide with the plunger *C* is drawn back out of the way and the drills in the turret get to work. The center hole is drilled and reamed and the side faced by the front tool carriage, after which the piece is ejected from the chuck and a new piece fed into place.

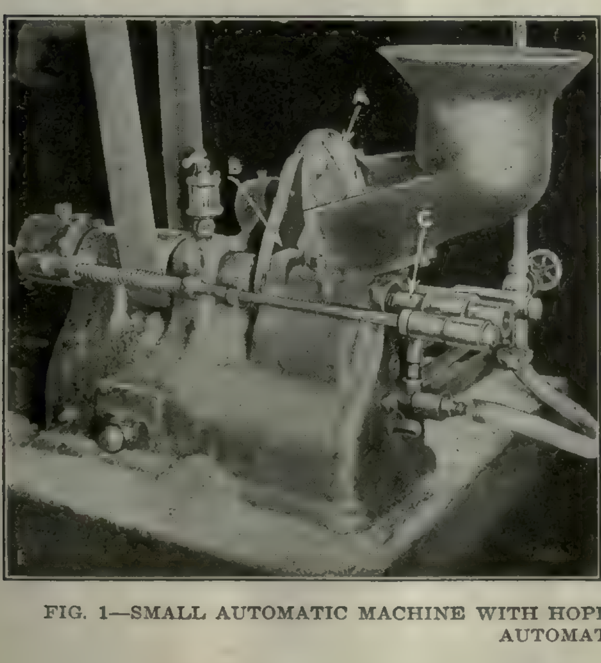
Another evidence of the way in which dial indicators are used can be seen at the left of the cross slide. These indicators are mounted in various ways so as to be convenient for the operator to test as many pieces as may be necessary as they come from the machine.

The Mechanics of Drafting

By V. P. Mendenhall

While a draftsman is not judged solely by the quantity of his output, there are certain mechanics of the profession which can be arranged to shorten the time consumed in detailing and allow more opportunity for the draftsman's training, experience, and other factors of ability to assert themselves. In making an assembly, or construction drawing there is very little opportunity for short cuts. The group assembly method, however, has many advantages on all but the simplest machines. When each unit is treated separately, the drawing can be made on a larger scale, there is not so much hidden mechanism, the sheet does not become so soiled, alterations do not affect details already approved, and, if desired, more than one draftsman can work on the same design.

With an accurate assembly, the following method of detailing will be found productive: The standard detail sheet is printed on the dull side of the tracing cloth. A backing sheet of detail paper is put on the board and the sheet outline, block divisions guide lines for such lettering as symbol, material, and number required, are printed in pencil. The tracing sheets are laid on this backing sheet one at a time, dull side up, the details outlined with a soft pencil and immediately inked in. The block outlines help to place the drawing, and the division lines are inked in as necessary to



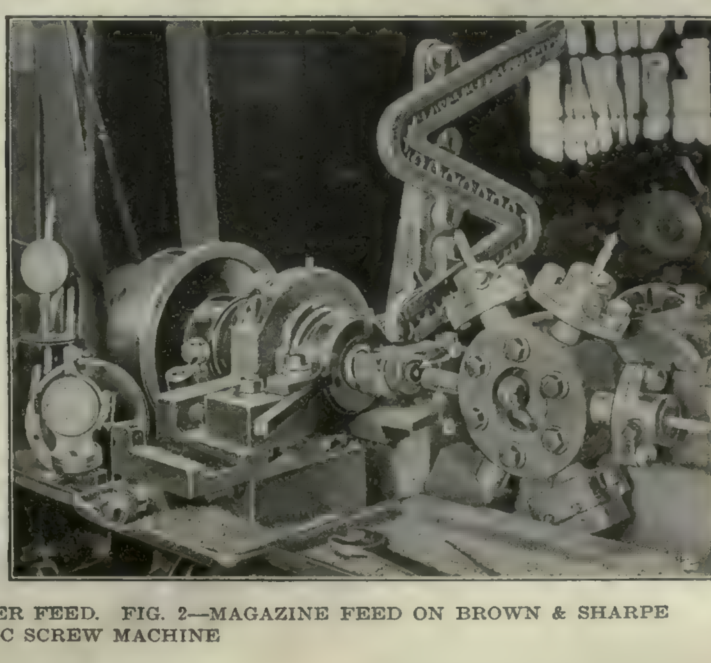


FIG. 1—SMALL AUTOMATIC MACHINE WITH HOPPER FEED. FIG. 2—MAGAZINE FEED ON BROWN & SHARPE AUTOMATIC SCREW MACHINE

enclose each detail. The sheet is then cleaned with gasoline. A draftsman who is accustomed to think ahead of his hands can show a noticeable increase in the work accomplished by this plan, especially if he is provided with a drafting machine.

One view will suffice for most of the studs and pins, as well as for flat plain work if the thickness is given in a note. Gears, pulleys, rollers, and bushings need only a cross-section. A left hand view or symetrical half can often be traced from the right hand printed face down. Fits should be given in thousandths. In the shop $(1\frac{1}{4})^{+2\text{ to }3}$ will prove a great time saver over $(1\frac{1}{4})^{D}$. For springs, the size of stock, mandrel and turns per inch should be given.

A great aid to the production clerk is a parts list of each machine giving the symbol, part number, sheet, number required, material and stock needed, and in what shape, that is, cut up, or in bar form for turret lathes and screw machines. Stock patterns for bushings are also noted. In addition, the assembly will be greatly accelerated by a bolt and screw list, including all the parts to be drawn from the supply room. Such lists will insure that the different parts and materials are ordered well in advance of assembly, and will go far towards standardizing methods of production.

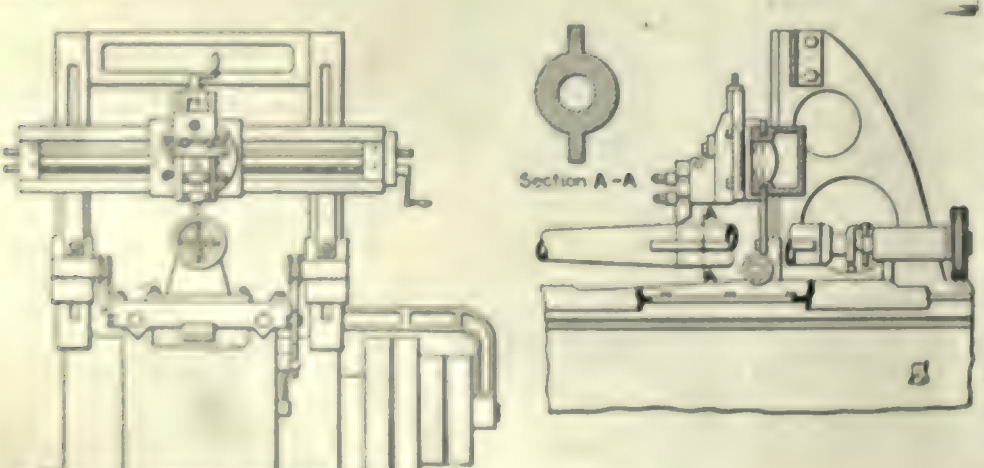
Planing Irregular Surfaces

By Joe V. Romig

Work having complicated surfaces—circular and flat, having more than one plane, or having a flat surface merging into a long taper or radius—can be machined on the planer by means of the simple equipment here described. The use of formers for producing multi-surfaced rounds in the lathe is common but the attachment of a forming device to a planer is unusual.

The example shown is that of a light cannon having on each side a parallel rib or shear forged in one piece with the jacket. The shears are for the purpose of mounting the cannon in the housing in such manner as to permit it to move endwise, and are a part of the recoil absorbing mechanism.

The body of the gun is round, parallel over a part of its length and tapered the rest of the way. To finish this surface by turning would have been impossible, as a glance at the section A-A will readily disclose. The forging was machined upon a planer in the manner herein described.



SET UP FOR PLANING IRREGULAR SURFACE

Cast-iron former bars of T-sections were made as may be seen in the sketch, and one of the internal angles planed on each so as to allow the bars to be bolted rigidly to the table. One edge of one of the T-s was then laid out to conform to the contour of the finished gun, and both were planed by bolting together, gripping them in the shaper vise and planing crosswise. Several hitches were necessary to complete the long bars but no real difficulty was encountered in following the line.

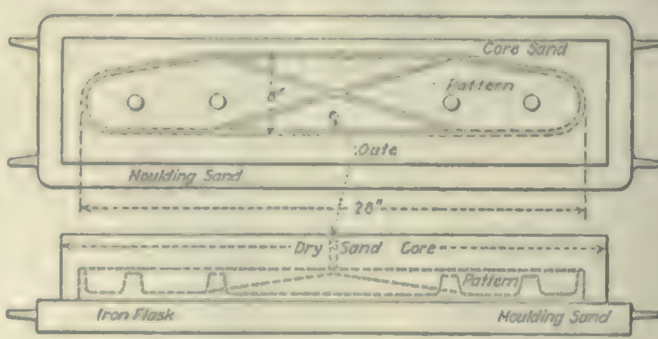
The former bars were then bolted to opposite sides of the planer table. Slides, each carrying a guiding roller, were fitted to the face of the planer housings and attached to the crossrail by suitable straps. The elevating screws were removed to allow the crossrail to rise and fall as the rollers traveled over their respective formers.

A pair of centers to take the work completed the set-up and the work of machining was simple and easy of accomplishment.

Making a Straight Casting from a Twisted Pattern

By M. E. Duggan

Dan Mulligan had money and was looking around for an easy way to get rid of it, so I advised him to try inventing. He did—and proved that this long-advertised method was not always successful. Dan



A GOOD CASTING FROM A POOR PATTERN

invented a machine for taking the wrinkles out of trousers. Being a novice in the art of spending money he could not grasp the idea of paying out enough all at once to get a good set of patterns for his experimental machine so he compromised by having a "good enough" set made, from which he obtained the castings for one machine. The patterns were then "parked" next to the roof of the pattern loft where the boiling sun poured down day by day—unless it rained, when the roof leaked a little. No further attention was paid to the patterns, however.

The first machine was an astonishing success, much to everybody's surprise, and Dan immediately ordered castings for six more, but alas! those patterns from which the first set were made so nicely were

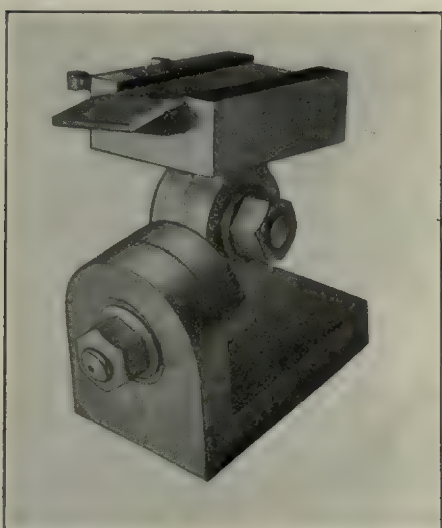
no longer in condition to produce others of like degree, for they were warped, twisted and some of them broken beyond repair. One of the castings was for a sort of steam table and required a true flat surface, for the finish was by grinding and there was no stock to be machined off. Here is the way we made a good casting from that twisted pattern.

The pattern was laid face down on the core bench and a rough frame of wood nailed around it as a sort of temporary flask. This was filled with core sand and, when ready, this "core" was put into the oven and baked. An iron flask of suitable size was then provided and partly filled with molding sand, rammed down good and hard and the surface swept off level and smooth. On this bed of molding sand the "core" was laid, still face down, and weighted. The iron was poured through a hole or gate that had been made in the core, and a good casting resulted, the upper face (which was at the bottom of the mold) being produced by the smooth bed of molding sand. The cut will make the procedure plain.

An Angle Grinding Fixture

By Henry M. Clary

The fixture shown in the photograph was designed for the purpose of holding tools similar to the one shown in the illustration while they were being shaped and ground. It has, however, been found very useful for grinding angles on all sorts of work. The fixture is very simple, consisting of three parts bolted together. The surfaces at the joints are ground even and graduated in degrees, so that a piece of work can be set at the exact angle desired, in either direction. Two setscrews in the head hold the piece in position. The fixture is in use in the shops of the Midwestern Tool Co., Chicago, Ill.



AN ANGLE GRINDING FIXTURE

Safeguarding Shaft Couplings

By Wm. J. Fisher

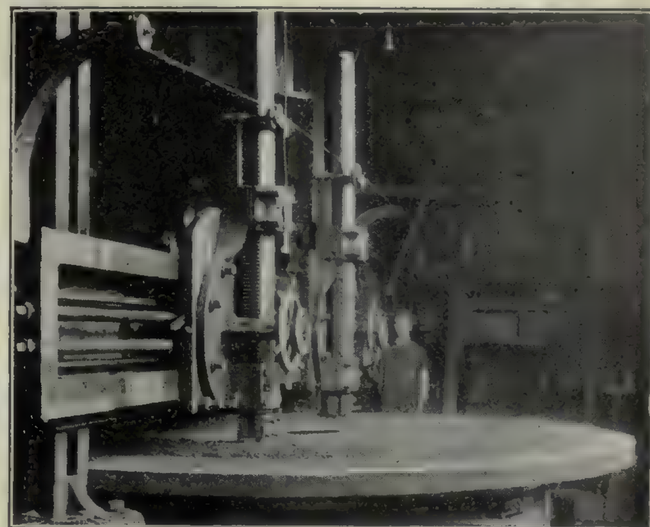
I was interested in an article by E. Hoke, on page 75 of *American Machinist*, on safeguarding shaft couplings. As I am interested in all safety appliances I read it over very carefully.

I cannot understand how the coupling could get by the inspector with that wicked looking gib-key standing out beyond the hub where it would surely catch anything more quickly than the bolt heads and nuts. Why should the key not have been fitted up from the inside, or flange end, of the coupling and cut off flush with the outside hub?

A Single Casting That Is in Two Parts

By Sandy Copeland

There is nothing unusual about the job or the casting shown in the illustration except in the way in which the latter is poured so that it may be machined as a single casting and shipped in two pieces. The piece is a "rubbing bed" used for surfacing large blocks of stone, and when mounted upon the machine for service it is bolted to a spider that is in turn keyed upon the end of a vertical shaft so that the disk revolves in a horizontal plane, just as it does on the boring mill only considerably faster.



A SINGLE CASTING MADE IN TWO PARTS

The finished disk is 13 ft. in diameter by about 3 in. thick and the casting weighs 10,800 lb., about 800 lb. being removed by the tools. As shown upon the table of the mill there are two tools at work, each taking a cut $\frac{3}{4}$ in. deep with a $\frac{3}{32}$-in. feed. When the mold in which it is to be cast is finished, and before lowering the cope to place, a wrought iron bar of rectangular section is laid across the diameter of the mold. This bar is $\frac{1}{2}$ in. thick and of a width equal to the thickness of the casting. It has six or eight $1\frac{1}{2}$ in. holes through it and is laid edgewise in the mold.

Binding the Parts Together

After closing the mold the iron is poured from both sides simultaneously, the molten metal passing through the holes in the bar and serving to bind the two parts together in a single casting strong enough to withstand any shocks that may be imposed by ordinary handling or in the machining operations. When the disk is finished it is mounted upon the spider and fastened thereto by bolts passing up through the spider and tapped into the under side of the disk. After assembling the machine and making sure that every thing is in shape to run, it is dismantled for shipment.

The disk, which thus far has remained a single casting, is then picked up by the yard crane and dropped upon a timber laid upon the ground lengthwise of the joint. One drop from a height of but a few inches is usually sufficient to break the casting. Upon reaching its destination the disk is reassembled in the machine, the bolts passing through the holes to which they were numbered in the original assembly, and the disk runs as true and smooth as when it came off the boring mill.

Editorial

THERE ARE several very important facts about tools that everyone should know, among them three that can and should be proclaimed from the housetops by the men who have learned them through sad experience, for there are still many who do not know them. Machine tools are an asset; small tools are an expense; improper tools are a liability.

Shall We Cancel the War Debts?

TWO NOTABLE contributions to the best thought on the problem of liquidating the debts of the World War were made at the banker's convention last week. Rt. Hon. Reginald McKenna, former British Chancellor of the Exchequer and a noted banker and economist, gave a picture of the situation which rivals in clarity of vision and conciseness of expression any presentation of the subject that has come to our notice.

Mr. Lamont of J. P. Morgan & Co., as one of the foremost American financiers, introduced a more idealistic tone into his address but showed that he has the same keen appreciation of the fundamental problems of inter-allied indebtedness and the reparation indemnities as has Mr. McKenna. He asked many questions and answered some of them by inference only, but in a way that left little doubt as to his personal feelings.

One question, perhaps the most vital one, was this: Should any part of the debt of the allies be cancelled by the American taxpayers? In seeking an answer to this question more than one phase must be considered if the result is to be sound and lasting. Altruism cannot overlook hard economic facts, and political expediency must respect moral principles. The question is so complicated that a hasty answer is inconceivable.

Mr. Lamont says the question of cancelling part of Europe's debt to us must be answered by the taxpayers. What, then, will be the answer of the makers and users of machinery? If they concede that Mr. McKenna is correct in saying that the debts can be paid by exportable surplus only, and they must concede it eventually, most of the available gold and securities being already in our hands, are they not faced with the choice of either agreeing to the cancellation of part of the debt or accepting payment in machine tools, printing presses, looms and other machinery?

As a matter of fact it seems likely to be something of a Hobson's choice, for, of all the countries of Europe that are in our debt, England is the only one which has the slightest chance of meeting either interest or principal payments, at least within the immediate future.

We Americans would be the last people in the world to doubt the good intentions of our debtors to repay in full, but the laws of economics make small allowance for the best intentions. Until the number of unbalanced national budgets is considerably reduced, we as creditors must discount good intentions about ninety-nine per cent.

Not a few believe that cancellation of all debts of European nations to the United States would make for a rapid return to prosperity for all concerned. They use the argument that so long as we shall probably never be paid anyway, we might as well make the best of a bad matter and start afresh. Others insist that the debits be kept on the books until some means of payment is found. Some of them refuse to believe that Europe is not hiding her resources and is not attempting to "do" us.

We believe that both camps of extremists are wrong and that both ignore basic facts. Those who favor cancellation forget that the mistakes of the Peace Conference have left many sore spots in Europe that are likely to break out if the threat of insolvency is removed. The suspicious and practical souls, on the other hand, are shutting their eyes to the unbalanced budgets, depreciated curriencies, unemployment, lack of capital and raw materials and disorganized industries, some or all of which afflict our debtors.

But isn't there a middle ground that America can take with some hope of improving the situation? Can she not charge off part of this indebtness in return for the protection afforded her in the year she took to raise and train her armies, but at the same time insist on holding to account for the remainder those of her debtors who would be likely to start new wars on the money they owe us.

Just what part should be cancelled and what should not is a very important detail to be worked out. It would vary with different countries perhaps. Possibly some better plan will be devised. But in the light of the information now available this one seems to meet the requirements fairly well.

Just Suppose

JUST SUPPOSE all the modern machine tools should suddenly disappear, and in their place we should find the much admired museum specimen of the "good old times." What would happen?

Well, for one thing, we should have to quit riding in automobiles for they would be in the same class as seagoing steam yachts and pearl necklaces. Nor would the bicycle be within reach of any but a favored few and so we should have to huddle together in cities and say farewell to our suburban home, our vegetable garden and our flower patch. Street cars? No, not even street cars, except a few short-haul horse cars, because motors would be scarce and expensive. Besides, it would be difficult to build generating stations and transmission lines for a reasonable amount of money.

All the people engaged in the making, maintaining, selling and running of these devices would have to go back to the farm and live the simple life, for the farm would be what it used to be--without labor saving devices, or means of communication with one's fellow beings, except with the aid of old Dobbin.

Without modern machine tools we would—

Hold on, this sounds like a nightmare, and besides we have them.

Yes, but—

Just suppose.

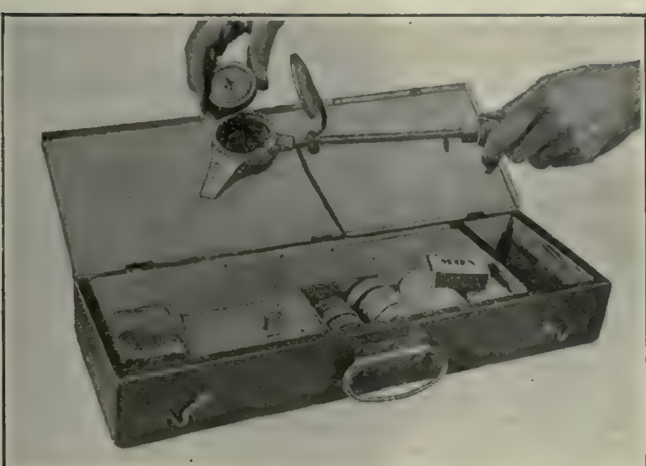
Shop Equipment News

Soldering Iron Heated by Chemical Action

A soldering iron which employs no heat from an outside source, but utilizes chemical reaction to bring it to proper temperature for use has been brought to this country by the International Sales Co., 921 Southern Building, Washington, D. C. In the use of the iron, a chemical transformation is employed by which it is possible to obtain a degree of heat of approximately 3,000 deg. C. in a few seconds. This chemical action has been so applied that by using an accurately measured quantity of the reacting substances the soldering iron can be heated in 7 sec., it it claimed, to a point where it is ready for immediate use.

The soldering iron has a receptacle cast in it, as shown in the illustration herewith. In this receptacle is placed a small tin container holding the required mixture. The head of a special match is inserted through an opening in this container, or briquet, and the wooden portion is broken off. A perforated lid is then closed over the receptacle and the protruding match-end lighted. Instantly an intense white glow appears through the holes in the lid and the iron is ready for use. The heat from this one application lasts about 10 min., after which another charge can be lighted and the operation continued. After the first heating, the duration of heat under one charge is increased 50 per cent, it is stated.

The iron and a supply of the briquets and matches are housed in a metal-lined box, with a hinged lid and handle for carrying. The charge can be set off in the

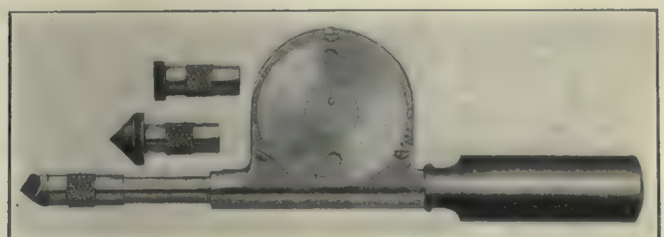


SOLDERING IRON HEATED BY CHEMICAL ACTION

box in a house or room with no danger from sparks, and practically no smoke. While in use there is no flame, but only a glowing mass within the receptable. Owing to the absence of the fire hazard, it is claimed that the iron may be used about the garage, shop or house or on an airplane, automobile, or motor boat with entire safety. The outfit is particularly useful for making quick repairs.

Brown & Sharpe No. 748 Speed Indicator

The accompanying illustration shows the speed indicator No. 748 that has recently been placed on the market by the Brown & Sharp Manufacturing Co., Providence, R. I. The indicator determines and registers the number of revolutions of shafting, motors and revolving parts in either direction, and measures both



B. & S. SPEED INDICATOR NO. 748

high and low speeds equally well. In design this indicator is entirely different from the former models. It has few parts, and is simple and reliable in operation. The readings are taken from one side of the indicator. The device can be quickly set at zero.

The indicator registers up to 5,000 revolutions by steps of five revolutions, although speeds much faster than 5,000 r.p.m. can be determined. The two arrows on the face of the dial indicate the figures to use for the different directions of rotation. The figures showing through the small round windows on the dial register steps of five revolutions directly. The small inside dial registers hundreds of revolutions. This latter dial can be turned to zero by the knurled knob on the back of the indicator.

The fiber handle serves as an insulation for the operator against electricity. The working parts are enclosed in a dull-nickeled case. Three points are furnished as shown, a steel point for ordinary speeds and rubber points for high speed. All unnecessary projections, rough edges, and corners which might interfere with the use of the indicator have been eliminated. The device is light and easily handled.

Norma Minimeter

On page 861, Vol. 55 of *American Machinist* there appeared a description of the Hirth minimeter placed on the market by the Coats Machine Tool Co., New York, N. Y. The Norma Company of America, Arnable Ave., Long Island City, N. Y., is now manufacturing and selling the minimeter, which is similar in design and construction to that previously described and illustrated. The device is intended for use in gaging, and measurements as small as 0.0001 in. are commercially obtainable. The instrument can be mounted in a variety of ways to suit it to a variety of measurements, both internal and external. Either inch or millimeter dimension scales can be furnished.

Nilson Kritiscope for Determining Critical Points in Steel

A device called the Nilson Kritiscope has recently been placed on the market by Herman H. Sticht & Co., 15 Park Row, New York, N. Y., for use in determining the critical points when heat-treating steel. These points or arrests that occur while the part is being heated can be detected magnetically, as it is a property of steel to lose its magnetism as soon as the lower arrest is reached and the rearrangement of the structure occurs. Thus the Kritiscope is brought near the work in the course of heating so that the point at which the magnetism is lost can be determined.

The accompanying illustration shows the device being brought in contact with a piece of work in a furnace, but it can also be used when a small part is being heated over a flame such as a bunsen burner. As the steel approaches cherry red in color, it should be tried with the indicator until no magnetic effect is shown. The tool is touched to the steel when first placed in the furnace and then drawn away slightly. If the bar or indicator remains in contact with the work, the latter is still magnetic and requires further heating.

The indicator that actually touches the heated piece is itself not a magnet, and hence can be heated without injury. This indicator receives its magnetization by induction from a permanent magnet located within the body of the Kritiscope. The walls of the body protect the magnet from over-heating, so that it always retains its magnetism. The Kritiscope is packed in a wooden case and is furnished complete with extension rods and a shield for protecting the hand of the operator.

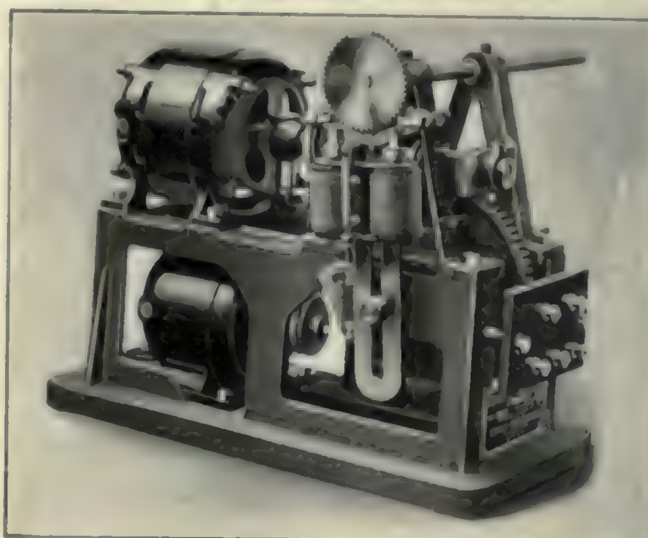
KRITISCOPE FOR DETERMINING CRITICAL POINTS

It should be noted that the temperature of the piece itself and its critical points are indicated by the use of the Kritiscope and not the temperature existing in the furnace, as is usually recorded by a pyrometer. The device does not require calibration and is not affected by vibration or rough handling. The Kritiscope is self contained and has no electrical leads or connections. It can be read quickly and directly to ascertain the condition of the steel and the proper time for quenching it.

Engelhard Automatic Temperature Regulator for Gas Furnace

On page 1015, Vol. 52, of *American Machinist* there appeared a description of an automatic temperature regulator made by Charles Engelhard, Inc., 30 Church St., New York, N. Y. The device has recently been redesigned, so that it appears as shown in the accompanying illustration.

The principal changes lie in the addition of a generator to provide the low-voltage current that was formerly supplied from an outside source such as a storage battery. The generator is run by a motor operating on current from a lighting circuit. The position and arrangement of the solenoids have also been changed. A terminal board has been added at the end of the frame, which also is of changed design.

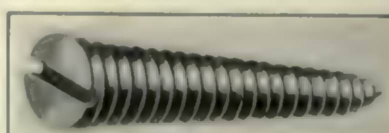


ENGELHARD AUTOMATIC TEMPERATURE REGULATOR

The device is ordinarily connected by means of chain to the valve on the gas pipe feeding the furnace. It is connected electrically to a pyrometer, so that the furnace temperature can be ascertained and held within a certain range. The machine itself has three main parts, the motive power, the escapement mechanism and the timer. The motive power consists of a $\frac{1}{12}$-hp. motor operating on either a.c. or d.c., a worm gear reduction having an 80 to 1 ratio, and a 25-watt, 6-volt, d.c. generator to furnish the power for the solenoids.

Plumb Take-Up Wedge for Hammer Handle

A device that provides for retightening the handle in the head of a hammer, hatchet or similar tool of the impact type has recently been applied to the tools made by Fayette R. Plumb, Inc., Philadelphia, Pa. This device, which is designated as a take-up wedge and is shown in the illustration herewith, consists of a tapered screw having uniform pitch throughout its length. A slot in the butt end of the screw enables turning by means of a screwdriver.



PLUMB TAKE-UP WEDGE FOR HAMMER HANDLES

Hickory is ordinarily employed for hammer handles

because of its toughness and springiness, although it shrinks with age and becomes loose in the head. The advantage of the take-up wedge is that not only can a handle be made tight when it is new, but it can always be retightened, so as to keep it tight in service.

To fit the screw to a tool, a hole is drilled in the end of the handle somewhat deeper than the length of the screw. It is then reamed to receive the screw, which is driven in until the butt end is flush with the handle. If the head becomes loose in the handle, a slight turn of the screw again spreads the wood uniformly so that it grips in its socket and removes the looseness. The screw thread prevents the wedge from flying out under shock.

Simplified Cost Accounting

By Robert Brainerd

The value of cost records has never been appreciated as keenly as in these days when a difference of a few cents on the cost sheet is often the difference between industrial life and death. Many and diverse are the systems in use, but for the small shop, the writer has failed to see a method of cost-keeping that fills the bill any better than that in use by the Saginaw Stamping and Tool Co., Saginaw, Michigan.

When an order is received for a job, a shop order is made out in duplicate, the original of which is sent to the shop superintendent with the blueprint for the job. The shop order number is marked on the corner or back of the print, which is then passed on to the foreman, and ultimately, to the workman.

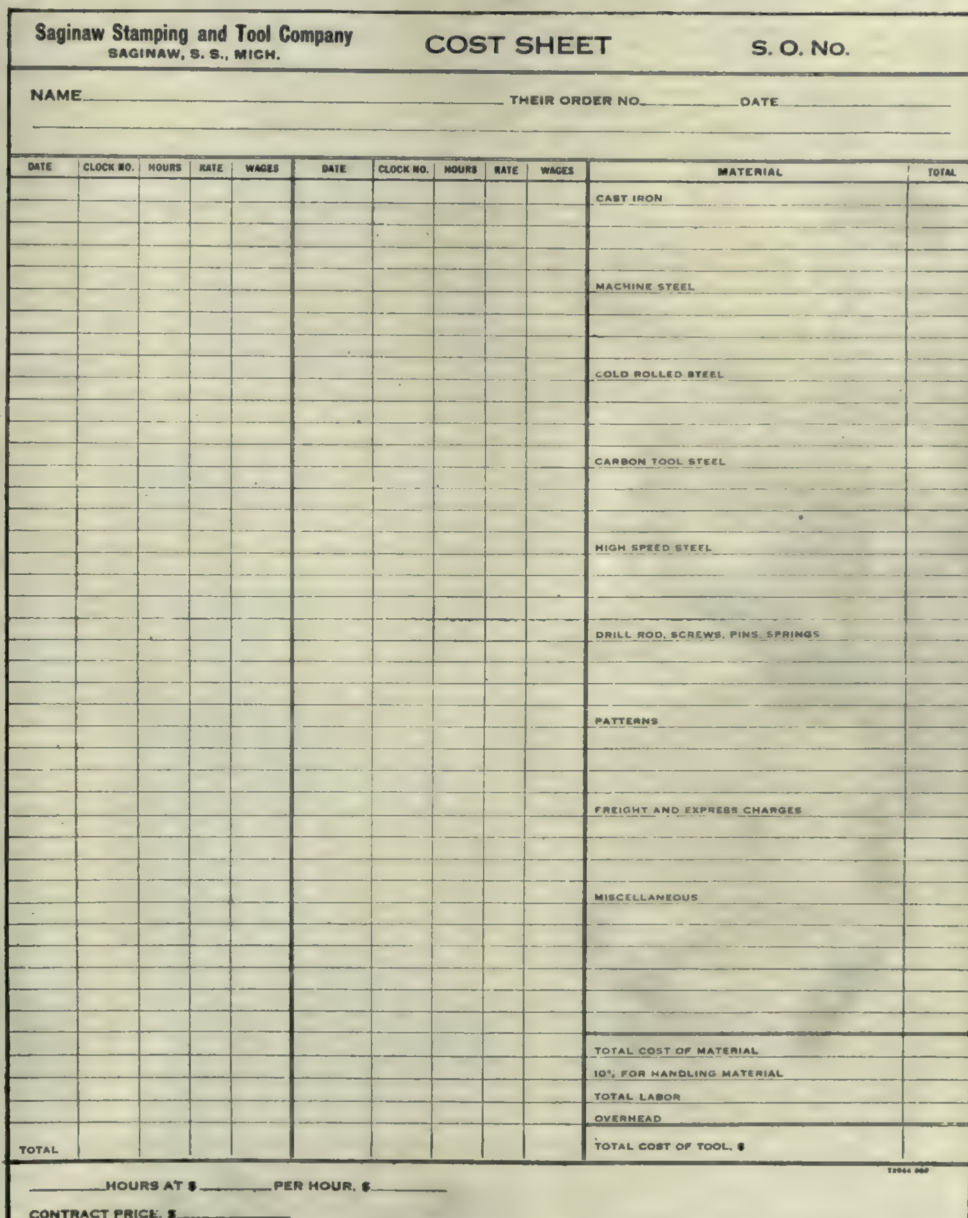
At the same time that this is done, the shop order is entered at the top of the cost sheet, as are the name of the firm from which the order was received, its order number and the date the order was received. The illustration shows the cost sheet in reduced size; full size is 8½x11 inches.

Each of the workmen who performs any labor on this job copies the shop order number on his clock card, and each day the amount of time spent on the job is recorded on the cost sheet. When the job is done, the total labor cost is entered in the last column opposite "total labor." Any material used on the job is entered on the shop order in the superintendent's charge, and on the completion of the job this is turned in to the office and the items transferred to the cost sheet in the proper locations. Ten per cent is added to the total cost of the materials to cover the cost of handling, freight, express, etc., this having been found to be approximately correct on the average. Adding the correct percentage for overhead expense is a simple matter.

The rate per hour to be charged for the job is entered in the lower left corner of the sheet, if the job is taken on an hourly basis; or the contract price is entered if a fixed sum is to be charged for the entire job. The rate per hour varies of course, with the nature of the job.

The results obtained are accurate enough for all practical purposes, and the low cost of obtaining the desired information recommends it for the small or medium sized shop.

There is another value to the cost sheets. Frequently it is necessary to estimate on similar work and records of past performance are invaluable. The shop that can estimate accurately has it all over the one that can't.



SMALL SHOP COST SHEET

News Section

American Gear Manufacturers' Association

Semi-Annual Meeting at Chicago Well Attended—Many Valuable Committee Reports on Standardized Gear Practice—Apprenticeship and Costs Live Subjects for Discussion

The ninth semi-annual meeting of the American Gear Manufacturers' Association took place at the Drake, Chicago, Oct. 9, 10 and 11. The meeting was characterized by the usual informality and close attention to business and much work was accomplished.

Most of the many standing committees brought in reports of progress that indicated the immense amount of hard work going on behind the scenes. Definite recommendations were presented by F. E. McMullen, of the Gleason Works as chairman of the Bevel and Spiral-Bevel Committee and were acted upon. The association approved by unanimous vote the motion of Mr. McMullen to adopt as suggested practice for future use, the Gleason system of bevel gears with three different pressure angles as published in *American Machinist*, page 849, Volume 56. The committee's recommendations as to nomenclature and thrust values for spiral bevel gears were adopted as recommended practice. This report will be published in an early issue.

A paper by Prof. D. L. Rich, of the University of Michigan on Standardization of Gear Sounds evoked considerable interest and led to a good deal of discussion. Prof. Rich stated that there were three ways of combating noise of any kind: By absorption of the noise in sound deadening material as in the soft hangings of auditoriums; by insulating the source of noise or the compartment in which it is produced; and by elimination of the noise at the source, as by improving the quality of the gears in a transmission. He discussed the various methods and instruments for measuring sounds and noises and gave as his conclusion that it would be possible to devise means of determining whether a given gear combination was noisier than a definite standard, but not how much.

Other papers were "The Evolution of the Gear," by George L. Markland, Jr., president of the Philadelphia Gear Works; "Why Buy a Pig in a Poke," by L. G. Hewins, Sales Manager The Van Dorn & Dutton Company, and "Engineering Research," by Prof. E. A. White of Michigan.

On Monday evening P. C. Molter, superintendent of the Department of Industrial Education of the National Metal Trades Association, addressed the members on Apprenticeship. The diminishing supply of skilled machinists in the industry was dwelt on by several members in the discussion that followed and the apprenticeship system was felt to be the only means of training new men to fill the gap.

At the business meeting three new member companies were elected: American Gear Company of Chicago, Dalton & Balch of Chicago, and the Manne Manufacturing Co. of San Francisco. Several additional representatives of member companies were also elected.

At the banquet the speakers were Gen. John V. Clinnin, who spoke on "The World War and Its Effect on American Business," and Judge Marcus Kavanaugh, who chose as his subject, "Business Men and Law Enforcement."

The meeting afforded the members present a good chance to get acquainted with the new secretary of the association, Mr. T. W. Owen, whose office is Room 107, 2443 Prospect Avenue, Cleveland, O. It was announced that the seventh annual convention of the association would be held in Cleveland on the last Thursday, Friday and Saturday in April, 1923.

American Engineering Standards Committee Handling 106 Projects

The growing interest in standardization on the part of almost every American industry is emphasized by the quarterly report of the activities of the American Engineering Standards Committee issued from the headquarters of the committee at 29 West 39th Street, New York City.

Of the projects which have official status before the A. E. S. C., twenty are concerned with mechanical engineering; 17 are civil engineering projects; 15 are electrical; 3 are automotive; 10 are concerned with transportation; 10 with ferrous metals; 11 with chemical; 5 with non-ferrous metals; 4 with mining; 2 with textiles; 1 with shipbuilding, and 8 projects are of general interest.

Twenty-four standards or safety codes have been approved and 36 are up for approval. The remaining 46 projects represent codes and standards which are either in the process of formulation, or which are now being considered by committees of representatives, designated by the various bodies, industrial, technical and governmental, interested in each particular subject. In this way, more than 200 such bodies are officially participating in the work of the A. E. S. C. through their accredited representatives.

A regular interchange of information as to the status of work under way is maintained by the American Engineering Standards Committee with the national standardizing bodies of Austria, Belgium, Canada, Czecho-Slovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden and Switzerland. This information is issued in the form of quarterly reports and includes a statement of the status of each project on which work is actively under way.

George Richards—An Appeal

We regret to learn that Mr. George Richards—thirty years or so ago, of the well-known Manchester firm—is new disabled owing to paralysis and quite incapable of any further work. He suffered serious financial loss during the war and, though direct appeals have been made to his relatives, is now dependent on the kindness of his friends for support. Endeavors are being made by some of these to raise a fund to assist him and, at his desire, to provide for the maintenance and education of his youngest child, a boy of 13, until he is able to support himself. Subscriptions will be gratefully received by Mr. A. J. Munro, 103 Cornwall Rd., South Tottenham, N. 15, or by Mr. Leslie N. Burt, 7 Outer Temple, W. C. 2. London, England.

This is, indeed, a worthy cause and one which merits the attention of the machine tool industry. Too often does it happen that a life spent with unexampled toil in the advancement of an industry and its products is found in the evening of its career dependent upon our generosity and gratitude. We feel sure that those of our readers who are acquainted with Mr. Richards' work in the past and know of his genius in the design of machine tools will not hesitate to help him in the adversity that has overtaken him.

Machine Tool Exports Show Little Change

Metal working machinery to the value of $1,032,483 was exported during August. This is slightly under the July exports, valued at $1,074,371. As compared with August 1921, the exports show an increase of $100,920. Exports for July, 1921, on the other hand, exceeded those of August of the current year by $702,012. The Department of Commerce furnishes the following details:

EXPORTS METAL-WORKING MACHINERY

	July, 1922	August, 1922
Lathes	$61,443	$52,963
Boring and drilling machines	28,059	31,370
Planers, shapers and slotters	33,881	11,980
Bending and power presses	7,351	16,061
Gear cutters	25,791	15,290
Milling machines	27,597	27,631
Sawing machines	1,013	3,145
Thread cutting and screw machines	16,756	13,530
Punching and shearing machines	9,581	6,735
Power hammers	8,973	10,534
Rolling machines	129,881	734
Wire-drawing machines	2,475	1,665
Polishing and burnishing machines	330	396
Sharpening and grinding machines	54,483	79,356
Chucks, centering, lathe, drill and other	17,519	23,566
Reamers, cutters, drills and other parts for machine tools	89,485	100,295
Pneumatic portable tools	41,980	44,772
Foundry and molding machinery	28,467	70,228
Other metal-working machinery and parts of	489,306	522,232
Total metal-working machinery	$1,074,371	$1,032,483
IMPORTS		
Machine tools	$14,762	$18,926

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

TO A FRIEND who congratulated him upon his serenity in a panic, the late Pierpont Morgan is said to have remarked, "It always stops raining." His philosophic observation is recalled now because upon the expectation and declaration of stock dividends the market value of the various Standard Oil securities has increased by over a billion dollars in the past year.

Nearly one-half of this increase is due to the advance recorded since Aug. 18 last, when the market value of the various Standard Oil issues was $1,728,000,000 as compared with $2,223,000,000 on October 10. But this advance has not added a penny to the earning power or assets of the properties affected, and unless their market value was absurdly low two months ago it is now too high.

But whatever the facts in respect of intrinsic values may be, it behooves us to remember that it cannot rain stock dividends or anything else all the time and it is quite possible that the wild and thoughtless buying of oil stocks in general and Standard Oil stocks in particular which this distribution of new shares has induced may mark the culmination of the bull movement in securities.

There are other reasons for thinking that this may be the case. The Standard Oil shares are now more widely distributed than ever before. In one way or another the money market will be called upon to supply a large share of the increased capital required to carry them at their enhanced valuation. Commercial loans are meantime increasing and Secretary Mellon's action in bringing out half a billion 30 year government bonds at 4¼ per cent has established that rate as the irreducible minimum at least for the present. We may therefore expect a gradual hardening of the money market, accentuated in all probability by the freight blockade which will retard the conversion of the goods in transit into cash.

These are the considerations which lead me to advise great caution in making commitments that assume a further advance in the stock market.

From this generalization the railway shares may perhaps be excepted, for it is quite possible that the phenomenal earnings indicated by the present heavy traffic may offset the influence of higher interest rates and the speculative liquidation of the oil and industrial stocks that seems to impend.

Neither is it to be expected that the commodity markets will be susceptible to the monetary and speculative influences to which the stock market is so sensitive. There has been no great speculation in merchandise. Stocks are very light. Wages are high. There is no unemployment anywhere. In fact, a scarcity of labor is reported from some regions and there is every indication that a nation that can spend half a million dollars on a baseball game will not be deterred from making normal purchases by the slight advance in prices thus far established or in prospect.

This prognosis is confirmed by the trade reports of the week. In both the primary and retail markets a good business at gradually rising prices seems to be passing. Wheat is firmer and slightly higher. So are corn and cotton. Cotton goods are conspicuously active and firmer. There are some who are coming to feel that this year's cotton crop has been slightly underestimated, but with the president of the Manchester Exchange pleading that America should bestir itself to raise 16,000,000 bales of cotton no one now fears that a yield of even 11½ million bales this year would depress prices.

> **Those who at the present time are attributing the advance in commodity prices to inflation are implying that our gold has less purchasing power than formerly. If this be true then the inflation is a permanent rather than a temporary condition, and likely to continue as long as we insist that debts be paid in gold rather than goods for our exportable surplus.**

Wool and woolen goods, silk and its products, furs, hemp, jute, burlaps, iron, steel, copper and most other metals, coffee, sugar and rubber are all in good demand at prices which are in nearly every case of the seller's making. The advance in rubber, which is now selling at 19½ cents for January delivery, is due to the gradual crystallization of the plans for restricting the production that have been so long under consideration, and the improvement in sugar to an appreciation of the fact that the surplus stock will have nearly disappeared before the new crop becomes available.

Eggs, of which there is, curiously, an overproduction, and coal are the only articles that have declined during the week and unless the official reports are misleading there is every reason to expect that there will be enough coal to go around during the winter if no one is allowed to "hog" more than a month's consumption in advance.

For the upward tendency in prices so generally reported there must of course be some general reason. Charles J. Webb, president of the Philadelphia Textile Association, attributes it to a "second inflation" against which he warned his hearers in an address last week.

But inflation is a much used word that is difficult of definition. When it first found a place in the economists' vocabulary it meant a rise in prices due to a dilution of the currency and a consequent depreciation of its value as expressed in commodities. But unless the gold that the banks are forcing into circulation has depreciated in value or purchasing power there has been no dilution or depreciation of our currency.

Therefore those who attribute the advance in commodity prices to inflation are by implication compelled to admit that gold has less purchasing power than formerly. This is, I think, the fact, and if it is the fact then the inflation of which so many are apprehensive is a permanent rather than a temporary condition that is likely to persist in this country as long as we insist upon being paid in gold rather than goods for our exportable surplus.

That it should be exclusively reflected in the commodity markets and without effect upon securities is entirely logical, for most securities, and especially bonds, are nothing more than certificates which attest the investment of so many dollars whose number and value as expressed in the gold in which they are payable is not affected by a change in the purchasing power of the gold as expressed in commodities.

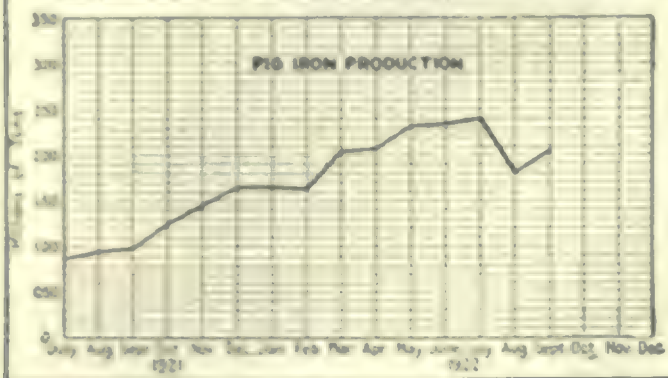
If this be correct, then it is highly probable that business will continue to feel the artificial stimulus of "gold inflation" and advancing prices until the latter is checked by an expansion of credit that will exhaust bank reserves and compel contraction. The weekly statement of the Federal Reserve banks indicates that this expansion has already commenced in that rediscounts have increased by 91 millions, but we are still some distance from the inevitable reversal for the reserve ratio of 75.7 per cent is only 1.7 below last week's figure and is quite high enough to assure comparatively easy money for some time to come.

Any serious curtailment of credit is not therefore by any means imminent, and it seems likely that the present upward movement in commodity prices will continue during the winter.

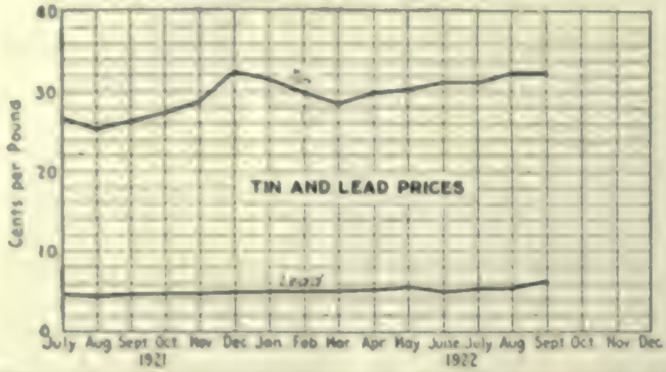
The news from abroad is reassuring and the barometer of sterling exchange, which is higher, indicates clearing weather in Europe politically as well as financially.

The German mark, which sold as low as 3⅜ cents a hundred last Tuesday, is so low that it is hardly worth talking about. My private advices are that dollars are generally displacing it as a medium of exchange in Germany and the time is probably approaching when the mark will be officially, as it is now practically, demonetized.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



PIG iron production during September totaled 2,033,720 tons as against 1,816,170 tons in August, an increase of 217,550 tons which was not unexpected in view of the settlement of the labor troubles in the coal and railway fields. While September production is about 370,000 tons below the high point reached in July, it compares favorably with the average monthly production for the 9 months of the current year amounting to 2,033,993. An increase in the number of furnaces placed in operation toward the end of September is expected to result in a large October output.

Tin and lead prices were strong during September, the average price of the former showing but a fractional decline from 32.134 cents in August to 32.075 in September. Lead moved up to 6.110 cents as against 5.824 cents in the previous month. While there has been but a narrow demand, the low status of stocks on hand has served to keep the price firm. Present indications point to higher prices in the near future.

Automobile share markets were strong during September, the average price for ten representative issues advancing to $45.65 per share as compared with $43.40 in the month previous. Except in a few cases, where new financing is under way, the car manufacturing companies show healthy financial statements. Production of cars and trucks continues to record high totals and the demand both for domestic and export consumption shows a steady increase.

Metal working machinery exports held up well in August and were valued at $1,032,483. This total is exceeded in the current year only by the exports for March, valued at $1,057,106 and July, valued at $1,074,371. As compared with the month of August, 1921, however, there is an increase shown of $100,920. Imports of machine tools continue in small volume. Tools to the value of $18,926 were brought in during August as against $14,762 in July and $16,101 in the same month a year ago. With an improvement in the European situation, and with an adjustment of war debts upon a reasonable basis, an era of industrial activity should follow, resulting in a wide expansion of machine tool exports.

Steel ingot production in September according to figures compiled by the American Iron and Steel Institute, totaled 2,373,779 tons, an increase of 159,197 tons over August. This compares with the current year's high point reached in May with a production of 2,711,141 tons.

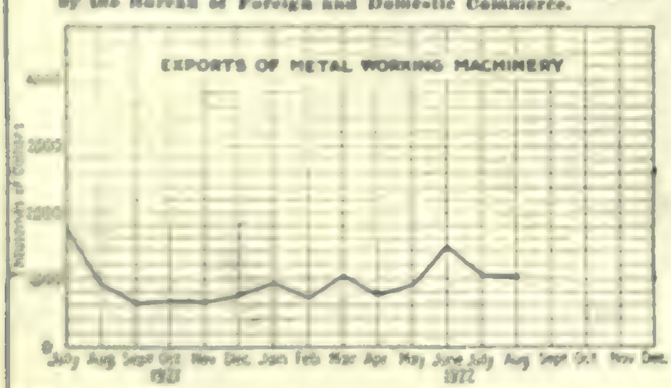
Railway earnings on American roads experienced a sharp decline in revenue during August due to the shopmen's strike as compared with July and with August, 1921. The total net operating income for 197 roads of Class 1, for August amounted to $52,579,799, or at the rate of 2.65 per cent as against July income of $69,239,037, or 4.04 per cent, on the assumed valuation of $19,165,800,000 for American railway properties, in excess of $95 millions monthly required for 6 per cent return

Comparative Prices of Shop Supplies

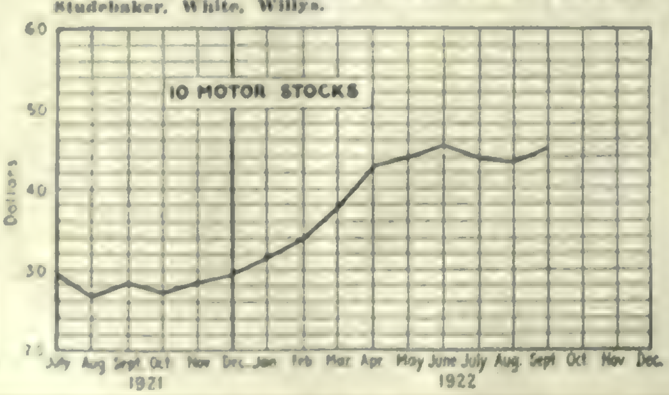
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0292	$0.0285	$0.0273
Cold finished shafting	per lb.	0.0378	0.0365	0.0384
Brass rods	per lb.	0.165	0.1700	0.135
Solder (½ and ½)	per lb.	0.22	0.225	0.20
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



British Textile Machinery Industry

Extraordinary Prosperity Since the War—Former Markets Being Recovered—Big Increase Shown in Exports

By A LONDON CORRESPONDENT

WHILE every other industry in Britain has been in the depths of depression during the last two years, it is a curious fact that the textile machinery trade has enjoyed a unique experience. At a time when every other English trade was suffering acute unemployment, due to the blighting influence of the very general slump, there has been no lack of work for the textile machinist in Lancashire. Orders have poured in from all parts of the world. The devastated factory towns of France and Belgium have been excellent customers, while from the Far East and many parts of the Empire heavy demands have come for the textile machinery specially made in the north of England.

The leading firms have indeed had the time of their lives, although no one can honestly begrudge their good fortune. The profits of one well-known Lancashire firm were enough, in 1921, to pay a dividend on the ordinary shares after providing for all liabilities, fixed charges, etc., and allowing a large sum to be carried forward of not less than 37 per cent, although the management wisely decided to put part of this to additional reserve against future lean years.

Exports Approach Pre-War Point

This is just a sample of what has been going on in the English textile machinery trade during the last 18 months or so. And there is every indication of this activity continuing as large orders are coming to hand from the Far East, especially India, which is one of the very best customers for our textile machinery.

To give an idea of the magnitude of the business done, I may add that in 1913 the value of shipments of textile machinery was just over £8,000,000, whereas in 1921 it was over £25,000,000. The tonnage last year, however, was 156,995 as against 176,074 in 1913, figures which are eloquent as to prices. Ten years ago the price paid per ton for this class of machinery was £47. In 1921 the average price was £160. This year the rates have been easier, the prices paid by foreign customers having gradually fallen to £148 per ton, but high rates will rule for many a long day as the demand shows no considerable diminution.

When the war ended it was found that France and Belgium were largely destitute of textile machinery, this being the case particularly in northern France, the object of the Germans having been to destroy the French textile industry which they thought they could do by smashing up all the productive machines. If they could have destroyed all the Lancashire textile machinery workshops and all the patterns contained therein, they would have been much nearer their object. Today the French textile factories which were destroyed have been largely rebuilt with new British machinery.

When the war came to a close an agreement was entered into between the British, French, and Belgium Governments that the two latter nations should have a prior claim upon deliveries from British textile machinery factories. This understanding has been carried out with the above-mentioned result. It may be added that a leading British association has put into operation in France a new mill of over 50,000 spindles.

While British textile machinists have been very busy repairing the ravages of war on the Continent, that alone would not have been sufficient to have created the boom had not large orders been received from the great Far Eastern markets, such as India, China, Japan, etc. It is officially stated that two English firms alone have booked orders aggregating £13,000,000.

> With the engineering industries of England in the past two years suffering, perhaps, the most severe depression ever experienced in their history, the activity of the producers of textile machinery in the British Isles stands out in bold relief. From all quarters of the globe have come orders for machinery to produce fabric for the world's inadequately clothed population. A careful survey seems to indicate that it is only a beginning.

Shipments of textile machinery to India of late years have been on a very extensive scale. In 1913 English exports were 50,000 tons, valued at £2,000,000, against over 60,000 tons in 1921, valued at nearly £9,000,000. It is currently reported on very good authority that British makers have extensive contracts on their books for Indian firms, and it is thought likely that shipments will continue on a large scale for the next three years at least and perhaps longer. The mills in India have increased in number, from 56 in 1880 to 253 today. In the same period there has been an increase in the number of spindles from 1,462,000 to 6,763,000, looms also increasing from 13,500 to 120,000.

Great Activity in the Orient

There is every indication that China also has entered upon a period of activity in cotton manufacturing and this is one of the most promising markets for textile machinery. In 1913 England sent only 3,382 tons of such machinery to China, valued at £138,058. Last year the shipments totalled 16,489 tons, and were valued at over £2,000,000. Today China has 63 cotton mills containing 1,650,000 spindles and 7,650 looms, with many others planned or contemplated. It is a source of satisfaction to see that a more enterprising and enlightened policy is now being adopted by commercial organizations in the extension of cotton spinning in the Orient.

Japan is another market where British textile machinery has done well lately and which offers splendid opportunities for the future. In 1913 English exports to that country of such machinery totaled 19,688 tons, valued at £802,643. In 1921 they totaled 22,531 tons, valued at over £3,000,000 and this in spite of the depressed condition of Japanese trade. Of course, during the period of the war Japanese manufacturers had the time of their lives and made huge fortunes, but matters are very different today. In consequence of the small amount of shipping which was available to send supplies of goods from England to India, Japanese merchants naturally took advantage of their opportunities and secured a substantial amount of business from India. Japan now possesses 119 mills containing 3,814,000 spindles and 50,600 looms. The latest reports from Japan indicate great activity in building new textile mills all requiring equipment.

Japanese Capital in China

But Japanese capitalists are not alone content with their home market. At the present time they are largely interested in erecting cotton mills in China and it has recently been reported that British firms have received new orders for spinning machinery to be supplied to China under the auspices of Japanese capitalists. One order, it is stated, is for over one million spindles. According to the latest official figures by the British Board of Trade,

TABLE NO. 1. SHOWING TONNAGE AND VALUE OF BRITISH TEXTILE MACHINERY FROM THE UNITED KINGDOM FROM 1913 UP TO AND INCLUDING THE FIRST SEVEN MONTHS OF 1922

Year	Tons	£
1913	178,074	8,281,848
1914	116,383	5,766,502
1915	59,447	3,332,365
1916	59,268	4,107,707
1917	49,271	4,203,671
1918	36,531	3,943,001
1919	65,938	8,430,725
1920	63,314	9,158,773
1921	157,005	25,148,832
1922 (7 months)	77,275	11,488,339

Japan and China have really been the backbone of the recent boom of English exports of textile machinery to those countries.

Lancashire textile manufacturers are, of course, quite aware of this enormous export of machinery which is for use in foreign factories and destined to produce textile goods in competition with their own. On the face of it, it looks as if Lancashire would gradually lose its export cotton trade and that it is in a sense "cutting its own throat" by sending large quantities of textile machinery to India, China and Japan, thus enabling manufacturers in those countries to produce large quantities of cloth. It is generally thought, however, that it will be a long time before the new mills can have very serious effect

Table No. 2. Showing the British Exports of Textile Machinery, the Country to Which Shipped, and the Tonnage and Value in Each Case

Exported to	1913 Tons	1913 £	1920 Tons	1920 £	1921 Tons	1921 £
Russia	15,108	995,296	168	40,973	3	2,235
Germany	15,917	783,896	43	15,771	341	121,399
Netherlands	12,171	412,515	1,374	182,493	2,470	374,581
France	12,630	735,901	17,001	2,836,054	24,383	4,332,017
Other European countries	22,695	1,162,142	8,948	1,404,067	12,720	2,788,299
China	3,382	138,058	2,616	306,022	16,499	2,097,799
Japan	19,658	802,645	8,051	860,221	22,531	3,086,398
U. S. A.	3,939	250,784	1,745	337,641	6,397	1,476,998
South America	12,879	551,432	2,259	363,546	5,404	868,092
British E. India	50,437	2,001,157	17,945	2,303,275	60,276	8,873,424
Australasia	1,417	64,008	632	109,698	1,691	284,531
Other countries	9,611	404,010	2,532	399,072	4,290	843,159
Totals	178,074	8,281,848	63,314	9,158,733	157,005	25,148,832

upon the export of textiles from Britain. It should also be remembered that the machinery recently installed is really four times dearer than pre-war values. This increased cost of machinery will be a serious handicap to those mills when they come to compete with mills not so burdened with expensive plant. It should also be remembered that the standard of living throughout the world steadily improves and as the huge populations of India, China and Japan become more civilized and rise nearer to Western ideals of life, they will tend to clothe themselves in fabrics that are of better quality than they have done heretofore.

In table No. 1 there is shown the development of this branch of British engineering industry, the tonnage and value of British textile machinery exports being given for the years 1913 to 1922.

In table No. 2 a segregation is shown of the principal markets to which British textile machinery has been exported in the years 1913, 1920, 1921.

It is interesting to note that the value of exports of textile machinery from the United States has risen from $1,611,279 in the year ended June, 1914, to $10,507,822 in 1921. The exports to China during this time have risen from $51,478 to $2,783,098 in 1920. To Japan they have increased from $10,608 to $3,764,247. These two countries have also taken the bulk of American exported textile machinery. British East India is another country well worth attention. In 1914 her importers of this class of machinery only purchased $[illegible] worth of machinery of American manufacture which in 1918 bounded up to over $300,000 but fell in 1920 to $44,707. In 1919, the United States were sending England over 3 millions' worth of this machinery, but in 1920, the last year for which figures are available, the trade had fallen to $[illegible]746.

The Far East is undoubtedly the great market for the future for both British and American textile machinery.

An encouraging demand for many years seems to be assured and there is not likely to be over-production or extreme competition so far as Britain is concerned. British makers will be very busy filling orders for the home mills, for replacement of old and worn-out machinery and for extensions so that their attention will not necessarily be given entirely to the foreign markets.

The textile machinery builders of this country have, indeed, been fortunate. They have been working at high pressure for the last two years, while the other branches of the industry have been in the depths of the depression, many principal firms only receiving last year 10 per cent of the orders they executed in 1920 and 1919.

The S. A. E. Production Meeting

The Production Meeting of the Society of Automotive Engineers to be held in Detroit, Oct. 26 and 27 is to be a marked departure, which it is hoped and believed will be helpful in many ways. Originated by the engineers of the industry, the society has never before seen its way clear to give the production departmnets the benefit of close co-operation and closer social unity and this meeting is the first step to bring about this very desirable condition.

The personnel of the committees insures an interesting meeting. Members are: Meeting and Papers Committee, Karl L. Herrmann, Chairman, Thomas J. Litle, Jr., F. A. Whitten and C. Harold Wills; Factory Visits Committee, Kirke K. Hoagg, Chairman, E. F. Roberts, Thomas J. Litle, Jr., Howard A. Coffin and George E. Goddard.

There is every reason to believe that this will become an annual affair and one which cannot fail to be of lasting benefit to the industry. One notable feature is that every paper will be written by men who are in the production departments of the various plants, and who know from actual experience what is being accomplished. A glance at the list of papers and their authors will show the kind of information to be expected.

The meeting should attract production men and machine tool builders from all parts of the country and nonmembers will be made welcome in the good old S. A. E. way. There will be two morning sessions and at least four factories will be visited in the afternoons. An informal dinner, which is always an interesting feature of these conventions, makes another method of getting acquainted with the men in the industry. Every production man who can arrange to attend should do so. The papers are to be as follows:

Thursday, Oct. 26, 9:30 a.m.: The Group-Bonus and Its Application, by E. Karl Wennerlund; Cylinders From the Ore to Finished Part, by P. E. Haglund and I. B. Scofield; Tool Allotment and Costs, by F. A. Mance; New Methods of Processing Splined Shafts, by J. A. Ford.

Friday, Oct. 27, 9:30 a.m.: Problems Met in the Production of Air-Cooled Engines, by William Dunk; Some Experience from a Production Note-Book, by H. J. Crain and J. Brodie; Production Errors in Gears, by K. L. Herrmann; Selection of Machine Tools, by A. J. Baker; Machine-Tool Efficiency, by R. K. Mitchell.

There are many unusual problems met in the building of air-cooled engines and William Dunk of the Franklin organization will describe them in his paper. A. J. Baker of the Willys-Overland Co. will offer some pertinent suggestions on the selection and purchase of machine-tools. His paper will interest tool supervisors and factory superintendents.

Exporters Convention Opens Oct. 25

"Better Times Through Foreign Trade" is the slogan for the thirteenth annual convention of the American Manufacturers Export Association which will be held in New York City, at the Waldorf-Astoria hotel, Oct. 25 and 26. Responses so far received from invitations sent out to members point to a record attendance.

The opening session will be held on Wednesday morning, Oct. 25, at which delegates will be registered, reports of officers and committees will be received and new officers elected.

President Myron W. Robinson will address the afternoon session at which Dr. Julius Klein of the Department of Commerce will preside.

The speakers for the afternoon session of Oct. 25 have been selected from the various divisions of the Department of Commerce and the topics to be discussed are: Trade Situation in Western Europe, by Alan G. Goldsmith, chief of the Western European Division; Trade Situation in Eastern Europe, by Dr. E. Dana Durant, chief of the Eastern European Division; Trade Situation in the Far East, by Frank R. Eldridge, Jr., chief of the Far Eastern Division; Trade Situation in Latin America, by Ralph H. Ackerman, chief of Latin-American Division; Foreign Trade Disputes and Arbitration, by Archibald J. Wolfe, chief of Commercial Laws Division.

At the morning session of Thursday, Oct. 26, the topic will be "Shipping" which will be discussed by: Hon. Edward C. Plummer, commissioner, United States Shipping Board; and W. Averill Harriman, chairman of the board, United American Lines. Homer L. Ferguson, president and general manager, Newport News Shipbuilding and Dry Dock Co. will act as chairman.

In the afternoon the new tariff law will be discussed by: W. S. Culbertson, vice-chairman, Tariff Commission, Washington, L. C., and U. S. Senator Joseph S. Frelinghuysen, of New Jersey. W. W. Nichols of the Allis-Chalmers Manufacturing Co., Inc. will preside.

The annual banquet will be held in the evening of Oct. 27 with Alba B. Johnson of Baldwin Locomotive Works acting as toastmaster.

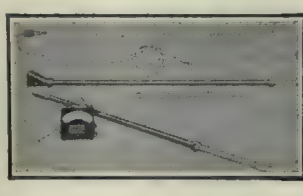
British Pig Iron Output Gains in August

According to a report recently issued by the National Federation of Iron and Steel Manufacturers of Great Britain the British production of pig iron in August amounted to 411,700 tons, or 12,600 tons more than in July. The average monthly output in 1913 was 855-000 tons. The August output included 120,200 tons of hematite, 137,400 tons of basic, 102,200 tons of foundry, and 22,900 tons of forge.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Pyrometer for Molten Metals, Portable
Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich.
"American Machinist," August 24, 1922

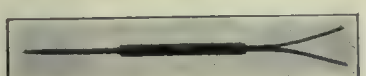


The pyrometer outfit gives instantaneous temperature measurements of molten metals and has renewable thermo-couple ends. It consists essentially of a standard Type-PA portable meter connected by 20 ft. of flexible copper cord to the thermocouple. The two bare wires on the end of the couple are ordinarily furnished in 16-in. lengths. They are inserted into the molten metal, such as brass, bronze, aluminum, copper or babbitt, and the temperature can be read almost instantly on the meter. The upper temperature limit is about 2,200 deg. F. The scale of the meter is graduated directly in degrees F. from 32 to 2,500. Size, 6½ x 6 x 3 in. Weight, 5 pounds.

Metal, Non-Ferrous Alloy, "De Bats," No. 4
De Bats Sales, Inc., 60 South St., Boston, Mass.
"American Machinist," August 24, 1922

The metal is in the tungsten-chromium-cobalt class and possesses endurance and ability to withstand high speeds when cutting cast iron and the higher alloy steels. It contains no ferrous compounds and is non-magnetic. It is melted in electric furnaces and cast in molds of steel in the form of toolbits, inserts for built-up milling cutters, twist drills and reamers. The metal cannot be forged nor annealed, and can be worked only by the grinding process. It may be given rake and clearance angles approaching those of high-speed steels. Standard sizes of toolbits are furnished to be held in holders, while for more severe duty slabs or blocks are welded to carbon-steel backings.

Scriber, Self-Guiding, "Duwell"
J. A. Finley Co., 20 Braintree St., Allston, Mass.
"American Machinist," August 24, 1922



The self-guiding scriber is intended for the use of mechanics, particularly tool makers. It has a double point by means of which an outline at the bottom of a small, irregular-shaped hole may be laid out. One of the points is made sharp to do the scribing while the other one is slightly rounded and a trifle shorter. The points are pressed together and put in the hole. The tool is twirled around and the spring point causes the scribing point to follow the outline of the hole. For larger holes the single point at the opposite end of the tool is used in the regular manner.

Centering Device, "Duwell"
J. A. Finley Co., 20 Braintree St., Allston, Mass.
"American Machinist," August 24, 1922

The tool is for center-marking round stock rapidly and accurately. The hub has a reamed hole through its axis to which is fitted a ground center punch. Extending radially from the hub are three steel posts, equi-distantly spaced around the periphery, and upon each post is a sliding jaw. A bushing or spider, having an equal number of radial bosses fits over the hub so that it may be rotated without endwise movement. Connecting rods join the radial bosses to the jaws upon the hub, so that when the bushing is rotated relative to the hub the toggle action of the rods causes the jaws to slide simultaneously inward or outward according to the direction of the rotation. After centering, a light blow of the hammer on the outer end of the punch marks the center.

Wrench, "Kant-slip"
Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.
"American Machinist," August 24, 1922

The wrench will grip work of any shape and readily adjust itself as to size. The sliding fulcrum is closed to the load and there are no screws, pins or springs to wear out or break. On top of the stationary jaw is a raised flat, forming a hammer head so that the wrench can be used as a hammer for light blows. The opposite end of the stationary member is formed into a screw-driver.

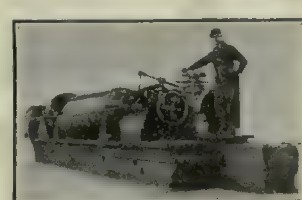
Washing Machine, Metal-Parts
Crescent Washing Machine Co., New Rochelle, N. Y.
"American Machinist," August 24, 1922

The machine is for washing metal parts that are handled in quantities of 50,000 to 100,000 or more per day, and is arranged for washing, rinsing and drying. It is fitted especially to clean work requiring a great force and volume of water. A 3-hp. motor drives the pump for the rinse water. Small objects are placed in racks made of wire mesh, and two racks 18 x 24 in. in size can be fed into the machine side by side. They are carried continuously through the machine on the conveyor, so that they pass under both the washing and rinsing sprays. Capacity, 24 in. high, 40 in. wide and 16 ft. long.

Micrometer, 1-Inch, No. 435
L. S. Starrett Co., Athol, Mass.
"American Machinist," August 24, 1922

The frame is drop-forged with a ribbed section that adds greatly to its rigidity. It is finished in black enamel. The diameter of the screw is 0.312 in. and that of the contact points 0.270 in. Decimal equivalents are marked on the thimble. The micrometer can be furnished either with or without a ratchet stop.

Grinding Machine, Roll, Heavy-Duty
Landis Tool Co., Waynesboro, Pa.
"American Machinist," August 31, 1922



The grinding machine is for finishing all types of hot and cold mill rolls. It is entirely self-contained and is driven by three separate motors, one driving the work, another driving the grinding wheel, and a small motor driving the water pump. All three are controlled by means of push buttons on the operator's platform, which is mounted on the grinding wheel carriage so that the operator has a clear view of the wheel and the work. The wheel can be moved rapidly toward and away from the work. An attachment is fitted for grinding the periphery of the roll either concave, convex or straight.

Clip, paste on 3 x 5-in. cards and file as desired

Death of Chas. S. Gingrich

In the death of Charles Sumner Gingrich the machine tool interests of the country have lost one of their most active and widely known members. Mr. Gingrich passed away on October 10, 1922, aged 49 years. For twenty-two years he had been in the sales engineering department of the Cincinnati Milling Machine Co., and during his latter career was in charge of this important division of the company's work.

Those who knew Mr. Gingrich appreciated his rather unusual and remarkable personality, for he was not only an acknowledged expert in his particular line, but he possessed a mind of distinctly scientific bent. His interest in his daily work did not exced his study of abstract scientific subjects of a diversified character. The general laws of nature as they are expressed in physics, astronomy, botany and chemistry, captured his vidid imagination and occupied the time he could spare from his business career. There was probably no field of material science in which he had not a very intelligent, well organized knowledge. Naturally his mind turned from abstract principles to direct application with ease and surety, and his study of the relation of science to business stimulated in him an unusual concern in educational matters. He had a deep interest in the engineering work of the University of Cincinnati, and in the young men of that institution. His interest was evidenced by an active co-operation with the students employed by his company and in fact with all embryo engineers with whom he came in contact.

Mr. Gingrich was a man who thought clearly, and who acted directly. He translated his theories and his human interests into deeds of practical worth, whether it was in his relations to his mechanical engineering field or to students in need of advice and counsel.

On his business side he was known best as one of the group of able men who, during the last twenty years, have brought the Cincinnati Milling Machine Co. to its present position in the field of mechanical engineering.

He had a host of good and loyal friends throughout the country and his loss will be felt keenly in his business circles as well as in the scientific groups which were his chief pleasure next to his home.

(The above commentary on the life of Mr. Gingrich was written by Herman Schneider, Dean of the College of Engineering, University of Cincinnati, his closest friend.)

A.B.P. Convention Emphasizes Need for Accurate Facts and Figures

The seventeenth annual convention of the Associated Business Papers, Inc., was held at Hotel Astor, New York, October 11, 12 and 13. Simultaneously with it, the editorial conference had a very interesting session. Chief among the papers was one by Henry B. Dennison, president of the Dennison Mfg. Co., who pointed out the necessity of facts and figures in modern business. He maintains a research department to secure and record facts such as costs of materials, details of sales, personnel and other phases of the business.

Older types of managers sometimes resent the use of charts and figures, contending that it tries to replace business judgment. Nothing could be more erroneous as judgment can be no better than the facts on which it is based —and many times much worse. The use of facts tends to prevent quick decisions or snap judgments which are frequently wrong. He recognizes the value of intuition, but even here, real facts and figures help out in many ways.

Facts as a Buying Guide

The growth of the demand for facts has been very noticeable in his own organization in which committees are used very extensively. When the executive group has the facts, better judgment can be expected. A particularly good example was the fluctuations in the price of turpentine. Taking the average price for a period of years the policy is to buy relatively little when the price is above the average and more when it is below. This is believed to be better than to attempt to always buy at the very lowest price.

Records of individual employees, their performance as a whole, not only quantity or quality, but faithfulness, resourcefulness, initiative and dependability are all important factors which can only be accurately and fairly known by suitable records. And now they are applying records and time study to sales. They find that waiting time varies from 13 to 21 per cent, that 15 per cent is spent in clerical work on reports, etc.

Perhaps the most interesting and vital chart from the viewpoint of the machine builder is the chart of facilities so as to know when to order new machine equipment. This must be based on the line of normal growth and cannot depend on immediate needs except in the case of equipment which can be bought out of stock in the open market. When special machines which will take from 6 to 18 months for delivery are needed, they must be ordered in sufficient time. Facts and figures are not an end in themselves, but merely an aid to sound business judgment. And the aim of all business should be service to mankind.

Theodore H. Price, the well known economist spoke on the problem of selling to foreign countries in spite of tariff and other handicaps. Theoretically this seems impossible, yet he believes that men will find a way to buy the things they really want. And as we raise and manufacture many things which the rest of the world desires, he feels that they will find some way to buy them. We must, however, take long time paper or promises of pay, perhaps in the form of securities.

Mr. Price does not share the pessimism regarding the countries of central Europe, but likens the conditions to those in the South after the Civil War. Then Europe loaned money on Southern property, the Scotch being particularly noticeable in loaning on Southern cotton plantations. England also helped materially in financing our early railroads, London being the trading center for U. S. railroad bonds. He believes that well selected European securities will come back into good paying properties and points to Czecho-Slovakia as an example of what can be done.

Mr. Price decries the stress which is being laid on business cycles, believing it bad psychology to implant the idea that a business depression must follow a period of good business. He believes that the peaks and hollows of these cycles can be largely wiped out by a proper study of business conditions. He has faith in the collective judgment of the people of a democracy as usually being wise and prevailing.

The third session received a message from the American Engineering Standards Committee. A recommendation that was made that we clarify our speech. The business sessions took up the problem of selling advertising.

Business Items

The Spotz Manufacturing Co., Inc., Stamford, Conn., has been incorporated under the laws of Connecticut to manufacture machinery, and mechanical devices, etc. The concern will have a capital stock of $100,000, and will commence business with $50,000. The incorporators include: C. A. Spotz, Greenwich, Conn.; Carleton Pratt, 58 West 72nd St., New York; H. M. Rice, 100 Broadway, New York; William H. Spect, 337 East 87th St., New York; F. F. Harrower, Norwalk, Conn.; G. H. Bergmark, 200 Washington Ave., Pleasantville, N. Y.; O. A. Helmer, 645 Lexington Ave., New York., and A. H. Emery, Jr., Glenbrook, Stamford, Conn.

The Ford Motor Co. American plants for August established a new high production record of 136,132 cars and trucks. This compares with 130,107 for the month previous and with 109,172 for August, 1921.

The Rock Island Railroad, it is reported, will place orders for 40 new locomotives in the near future. Of the total order, 30 locomotives will be of the Mikado type and the remaining 10 of the Mountain type.

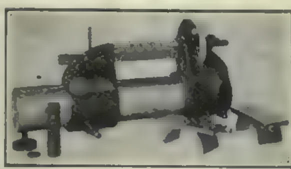
The Corner-Lock Manufacturing Co., Natick, Mass., has been incorporated under the laws of Massachusetts, to engage in the manufacture of locks, devices, etc. The capital stock is $50,000, and the incorporators include: Frank W. Everett, president; William F. Poole, 269 Chapman St., Canton, Mass., treasurer, and Dwight W. Robinson, secretary.

The Osgood Bradley Car Co., Worcester, Mass., has recently received an order for 100 electric cars for the United Electric Railways Co., Providence, R. I. The cars will cost about $12,000 each. The company has enough business on hand to keep them busy

Condensed-Clipping Index of Equipment

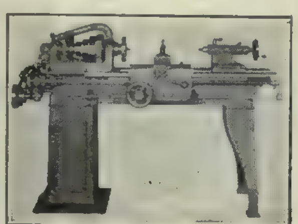
Patented Aug. 20, 1918

Micrometer, Bench Measuring Machine, "Super"
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," August 31, 1922



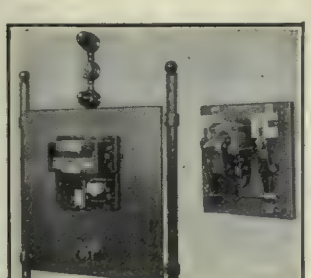
The "super-micrometer" has a capacity up to 8 in. in diameter, although its direct measuring capacity is only 0.500 in. The wheel is moved by a belt engaged by the knurled knob which has a smaller knob attached to it for rapid spindle adjustment. The final adjustment is made by turning the large knob very slowly. The rotation of the knob is continued until the belt slips. The standard inch blocks used in setting up are accurate within five millionths of an inch. The marks on the spindle are 0.050 in. apart. The 500 divisions on the dividing wheel are $\frac{1}{32}$ in. apart and each one denotes 0.0001 in. The channeled bar may be reversed for supporting flat work and the two tables can be laid on the bed to support larger work.

Lathe, "Junior," 12-Inch
Hendey Machine Co., Torrington, Conn.
"American Machinist," August 31, 1922



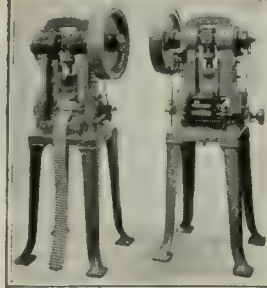
The tool is for light manufacturing purposes, in small shops and for vocational school service, where the full complement of attachments is not needed. It is belt-driven through a four-step cone, and is provided with change gears for screw cutting. Feed may be obtained either through the change gears or through a feed belt running over a three-step cone. Threads from 2 to 36 per in. may be cut. As in the regular model, the carriage traverse is stopped, started or reversed by the movement of a lever on the apron. With the two-speed countershaft furnished, 16 spindle speeds are available. The carriage is fitted with power crossfeed and compound rests.

Temperature Regulator, Automatic
Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich.
"American Machinist," August 31, 1922



The apparatus is for controling the temperature of electric, oil or gas furnaces automatically, and operates every 30 sec. to test the temperature. The regulator is best adapted to the electric furnace. When the furnace is operating within 8 deg. F. of the desired temperature, a white signal light appears. If the temperature goes below this limit, a green light appears, while if it goes above a red one is lighted. The mechanism operates the control switch, so that the error is corrected before it has deviated more than 10 deg. from the desired temperature. The small motor operating the regulator can be supplied for either a.c. or d.c. of 110 to 220 volts.

Press, Punch, Pillar
Geo. W. Dover, Inc., Providence, R. I.
"American Machinist," August 31, 1922

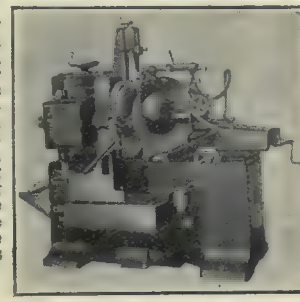


The press was developed primarily for work on radiator cells, although it is adapted to any sort of sheet-metal work within its capacity. It may be equipped with a roll feed. The machine is driven by a 3-in. belt on an 18-in. diameter flywheel having a solid web. Ram: stroke, $1\frac{1}{4}$ in.; vertical adjustment, 2 in.; maximum distance to bed, 5 in. Bed, $9\frac{1}{2}$ x 11 in. Floor space, 36 x 40 in. Weight with legs, 700 pounds.

Press, Toggle and Lever, Pneumatic
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
"American Machinist," August 31, 1922

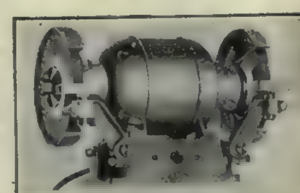
The general utility press is operated by means of compressed air or steam, with a power mechanism similar to that used on the riveters formerly made by the concern. It can be arranged with various forms of platens or work-supporting structures, so as to make it adaptable to straightening, bending, forcing, marking, embossing, coining, forging, briquetting and multiple riveting. The machine is made in tonnages of 15, 20, 30, 50, 70, 80, 100, 125, 150 and 200. It can be moved without moving any auxiliary equipment and requires only a small floor space. The die is mounted on an adjusting screw, controlled by hand or foot. The length of stroke can be adjusted.

Grinding Machine, Centerless
Reeves Pulley Co., Columbus, Ind.
"American Machinist," August 31, 1922



The special feature of the new model is the "drop-in" work rest which makes it possible to grind either shouldered, tapered or straight work. The rest supports the work in a true horizontal position between the two wheels, and a stop is provided which may be adjusted for different lengths of rolls. Another feature is the balancing ways and arbor for grinding wheels. Holes are drilled in the chuck just within the bore of the wheel and the balancing pins are furnished to be placed in the holes opposite the heavy spot.

Grinder, Electric, 8-Inch
Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md.
'American Machinist," August 31, 1922



The small bench grinder carries wheels 8-in. in diameter and $\frac{3}{4}$ in. wide, and is driven by a $\frac{1}{2}$-hp. motor. The motor is not of the universal type, but is intended for operation on either d.c. or a.c. of 40 or 50 cycles and can be furnished for voltages of either 110 or 220. Large bearings carry the combined motor shaft and spindle. The no-load speed is 3,600 r.p.m. Two abrasive wheels, two wheel guards, two adjustable tool rests, a toggle switch in the base and 5 ft. of electric cable fitted with an attachment plug are furnished. The machine is arranged for mounting on a bench, but may be equipped with a pedestal. Weight, 75 pounds.

Drill, Wall Bracket
Hammond Manufacturing Co., 6545 Carnegie Ave., Cleveland, Ohio
"American Machinist," August 31, 1922

The light swinging drill is for attachment to a wall or post and reaches any point within a radius of $3\frac{1}{2}$ ft. of its fastenings. It is adapted to work on parts for electrical instruments, switchboards, and stoves. The drill is belt-driven through tight and loose pulleys. The countershaft is geared to the upright shaft, from which two belts carry the drive to the spindle. The countershaft yoke can be set to any position to conform to the overhead drive, and has a belt-shifting lever. The two arms swing on stationary sleeves. The spindle has a No. 2 Morse taper hole and a traverse of $2\frac{1}{2}$ in. Two spindle speeds of 500 and 1,300 r.p.m. are provided. Capacity, $\frac{5}{8}$ in. in steel. Weight, 250 pounds.

until next summer, and it is also expected to add to the present working force of 1,[illegible] men.

The Connecticut Metal Treating Co., 207 Knowlton Street, Bridgeport, Conn., whose factory was completely destroyed by fire recently, has temporarily taken over the hardening plant of the Bridgeport Engineering Corporation, on Seymour Street, Stratford, Conn., and will continue operations there, until their new factory, now being planned, is completed.

The Delta File Works, Philadelphia, has reduced its list of files in accordance with the suggestion of Secretary Hoover of the Department of Commerce. The new list is supposed to include all the files needed by 95 per cent of file users, and the company points out to dealers that the other 5 per cent of business costs more than it is worth. This is in line with the tendency of manufacturers in some other lines and is a step in the right direction.

The Atlas Machinery and Supply Co., the Interstate Belting and Packing Co., and the Walstrum Armature Works, at Birmingham, Ala., suffered an aggregate loss of about $30,000 in a fire of unknown origin.

The McWane Cast Iron Pipe Co., according to an announcement recently by J. R. McWane, president of the company, has started work on the large plant to be constructed at Birmingham. It will require several months to construct the factory, the first unit being 340 by 108 feet, with a daily capacity of 8,000 feet of pipe. Additional units will be added covering, ultimately, about 30 acres.

The Mobile Pulley and Machine Works announces that an additional unit to its plant for the manufacture of steel and miscellaneous steel castings will be established at Mobile in the near future.

The Kilby Pipe Co., incorporated this month by E. M. Kilby and others, of Anniston, announces that another plant for the manufacture of pipe is to be established this year at Anniston, Ala. Foundry and shops will be established for the manufacture of castings and pipe fittings. This will give Anniston about fifteen large pipe plants.

The St. Petersburg Welding and Machine Co. has been organized and incorporated at St. Petersburg, Fla., with a capital of $20,000, and plans the establishment of a welding plant and machine shop. Officers are: T. D. Orr, St. Petersburg, president; D. J. Galaher, vice-president; A. M. Galaher, treasurer, and M. D. Shilling, secretary.

The Northwestern Expanded Metal Co., of Chicago, with a southern office at 716 Forsyth Building, Atlanta, has moved this office to 33 Poplar Street, Atlanta, where much larger quarters are provided, according to Arthur J. Swanson, southern manager.

The Southern Machinery Co., of Quitman, Ga., is increasing the capacity of its shop and foundry approximately fifty per cent by the construction of an additional unit, according to F. C. Underwood, president. The addition will be about as large as the present plant.

The Elliot Co., of Jeannette and Pittsburgh, Pa., manufacturer of power accessories, recently mentioned as planning the establishment of a southern sales office and warehouse in Atlanta, has opened offices in the Haas-Howell building in charge of H. A. Hoffman. The Atlanta office is the twelfth branch established by the Elliot Co.

The Rivett Lathe and Grinder Co., Boston, Mass., manufacturer of precision bench lathes, internal grinding machines and radial grinding machines announces a change of address for their Detroit sales office, which is operated in conjunction with that of Reed-Prentice Co., Becker Milling Machine Co., and Whitcomb Blaisdell Machine Tool Co., under the management of T. C. McDonald. The new quarters are located at 6526 Cass Ave., opposite General Motors Building. The sales force has been augmented by the addition of E. B. Barber, formerly superintendent of the factories of Lafayette Motor Co.

The Ampco Twist Drill and Tool Co., 18th and Howard Streets, Detroit, Michigan, has taken over the entire assets of the Detroit Reamer and Tool Co., formerly of West Congress Street, Detroit, Mich. The machinery and tools will be added to the equipment of the Ampco Twist Drill and Tool Co.

The West Sales Co., 1013 Ford Bldg., Detroit, Mich., will in the future be known as the West Tool Co., with offices at the same address. There will be no change in the organization.

The American Ship Building Company for the year ended June 30, 1922, reports total income of $1,585,182 before taxes and charges.

The Liquid Steel Welding Corporation, 401 West 23d St., Kansas City, Mo., has been organized by Anton Lucas, formerly with the Metal and Thermit Corporation, and will manufacture materials and appliances for welding, and welding compounds.

Lewis & Osborne, 713 Ohio Street, Wichita, Kan., have opened a new machine shop for general machine work and welding, and will install new equipment.

The Cutler Hammer Manufacturing Co., manufacturer of electric motor controllers, clutches, brakes, and other electrical equipment, New York City, announces the opening of a branch office in Buffalo, N. Y., 358 Ellicott Square, for the purpose of covering the territory of Western New York and the Province of Ontario, Canada. B. A. Hansen, formerly located in New York, has been placed in charge.

The Bridgeport Brass Co., Bridgeport, Conn., announces the opening of a Detroit office in the General Motors Building, Detroit, with Frank H. Longyear as district manager.

The Westinghouse Electric and Manufacturing Co. announces the following changes in its New York and Buffalo offices: C. W. Underwood, manager of the Buffalo office, has been appointed northern representative, with offices in Buffalo. The territory of the Buffalo office has been united with that of the New York office and A. E. Allen, manager of the New York office, will have charge of the Buffalo office also. Other changes, affecting these two offices, include the appointments of W. R. Marshall as branch manager of the Buffalo office; of E. W. Loomis as manager of the industrial division of the New York office; of W. A. Rossell as special power representative of the combined districts and of G. T. Dunklin as manager of the merchandising division of the New York office. The supply and power divisions of the New York office have been merged into the central station division under C. E. Stephens, manager, and the present railway division will in the future be known as the transportation division.

The Wilde Drop Forge and Tool Co., Kansas City, Mo., has filed incorporation papers with the secretary of State, Kansas, showing a capital stock of $50,000 and 1,000 shares of no par value. The company will manufacture, buy and sell tools, machinery of various kinds, act as manufacturer's agents and brokers. The shareholders are Mary Wilde, Goldie Wilde and Paul Froeschl.

The Porter-Cable Machine Co., Syracuse, N. Y., has purchased the Syracuse Sander Manufacturing Co., manufacturer of disc, oscillating spindle and belt sanders, and expects to move the business into the former's plant.

Personals

NEAL W. FOSTER, who has been acting manager of the National Acme Co., Windsor division, since the retirement of Mr. Gridley, has been appointed general manager to succeed Mr. Gridley and will have full charge of the Windsor plant.

DANIEL H. PARKER, who has been at the head of the purchasing department of the National Acme Co., Windsor division, has been appointed office manager of the Windsor plant.

TIMOTHY BYRNES has just been appointed general manager of the Lackawanna plant of the Bethlehem Steel Corporation.

ANTON LUCAS, for the past twenty-five years associated with the Goldschmidt Thermit Co., and its successor, the Metal and Thermit Corporation, has resigned and organized the Liquid Steel Welding Corporation, 401 West 23rd Street, Kansas City, Mo., of which company he will be general manager.

OLIVER L. HENN, formerly superintendent of the Windsor plant of the National Acme Co., has been appointed works manager.

BERT N. GREENWOOD, formerly with the Greenfield Tap and Die Corporation and with their predecessor in the manufacture of Greenfield grinders, the Greenfield Machine Co., has joined the sales force of Russell, Holbrook & Henderson, Inc., and will be stationed at Bridgeport, Conn.

KEITH J. EVANS, advertising manager of Jos. T. Ryerson & Son, Chicago, and Miss Harriet S. Guthrie were married in Riverside, Ill., on October 7.

J. F. GEARY, recently superintendent for the Niagara Radiator Co., North Tonawanda, N. Y., and previously in charge of various plants of the United States Radiator Corporation and American Radiator Co., is now district manager in western New York, Ontario and northwestern Pennsylvania for the Business Training Corporation of New York, specialists in training courses in production methods for foremen and production executives.

Stanley T. Goss, until recently vice president and sales manager of the New Britain Machine Co., has joined the staff of A. L. DeLeeuw, consulting engineer, as business manager.

E. E. Hoffman, of New York, has been appointed plant engineer of the Hendee Manufacturing Co., motorcycle producers, Springfield, Mass. He will have supervision of product design, tools and tool design, maintenance, inspection, material specifications and standardization.

C. H. Sawyer, formerly Rochester manager for the Syracuse Supply Co., and later connected with its Syracuse office, has taken charge of the Syracuse office of D. R. Clarkson and Co., Machine Tool Dealers, of Rochester.

Col. C. L'H. Ruggles, the head of the technical division of the Ordnance Department, is acting as chief of Ordnance during the absence of Gen. C. O. Williams.

Obituary

Frederick E. Anthony, who for many years was in charge of the automatic screw machine tool designing at the Brown & Sharpe Manufacturing Co., died October 8, on his fifty-eighth birthday. Mr. Anthony was born in East Providence, and at the age of seventeen entered Brown & Sharpe's employ as an apprentice. He remained with the company until January, 1890, after which he worked with the Eastman Kodak Company and with Bugbee & Niles, of North Attleboro. In October, 1898, he again returned to the employ of the company, where he remained up to the time of his death. He represented the type of a trained mechanic which has made so much for the progress of mechanical lines in this country. He was fertile in devising ways and means of doing work, and his sound mechanical judgment and training kept him from various pitfalls that are so apt to embarrass a mechanical genius. Through his advice and experience, many of the details of the automatic screw machines were brought out.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering machinery and machine-tool lines—Belgium and France. Agency desired by a Belgian engineer now in the United States. Reference No. 3814.

Structural steel, window panes, plumbing equipment, light hardware, and bricks and plaster for a municipal building—Mexico. Correspondence should be in Spanish. Reference No. 3815.

Printing types and printing presses—India. Purchase is desired. Reference No. 3824.

Sheet aluminum for the manufacture of kitchen utensils—Italy. Purchase desired. Quotations, c.i.f. Italian port. Reference No. 3834.

Machinery and engineering supplies—New Zealand. Purchase and agency desired. Quotations, c.i.f. Australasian ports. Reference No. 3840.

Machinery for the manufactuer of glue, including equipment for solidifying and cutting gelatin, vacuum tanks, and dryers—Chile. Purchase desired. Quotations, c.i.f. Valparaiso. Reference No. 3841.

Small motor-driven irrigation pumps for farms, larger pumps for deep wells, and small centrifugal pumps—Greece. Purchase desired. Quotations, f.o.b. New York. Reference No. 3822.

Olive oil refining plant complete—Spain. Purchase desired. Quotations, c.i.f. Spanish port. Correspondence, Spanish. Reference No. 3842.

Popcorn machines—Mexico. Purchase desired. Catalogues and prices are requested. Reference No. 3843.

Machinery for distilling fruit essences—India. Purchase and agency desired. Quotations, c.i.f. Bombay. Terms, payment against documents. Reference No. 3844.

Carborundum powder—Japan. Purchase desired. Samples and prices are requested. Reference No. 3847.

Hardware, such as wood screws, wire nails, rose nails, bolts and nuts, rivets, files, and tool steel; cotton-mill stores; electrical goods and accessories; all kinds of tin and wooden ware; mechanical toys—India. Agency desired. Reference No. 3863.

Glassware, enamel and aluminum ware, lamp ware, safes, cutlery, hardware, rice mills and machinery, and sundries—India. Purchase desired. Terms, payment against documents. Reference No. 3870.

Wire, screws and hinges for bed springs—Spain. Purchase desired. Quotations, f.o.b. New York. Correspondence, Spanish. Reference No. 3873.

Machines for the preparation of popcorn for confections—Belgium. Agency desired. Reference No. 3879.

Galvanized chains for vessels; and pulp-machine wires—Norway. Agency desired. Quotations, f.o.b. New York. Payment to be arranged through Norwegian bank. Reference No. 3880.

Steel tubes, fittings, valves, and all similar steel and iron products—Netherlands. Agency desired from manufacturers. Quotations, f.o.b. American port. Payment, cash against documents. Reference No. 3893.

Trade Catalogs

Condensed Catalog of Mechanical Equipment. Issued by the American Society of mechanical Engineers. The catalog is now 9 x 12 in., the size of *Mechanical Engineering*, and is bound in limp covers. It contains 622 pages on thin paper and includes a general classified directory as well as a directory of consulting engineers.

Books on Practical and Radio Subjects. The Norman W. Henley Publishing Co., 2 West 45th St., New York City. This company has just issued for free distribution a new catalog of their practical books on various subjects, including their latest publications on Radio matters.

Centrifugal Pumps. The Coeur d'Alene Hardware and Foundry Co., Wallace, Idaho. A new publication, known as Bulletin No. 21, has just been issued by this company. It contains a complete description with detailed illustrations of the company's line of single stage, single suction volute centrifugal pumps for slime, sand and water. The bulletin also contains several useful tables on hydraulics.

Friction Clutches and Transmission Equipment. McMahon & Co., Worcester, Mass. An illustrated bulletin covering the various types of friction clutches, countershafts and pulleys manufactured by this company.

Nitrol. The American Kreuger and Toll Corporation, 522 Fifth Ave., New York City. This company has recently issued a new folder on the subject of nitrol, a hardening agent for iron and steel. The folder gives a full description of the product with numerous micro-photographs showing the effect of the agent on steel under varying conditions.

Automatic Regulators. Charles Engelhard, Inc., 30 Church St., New York City. A new publication known as Bulletin 24, of catalog P-3 containing fourteen pages has just been issued by this company. The publication contains complete descriptive matter with illustrations on the various types of thermo electric pyrometers, electric resistance thermometers, regulating units, etc., made by this company.

Motor Grinders and Buffs. The J. G. Blount Co., Everett, Mass. A booklet containing complete information regarding the numerous types and sizes of motor grinders and motor buffs produced by this company.

Pamphlets Received

Economic Development of Shantung Province, China. Trade information bulletin No. 70 of the Department of Commerce on the economic conditions in Shantung province, transmitted by the American Consul at Tsinau. Distributed by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

International Association of Public Employment Services. Bulletin No. 311, of the Bureau of Labor Statistics, Department of Labor, containing the proceedings of the ninth annual meeting of the International Association of Public Employment Services, held at Buffalo, N. Y., September 7 to 9, 1921.

Digest of Patent Laws of the World. The Midas Trade Mark and Patent Bureau, Ellsworth Building, Chicago, Ill. This bureau has just issued a new folder, known as Bulletin No. 106, containing a digest of the patent laws of the world. In concise form, information is contained on such matters as duration, proper applicant, filing limitation, tax periods and patent workings in every country. There is also presented a graphic chart of U. S. patent procedure.

Sampling and Analysis of Pig Iron. The Carnegie Steel Co., Bureau of Technical Instruction, Pittsburg, Pa. This company has just issued a 40-page pamphlet covering the methods employed by the chemists of the U. S. Steel Corporation for the sampling and analysis of pig iron. The publication, one of a series of seven thus far issued by the Bureau, contains a complete description of the various methods of procedure followed in the determination of the various constituents of pig iron. A circular of information regarding this pamphlet, as well as the other six publications on kindred subjects, may be had on application to the Bureau of Technical Information, Carnegie Steel Co., Pittsburg, Pa.

Forthcoming Meetings

National Hardware Association of the United States. Convention, Atlantic City, N. J. Oct. 17, 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. T. James Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa.

American Hardware Manufacturers' Association. Convention, Atlantic City, N. J., Oct. 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Tin quoted at 34½c. as against 33c.; zinc sheets, 9½c. advanced from 9¼c. and solder (½ and ½) 25½c. as compared with 25c. per lb., one week ago, in New York warehouses. Lead, 6.3c. as against 6¼c. in East St. Louis. Increasing demand for tin plates; price tendency upward. Aluminum ingots up 2c. in Cleveland; babbitt metal also advanced, 1½c.@1¾c. per lb. Zinc showing upward trend. Linseed oil prices firm; tending upward.

Declines—Structural shapes and soft steel bars, $2.15@$2.25 f.o.b. Pittsburgh, on ordinary tonnages; $1.90@$2, however, quoted on large orders. Plates, $2@$2.15; with undesirable specifications at a minimum of $2.25 per 100 lb. Substantial increase in discounts on rubber and duck belting, in New York warehouses. No. 2 foundry pig iron down $[illegible] in Philadelphia and $1 in Pittsburgh; basic declined $2.50 per ton in Philadelphia.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	28.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	37.17
Basic	29.50
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	34.00
Basic	33.00
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	9.0	6.0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]@2.75	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	2.[illegible]	4.29	3.80	4.10
No. 16	2.[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	3.[illegible]	4.70	4.20	4.70
Nos. 22 and 24	3.[illegible]	4.75	4.25	4.70
Nos. 25 and 26	3.[illegible]	4.80	4.30	4.75
No. 28	3.[illegible]@3.90	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.15	5.30	4.80	....
Nos. 22 and 24	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	34	19
LAP WELD					
2	61	49½	2	29	15
2½ to 6	65	53½	2½ to 4	32½	19
7 to 8	62	49½	4½ to 6	32½	19
9 to 12	61	48½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	34	20
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	30	17
2½ to 4	63	52½	2½ to 4	33	21
4½ to 6	62	51½	4½ to 6	32	20
7 to 8	[illegible]	45½	7 to 8	25	13
9 to 12	52	39½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{2}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	34.25
Lead (up to carlots), St. Louis.... 6.30; New York,	6.75@6.87½
Zinc (up to carlots), St. Louis.... 6.65; New York..	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.50	10.25	.....
Solder (½ and ½), (caselots)	25.50	23.50	20.00
Babbitt metal (83% tin)	34.00	44.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville....per net ton 12.00@12.50			
Coke, prompt foundry, Connellsville...per net ton 13.50@14.00			

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	[50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40–10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55–5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	40–5%	40½%	50%
Heavy grade	30–5%	30–5%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40–10%
Second grade	65–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—G. W. Kaull, 2134 Clark St. (machine shop)—forced feed rolling machine.

Ill., Chicago—J. H. Kruse, 2612 Chase Ave.—Hartley Universal cutting machine for machine shop.

Me., Portland—The Wright Moses Motor Co., 122 High St.—equipment for proposed garage on Forest Ave.

Mass., East Milton—Wadsworth & Jones, Adams St.—tools and equipment for proposed garage.

Mass., Somerville—Somerville Sales & Service Co., Highland and Willow Aves.—machinery, tools and equipment for proposed garage.

Mich., Iron River—Lindwall & Lindstrom (garage)—repair shop machinery, including drill press and also air tanks.

Minn., Minneapolis—City Water Dept., City Hall, K. E. Alexander, City Purch. Agt.—will receive bids in about a month for one metal lathe for repair work, one small circular saw for carpenter, one power hammer, one drill press and grinding apparatus for proposed shop building.

Mo., Joplin—The Norton Taxicab Co., 520 Wall St., V. Norton, Purch. Agt.—complete garage machine shop equipment.

Mo., St. Louis—Schmidt Bros., 4371 Laclede St., (machine shop)—electric drill.

N. J., Garfield—De Matia Bros.—small radial drill press, between 3 and 3½ ft.

N. Y., Brooklyn—S. O. S. Welding Corp., 235 6th St.—one 8 ft. horizontal plate bending roll, and one small traveling crane.

N. Y., Buffalo—G. C. Kline, 2257 Niagara St.—small tools, etc., for addition to automobile repair shop.

N. Y., Buffalo—H. Knauss, 60 Saratoga St.—machinery and equipment for proposed 1 story garage and repair shop.

N. Y., Dunkirk—J. A. Wolpert, 210 Main St.—machinery, tools and equipment for garage and repair shop, to replace that which was recently destroyed by fire.

N. Y., Rochester—The Rochester Taxicab Co., 195 St. Paul St.—machinery, tools and equipment for \$75,000 garage and service station.

N. Y., Rochester—C. F. Spies, 662 Winton Rd.—small tools, accessories, etc., for gas and service station at 669 Winton Rd.

O., Canton—The National Pressed Gear Co., 222 Cleveland Ave.—additional machinery for drop forged gear plant.

O., Cincinnati—The G. C. Dom Supply Co., 125 East Pearl St.—30 in. foot power tinners squaring shears.

Ore., Portland—R. S. Hughson, 10th and Couch Sts.—one machine turret lathe, 11 to 13 in. swing, with accessories and tools; 6 large size liquid fire extinguishers; one tool post grinder; one oxy-acetylene welding outfit.

Pa., Centerville—L. D. and L. L. Saunders—machinery, tools and equipment for proposed garage and service station.

Pa., Phila.—A. F. Hendricks Co., 907 Locust St., (sheet metal manufacturing products)—metal working machines.

Pa., Phila.—Humphrey & Co., Front St. and Tusculum Ave.—punches, shears, drills, etc., for steel plant.

Pa., Phila.—H. F. Munro, 1737 North 5th St., (sheet iron and metal products)—drill presses, punches, riveting machines, shears, etc.

Pa., Phila.—Pennsylvania R.R., Broad St. Sta., M. Smith, Purch. Agt.—one journal and axel lathe.

Pa., Pittsburgh—The Carnegie Steel Co., Carnegie Bldg.—drill press, pipe machines, grinder and woodworking machinery for new byproduct plant.

Pa., Pittsburgh—The Du Roth Steel Truck & Car Wheel Co., Keystone Bldg., A. Du Roth, Purch. Agt.—one 10 ton, one 5 ton and one 2 ton crane, also chain blocks, belting, shafting, lathes and presses.

Pa., Williamsport — S. T. McCormick, 3rd, 212-215 Hepburn St.—machinery, tools and equipment for \$32,000 garage.

Tex., Electra—Magnolia Petroleum Co. (petroleum refinery)—machine shop equipment.

Wis., Appleton—Outagamie County, Court House, A. G. Brusewitz, Chn.—one 16 in. x 8 ft. lathe equipped for thread cutting, taper attachments backing off attachments and straight tool holder; one Dunmore grinder for use on lathe; one milling machine equipped with arbor, vise and dividing head; one shaper; one small high speed drill press; one drill press for paper shank equipped with check to take up to ¾ in. straight shank drills; one large emery stand; one 10 ton traveling crane; one 5 gal. gas pump and 800 gal. tank; five 120 gal. oil storage tanks, complete with pumps, barrel rake and chain hoist.

Wis., Burlington—J. A. Alby & Son Co., (garage)—power saw, lathe, gasoline storage tanks and pump.

Wis., Eau Claire—Garton Bros. Co., 227 Chestnut St., E. F. Garton, Mgr.—automobile repair machinery.

Wis., Madison—W. Mead, 201 Science Hall—one lathe, motor driven.

Wis., Milwaukee—Pabst Corp., 917 Chestnut St., H. W. Marsh, Secy.—nipple cutting and threading machines for the manufacture of nipples for galvanized iron pipe.

Wis., Rhinelander—J. Segerstrom & Co., (garage)—automobile repair machinery.

Wis., Sarona—A. J. Henderson—garage and blacksmith shop equipment to replace that which was destroyed by fire.

Machinery Wanted

Ala., Gadsen — Bd. Educ. — vocational equipment for proposed \$200,000 high school.

Calif., San Francisco—H. Wolger, 2222 Fillmore St., (cabinet maker)—trim saw and jointer for power equipment.

D. C., Wash.—A. L. Flint, Genl. Purch. Officer of the Panama Canal, Wash., D. C., receiving bids until Nov. 2, for steel, rivets, bolts, nails, section cars, mowing machines, brass sheets and tubing, copper tubing, boiler tubes, pig tin, valves, etc.

Ind., Indianapolis—Gem Laundry Co., 241 Indiana Ave.—machinery and equipment for \$40,000 addition to laundry.

Ia., Dubuque—Bd. Educ., 245 B. and I. Bldg., L. Palen, Secy.—wood working machinery, including band saw, circle saw, mortiser, etc., for manual training department.

Kan., Wichita—C. F. Lewis, 713 Ohio St. (machine shop)—welding outfit, air compressor, emery stand, wheel, electric motor, belting, shafting and hangers.

Ky., Ashland—S. S. Willis—machinery and equipment for proposed brick plant at Summit.

Ky., Louisville—The Pyne Co., 927 Shelby Parkway—power punch and T. and L. pulleys.

Ky., Russellville—Independence Nitro Co. —complete machinery and equipment for proposed plant for the manufacture of nitroglycerin, capacity 800 qts. per day.

Ky., Whick—Noble Coal & Lumber Co., G. Noble, Pres.—electrical and mechanical mining equipment for mines.

Ky., Williamsburg—The Iroquois Natural Gas Co. — machinery and equipment for proposed plant for the manufacture of carbon black.

Md., Baltimore — D. C. Elpinstone, 408 Continental Bldg.—one electric locomotive crane suitable for handling a 2 cu. yd. bucket.

Mass., Brighton (Boston P. O.)—Cambridge Cement Stone Co., 156 Lincoln St. —concrete block machinery, also miscellaneous tools for repairs.

Mass., Fairhaven—The Atlas Tack Co.—Complete equipment for proposed tack manufacturing plant at St. Louis, Mo.

Mass., Natick—Natick Box Co., C. A. Coombs, Owner—woodworking and box making machinery of various kinds.

Mass., Somerville—Hoghosian Bros., 19 Simpson Ave. — machinery for candy factory.

Mich., Marshall—The Chronicle—printing press.

Mich., Republic—Cleveland Cliffs Iron Co.—blacksmith shop equipment.

Minn., Minneapolis—The Pillsbury Milling Co., 302 Metropolitan Life Bldg., A. C. Loring, Pres.—machinery, including conveying and handling machinery, for proposed \$2,500,000 flour mill at Buffalo, N. Y.

Minn., Morris—The City, F. J. Haight, Mgr. of Waterworks—crane for pump station.

Miss., Jackson—The Clarion Ledger—model K linotype.

Mo., Joplin—The Carlson Printing Co., 618 Joplin St., A. C. Carlson, Purch. Agt.—complete job printing equipment, including job presses, belting, hangers, pulleys and bearings.

Mo., St. Louis—Pevely Dairy Co., 1001 South Grand St.—paper cutter with 26 in. blade.

Mo., St. Louis—The Rebstock Co., 1439 North 19th St.—conveyors, gravity rollers, belting, belt and collar conveyors.

N. Y., Binghamton—The Nineteen Hundred Washer Co., 205 Clinton St., (manufacturer of washing machines), P. J. Bickel, Secy.—additional machinery for proposed increase in output.

N. Y., Bowmansville—The Bowmansville Creamery, Inc., A. Snell, Purch. Agt.—equipment for refrigerating and creamery plant.

N. Y., Brooklyn—H. J. Wheeler Salvage Co., 224 Bush St.—low pressure compression cylinder, not less than 24 in. nor more than 36 in.

N. Y., Buffalo—Automatic Gear Co., 712 Erie County Bank Bldg., F. E. Freedman, Purch. Agt.—machinery for the manufacture of gears.

N. Y., Buffalo—The Eagle Bottling Wks., 415 Sycamore St., H. Cohen, Purch. Agt.—equipment for the manufacture of beverages.

N. Y., Buffalo—N. B. Falls Lubrication Co., 103 Manitoba St., N. B. Falls, Genl. Mgr.—three 12,000 gal. capacity each, gasoline and kerosene storage tanks, to be of $\frac{3}{16}$ and ¼ in. metal, suitable for mounting upon wooden standards.

N. Y., Buffalo—The Gebhard Paper Co., 178 Ellicott St., A. Gebhard, Purch. Agt.—one 44 in. automatic paper cutter, one lever cutter and other printing equipment.

N. Y., Buffalo—P. J. Gunn, 80 Elk St.—machinery and equipment for battery service and engineering station.

N. Y., Buffalo—The Hall Paint Co., 143 Grape St.—equipment for the manufacture of paint.

N. Y., Buffalo—W. F. Hoffman, 23 Poplar St.—machinery and equipment for woodworking shop, including band saw, combination saw, lathe and cutoff saw.

N. Y., Buffalo—The Stabryte Steel Co., Inc., 8 Lord St., H. E. Bredemeier, Purch. Agt.—machinery for the manufacture of hardware and cutlery.

N. Y., Corning—Corning Hospital—mechanical and laundry equipment for proposed laundry.

N. Y., Jamestown — The International Casement Co., 84 Hopkins Ave., (manufacturer of steel window frames, etc.)—additional machinery for addition to factory.

N. Y., Jamestown—Jamestown Worsted Mills Co., 335 Harrison St.—machinery and equipment for proposed 1 and 2 story addition to mills.

N. Y., Jamestown — Watson Mfg. Co., Taylor St., (manufacturer of steel window and door screens)—additional machinery for four story addition to factory.

N. Y., Lockport—The Harrison Radiator Co., Washburn St.—machinery and equipment for proposed 3 story addition to radiator factory.

N. Y., New York—Acme Lighting Fixture Co., 107 West 13th St.—plating tank.

N. Y., New York—M. Buschbaum, 15 Park Row—Mayo knitting machines, 16 or 17 needles.

N. Y., New York—A. Loewy, 200 5th Ave., (machinery)—baling machine.

N. Y., Perry—The Fanning Co., Inc., (ice manufacturers) — refrigeration machinery and equipment for proposed 1,800 ton ice plant.

N. Y., Poughkeepsie—The Central Hudson Gas & Electric Co., 50 Market St.—small grinding outfit which will operate on ordinary lamp socket.

N. Y., Spencerport—J. E. Hay—one hand soleing machine and one stitching machine.

O., Akron—Rauschenberger Tire Co.—rubber working machinery for its auto tire factory at Granville, Wis.

O., Cleveland—Merit Motor Co., East 65th and Cedar Sts., (manufacturers of automobiles)—machinery and equipment for proposed plant at Niagara Falls, Ont.

O., Columbus—National Ice & Storage Co., 5th and Naghten Sts.—$10,000 worth of special ice machinery, electrically driven.

O., Lancaster—The Fairfield Eng. Co.—machinery and equipment for the manufacture of coal loading machinery, to replace that which was destroyed by fire.

O., Sebring—The Crescent China Co.—machinery and equipment for china ware manufacturing plant, including jigger shop, coal loading plant, kilns, etc.

O., Warren—H. W. Ward, North Mahoning Ave., (greenhouses) one large power driven feed cutting machine.

Okla., Eufaula—F. M. Billings—one 2 page, 7 column cylinder press for newspaper work.

Okla., Ponca City—Bd. Educ.—vocational equipment for proposed $200,000 high school.

Pa., Boyertown — Eastern Fdry. Co.—equipment for 1 and 2 story foundries.

Pa., Johnstown—Bd. Educ.—machinery for vocational department of proposed high school.

Pa., Lancaster — Fleck-Marshall Co., (manufacturer of plumbing supplies)—machinery and equipment for plant at Williamsport.

Pa., Marwood—Highland View Mfg. Co., (manufacturer of wood and metal specialties), J. Whewell, Pres.—machinery and tools, incl. hammers, nickel steel, etc., for proposed plant (under construction).

Pa., Phila.—Brehem & Stehle, Trenton and Allegheny Aves., (dyers) W. H. Brehem, Purch. Agt.—dryers, extractors, etc., for proposed dye plant.

Pa., Phila.—Dept. of Pub. Safety, 1328 Race St.—1 ton electric cable hoist.

Pa., Phila.—Dolfingers Standard Dairies, 16th and Tasker Sts.—refrigerating machines, sterilizers, bottle washing and filling machinery.

Pa., Phila.—G. J. Littlewood & Sons, Main St. and Walnut Lane, (dye and bleechers)—centrifugal dryers, extracators and other bleaching machinery.

Pa., Phila.—Roosevelt Worsted Mills, 2023 Naudain St., F. Quitner, Purch. Agt. Machinery for—looms, cards, combs, etc.

Pa., Phila.—M. L. Shoemaker & Co., Venango St. and Delaware Ave., (fertilizer manufacturers)—grinders, maceraters, etc., for plant.

Pa., Pittsburgh—H. J. Heinz, 1062 Progress St., N. S., (pickles and preserves)—one 2 ton crane.

Pa., Pittsburgh — Kund & Eiben Mfg. Co., 204 Warrington Ave., (cabinet makers)—woodworking machinery, direct driven from individual motors.

Pa., Pittsburgh—Neely Nut & Bolt Co., 26 South 22nd St.—one 60 ft. span 5 ton crane.

Pa., Pittsburgh—Pittsburgh Valve Fdry. & Constr. Co., Penn Ave.—one 5 ton crane.

Pa., Scranton—Nagelberg & Fiegenbaum, 1005 Capouse St.—machinery and equipment for clothing and underwear factory.

Pa., Warren—C. Hamm, 28 Clark St.—wood working machinery.

Pa., Warren—The Seneca Oil Wks., South Carver St.—machinery and equipment for proposed addition to refinery.

Pa., Williamsport—Williamsport Building Products Co., 1603 Erie Ave.—additional machinery and equipment for proposed building products factory.

Pa., York—Markel Hall Hosiery Mills—Scott & Williams knitting machines, Model B-5.

Tenn., Knoxville—The Appalachian Marble Co., Inc., P. O. Box 837—pumping outfit, prefer direct connected turbine set, capacity 50 gal. per minute against a head of 85 to 100 lb. gauge pressure.

Tenn., Memphis—Clover Farm Dairy Co., 789 Union Ave—$70,000 worth of modern machinery for creamery, dairy and ice cream factory.

Va., Richmond—J. W. Ferguson & Sons, 105 North 14th St., (printers)—one large Miehle press, folding machine and job presses.

Wash., Centralia—H. Staistedt, 412 North Diamond St.—one 150 to 200 lb. belt driven drop hammer.

W. Va., Wellsburg—The Hammond Bag & Paper Co., P. O. Box 467 — special bag machinery, hangers, pulleys, belting and shafting.

Wis., Algoma—Algoma Wood Products Co.—woodworking and special machinery, also power machinery.

Wis., Appleton—T. Heide, 635 Appleton St.—refrigerating machinery.

Wis., Madison—State Bd. of Control, Capitol, M. J. Tappins, Secy.—receiving bids until Oct. 24 for refrigerating machinery.

Wis., Merrill—Heineman Lumber Co., H. H. Heineman, Purch. Agt.—saw mill machinery, belting and shafting.

Wis., Milwaukee—Burleigh Hardware Co., c/o A. H. Butenhoff, 1400 28th St.—sheet metal working machinery, brake, etc.

Wis., Milwaukee—G. O. Dallmann, 375 Manitoba Ave., (woodwork)—circle saw with motor.

Wis., Milwaukee—W. A. Getzel, 1218 23rd Ave., (millwork)—trim saw.

Wis., Milwaukee—J. Jazwiecki, 849 Lincoln Ave., (bakery)—mechanical bake oven, electrical mixers, etc.

Wis., Milwaukee—J. H. Marshutz, 1005 Trust Co. Bldg.—overhead crane.

Wis., Milwaukee—Terner Metal Specialty Co., c/o J. Eder, 606 Caswell Blk.—stamping machine.

Wis., Milwaukee—Waukesha Dairy Co., 342 6th St.—dairy and refrigeration machinery for proposed addition to plant.

Wis., Park Falls—The Flambeau Paper Co., G. Walds, Mgr.—power and pulp mill machinery.

Wis., Plymouth—The Badger Cabinet Co.—woodworking and special machinery for chair factory at Pulaski.

Wis., South Milwaukee—The Burnham Bros. Brick Co., 68 Wisconsin St.—crane for proposed dryer plant.

B. C., Vancouver — J. Read, c/o Bridge River Power Co., 602 Hastings St., W.—machinery and equipment for proposed large pulp and paper mill.

Ont., Brantford—Brantford Arena Co., A. Ballyntyne, Pres.—ice making equipment for proposed arena.

Ont., Galt—Stauffer-Dobbie, Ltd., (carpets)—"Royle" Jacquard cutting machine.

Ont., Humberstone—Humberstone Shoe Co. Ltd., H. H. Knoll, Purch. Agt.—two 4 in. gearless sole cutting machines, one 5 hp. electric motor, 1 clicking machine, 60 ft. of 1 1/8 in. shafting with hanger couplings, wooden shoe racks, etc.

Ont., London—The Corrugated Carton proposed factory.

Ont., St. Thomas—W. A. McIntyre, Chn. City Gas Comn.—equipment for gas plant.

Ont., Weston—Moffats Ltd., F. W. Moffat, Purch. Agt.—equipment for porcelain enameling department.

Que., Pointe aux Trembles — Parlor Furniture Mfg. Co. Ltd., Victoria St., G. Langelier, Purch. Agt.—woodworking machinery to replace that which was destroyed by fire.

Metal Working Shops

Calif., Oakland — The Chevrolet Motor Co., Foothill Blvd. and 69th Ave., awarded the contract for the construction of a 2 story, 80 x 684 ft. factory on Hillside Ave. and 72nd St. Estimated cost $300,000. Noted Oct. 12.

Calif., San Francisco — J. Madison, 112 Market St., has had plans prepared for the construction of a 3 story factory, on Harrison St. near Langton St. Estimated cost $29,950. N. Blaisdell, 255 California St., Archt. Pacific Meter Co., 1123 Harrisosn St., lessee.

Calif., San Francisco — J. Pasqualetti, 785 Market St., awarded the contract for the construction of a 2 story garage, on O'Farrell St. near Steiner St. Estimated cost $38,900. Noted July 20.

Conn., Bridgeport—The Atlas Body Wks., Inc., 147 McKinley Ave., awarded the contract for the construction of a 1 story, 76 x 90 ft. addition to its factory and a 1 story, 15 x 30 ft. power house. Estimated cost $25,000. Noted Sept. 14.

Conn., Danbury—The Ball & Roller Bearing Co., 22 Maple Ave., awarded the contract for the construction of a 2 story, 50 x 114 ft. addition to its factory, on Maple Ave. and Crosby Sts. Estimated cost $40,000.

Conn., Plantsville—The Blakeslee Forging Co. is having plans prepared for the construction of a 2 story, 40 x 42 ft. addition to its forge shop. Estimated cost $15,000. Greenwood & Noerr, 847 Main St., Engrs. and Archts.

Conn., Waterbury—The Plume & Atwood Mfg. Co., 470 Bank St., manufacturer of brass goods, awarded the contract for the construction of a 1 story, 27 x 30 ft. addition to its factory. Estimated cost $5,000.

D. C., Wash. — The Lambert Hudson Motor Co., 1212 Connecticut Ave., awarded the contract for the construction of a service station on 22nd and M Sts., N. W. Estimated cost $150,000. W. E. Lambert, Pres.

Ill., Chicago—Kocher & Larson, Archts., 6250 South Halsted St., are receiving bids for the construction of a 1 and 2 story, 36 x 146 ft. addition to factory, for the Advance Fdry. & Pattern Co., 2734 West 36th St. Estimated cost $50,000.

Ind., Indianapolis — The Conduitt Automobile Co., 314 North Delaware St., awarded the contract for the construction of a 3 story, 63 x 200 ft. automobile sales and service station, on North Meridian Ave. Estimated cost $150,000. Noted Sept. 7.

Me., Portland—Clough & Maxim, Fidelity Bldg., will build a 1 story, 55 x 200 ft. automobile service station on Forest Ave. Estimated cost $40,000. Poor & Thomas, Brown Bldg., Archts. The Wright Moses Motor Co., 122 High St., Lessees.

Mass., East Milton—Wadsworth & Jones, Adams St., plan to build a garage. Cost between $15,000 and $18,000.

Mass., Fall River—The Bd. of Water Comrs. awarded the contract for the construction of a 2 story, 30 x 145 ft. machine shop on Bedford St. Estimated cost $40,000.

Mass., Lawrence—The Champion-International Paper Co., 38 Prospect St., is having plans prepared for the construction of a 1 story, 65 x 115 ft. machine shop. Estimated cost $30,000. Private plans.

Mass., Roxbury (Boston P. O.)—J. J. Walsh Co., 1540 Columbus Ave., is receiving bids for the construction of a 2 story, 50 x 100 ft. addition to its automobile body factory. Estimated cost $24,000. S. J. Rantin, 1117 Columbus Ave., Archt.

Mo., St. Louis—The Atlas Tack Co., Fairhaven, Mass., awarded the contract for the construction of a tack manufacturing plant, consisting of a 1 story, 203 x 503 ft. main plant, a 2 story, 25 x 203 ft. office building, 30 x 67 ft. and 30 x 187 ft. storage sheds, and also a 20 x 30 ft. transformer house, on Union and Geraldine Sts., here. Estimated cost $400,000.

N. Y., Buffalo—The Birk-Notman Motor Co., Inc., 828 Main St., plans to build a 1 story, 50 x 150 ft. garage on Hertel and Delaware Aves. Estimated cost $40,000.

N. Y., Lockport—The Harrison Radiator Co., Washburn St., is having plans prepared for the construction of a 3 story, 150 x 300 ft. addition to its plant. J. R. Tyler, 715 Union Trust Bldg., Rochester, Archt.

N. Y., New York—A. Revere, c/o H. J. Nurick, Archt. and Engr., 44 Court St., Brooklyn, will soon receive bids for the construction of a 3 story, 75 x 100 ft. garage at 531 West 36th St. Estimated cost $75,000.

N. Y., New York—The Transit Comn., 49 Lafayette St., will receive bids until Oct. 20, for furnishing and erecting steel, and building foundation for third addition to its shops at Lenox Ave. and 148th St.

N. Y., Rochester—F. J. Zorn, 64 North Plymouth Ave., is receiving bids for the construction of a 2 story, 100 x 212 ft. and 58 x 182 ft. garage at 195 St. Paul St. Estimated cost $75,000. Foote & Carpenter, State and Church Sts., Archts.

N. Y., Springville—A. C. Fisher plans to build a 50 x 100 ft. machine shop. Cost will exceed $5,000.

O., Canton—The National Pressed Gear Co., Crane Bldg., awarded the contract for the construction of the first unit of its proposed factory, 1 story, 50 x 175 ft., on Allen Ave., S. E. Estimated cost $200,000.

O., Cleveland—The R. and L. Baker Co., c/o K. E. Stahl, 2180 West 25th St., awarded the contract for the construction of a 1 story, 36 x 48 ft. kiln and a 69 x 112 ft. addition to its factory, for the manufacture of automobiles. Estimated cost $60,000.

O., Cleveland—The Gabriel Mfg. Co., 1401 East 40th St., awarded the contract for the construction of a 2 story, 60 x 160 ft. addition to its factory, for the manufacture of auto accessories. Estimated cost $60,000. C. Foster, Mgr.

O., Columbus — The Lawwell-McLeish Co., 97 North 4th St., awarded the contract for the construction of a 2 story, 63 x 94 ft. garage. Estimated cost $17,875. Noted Aug. 17.

O., Lancaster—The Fairfield Eng. Co. plans to build a factory for the manufacture of coal loading machinery, to replace the one which was recently destroyed by fire. Estimated cost $250,000.

O., Newburg Heights (Cleveland P. O.)—The [illegible] Manufacturing, Inc., c/o O. [illegible] Harvard Ave., plans to build a 2 story, [illegible] x 100 ft. factory. Estimated cost [illegible]. Private plans.

Pa., Altoona—The Pennsylvania R.R., Broad St. Sta., Phila., plans to build a 1 story erecting and machine auxiliary shops on [illegible] St., and will also convert present roundhouse into a locomotive repair shop. A. C. Shand, Broad St. Sta., Phila., Ch. Engr.

Pa., Butler—Rieck McJunkin Dairy Co., Forbes St., Pittsburgh, will build a 2 and 3 story top addition to its garage and warehouse, on McKean and East Wayne Sts. Estimated cost $60,000. A. Daniels, c/o owner, Archt. Noted July 6.

Pa., Clairton—The Carnegie Steel Co., Carnegie Bldg., Pittsburgh, awarded the contract for the construction of an addition to its byproduct plant, consisting of over [illegible] byproduct ovens with full equipment, here. Estimated cost [illegible].

Pa., Juniata—The Pennsylvania R.R., Broad St. Sta., Phila., is having plans prepared for the construction of 1 story, 100 x [illegible] ft. erecting and machine auxiliary shops here. Estimated cost $300,000. W. H. [illegible], Broad St. Sta., Phila., Archt. A. C. Shand, Ch. Engr.

Pa., Phila.—W. [illegible], 956 Foulkrod St., awarded the contract for the construction of a 1 story, 32 x 60 ft. machine shop, on Cottman and G Sts.

Pa., Phila.—C. E. Wunder, Archt., 1415 Locust St., is receiving bids for the construction of a 2 story, 60 x 144 ft. steel factory on Van Dyke St. and Torresdale Ave., for Humphreys & Co., Front St. and Tusculum Ave.

Pa., Pittsburgh—The Commercial Land Co., c/o A. H. Byers, 235 Water St., awarded the contract for the construction of a 4 story garage and office building on Rebecca St. and Baum Blvd. Estimated cost $175,000. Noted Aug. 3.

Pa., Pittsburgh—The Hanlon Gregory Galvanizing Co., 24th St., awarded the contract for the construction of a 1 story, 100 x 400 ft. mill, on 56th and Butler Sts. Estimated cost $100,000. Noted Oct. 5.

Pa., Pittsburgh—R. W. Hinkle, 601 Foreland St., and Buettner Bros., 3271 East St., awarded the contract for the construction of a 1 story, 30 x 110 ft. garage, at 21 and 23 Foreland St. Estimated cost $40,000.

Pa., Vandergrift—McCutcheon Bros. are receiving bids for the construction of a 1 story, [illegible] x 130 ft. garage on Washington Ave. and 12th Alley. Estimated cost $40,000. G. M. Rowland, Bakewell Bldg., Pittsburgh, Archt. Blum, Weldin & Co., Bakewell Bldg., Pittsburgh, Engrs.

Pa., Washington—Hazel Atlas Glass Co., South Main St., will build a 3 story, 44 x 79 ft. machine shop. Estimated cost $50,000. L. Mehard, c/o owner, Engr.

Pa., Washington—L. Snyder awarded the contract for the construction of a 1 story, 44 x 65 ft. machine shop. Estimated cost $10,000.

Pa., Williamsport—The Fleck Marshall Co., Lancaster, has purchased the Rothfuss Howard Iron Wks., on East 3rd St., here, and plans to build a 2 story foundry and machine shop. J. Fleck, 50 North 5th St., Phila., Pres.

Pa., Williamsport — The Williamsport Wire Rope Co. awarded the contract for the construction of a 1 story, 80 x 142 ft. addition to its factory, for the manufacture of wire rope and similar products. Estimated cost $10,000.

W. Va., Fairmont—F. W. McIntire plans to build a 2 story, 50 x 160 ft. garage. Private plans.

W. Va., Huntington—R. L. Day, Archt., 1st Natl. Bank Bldg., is receiving bids for the construction of a 1 story, 108 x 201 ft. addition to stamping plant, for the Armstrong Mfg. Co.

Wis., Appleton—P. Rademacher, 801 Superior St., will build a 1 story, 32 x 120 ft. garage. Estimated cost $40,000. Private plans.

Wis., Burlington—J. Alby & Son will build a 2 story, 30 x 80 ft. garage. Estimated cost $40,000. Noted Aug. 29.

Wis., Eau Claire—Gaston Bros. Co., 227 [illegible] St., awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on Madison St. Estimated cost [illegible]. E. P. Gaston, Mgr.

Wis., Kewaunee—The Leyse Aluminum Co. plans to build a 2 story, 70 x 160 ft. factory for the manufacture of aluminum products. A. H. Leyse, Pres. Architect not selected.

Wis., Kohler—Brust & Philipp, Archts., 465 B'way, Milwaukee, are receiving bids for the construction of a 4 story, 70 x 160 ft. factory for the manufacture of plumbing fixtures, here, for Kohler Co. Estimated cost $1[illegible],000.

Wis., Madison—The University of Wisconsin plans to build a 1 story, 60 x 95 ft. machine shop, for use in the department of engineering, on Breeze Terrace. M. E. McCaffery, Secy. Architect not selected.

Wis., Marinette— C. Anderson & Sons, Cook and Merryman Sts., are having plans prepared for the construction of a 2 story, 50 x 75 ft. factory for the manufacture of brick conveyors. Estimated cost $75,000. Private plans.

Wis., West Bend—The Amer. Service & Storage Garage, c/o M. A. Johannes, is having plans prepared for the construction of a 2 story, 60 x 80 ft. garage. Estimated cost $40,000. L. Hunt, 445 Milwaukee St., Milwaukee, Archt.

Ont., Niagara Falls—The Cameron Motor Co., Cleveland, O., plans to build a branch factory, here.

Ont., Niagara Falls—D. W. Robert Mfg. Co., Lockport, N. Y., will receive bids about March 1 for the construction of a 1 story, 40 x 80 ft. factory, for the manufacture of knives for paper cutting, here. Estimated cost $5,000. Architect not announced.

Ont., Toronto — The Toronto Hardware Mfg. Co., 402 Dufferin St., plans to build a factory. Estimated cost $60,000. Architect not selected.

Ont., Weston—Moffatts Ltd. awarded the contract for the construction of a 2 story, 60 x 100 ft. addition to stove factory. Estimated cost $60,000.

General Manufacturing

Calif., Petaluma—B. Jones, Archt., Petaluma, is receiving bids for the construction of a packing plant, for the Poultry Producers of Central California, 323 East Washington St. Noted Oct. 5.

Calif., San Francisco — The Legallett-Hellwig-Norton Co., 1600 Fairfax Ave., awarded the contract for the construction of a 3 story, 50 x 105 ft. factory for tanning plant. Estimated cost $12,000.

Calif., San Francisco—C. E. Lewis, 306 Sacramento St., has had plans prepared for the construction of a 2 story, 25 x 120 ft. glove factory, on 6th St. near Folsom St. Estimated cost $6,500.

Calif., Taft—Cottage Laundry, 332 Main St., plans to build a 1 and 2 story laundry. Estimated cost $50,000. B. Mills, owner. Architect not selected.

Conn., Bridgeport — Fletcher-Thompson, Inc., Engrs. and Archts., 542 Fairfield Ave., are receiving bids for the construction of a 3 story, 60 x 110 ft. addition to ice cream plant, for the Huber Ice Cream Co., 800 Seaview Ave. Estimated cost $150,000.

Conn., East Lyme—The Niantic Mfg. Co. awarded the contract for the construction of a 1 story, 30 x 30 ft. addition to its woolen mill. Estimated cost $5,000.

D. C., Wash.—N. Auth Provision Co., 632 D St., awarded the contract for altering and building an addition to its plant. Estimated cost $74,950.

Ill., Chicago—A. S. Alschuler, Archt., 28 East Jackson Blvd., is receiving bids for the construction of a 3 story, 100 x 200 ft. candy factory, on Cicero and Kinzie Sts., for E. J. Brach & Sons, 215 West Ohio St. Estimated cost $1,000,000. Noted Sept. 14.

Ill., Chicago—The Bassick Mfg. Co., 2638 North Crawford Ave., is having plans prepared for the construction of a 1 story, 50 x 142 ft. factory for the manufacture of lubricating oils, on North Homan Ave. R. S. Ostergren, 155 North Clark St., Archt.

Ill., Chicago—The Valentine Seaver Co., 1721 Sedgwick St., awarded the contract for the construction of a 4 story, 102 x 171 x 272 ft. furniture factory, on Greenview and Wrightwood Sts. Estimated cost $400,000. Noted Oct. 12.

Ind., Borden—The Indiana Borden Cabinet Co. plans to build a 2 story addition to its furniture factory. Estimated cost $35,000. Architect not selected.

Ind., Indianapolis—The Enquirer Printing Co., 209 East Ohio St., awarded the contract for the construction of a 2 story, 55 x 93 ft. printing plant. Estimated cost $35,000. Noted Sept. 14.

Ind., Madison—The Pearl Packing Co. plans to build a 1 story, 56 x 129 ft. packing plant. Estimated cost $26,000. M. P. Burt Co., Falls Bldg., Memphis, Tenn., Engr.

Ky., Williamsburg—The Iroquois Natural Gas Co. plans to build a large plant for the manufacture of carbon black. Estimated announced.

Mass., Cambridge—The Boston Woven Hose & Rubber Co., 15 State St., awarded the contract for the construction of a 1 story, 42 x 82 ft. factory. Estimated cost $20,000.

Mass., East Lee—The Mountain Mill Paper Co. will build a 3 story, 35 x 60 ft. addition to its mill.

Mass., Watertown — The Hood Rubber Co., Nichols Ave., will build a 1 story, 50 x 150 ft. addition to its vulcanizing plant. Estimated cost $7,500.

Mass., Watertown—Vose & Sons Piano Co., 1010 Massachusetts Ave., Roxbury, is having plans prepared for a piano factory on School and Arsenal Sts., here. Estimated cost $300,000. Densmore & LeClear, 88 Broad St., Boston, Archts.

N. Y., Buffalo — The Pillsbury Milling Co., 302 Metropolitan Life Bldg., Minneapolis, Minn., will receive bids about March 1 for the construction of a large flour mill, capacity 7,000 bbl. per day, here. Estimated cost $2,500,000. A. C. Loring, Pres. Architect not announced.

N. Y., Jamestown — The Jamestown Lounge Co., 40 Winsor St., will build a 6 story, 102 x 144 ft. addition to its factory. Noted Oct. 12.

N. Y., Perry—The Fanning Co., Inc., has awarded the contract for the construction of an 1,800 ton ice plant.

N. Y., Yonkers—Alex Smith & Sons, Elm Ave., awarded the contract for the construction of a 4 story, 130 x 136 ft. spinning mill, a 2 story, 50 x 150 ft. yarn storage building, 1 story, 75 x 200 ft. waste storage building and 1 story, 30 x 60 ft. dye house. Estimated total cost $300,000.

O., Cleveland — The Excelsior Varnish Co., 1242 West 74th St., awarded the contract for the construction of a 2 story, 30 x 42 ft. factory. Estimated cost $25,000. J. C. Vick, Mgr.

O., Cleveland—The Mechanical Rubber Co., c/o A. C. Kingston, Mgr., foot of Lisbon Rd., awarded the contract for the construction of a 3 story, 40 x 50 ft. factory. Estimated cost $40,000.

O., Cleveland — The Whitmer-Jackson Sash & Door Co., 1996 West 3rd St., has had plans prepared for the construction of a 2 story, 70 x 151 ft. addition to its lumber mill. Estimated cost $40,000. S. H. Whitmer, Pres. H. M. Morse, Finance Bldg., Archt.

O., Columbus—National Ice & Storage Co., 5th and Naghten Sts., is having plans prepared for a 2 story ice factory on West Broad St. Estimated cost $20,000. Bassett & Tressell, Citizen's Bank Bldg., Archts.

Pa., Jacobs Creek—The United States of America Drug & Chemical Co. is receiving bids for the construction of a 3 story, 72 x 120 ft. drug and chemical factory. Estimated cost $150,000. P. Rossello, 406 Congress Bldg., Detroit, Mich., Archt.

Pa., Kane—The Sakura Soap Co., will build a 1 story, 45 x 126 ft. addition to its factory. E. A. Phillips, Warren Trust Bldg., Warren, Pa., Archt.

Pa., McKees Rocks — The Chesebrough Mfg. Co., 17 State St., New York City, awarded the contract for the construction of a 2 story, 106 x 143 x 190 x 195 ft. finishing building, a 1 and 2 story, 31 x 103 ft. tank house, and a 1 story, 36 x 39 ft. boiler house, here. Estimated cost $200,000. This is the first unit of proposed $1,000,000 manufacturing plant. Noted Oct. 5.

Pa., Oakmont—Mills, Rhines, Bellman & Nordhoff, Archts., 1234 Ohio Bldg., Toledo, O., are receiving bids for altering and constructing a 2 story, 74 x 94 x 157 x 158 ft. addition to paper bag factory, here, for the Valve Bag Co. of America, 3444 Summit Ave., Toledo, O.

Pa., Phila.—The Logan Ice Co., 10th and Windrim Sts., awarded the contract for the construction of a 1 story, 96 x 182 ft. ice manufacturing plant, consisting of 4 buildings.

Pa., Phila.—The Standard Provision Co., Callowhill and Willow Sts., awarded the contract for the construction of a 3 story, 70 x 160 ft. packing plant. Estimated cost $120,000. Noted Aug. 29.

Pa., Rossmere (Lancaster P. O.)—Rowe-Stuart Motors Corp. awarded the contract for the construction of a 1 story, 120 x 300 ft. factory, for the manufacture of special pneumatic tires and other rubber automobile goods.

Pa., Warren—C. Hamm, 28 Clark St., will build a 2 story, 35 x 120 ft. woodworking shop, to replace the one destroyed by fire.

Pa., Warren—The Seneca Oil Wks., South Carver St., plans to build a new cracking plant in connection with its refinery, for the manufacture of gasoline from low grade oil. Estimated cost $60,000. Architect not

American Machinist

Volume 57 NEW YORK, OCTOBER 26, 1922 Number 17

633

International Standardization

The Four Stages of Industrial Standardization—National and International Bodies—Examples of Accomplishment—Information the Basis of Co-operation

By P. G. Agnew
Secretary of the American Engineering Standards Committee

In discussing so complex a subject as international standardization it is well to be explicit on fundamentals. Industrial standardization means to single out specific products and materials, to settle upon their properties and dimensions, and to concentrate upon them in production and in use—all to the end of bringing about the greatest overall industrial efficiency. This involves:

(a) Nomenclature

(b) Purchase specifications

(c) Methods of test

(d) Uniformity in dimensions necessary to secure interchangeability of supplies, and the interworking of apparatus and parts.

(e) Provisions for safety

(f) Concentration upon the optimum number of types, sizes and grades of manufactured products

According to the scale upon which it is carried out, the process of industrial standardization may be classified roughly into four stages, namely:

1. By individual firms
2. By societies or associations
3. On a national scale
4. On an international scale

The number of individuals and organizations interested in any particular piece of standardization work increases greatly as it develops from one of these stages to the next. On this account, and for many other reasons, the difficulties increase in a greater ratio from stage to stage than do the number of parties at interest. Likewise, the extent to which standardization may be carried is very much less in scope, in incisiveness, and in elaboration of detail. On the other hand, its importance industrially increases from stage to stage, and when international standardization can actually be carried out it is bound to be far-reaching in its effects.

> There are many and serious obstacles in the way of the development of international industrial standardization, such as differences in languages, racial temperament, historical and industrial background, limitations imposed by geographical conditions, the metric and English systems of weights and measures, national animosities and rivalries, exigencies of commercial conditions, ignorance on the part of industrial leaders of the significance of or even of the existence of foreign work, and the instinctive conservatism, not to say suspicion, of a large proportion of men toward new developments and ideas.

Generally two or more of these stages develop simultaneously. In fact, all four stages may be developing at the same time. Furthermore, as a practical matter no sharp line of demarkation can be drawn between the four stages. A piece of standardization work which has been carried out by a society or an association may have been put upon so sound a basis that it becomes essentially a national standard. The same is true even of the work of individual companies. Several striking examples of the latter are to be found in the field of mechanical engineering, e.g., in tapers and wire gages.

Standardization by individual firms is now well developed in all the principal industrial countries. It is an essential element in mass production. Unquestionably up to the present it has been pushed farthest in the United States.

Standardization by societies and associations has also been greatly developed in industrial countries. In many cases standards so developed have come into such general use as to make them essentially national in character. In far more numerous cases such standards are receiving increasing recognition, but systematic co-operation and understandings with other interested bodies will be necessary to bring about full national recognition.

National Bodies. The movement for industrial standardization along national lines, although a recent one, is now getting well under way. There are now fourteen national standardizing bodies in all: in Austria, Belgium, Canada, Czecho-Slovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden, Switzerland and the United States. While the British Engineering Standards Association is the only one of these which antedates the World War, and some of them have been only recently organized, the opportunities and need for the work are such that more than half of them have already accomplished work of real significance and importance in the development of their national industries. The work is being woven intimately into the industrial fabric. Of the national bodies the British and the German are the largest and their work is the most extensive at the present writing.

Steps in International Work. Naturally much less has yet been accomplished in international industrial standardization than in national work. Yet beginnings

have been made in several fields and in some lines substantial progress has been made. Three formal international bodies have been set up for standardization work. These are in the electrical, illumination, and aircraft fields. The national bodies are in touch with each other and are interchanging information on many projects in process in their respective countries. Through these and other means considerable international uniformity has been brought about in a variety of specific subjects. Examples are mentioned below. Furthermore, a great deal of essential work has been accomplished in securing international uniformity in the use of fundamental units and methods of measurement which are a prerequisite to nearly all phases of industrial standardization.

International Electrotechnical Commission. The oldest and most experienced of the international bodies whose primary purpose is industrial standardization is the International Electrotechnical Commission, which was organized in 1906. The commission itself consists of a national committee in each of the 26 countries represented. These national committees are made up of accredited representatives of the various technical and industrial associations interested in standardization in the electrical industry. Nearly the whole of the work is done through advisory technical committees international in composition. Formal actions are taken at plenary sessions which are held at infrequent intervals. Agreements have been reached and published on a considerable number of electrical subjects, including such matters as definitions, symbols and general rules for acceptance tests. The most important part of the work is that dealing with the rating of electrical machinery and apparatus, that is to say, rules for determining what capacity may be claimed for apparatus and machinery as a basis of sale or tender. The war seriously interfered with the development of the commission's work. The question of a revision of some of the most important parts of the work on rating has recently been raised. The president of the commission is an American, Dr. C. O. Mailloux.

There are important considerations and powerful forces tending toward international standardization, such as the scientific basis which has been laid in the extensive system of physical and chemical units and measurements; the growth of international trade; the increasing use of specifications and other industrial standards in foreign commerce; the increasing interdependence of national industries; the increasing knowledge of international affairs; the greater tendency to study foreign industrial developments; and the fact that industrial leaders are taking a larger and larger perspective in planning for the future.

International Commission on Illumination. This commission, which was modeled somewhat after the lines of the International Electrotechnical Commission, was organized in 1913. Its work up to the present time has dealt with fundamental photometric definitions and quantities, heterochromatic photometry, definitions and symbols, lighting in factories and schools, and automobile headlights. The president of this commission also is an American, Dr. Edward P. Hyde.

International Aircraft Standards Commission. This organization is also modeled somewhat after the International Electrotechnical Commission but the national committees are primarily governmental in character. The commission has developed from the co-operative efforts of the allied governments during the war in aircraft matters. There is no American national committee. At present, the commission is not active except as an agency through which the national committees exchange information on standardization matters relating to aircraft. The principal reason leading to this partial cessation of functions is due to the fact that the exact relation of the commission to the International Air Convention has not been clearly worked out. The Air Convention was an annex to the Versailles Treaty. The commission had under way work on a considerable number of problems. In these, dimensional standardization played a much larger role than has been the case with the International Electrotechnical Commission and the International Commission on Illumination. The work of these two latter bodies, as already indicated, has primarily to do with specifications, methods of tests and nomenclature.

International Chamber of Commerce. Considerable interest in industrial standardization has been taken by the International Chamber of Commerce. It has been decided that the Chamber will, however, not go into the field of technical standardization but will use its prestige and facilities to further the standardization movement and to promote the use of recognized standards and the actual understanding of such work on the part of nationals engaged in international trade.

International Scientific Bodies. By far the most important of the international scientific bodies from the point of view of national standardization is the International Bureau of Weights and Measures. This is a governmental body and through it there has been accomplished a considerable amount of important legislation throughout the world, dealing with fundamental units and concrete standards of weights and measures. Important work on the temperature scale has also been accomplished by it. Specialized standardization work of important scientific fundamentals, such as standards of wave length, geodetic measurements, and the like, have been accomplished by international scientific bodies, such as those known as International Unions, now affiliated with the International Research Council. Probably even more has been accomplished by co-operation between the national standardizing laboratories.

All of the other national standardizing bodies have drawn heavily upon the experience and the methods of the British Engineering Standards Association. The British developed the method of co-operation which has come to be technically known as a "sectional committee." The actual formulation of specifications and other forms of industrial standards and the technical decisions involved are in the hands of such a sectional committee which is made up primarily of accredited representatives of the various bodies concerned with the standard in question. This general method, or some adaptation of it, has been adopted by all of the national standardizing bodies. The American Engineering Standards Committee had the advantage, during the period of organization, of having the counsel and advice of Mr. le Maistre, the Secretary of the British Engineering

Standards Association. Mr. le Maistre was in America twice during this period, the last time being upon the specific request from the Americans for such assistance.

Conference of Secretaries. In April, 1921, there was held in London a conference of Secretaries of national standardizing bodies. While this conference was wholly unofficial in character, it was the most important single step yet taken to bring about international co-operation in the broad field of industrial standardization. In addition to an extremely valuable interchange of experience, the conference resulted in an arrangement for the systematic interchange of information on the status of the various projects which each body has under way. This information is sent every three months to each of the bodies. The information is arranged uniformly and is written on uniform blanks, all by agreement between the offices of the various bodies.

This systematic interchange of information is limited to the indication, by means of numbers, of the stage of development which each project has reached. Minutes of meetings and drafts of standards are not included. The interchange of such information is subject to separate decision in each case, according to the policy of each national industry concerned. All approved standards are interchanged as a matter of routine. Another forward step was a reciprocal arrangement by which each body acts as a sales agent for the approved standards of the other bodies. Thus the standards of each country are always readily available to each of the others, not only to the working technical committees, but to industries of each country generally. The advantages of this co-operation are evident.

> It seems to me that the problems now confronting much of the national standardization movements are much the same as those that surrounded the movements toward trade associations in this country a few years ago, while international standardization will follow in much the same way, but without going so far or so rapidly.
>
> Whatever the ultimate outcome may be it seems to me that the next step in any case is the same—to develop as full and as free an interchange of information as conditions will permit.

It was the view of the Conference that international co-operation in industrial standardization work should proceed along such informal lines, being based primarily upon the interchange of information on active subjects of mutual interest rather than by any attempt at the present time to form a general international standardizing body; that in cases in which formal organization should be found necessary, the organization should preferably be by subject or industry, somewhat along the lines of the International Electrotechnical Commission; but that in all cases efforts should first be made to secure results by less formal methods; and to this end it would often be desirable that, in a given subject, the office of one of the national bodies most interested should, by informal agreement, perform such secretarial functions as would further international agreement in the particular subject.

This would result in some one of the following degrees of organization:

(a) Mere interchange of information and proposals by general correspondence.

(b) Informal subject centers, the office of one of the National bodies most interested performing, by informal agreement, such functions of a secretariat as may further international agreement in the particular subject.

(c) One or more conferences, without a permanent organization, where (b) should be found to be insufficient.

(d) A permanent international body.

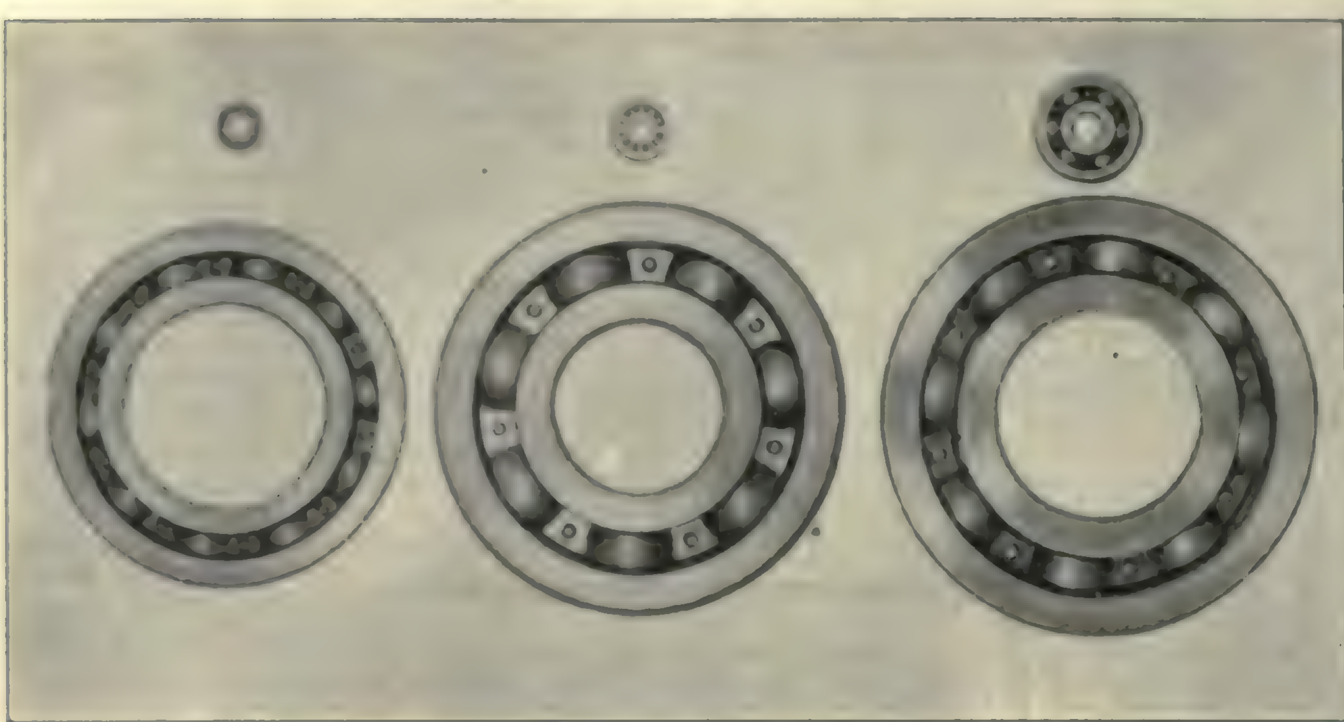
Generally speaking, standardization work in any given industry is apt to be taken up earliest in those countries to which the particular industry is of most importance. In this connection the interesting suggestion has been made by Dr. E. Adler that in bringing about standardization internationally, different countries might be formally recognized as leaders for specific pieces of work with which they are most concerned. While each would bear a special responsibility for those problems for which it would be serving as leader, it would have the co-operation of the other countries concerned thus making the arrangement somewhat like the sponsorship plan of the American Engineering Standards Committee.

It often happens that the same standard is used in two or three, or more, countries, without attaining such use in other industrial countries. This naturally results from commercial interchange, geographical position, the use of metric or English weights and measures linguistic, and other conditions. For example, the commercial and other relations between Belgium and France, Great Britain and her colonies, Germany and her neighbors, Austria, Switzerland, Holland and Sweden, and Canada and the United States have led to such results. The secretaries of the national bodies of Austria, Holland and Switzerland regularly attend group meetings of the German sectional committees.

In addition to the specific examples of international standardization work of the international bodies, which have already been referred to, mention should be made of some examples of projects on which co-operation between national bodies is now going forward.

Ball Bearings. Prior to the war a large measure of international uniformity in the subject of ball bearings had come about, without any formal organization but merely through ordinary commercial and engineering interchange. Of those forms of bearings which are more important industrially, at least 90 per cent are made to dimensions that are standard internationally. This refers mainly to width and inside and outside diameters of bearings, which provide interchangeability. The countries primarily concerned, and in the order of production, are: United States, Germany, Sweden and Great Britain. There has been a considerable interchange of information and suggestions and recently definite proposals were put forward by the American sectional committee, which is working under the joint sponsorship of the Society of Automotive Engineers and the American Society of Mechanical Engineers.

The most extensively used type of ball bearing is undoubtedly the radial bearing, the main purpose of which is to carry radial load. This bearing is built in three series, light, medium and heavy, the selection of series being dependent upon the load which the bearing of a



(Courtesy of S K F Industries)

EXAMPLES OF INTERNATIONAL UNIFORMITY

Six of fifty-nine ball bearings which are interchangeable internationally—the largest and smallest in the heavy, medium, and light series.

certain inside diameter has to carry. The illustration shows the three largest sizes of the above series, which are internationally standardized. The inside diameters are 110 m/m for the light series, 100 m/m for the medium series, and 85 m/m for the heavy series. It also shows the smallest bearings of the corresponding series, the inside diameter being 10 m/m for the light series, 10 m/m for the medium series, and 17 m/m for the heavy series.

The total number of internationally standardized sizes of these three series is 59, which covers practically all the commercial sizes of bearings which are in common use. Efforts are being made to agree on international standards for the extension of these series up to about 300 m/m bore, as well as for thrust bearings and the probabilities are that international standards will be set for all commercially used anti-friction bearings.

Gaging. Everywhere there seems to be a keen interest in national systems of limit gaging, doubtless due in large part to experience during the war in mass production of munitions, in which interchangeability of parts and supplies made by different manufacturers was a necessity. In this the continental work is more advanced than is the British and American work, which has not yet reached the stage of final formal adoption, the decisions being yet in the tentative stage.

On one important point, whether the shaft or the hole shall be the fundamental basis of reference, the American, British, Dutch, German, Swedish and Swiss work is in agreement. The decision is that the hole or, in the case of screw threads, the nut shall be the fundamental basis. The published Austrian standards appear to place the two methods upon an equal basis.

Among these, the continental countries and the American sectional committee (under the sponsorship of the American Society of Mechanical Engineers) have decided upon 20 deg. C. (68 deg. F.) as the standard temperature of reference. The British and Canadians use 62 deg. F. (16.7 deg. C.).

One of the most discussed questions is that of allowances and tolerances, and particularly whether the tolerance shall be stated as a plus or minus quantity or as a plus or a minus quantity. As a simple example consider a hole and shaft for each of which there is to be a tolerance of 0.002 in. to provide for variations in manufacture. Shall the hole be dimensioned at 1.001 in., ± 0.001 in. and the shaft as 0.999 in. ± 0.001 in., or shall the hole be dimensioned as 1.000 in. + 0.002 in. and the shaft as 1.000 in. — 0.002 in.? The first is often referred to as the "bi-lateral system," and the latter as the "unilateral system." The continental bodies have definitely, and the American sectional committee has tentatively, adopted the unilateral system. In Great Britain a very spirited discussion on the relative merits of the two systems has been going on for some time but I am not informed of any definite decision yet taken. It is interesting to note that the American sectional committee was organized as a result of a request for co-operation from the British.

Wrench Openings. Provisional agreement has been reached, informally, between most of the continental countries on the widths across flats on nuts and boltheads. The Swiss, who are serving informally as a secretariat according to the general scheme of co-operation sketched above, have made definite proposals for international agreement on a series of dimensions for wrench openings. The proposals include tolerances which are formulated with the intention of making it possible to bridge difficulties arising over the metric-inch question by making the tolerances such as to cover in practice the differences between metric and inch sizes. There are circumstances which make the time favorable for the consideration of the Swiss proposals. The Belgians are revising their work on bolts, and the British have organized work on the same subject and will revise their specifications for spanners. It is not unlikely that the British may reduce their nut and bolthead sizes, which are larger than those in other countries, in order

to make them more adaptable to the up-setting process of fabrication. The American work, which was organized as a result of the Swiss proposals, is just getting well under way.

Screw Threads. Work on screw threads has been active in recent years both in Europe and America. Few, if any, standardizing projects are as far reaching or as difficult. Changes of any kind are very hard to carry out even in the practice of an individual firm, to say nothing of the difficulties when considered internationally.

Whitworth threads are used very extensively in continental Europe, side by side with metric threads and on the whole more extensively. While I do not have authoritative information from all of the countries, I understand that at least the following have already adopted or are practically certain to adopt three series of threads for all but very specialized uses, namely: Austria, France, Germany, Holland, Italy, Sweden, and Switzerland. The three series are the International Metric thread, the Metric Fine thread and the Whitworth. Some of the countries have already definitely decided to abandon several less used metric series. It appears that in these countries the metric threads will be considered the primary standard and the inch threads as secondary, even though the inch threads are now in greater use. It has often been suggested that it is very desirable that the English-speaking countries list the International Metric and the Metric Fine threads as auxiliary standards, in order that, in those cases in which metric threads are used, the practice of the metric countries should be followed.

Agree on Thread

In this country the National Screw Thread Commission and the American sectional committee (the American Society of Mechanical Engineers and the Society of Automotive Engineers, sponsors) have now reached tentative agreement on the various details for the coarse and fine series of the American form of thread. The results have been transmitted to the British and Canadian associations. Whether some form of unification of the Whitworth and the American coarse series (practically the "U. S. Standard") should be carried out has often been discussed. Latterly, the opinion has frequently been expressed that discussions should not center, as formerly, upon the form of thread, since in the coarse fits the actual forms depart widely from the theoretical form. The pitches of the two series are identical with exception of the half-inch size, for which the Whitworth has twelve threads and the American thirteen per inch. Should the suggestion prove correct that the differences in form of thread may be ignored for loose fits and for all rougher work, a great part of the difficult problem would still remain unsolved. If the two series are to be unified, a great amount of study must be given to the questions, (a) What basis or bases of unification are possible and feasible? (b) Would the industrial advantages of unifying the two systems outweigh the cost and trouble of its achevement? In my opinion, far more extensive and explicit information than is now available will be necessary for the correct solution of these questions.

Information the Basis of Co-operation

Specifications for Zinc. The national bodies in countries concerned with the production of zinc and zinc ores are studying proposals put forward by the Belgians for international agreement on specifications for zinc and zinc ores. These are intended to clarify certain technical matters which affect the international market and about which misunderstandings arise. The American sectional committee was organized as a result of the Belgian request for co-operation.

From the very nature of industrial standardization it should be evident that there must be a full, mutual understanding and appreciation of the problems and point of view of the various parties at interest. This is true regardless of the scale upon which standardization in any particular project is carried out, whether by firms, by associations, nationally, or internationally. In any case there must be an interchange of information, the freer the interchange the better. It should occur as early as possible in the development of the work, in order that the necessary mutual understanding may be brought about. It is not enough to interchange information on completed work. Each country wants to have its standards become international standards.

Must Enlarge Views

If all the different countries wait until their work is completed before submitting it to the others, any one of them, by proposing its own standard for international adoption, places the others in the position of being asked to sign on the dotted line. Human nature is such that this does not work well. If information be exchanged during the development of the work, opportunity is given for each to understand and appreciate the other's point of view, and each is much less apt to become committed to policies and provisions which it would have been willing or even glad to have had different, had it had the advantage of such information during the development of its own work. Thus are agreements made easier and technical and industrial progress facilitated by the mere interchange of information.

For these reasons, the secretaries of the national standardizing bodies made the question of the interchange of information the principal consideration in their conference in London, as has already been indicated. I believe that the simple, systematic interchange of information on the status of projects there initiated will prove to have been a milestone in the industrial standardization movement, from the national as well as from the international point of view.

Publications of Value

Another very important development is the special publications, in journal form, of the national bodies in Austria, Germany, Italy and Sweden. In these, drafts of proposed standards, abstracts of minutes, etc., are given in much fuller form than such information is made generally available in Anglo-Saxon countries. The Germans consider that their "Mitteilungen" has been one of the prime factors in the extremely rapid development of their work. The information in these publications, while intended for their own industries, is, of course, available in other countries.

An A.E.S.C. European Representative. It has been suggested that the American Engineering Standards Committee could perform an extraordinarily important service to American industries by maintaining a representative in Europe. An engineer having the right combination of temperament, experience and linguistic ability would be able to supply an amount of information to our working committees on the standardization work going on in Europe and furnish a knowledge of

the industrial background upon which the standardization work is based that is quite impossible without direct personal contact. On the other hand, he could perform a like service in giving to the European bodies the American viewpoint and background. The benefits to American industries of the work of such a representative would be out of all proportion to the cost. Even the byproduct services which he would render should far exceed the entire cost.

In this connection it is instructive to note that Germany and Japan are the only two countries that have adopted a policy of studying technical and industrial progress in other countries systematically and intensively. There is no doubt that this policy has contributed in an important way to the meteoric development of the industries of Germany and of Japan.

WHAT OF THE FUTURE?

There are many and serious obstacles in the way of the development of international industrial standardization, such as differences in language, racial temperament, historical and industrial background, limitations imposed by geographical conditions, the metric and English systems of weights and measures, national animosities and rivalries, exigencies of commercial conditions, ignorance on the part of industrial leaders of the significance or even of the existence of foreign work, and the instinctive conservatism, not to say suspicion, of a large proportion of men toward new developments and ideas.

On the other hand, there are important considerations and powerful forces tending toward international standardization, such as the scientific basis which has been laid in the extensive system of physical and chemical units and measurements, much as an alphabet forms a basis for written language; the growth of international trade; the increasing use of specifications and other industrial standards in foreign commerce; the increasing interdependence of national industries upon each other; the increasing general interest in and knowledge of international affairs; the greater tendency to study foreign industrial developments and to adopt those which are applicable to home industries; the circumstance that specific industries are developing more and more along the same lines in different countries; and the fact that industrial leaders are taking a larger and larger perspective in planning for the future.

STANDARDIZATION NEAR

The actual line of development must necessarily be the resultant of such conflicting tendencies and forces. In my opinion, a very considerable amount of international standardization will take place in the next few decades. This opinion is based largely upon evolutionary considerations. For example, it seems to me that the problems now confronting each of the national standardization movements are much the same as those that surrounded the movement toward trade associations in this country a few years ago, while international standardization will follow in much the same way but without going so far or so rapidly.

Whatever the ultimate outcome may be, and whatever one's estimate of the success of the movement toward international standardization may be, it seems to me the next step is in any case the same—to develop as full and as free an interchange of information as conditions will permit. Through some such procedure can standardization best be firmly established.

Experimental Production of Alloy Steels

BY H. W. GILLET AND E. L. MACK

Bulletin No. 199, of the Bureau of Mines, Department of the Interior, gives some of the results of the experimental heats of alloy steels recently made by the bureau for the Army and the Navy. The steels for the Army were desired for work on gun erosion, especially in regard to the effect of nitrogen on steel.

The use of a small direct-arc electric furnace for making small experimental heats of alloy steel is attended with difficulty in the control of the carbon content. Indirect-arc types, however, such as the Stassano, Rennerfelt, or the simple homemade furnace described allow a much better control of the carbon content. The raw material used must be sufficiently low in sulphur and phosphorus to obviate the making of refining slags, and straight melting, analogous to the crucible-steel practice, must be done. With these provisions, the making of special alloy steels in 50- to 100-lb. heats, to chemical specification, is relatively simple in a 50-kw. indirect-arc furnace.

RESULTS NOT PROMISING

This report deals only with the preparation of the various steels and with the recovery and the segregation of the different alloying elements. Some of the steels whose preparations are discussed in this section were of rather unusual composition; and many were nickel steels high in silicon, or steels higher in the various alloying elements than the common steel compositions.

As the composition of many of the steels is suitable only for special uses, no direct general conclusions can be drawn as to the value or lack of value of zirconium, titanium, uranium, boron and cerium as true alloying elements in the commonly used types of steels. In various physical tests of the steels covered by this report, steels in which these elements are present in appreciable percentages, the results so far obtained have not in general been promising. Nor have they been as good as those of similar steels of the series without these elements. Recent reports of tests of plain carbon steels of low carbon content to which less than 0.25 per cent of zirconium has been added are said to indicate that zirconium may have a beneficial effect, especially on notched-bar impact tests.

USED IN DEGASIFYING "WILD" STEEL

Although these elements are readily oxidized, none of them appear to be as efficient as aluminum or vanadium in degasifying "wild" steel. No special study has been made of very small amounts of these elements used as scavengers only, but all of them seem likely to leave their oxides or other compounds trapped in the steel as inclusions when they are added immediately before pouring, as is necessary in order to get a good recovery when using them as alloying elements rather than as scavengers.

Boron is almost quantitatively recovered when added at the end of the heat and may be added at the start of the heat without great loss. In the amounts studied up to 0.6 per cent, no appreciable tendency to segregation was noted.

A complete copy of the paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of fifteen cents.

Methods of Machine Tool Design

Continuation of the Section on Feed Mechanisms—Various Cam Arrangements for Screw Machines—The "Program" Machine and Its Future Possibilities

By A. L. DE LEEUW
Consulting Editor, *American Machinist*

THE problem of keeping the size of a cam down to the lowest possible dimensions is a very important one, not only because large cams increase the size of the machine, and are apt to make it unsightly, but because they are also apt to decrease the strength and rigidity of the frame. The means employed to minimize the size of the cams are the following: Steep slope of the cam; return movements made by springs or weights; some of the functions actuated by springs or weights; some of the functions actuated by cams which revolve only when required and which revolve at a high speed, while the main cam may revolve at a lower speed.

The first method, that of using steep slopes for the cam, is very limited in its application. A steep slope is not advisable during feeding operations, although some instances have come to the writer's attention where a feed cam was used with an angle of 65 degrees. Of course, such an arrangement sets up excessive side strains, is very wasteful of power, and causes an uneven action on the tool. As a rule, cam slopes are held down to 45 deg. or less, even for return cams, whereas it is good policy to limit the slope of feed cams to 1 in 3. Attention should be called to the fact that not much can be gained in smooth action of the cam by making the slope less than 1 in 3. The smaller the angle of slope becomes, the less can be gained by making it still smaller.

Use of Springs or Weights

The second method of using springs or weights for return movements is safe when light members must be returned and when there is practically no danger of anything sticking. Where there is any danger at all that a tool may stick in the work or a slide may stick on its bearing, on account of the gumming up by cutting compounds or choking up by chips, this method is not safe.

The third method applies to such functions as feeding the stock in an automatic screw machine or doing any of the "productive" operations of some other automatic machines which call for a definite and limited amount of power only. A spring or weight can be applied in such cases.

The fourth method is the one referred to before and used in such machines as the Brown & Sharpe automatic screw machine where the shifting of belts, opening and closing of chucks and stock feed, are all accomplished by a cam which is clutch-operated and which makes a full or half revolution at a rapid rate after which it stops until it is tripped again. While such a cam is operating, the main cams of the machine keep on revolving at their relatively slow rate.

The peculiar construction of certain machines lend themselves to still other methods. An interesting way of reducing the size of some of the cams is employed in the Cleveland screw machine. In this machine two cams are used for the feed motion, one for the turret and another one for the cross-slides. The turret cam makes a full revolution for each movement of the turret. If there are five tool positions in the turret, then this cam will make the turret go forward and backward five times during the complete cycle. This cam causes the same stroke, whatever tool is used and whether the active stroke is long or short. Controlling mechanism at some other part of the machine causes this cam to revolve either fast or slow.

Variation of Speed

The actual feed stroke can be made as long or short as may be desired. If, for instance, there is a total stroke of 6 in., it will be possible to run the cam slowly for this entire 6 in. and return it fast to its starting position. Or the cam may advance fast for 4 in., then slow for 2 in., and then return fast the entire 6 in., or any other method of dividing up the total 6 in. Then, again, it would be possible to advance rapidly for 4 in. (or any other amount less than 6 in.), then feed slow for 2 in., and keep this slow movement for part of the return—let us say 1 in., after which it returns fast the remaining 5 in.

Not only is it possible to make any part of the forward or backward stroke fast or slow, but the slow movement can be given different rates of speed by a feed-changing device, so that on one stroke we may have a feed of 0.006 in. per revolution of the spindle and on another stroke—that is, for another tool—we may have a feed of 0.020 in. per revolution of the spindle. There is on this same machine, as was said before, a second cam which operates the cross-slide. This cam makes one revolution for a complete cycle of the machine, that is, the latter cam makes one revolution while the other cam makes five (supposing there are five holes in the turret).

Dividing Functions Among Several Cams

The cross-slide cam also has the fast and slow motion and it should be noted that both cams are running fast or slow at the same time because they are driven by the same mechanism. The cross-slide cam is not fixed but can be changed. Cam straps can be taken off and other straps put on to suit the requirements. It may very well be that the cross-slide cam requires a long movement or stroke at the same time the corresponding turret tool should get along with a short stroke. In that case, it is necessary to continue this slow movement, though the turret cam might have had a fast movement. This arrangement makes it possible to utilize a relatively small cam for the turret, but it does not obviate the necessity of using a large cam in the machine.

When the stroke required for various operations is long, the cam assumes very large proportions and that regardless of whether the stroke is used for feeding the tools or for any other purpose. It is therefore desirable to have some other method by which cams can be held down in size. If there were a cam for each operation and if this cam should be turning only when that particular operation takes place, it would be possible to keep these cams down to a very limited size.

For the author's forthcoming book.

if it were found that some of the operations are short, then these operations might be combined in one single cam. Referring to the schedule of the screw machine with four tools which was discussed in a previous paragraph, we would do operations *a*, *b*, and *c* with one cam. After performing these operations the cam would stop, so that no space would be required for *d* (dwell of first tool and cross-slide tool). Another cam would then be set in operation for *d-1*, *d-2* and *d-3* (indexing and locking of turret), after which this cam would stop. A third cam would be used for *e*, *f* and *g*, whereas the second cam would be set in motion once more for *h-1*, *h-2* and *h-3*. A fourth cam would then perform operations *i*, *j* and *k*; after which the second cam would take care of *l-1*, *l-2* and *l-3*, and so on.

Distributing Operations over Several Cams

This leads to a great many cams and may be objectionable for that reason. If the feed motions do not require a long stroke, it would be perfectly feasible to have all the cam straps for *a*, *b* and *c*—*e*, *f*, and *g*—*i*, *j*, and *k*—*m*, *n*, and *o*, all on one drum, while the straps for *p*, *q* and *r*—and *t-1*, *t-2*, *t-3* and *t-4* could be on another drum. There would then be altogether three cams, one for the turret advance and feed motions, one for belt shifting, chuck opening and closing and stock feed, and one for turret indexing. In addition, there would be a similar cam for the cross-slide feed motions. All of these cams would be of relatively small size.

The difficulty we encounter with such an arrangement is this: that we must take good care that each cam operates at the proper moment and that there is no accumulation of error. There must be some controlling mechanism which will start and stop each cam at the proper moment and which will prevent them from getting out of time.

Such a controlling mechanism might be a disk which revolves once for a complete cycle of operations. Dogs mounted on this disk would operate clutches which would engage or disengage the various cams. Such a control mechanism would insure that each cam operates at the proper moment, but it would not insure the proper timing. To illustrate this, let us assume that there are two cams for different operations. We will call these cams *A* and *B* and assume that they are thrown into action by a positive clutch. When cam *A* has made one revolution (or as much of a revolution as may be necessary for a single stroke), the control mechanism throws out the clutch for this cam and, at the same time, throws in a clutch for cam *B*.

Controlling the Individual Cams

It may happen that the teeth of this clutch strike so that a part of a revolution of the clutch passes before cam *B* is engaged. To visualize the thing still better, let us assume that each of the two cams *A* and *B* occupies one-half of the total cycle and therefore one-half of the control disk. The striking of the clutch teeth has wasted, let us say, one degree of this movement, so that cam *B* will revolve through 179 deg. when the dog on the control disk throws it out of action. On the next cycle there may be a similar striking of the clutch teeth, again robbing cam *B* of one degree of its movement. It will be seen that whatever error there is in the engagement of the clutches is accumulated, so that in the course of time the cams must be in the wrong relation to one another. This method of control, then, which depends on a full cycle of the machine, cannot be used with this system.

To make such a system operative cam *A* should throw itself out after it has turned through the proper angle or the proper number of revolutions and it should throw in cam *B*. Cam *B*, in its turn, after making its proper number of revolutions, should throw itself out and throw cam *A* into action.

No Possibility of Accumulation of Errors

To show that such an arrangement would keep all functions in time, we will assume again the same conditions as before and see whether there is a possibility of an accumulation of error. Cam *A* completes a revolution, which corresponds to half the cycle, and throws its cam out which, of course, is a positive action happening at the exact place where the dog is set. It also throws into action cam *B* by means of a clutch. This clutch may fail to engage for a moment because the teeth strike. As a result there will be a period of idleness between the end of the action of cam *A* and the beginning of the action of cam *B*. But finally cam *B* will start its functioning, make a complete revolution, throw itself out, and start cam *A*. Whatever the delay may be in the throwing in of the clutches, such delay does not have any effect on the functioning of the two cams.

Combining Other Mechanisms With Cams

Some of the functions of an automatic machine may not be controlled by cams but by some other kind of mechanism. For instance, the indexing of a turret or other member may be effected by a Geneva motion which is revolved through one-fourth, or one-third, or any other fraction of a revolution. With the ordinary arrangement of cams, an idle space must be provided on all of these cams during the time that such operation takes place. If the operation was started by the throwing in of a clutch, the idle space on the cam must be made long enough so that any delay in the engagement of the clutches will not cause one of the cams to start its action before the proper time, for instance, after the indexing is completed. We see, then, that whether machine functions are controlled by cams, or by any other kind of mechanism, those cams which are actually used must be of a size sufficient for all the time occupied by such other mechanisms.

However, the final size of the cam may be made less by having some of the functions of the machine operated by a different kind of mechanism. If, in the previous example, the indexing was done by means of a part of the cam, then, in order to save time, it would be necessary to run the cam at high speed during that period and, as a consequence, a large portion of the circumference of the cam would be occupied for the period of indexing. If, on the other hand, the indexing was controlled by, say, a Geneva motion, we could throw this into action by a clutch on a shaft running at fairly high speed, meanwhile running the cam at a low speed so that, during the short time required for the indexing, only a very small part of the main cam would have passed a given point. Arranging things this way, however, is not always safe. Should the clutch refuse to engage for a considerable length of time, the index might take place after the cam has started some other function of the machine and this might lead to serious trouble. In short, then, if we wish to operate various functions of the machine by cams and other mechanisms not positively connected, we should arrange matters so that each previous element throws itself out at the end of its functioning, at the

same time throwing the next element into action. This system lends itself very well to highly complicated machines, has the advantage of using small cams, and simplifies the setting up and the analysis preparatory to the changing of a job.

Taking, again, the example of the automatic screw machine with four turret positions, we might make one cam for all the advances, feeds, and returns of the turret. We could do this in two ways: either make the cam sufficient for a single stroke only, or else make it so that one-fourth of the cam is used per stroke.

Applying Separate Cams to a Screw Machine

In the first case, we would have an arrangement resembling very much the turret feed cam of the Cleveland screw machine, but in this example the cross-slide cams might also be made small. It would be possible here to have a long cross-slide operation combined with a short turret movement. We may assume that the turret cam has started and after the turret is on its way a dog on this turret cam throws the cross-slide cam into operation. This cross-slide cam may go as fast or slow as may be required. It will keep on running for a complete revolution when it will throw itself out.

In other words, after it has once started it has no further relation with the turret cam. At the end of the stroke of the turret cam—that is, after this cam has made one full revolution—the index mechanism is thrown in, and at its completion the turret cam is thrown in, this time by the indexing mechanism. This will be repeated three times, but at the end of the fourth time, the index mechanism does not throw into action the turret cam but some other cam used for opening and closing the chuck and feeding the stock.

All that would be necessary to accomplish this would be to have a disk upon which dogs are mounted and which makes one full turn for four index movements. The first three dogs would have acted directly on the turret cam mechanism, whereas the fourth dog acts on the stock feed cam. When this latter cam has made one full revolution, it throws itself out and may throw into action the turret cam, this starting again a complete cycle.

The Other Arrangement of Cams

If our machine had been a chucking machine instead of a screw machine, the stock feed cam would have been omitted and the fourth dog on the index mechanism would have thrown this mechanism out of action without starting the turret cam, thus stopping the machine. If such a chucking machine were provided with a collet chuck or any other kind of chuck which can be operated by a single movement, we might have had a cam for this operation and we would start the cycle by starting that cam. It will be seen that this arrangement of successive cam operations is much more elastic than the common arrangement by which the time of all the various operations is laid out on the circumference of one single cam.

If the second scheme had been followed—that is, if we had put the feed cam for the four turret positions on one drum—we would have had the following sequence of trips. The first part of the feed cam advances and returns the turret and then throws itself out of action and starts the index. The index having been completed, its mechanism throws itself out and starts the feed cam again, which makes another quarter turn, repeating the operation until, at the end of the fourth indexing operation, the machine either stops itself or the index mechanism acts upon a cam for chucking, etc. The four parts of the feed cam may be equal or unequal. If equal, the dogs for tripping the index mechanism may be stationary. If not equal, they must be adjustable so as to place them always in the proper relation to the end of the cam groove. The manner in which the index mechanism may cause a tripping of the feed cam for the first three movements and of some other cam at the end of the fourth movement may be accomplished by having a disk on which dogs are mounted and which turns once during the four complete operations of the indexing mechanism. The fourth dog would be different from the other three and would operate in a different plane.

A Glimpse of the Future of Automatic Machines

It is, perhaps, not out of place here to enlarge somewhat on the possibilities of such a system of control of automatic functions of machine elements; to look into the future, so to speak, and describe a style of machine which is not yet in existence but which would have certain definite advantages and lend itself to automatic machining operations on pieces which are not made in sufficiently large quantities to justify the setting up and camming of the present style of automatic machines.

I would call this style a "program machine." Such a machine might have a turret with tools, cross-slides, milling attachments, drilling spindles, or any other kind of tool or work carrying elements. The functioning of the machine might include the chucking of stock, the operation of magazines, the feeding of bar stock, the shifting of belts or gears, the throwing in of clutches, the indexing of a turret, the starting of a stream of lubricant—in short, any operation which is now done by any of the existing automatic machines.

Each element to be moved would have its mechanism which goes through a predetermined cycle and then stops itself. Such a mechanism might be a cam or an indexing mechanism, or a one-revolution clutch, or it might even be a screw which makes a certain number of turns forward and then reverses; but all of them would have this much in common: that they would go through a certain cycle of operations and then throw themselves out of action. The differences between such a system and the system of camming described in the previous paragraphs would be this, that in this system an element throws itself out at the end of its cycle but does not throw into action any other element. This throwing into action might be done either by hand or by another mechanism which may or may not be supplied with such a machine.

The "Program" Mechanism

In case the elements must be started by hand, the auxiliary mechanism, which we will call the "program," might consist of an endless chain which is advanced one link every time a cycle comes to an end. The movement of this chain would bring a letter or set of instructions before the operator, bringing it under a window so as to make it visible. There would be a number of starting levers or buttons or knobs which take the place of such elements as are ordinarily acted upon by the dogs of an automatic machine. These levers or knobs would be plainly marked with a letter. At the end of a cycle, then, we will say that the letter *D* appears, which tells the operator that he must move the lever or knob marked with that letter *D*. At the end of the next cycle the letter *A* appears. At the end of this cycle the letter *C*, etc. The chain would have as many links as there are

operations to be performed. With a four-hole turret, of which all holes are provided with tools, the letter *A* would appear four times (if *A* stands for starting the turret), and the letter *C* also four times (if *C* stands for starting the index). If, on the other hand, this four-hole turret were provided with two tools only (that is to say, if two holes were idle), we would get the following: *A, C, A, C, C, C,* and then *A* again. Instead of having single letters appear, it might be possible to have written instructions appear, telling the operator not only which letter to start next, but also whether he should measure or do other things which may be required.

Making the Program Machine Automatic

This machine might be provided with a number of small pneumatic cylinders and the links of the chain might be provided with pins which would operate the valves for these cylinders. Such an arrangement would make the machine entirely automatic. By leaving the pin out of the last link of the chain, the machine could be made to stop at the end of the completed cycle. Almost endless variations to this arrangement could be devised. Instead of a chain, a perforated roll of paper might be used, very much like the music rolls for a player piano. The author, in the June, 1920, issue of *Industrial Management*, expressed his belief that such a style of machine is needed and will ultimately be brought out.

The exact form which such a machine would take cannot be predicted. It would replace a group of machines. It would have the advantage over such a group that a mere change of the letters or instructions on the chain would have the same effect as a complete regrouping of the machine. Suppose there were a group of six simple machines, of which three can be operated by one man. The next job might need only five of these six machines and would require an entirely different grouping. It is, of course, out of the question to change machines around for every job, so that, with a number of machines grouped in a permanent way, we will have almost always an unsatisfactory arrangement; perhaps one or two idle machines and loss of time in many other ways. The program machine would overcome these disadvantages completely.

This Lily Needs No Painting

By Charles W. Lee

There are few lines of industry in which greater care is required than in the manufacture of machinery. There is no easy, hurry-up path to success and the buyer will always be found critical of any product for which he pays his good money. The following episode, which is founded on fact, will illustrate this point as well as any which has ever come to our notice.

A certain maker of machinery, who holds the mistaken opinion that the way to succeed in the machinery business is to "get 'em done, get 'em out and get the money for 'em," was sent the following letter which speaks for itself:

"Your machines were duly received and dismantled for inspection. But we find it impossible to re-assemble them in proper alignment because we can find no newspapers in our city that are of the same thickness as your local newspaper. Please send us three or four copies of the latter."

Machine Shop Bulls—I

By Joe V. Romig

To make a bull means, in the parlance of the machine shop, to spoil a job, and this sad and awful experience comes to every machinist occasionally, and to some more often.

A familiar saying of the machine shop is, "The guy that never spoils a job, never makes any right." Although this saying does not offer an excuse for a bull, it contains a bit of truth, nevertheless.

One of two things usually happens when a bull is made. Either it is covered up or repaired, or it is found out with the resulting dismissal of the bull maker or his being retained with a reprimand. It depends pretty much on the foreman.

Once, two hoboes, brothers, so they said they were, applied to the shop foreman for positions as machinists. They had rolled into the mill's railroad siding on a coal train and they surely looked like two regular hard boiled guys. Machinists were scarce at the time, and they were taken on.

Sam was shunted to the outside repair gang, while Tom was put to work on a small lathe in the machine shop. Tom's first job was a small eccentric, a repair job for one of the mill's small hoisting engines. A drawing was given him by the foreman, showing plainly all the dimensions, and specifically calling for the bore to be ½ in. off center.

The Literal Word

When he finished the job he took it to the boss and asked what was next on his program sheet. One look at the roughly finished job was enough for "Reds," our foreman, as he saw the centrally bored eccentric hole.

"Ye gods, man!" he shrieked, "How much throw did you give this job?"

"Throw, what do you mean?" replied Tom, the hobo machinist.

"You're fired, get out of my sight!" screamed old "Reds," as he turned away in disgust.

In the meantime, Sam was also having his own troubles. His instructions had been to tear out a section of leaky water pipe, and he followed them literally, not taking the time to shut off the source of water.

Although the pipe leaked badly while he was sawing out the section, he kept on until the section blew out and drenched him in the outflow, much to the amusement of the rest of the gang.

The brothers met together at the pay clerk's window, after which they left by the same route in which they had come, namely *a la* bumper.

"Quid Pro Quo"

By R. Grimshaw

This proverbial expression, signifying "something for an equivalent" should apply in all business relations, for no transaction will be permanently profitable unless satisfactory to both parties concerned. In particular application to industry it means "a fair day's work for a fair day's pay" neither element being considered more important than the other, and neither side to the bargain or transaction to make mental reservations or to break contract in letter or in spirit. The foreman can see to it that this motto is enforced as against both management and workers.

FIG. 1—ASSEMBLING THE STRIPS IN FRAME. FIG. 2—SOLDERING THE STRIPS TOGETHER

Forming the Franklin Grille

MOST PEOPLE like to have things that appear conventional rather than otherwise, even to their automobiles. So, in order to resemble the effect of the honeycomb radiator, the Franklin engineers designed a grille for the front of the hood which appears conventional and yet serves its purpose of admitting air freely while protecting the motor as in other cars.

This grille is made up from sinuous strips of sheet metal, formed by passing them between corrugating rolls. The strips are then laid in rows between points in a suitable frame as shown in Fig. 1 with the points so spaced as to bring the tops of the curves together and leave a series of openings between the strips. When the frame is filled and the strips clamped in place, it passes to the next operation where it is dipped in acid and then into molten solder, as in Fig. 2. The solder unites the strips into a solid grille so that it can then be handled as one piece.

The grille is then taken to a band saw where the outside is trimmed according to a templet clamped to it. This operation is shown in Fig. 3. A round hole is also sawed at *A* where the grille fits over the starting-crank end of the crankshaft. The grille is then mounted in a suitable frame or case in the same way as the core of a radiator in a water-cooled car. It has no need for water connections, however, and so is much simpler and lighter than the regular radiator.

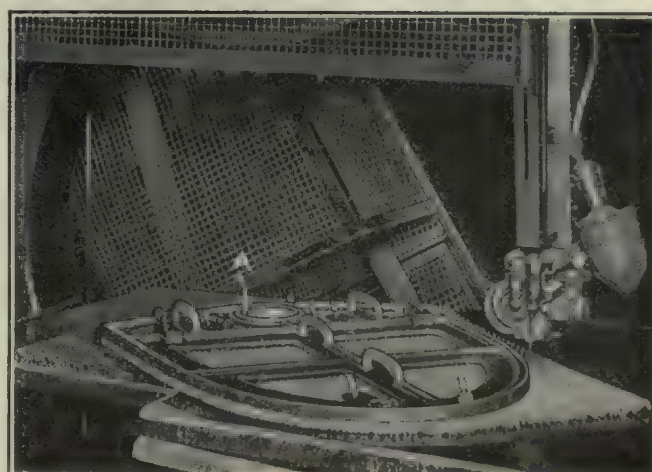


FIG. 3—SAWING THE GRILLE TO SHAPE

The Disease Called Drafting

By Entropy

Out of every graduating class from every engineering school there is sure to be a small number of young men who do not immediately find the jobs they would like. A very few of these men go back to the school and teach, the rest get jobs as draftsmen. They make themselves think by so doing that they are entering on a state, humble to be sure, of engineering. What they find out, unless they recover their wits soon, is that they have tied one end of a rope around their necks the other end of which is tied to a large and husky mill stone.

There is no very logical reason for this condition. It is simply a fact that managers, as a rule, are not looking toward their drafting rooms for material from which to select executives. Cause and effect work here very much like a dog chasing its tail. The fact that the drafting room is not regarded as the place to find executives makes men who have strong ambitions fight shy of going into them at all. Consequently, the drafting jobs do not attract the best type of men in any considerable numbers. As a result of that the work turned out in drafting rooms is not so well thought out as it should be. It is much criticized, and being criticized is made still less attractive to men who aim to be successful, and consequently the drafting room becomes the graveyard of hopes for both old and young.

This is just mere shortsightedness all along the line, and can be cured by attacking the problem anywhere in the circle it describes. The most natural and easiest place to begin the reform would be for the management to look over its drafting force each time it wanted to make a promotion, and if possible to take enough men from that source to give the rest of the men encouragement to try for higher jobs. Once the circle is broken there will be better men using the drafting room as a stepping stone for promotion, better drawings and better co-operation between engineering and production departments.

Circulating the Trade Magazines

By Dorothy A. Washburn

Each new magazine is sent to the record department, which contains the centralized files for letters, invoices, orders, catalogs, etc., and the library. The librarian in charge receives the magazine and makes a record of it. A card in duplicate is typed, headed by the name of the magazine, and listing the names of the persons to whom it is to be sent, with a column for the date, similar to Fig. 1.

At the head of the column is written the date of the magazine and after each name is written the date that person is to return it to the record department. The cards are then filed in two separate divisions. One file gives the date the magazine is to be returned, and the other the reader to whom it is sent.

A printed form similar to Fig. 2 is pasted on the front of the magazine. In the date column is stamped the date the magazine is to be returned, and it is then sent on its way.

As a rule the length of time allowed to read each copy is about three days. If anyone wishes the copy again, and requests its return, it is sent back for a longer period after others have read it.

The person receiving the magazine knows he is to return it by the date stamped. He signs his name in the column headed "Name" on the slip, so that when

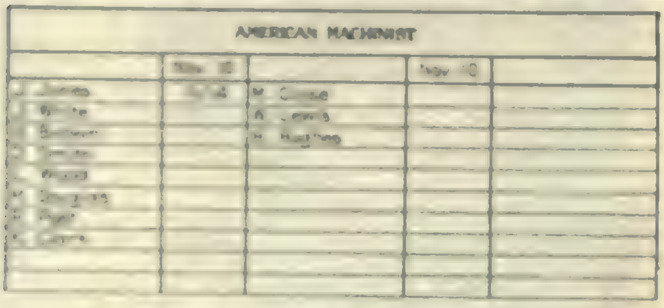


FIG. 1. MAGAZINE RECORD CARD

a magazine is returned to the record department the librarian knows that the person for whom the magazine was intended, actually received it.

After the cards (Fig. 1) are made out and the slips pasted on the magazine, the file to subscribers is glanced through, and it can easily be seen who has magazines and who has not. The new magazine is then sent to the person on the list for that magazine who has no reading material. This is true also of the magazines which have been out and are being returned. The two cards representing that magazine are taken from the files, a line drawn through the last date written after a reader's name, the reader's file looked over, the magazine redated and sent on to someone who has no magazine.

If the tickler file shows a magazine has not been returned on the date it was due, the day following a typed request is sent out, similar to that shown below:

Date............................

Mr. ....

Please return the following overdue magazines

....

Thank You.

RECORD DEPT.

When the cards show a date after every name on the list, the circulation of that magazine is then complete as far as the list is concerned. A line is drawn through the column on each card to show it is no longer in use.

For the final disposition, the most important of the magazines are bound yearly or semi-yearly, and as complete indices come with them, any article may be very easily looked up. The rest of the magazines are disposed of in various ways. All are kept on file for one year, after which time, they are sent to the various departments, to take out the articles most interesting to them.

In comparing this method with others, the biggest advantage seems to be the quick and complete circulation of the magazines to so many people. The magazines do not go uniformly to the same people in the same routine each week or month, but instead each one has a fair chance to receive the new copies. This keeps the interest of all the people, for everyone is anxious to receive the new copies, and it proves an incentive to them to get right down to the magazine they have and read and return it promptly. It prevents one man having several copies lying around on his desk for a week or so, and then being a long time without any. This method also enables anyone in the plant to receive each copy of any magazine he desires. He merely sends his name in for the librarian to put on the list.

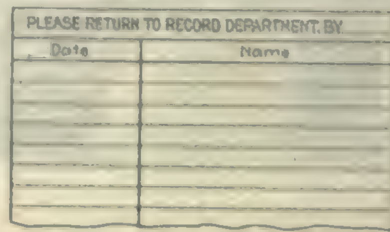


FIG. 2—SLIP PASTED ON MAGAZINES

By a method mentioned in the *American Machinist*, Vol. 53, page 803, only certain persons who may be interested in particular articles were the ones to whom the magazine was sent. It seems to me it would be rather difficult to determine just what articles might interest each particular person, but when a person receives a magazine he can easily tell which articles he wishes to digest thoroughly, and which are of no value to him.

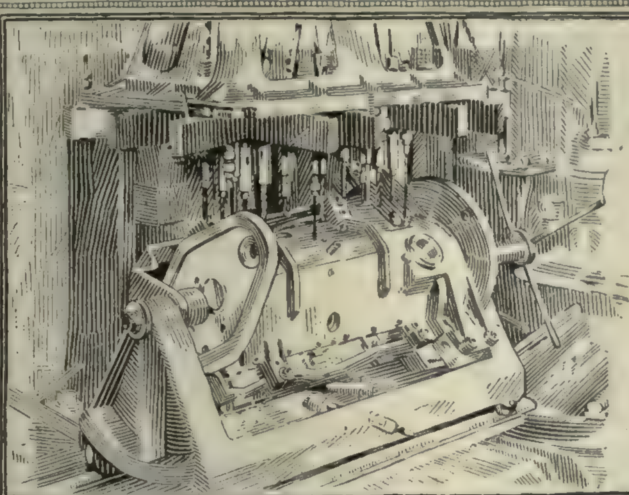
This plan has proved very successful for the past two years in circulating four weekly and nine monthly magazines, a total of twenty-five per month. Because of the long lists, each magazine travels to quite a number of people but as it is returned to the librarian each time there is no difficulty in locating it or any other magazine which anyone may wish to look up. Inasmuch, as this plan gives shop employees and officials an equal chance to receive each copy, to receive new copies at the earliest possible date, to have reading material at all times, and as it also enables us to circulate the magazines quickly, and finally to keep them in ways by which they are easily accessible, we feel that we are certainly using the trade magazines to capacity

Chink-in Work

By C. E. Jenson

"Chink-in work" is that which is taken on special contract or put in hand on the manufacturer's own initiative, to fill in time that otherwise might have to be paid for—with the alternative of having to close down, run on short time, or lay off hands.

Every manufactory should have a list of chink-in work that it could make, with a memorandum of the best probable markets for the output.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Details of Blanking Dies Continued—Plain and Automatic Stock Stops—Types of Mechanical Feeding Devices—Examples of Modern Die Design

IN FEEDING sheet stock through a die for a blanking operation it is necessary to provide an accurate stop so that the work will be produced with uniformity, and the waste of material will be as small as possible. On certain classes of work a positive stop is not always used, as the workman's eyesight may be utilized, and very good results obtained in this manner. In the example shown at *A* in Fig. 462 a die of this kind is illustrated. A sight hole *B* is placed in the stripper plate *C* in such a way that the workman can look down through the hole and see the edge of the work, thus obtaining the correct location for each successive blanking operation. The appearance when looking through the hole is indicated by the small detail shown at *D*. There are some shops that use this method almost exclusively, but the majority prefer something more positive and less subject to errors on the part of the workman.

Must Be Handy

In designing a stop for a given piece of work, it is well to remember that it must be so arranged that the operator can find it readily. He must depend upon his sense of touch when doing this, but care must be taken to make the stop in such a way that it will be as little trouble as possible. When the punch recedes from the work it pulls the stock up with it until it strikes the stripper plate, at which time the workman, by using a little pressure on the stock in a longitudinal direction, can slide it along to the stop just at the moment when the punch leaves the stock so that it is free to move.

A very simple form of stop is shown in the example *E*. It is a round pin *F* placed in the die as shown, so that after one blank has been cut out, the edge of the stock will come against the pin in such a position that the right amount of stock will be left between blanks. The enlarged detail at *G* brings out a point of importance in connection with the placing of stock stops. The pin *F* is too close to the opening in the die and a fracture might be caused if it were placed as shown. The distance *H* should always be less than that at *K*, so that stock can be moved freely over the head of the pin when feeding.

———

In order to prevent the placing of the stop pin too close to the edge of the die opening, a form like that shown at *L* is frequently used. Here the pin *M* has an extension end on it as indicated, so that the hole *N* can be placed a sufficient distance away from the die opening. Usually pins of this kind are made solid; but it is possible to use a design similar to that shown at *O*, in which the stem and extension are separate pieces fastened to each other in some approved manner. In general the solid type is to be preferred, as there is no likelihood of separation.

It is not always necessary to place the stock stop in the die itself. It can be positioned in the stripper plate, as shown in the example *P*, if this seems advisable. In this example the die is cut away at *Q*, so that the stock can be tipped to pass by the stop pin *R* which is set in the stripper plate. An arrangement of this kind may sometimes be found an advantage. Several other methods can be used when the stock stop is placed in the stripper plate. In the example *S* the stop *T* is pivoted, so that when in the correct position the small end lies down against the face of the die. The work *U* is passed through the die and pulled back against the stop to determine the right position. It can be seen that the stock will readily pass by the stop when feeding, but that any movement in the opposite direction is restricted by the stop falling down and striking the face of the die.

Automatic Stops

Another stop of very similar form is shown at *V*. In this case a coil spring is placed at *W* in order to make sure that the stop will be forced down and strike the face of the die. The action of the stock on the stop as it passes through the die is clearly shown in the example at *X*. Another form of stop is shown at *Y*, in which the spring used is of somewhat different kind and acts on the pin to which the stop is fastened. The type of stop selected is dependent to some extent upon the work which is being blanked and to the designer's own preference.

Stops which are automatic in their action to all intents and purposes can be applied to many kinds of blanking operations. An example of a stop of this kind is shown in Fig. 463. The diagram at *A* shows the stop

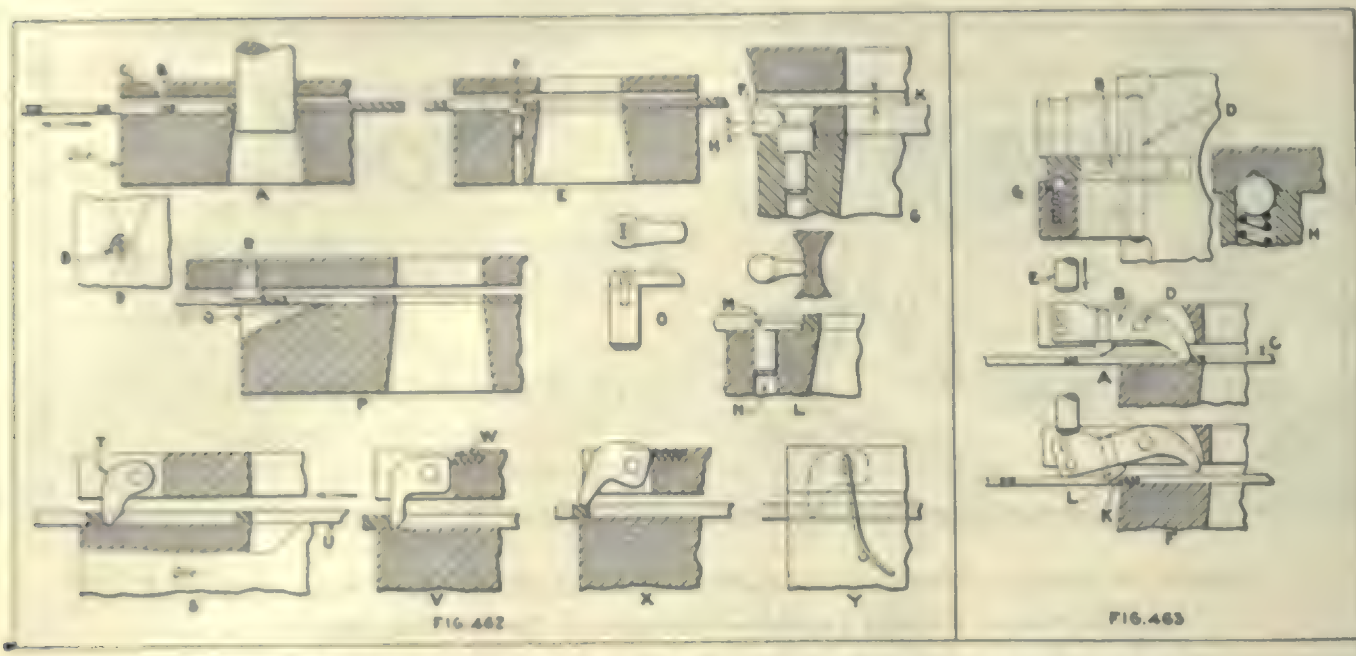


FIG. 462—EXAMPLES OF STOCK STOPS. FIG. 463—AUTOMATICALLY OPERATED STOP

B in position against the stock *C*, which is being fed through the press. This stop is pivoted at *D* on the stripper plate, and it is actuated by means of the pin *E* in the punch holder. As the punch comes down, the pin *E* presses down upon the end of the stop and causes it to take the position shown at *F*. Referring to the plan view it will be noted that there is a ball detent *G*, which snaps into a depression in the side of the stop after it has been pushed down by the pin *E*. An enlarged detail of the ball detent is shown at *H*.

The stop remains in the position shown at *F* until the punch has raised itself from the work, at which time the operator pushes the stock along so that the portion *K* strikes the pin *L* and causes the stop to assume the original position shown at *A*. When so located, a continuation of the feeding movement by the operator brings the stock firmly against the stop. The action of the press simply releases the stop, throws it out of the way and puts it into a position such that the forward movement of the stock in feeding automatically drops the stop and brings it down again to the locating position.

Punch presses can be fitted with standard stops when so specified. An arrangement of this kind consists of a pointed finger which is adjustable for various sizes of blanks. The finger can be so adjusted that at the proper time it drops into the hole punched at the preceding stroke, thus forming a positive and accurate stop.

Automatic Feeds

Mechanically operated feeds for punch presses may be grouped roughly into two distinct classes; *viz.*, first-operation work feeds, which are used on the rough stock before anything else has been done to it; and, second, other feeds which are applied to blanks or forms which have already been put through one or more punch press operations.

Considering first the feeds applied to first operation work, we have the following:

Roller Feeds, Single or Double. This kind of mechanically operated feed is applied to flat bars or sheets held between rollers by spring pressure. The feed is actuated intermittently by the action of the press.

Push Feeds. In this kind of power feed the work is held by stationary gripping fingers while the punching operation is going on. Between the strokes of the press the stationary fingers release the work, and sliding gripping fingers take hold of it and move it along longitudinally a pre-determined distance, after which the stationary fingers grip the work once more and hold it firmly while the sliding fingers return to their original position.

Reel Feeds. This type of feed is designed to handle flexible material in strips from a reel. The reel is arranged so that it has a brake on it, and the stock is

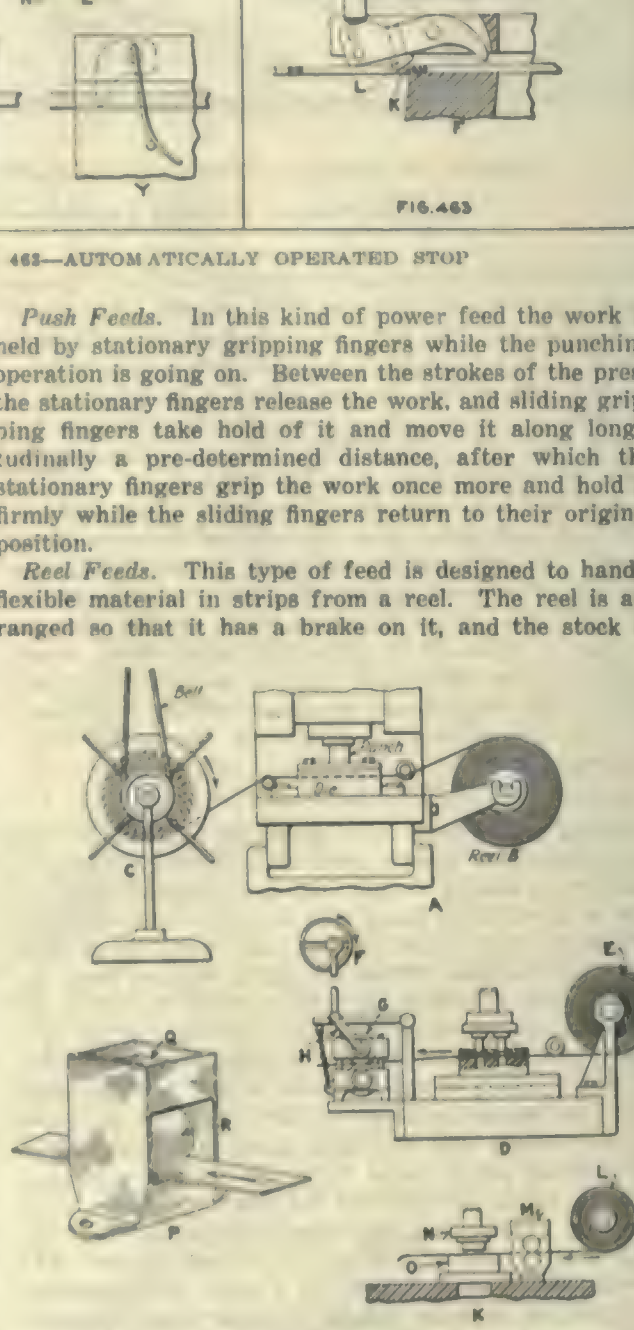


FIG. 464—APPLICATIONS OF AUTOMATIC FEED

pulled through the dies and wound on another reel operating intermittently between the strokes of the press.

Gravity Feeds. When the axis of the press ram is set at an angle to the vertical, so that the material

slides down the incline by gravity against a let-off gage placed at the rear of the dies and worked automatically, the feed is termed gravity feed.

The feeds in the second group are used only on work which has previously been stamped, blanked, or otherwise shaped on the punch press.

Dial Feeds. Feeds of this kind are used for forming, coiling, redrawing or repunching work. This type of device consists of a disk or dial which rotates intermittently, and which has a series of equally spaced openings or pockets in which the work is placed by hand. The dial revolves so that the pieces are successively located directly under the punch, and yet the operator's fingers are in such a position while loading that there is no danger from the punch.

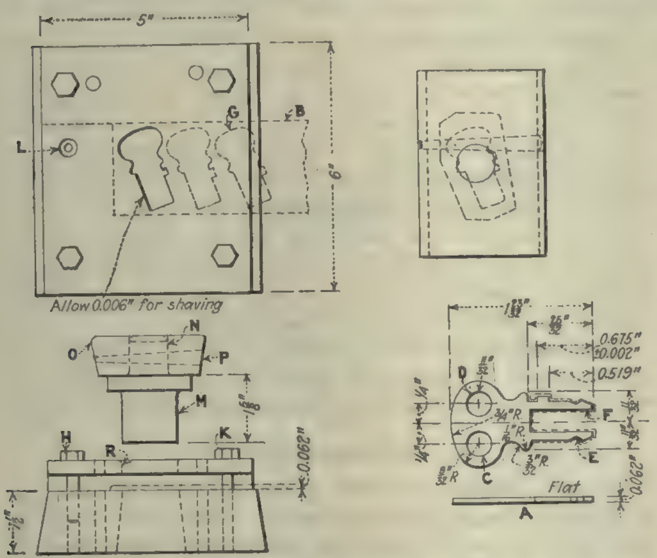


FIG. 465—EXAMPLE OF PLAIN BLANKING DIE AND PUNCH FOR KEY

Friction Disk Feeds. This arrangement is such that the articles are pushed from a table on to a revolving disk, by means of which they are carried by friction between guides or plates and thus delivered to the dies. Each piece is stopped by a let-off device which limits its movement as it is carried in to the final position.

Conveyor Feeds. Occasionally the lower die is so arranged that it conveys the work by swinging or sliding so that it comes into correct position under the upper die. This arrangement is termed a conveyor feed.

Carriage Feeds. This type of feed is of the reciprocating order. A carriage comes forward and receives the work, after which it returns between the dies and then repeats this operation for each piece handled.

Hopper or Tube Feeds. This type of feed is also occasionally termed magazine feed. It is used for small articles such as medals, coins, washers, locknuts, trade-checks and other work produced in large quantities. The parts are piled one on top of the other in a tube or magazine, and allowed to descend by gravity into a dial conveyor or carrier. Applications of this form of feed can be made in certain kinds of high production work to great advantage.

In order to illustrate more clearly the application of automatic feed to certain kinds of work, several diagrams are shown in Fig. 464. In the example *A* the stock is fed from a reel *B* through the dies, as shown, and to another reel *C* on which it is wound up. An arrangement is provided so that there is friction on the reel *B*, and the reel *C* operates intermittently at each stroke of the press.

Another method which is used for stock which comes on a reel is shown at *D*. Here the reel *E* carries the stock, which is fed through the dies in the direction of the arrow. The method of feeding is by means of the eccentric *F*, which operates the rolls *G* through which the stock is drawn. A pawl attached to the arm *H* moves the feed roll forward at each upward stroke of the press. The applications of ratchet feed have been mentioned previously.

Certain kinds of stock require oiling before passing through the punch, and the designer should bear this point in mind and provide an oiler of some sort so as to take care of the situation. An example of this kind is shown at *K*, in which the stock is fed from a roll *L* through an oiler *M* and between the punch and die at *N* and *A*. A simple type of oiling device is shown in the enlarged view at *P*. An oil chamber *Q* is open at the bottom so that it discharges on to a felt roll *R*. The construction of this device is naturally governed by the lubrication required and the quality and kind of material which is in process.

Examples of Blanking Dies

We have endeavored to familiarize the designer with the various points of importance in connection with the design of blanking dies. We have taken up all of the points of importance in detail, and we shall show only two examples of blanking dies in order to apply some of the principles which have been set forth in the article. Fig. 465 shows an example of a plain blanking die and punch for the key *A*. The drawing of the key is double size, in order that the dimensions may be more clearly apparent. It is made of 0.062-in. stock; the operations necessary on it are, first, blank, second, pierce, and, third, shave portions indicated by the dotted line.

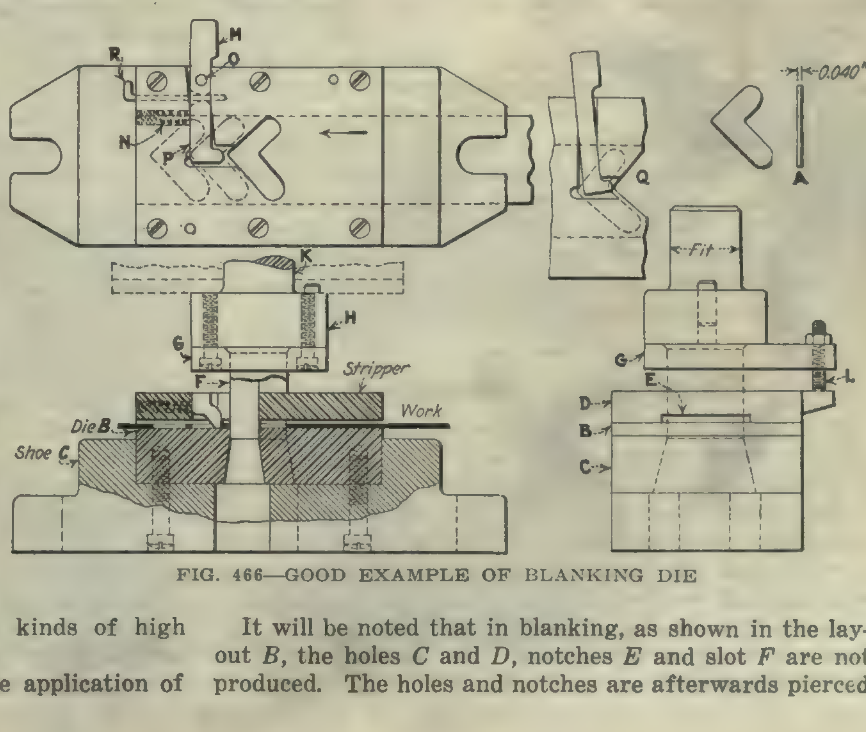


FIG. 466—GOOD EXAMPLE OF BLANKING DIE

It will be noted that in blanking, as shown in the layout *B*, the holes *C* and *D*, notches *E* and slot *F* are not produced. The holes and notches are afterwards pierced

and shaved. The blank layout is at a slight angle, in order to produce an economical run of stock. In the illustration the die is shown complete with the stripper plate, having a guide on one side only as indicated at *G*. The other side is open, but support for the plate is obtained by the two screws at *H* and *K*. The stripper plate is cut out where the punch enters, so that there is a slight radius on it as shown at *R*.

A sight hole is provided at *L*, so that the workman can adjust the stock properly for the first two blanks, after which the finger gage on the machine can be set for the regular run. The punch *M* has a round shank *N* which fits the punch holder *O*. The punch is held in place and located by a taper pin *P*. This is a very good example of a simple and efficient blanking die in which a number of the principles previously mentioned are applied.

Another example of a blanking die is shown in Fig. 466 for the part at *A*. The stock in this blank is 0.040 in. thick and the blank itself is of irregular shape, as indicated. The die *B* is fitted to the shoe *C* and located by means of screws and dowels. The stripper plate *D* is of one-piece construction, being relieved at *E* to receive the work. The punch *F* is made to the shape of the part and has no flange or shoulder, but is fitted into the punch plate G and peened over to prevent it from pulling out. The punch plate is held on the punch holduer *H*, which has a shank *K* that is fitted to the press.

The finger stop shown in this die is somewhat different from those previously indicated. The punch plate *G* contains a screw *L*, which strikes the finger stop *M* on the downward stroke of the press. This raises the finger out of the work opening which has previously been cut by the punch, and the finger is forced toward the die opening by means of the spring *N*. The finger is then constrained to move down on to the stock again by the action of the spring *O*, and instead of going into the opening it strikes on the stock surrounding it. There is still pressure exerted on the stop, however, so that when the work is moved in the direction of the arrow the finger drops into the opening which has just been produced. As the stock is moved forward, the finger strikes against the portion of the stripper indicated at *P*.

The action of this finger stop is clearly shown at *Q*, where the finger is in the downward position before the stock has been moved along for the next blank. The finger *M* is held in position by the pin *R*. A taper pin is used as a pivot, and the hole in the finger is made large enough so that the required rocking action can be obtained. The hole is countersunk on both sides and a $\frac{1}{16}$-in. land provided in the center. In general, this die and punch may be considered as a good example of modern practice in designing blanking dies.

Finish Affects Maintenance

It is very rarely that an operative will not give a highly finished machine more care than one which is painted or left rough. Usually he will have more pride in the matter; but even if he has not, as neglect to wipe down shows promptly and may result in reproach or reprimand, the necessity for going over every part with waste to keep everything clean, enables detection of minor troubles that should be attended to, but that otherwise might go unobserved. The finish is a sort of long-life insurance.

The Passing of Craftsmanship

By Entropy

It is the fashion to deplore the passing of any old custom. The failure of modern mechanics to have the painstaking interest in their work which is seen in that of the men of a century ago is no exception to the rule. Is it a total loss?

These old time workmen did their jobs for the sake of doing them well. They derived a great deal of their reward for their work from the praise of their neighbors. The writer remembers an uncle who worked at odd minutes for months to make the smallest possible pair of blacksmith's tongs, forging them like a large pair. He succeeded in making one that was only about an inch long, but he would not sell it. All he wanted was to be able to exhibit it. If he had known of anyone making a smaller pair, his would have lost all value and he would have tried for the record.

Now very little of this spirit is seen in shops. It still prevails in sport, but sport and the shop come no nearer today than the use of horse shoes for "pitching."

Old Spirit Gone

What is happening, and quite rapidly, is that the draftsman, designer or engineer is setting up limits in the drafting room which are checked in the inspection department. The workman gets comparatively little credit for keeping within narrower limits than have been set for him. He is no longer able to take any of his work home to show the neighbors, and unlike the village smithy, the shop is not open to everyone that happens along to watch the workmanship of the craftsmen. Within the limits set for him all that is asked of the modern workman is production in as great quantities as possible.

After all, this is merely a shifting of the rules of the game. The product of the shop under the regime of limits and tolerances is as good as the nature of the work demands, as good as the public will pay for. Anything better does not add greatly to the customer's satisfaction nor to his well being. Extreme nicety of workmanship remains what it has always been, something to be exhibited, but the audience cannot get in to see the exhibition. It may be that these limits and tolerances have been made under pressure of the war and the succeeding madness too easy of attainment, and it may be that we shall see a tightening up of quality of workmanship, but that is rather doubtful in the machinist trade.

If it were cabinet making or furniture, which is sold for its beauty and apparent excellence of manufacture it would be different, but almost all machinery is extremely materialistic. There is very little opportunity for a mechanical device to appeal to the eye or ear through its beauty. In fact most mechanisms are today being housed in and so covered up that the engine of a high grade motor car looks like a block of solid cast iron. Its valve levers and even spark plugs are housed in under a cover or hood of its own. Mechanism is concealed as something essential but not to be admired nor too often inquired into by the uninitiated. There is a very good reason for this precaution for many an automobile driver is cursed with dangerously little knowledge of machinery and at the same time an appetite for tinkering which is likely to be appeased at the expense of the parts easiest to get at. For safety's sake fine workmanship must forego admiration.

Combination Piercing, Blanking and Forming Dies

Construction and Operation of Two Dies Which Replaced Four—Safety Features Taken Care of—Wearing Parts Easily Replaced and Adjusted

By C. J. DORER
Chief Engineer, White Sewing Machine Co.

IT IS OFTEN a puzzling task to combine piercing, blanking and forming operations to get the most out of a single die and thereby cut down the number of operations. The particular case which I am about to cite is one which was formerly done in four operations, and is now done in two. The cost of the two dies as now used, and hereinafter described, is slightly less than that of the other four. Also, the operating time was cut to fifty per cent of the previous operating time.

The piercing and blanking die is run at the rate of 112 strokes per min., the operator getting 67 blanks. The forming die is run at the rate of 42 strokes per min., the operator getting 42 blanks. In order to obtain such results, care must be taken to get all parts requiring the operator's touch into plain sight and easy reach. This fact is often lost sight of in the attempt to cut the original cost of the die. These dies were designed with the idea of being practical labor-saving devices and have proved to be so.

Varied Design

In the design, use was made of a number of schemes, such as a bushed stripper plate, disappearing pilots, spring and push fingers, a sectional bushed pillar die, kickers and spring pads. Such things are always of value to a designer of dies, even though the case may not be as complex as this one.

The piece described has two compound bends and is made of 0.060-in. stock, the smallest piercing punch being 0.078 in. in diameter. It will be noted upon examination of the blank that the corners where the double vertical bend takes place have been undercut so as to prevent the stock from tearing at this point.

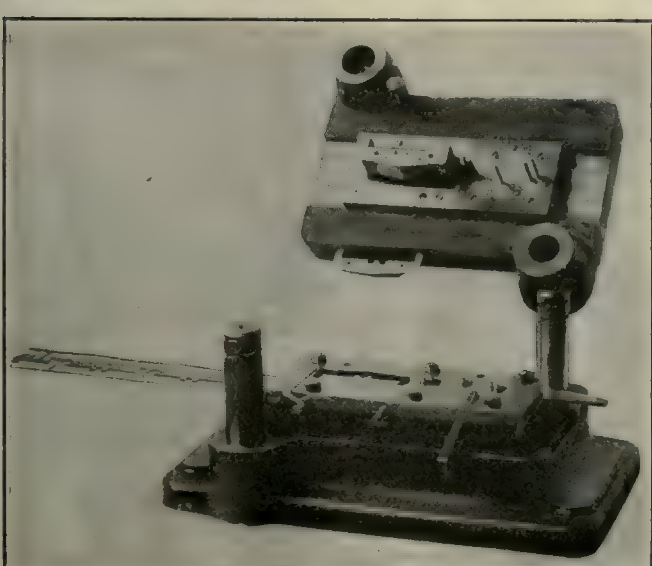
The blank and formed piece, also a section of the strip, are shown in the photographs of Figs. 1 and 2. It was necessary to hold the blank and pierced holes correct to 0.001 in. The pierced holes had a limit of 0.001 in., which meant that they could not increase in size as the die wore. In order to get the greatest amount of blanks out of the least amount of stock, the blanks were interlaced in the strip, as shown in Fig. 1. Owing to the staggering and interlacing of the blanks, the strip had to be started at a different point when going through the blanking die the second time.

Layout of the Blanking Die

The piercing and blanking die was laid out and built as a pillar die in order to maintain accuracy and cut the setting up time to the lowest possible point. It will be noted that the two pillars *A* and *B*, Fig. 3, are of different sizes to prevent accidental reversing of the die. They are placed across the corners to get as great a center distance as possible.

The die block was split in two pieces—C_1 and C_2. The split was placed between the piercing holes and material left for grinding, so that in case the blocks warped in hardening they could be ground and the center distance between holes maintained. The two blocks were set flush and screwed and doweled in the shoe in the customary manner. The same held true for the punch pad, parts D_1 and D_2, which was divided between the piercing holes and the blanking punch.

The stripper *E* was screwed and doweled to the die and the holes through which the piercing punches passed bushed with hardened tool steel bushings. The stripper was made in one piece and left soft so as to insure absolute alignment with the holes in the die.



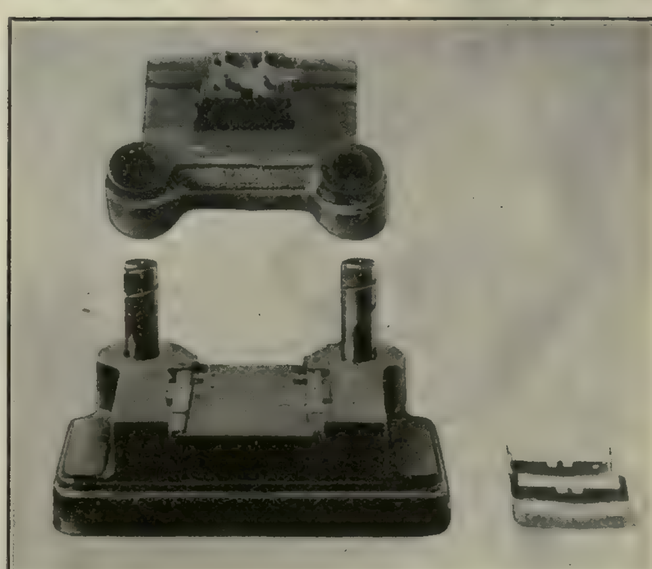


FIG. 1—BLANKING AND PIERCING PILLAR DIES. FIG. 2—FORMING DIE AND WORK

Owing to the closeness of the holes it was necessary to flatten the bushings F_1 and F_2 on one side, and press them in together. The punches G_1 and G_2 have a slightly enlarged shank to stiffen them as much as possible and to prevent the cutting edge from striking the bushings. The shanks are a sliding fit in the bushings. This was done to prevent the punches from walking on the stock, which is the ruination of any die.

Removing the stripper from a die is often troublesome, especially if it is a complicated one and parts of it are attached to parts of the shoe or die block. This difficulty was overcome in this case by building the stripper as a separate unit. It will be noted upon examination of the drawing that the stripper, back gage and other parts will lift off as one unit by removing the six cap screws and leave the die flush and even for grinding. By using cap screws for this purpose the stripper can be removed while the die is set up in the press.

Bushings H_1 and H_2 (see drawings) were placed in the die block in order to hold the holes to size. These can readily be replaced by removing the stripper, turning over the die and pushing them out from the bottom.

The blanking punch *J* was made in one piece and set in the left half of the punch pad in the customary manner by riveting over. The two pilots K_1 and K_2 are disappearing pilots backed up by springs, and are shown in section *Y-Y*. In case of a mispunch, or other accident, these pilots will push up and not set up a bad strain in the whole die. Such pilots are easily placed in any die by simply counterboring the punch and punch holder as shown.

The stock is fed in, as usual, from the right up to push finger *L*, which is normally held out by a spring. This is a flat finger which slides in and out in a slot and is prevented from coming clear out by plate *M*. After the first stroke of the press, the stock is fed to automatic finger *N* and with the next stroke a complete pierced blank is made. From then on the operation is continuous throughout the length of the strip.

Finger *N* is pressed down at each stroke by screw *P*, which is set in the punch holder, and is pivoted on pin *R*. The pin is easily put in and removed with the fingers. It is held in place by a set screw. Spring *S*, by its upwards and sidewards action, lifts the finger and lands it on the fin, permitting the stock to slide over for the next blank.

Owing to the interlacing of blanks, a third finger *I* was necessary when starting the stock through the second time. This finger had to enter the opening left by the first blank after the first run. A push finger could not be used, as it would strike the outer fin left by the blank, so a pivoted finger was used. It is pivoted the same as finger *N*, the operating end being held up by spring *U*. When using this finger the operator pushes it up, thus engaging the stock. To understand the necessity for this construction, one must study the blank and strip shown in Fig. 1.

In a die which is built low and compact as this one is, it is always advisable to have fingers which extend out from the die. Any design which tends to cause the operator to place his fingers under the punch holder should be avoided. It is apt to result in the loss of a finger or part of a hand. Too much emphasis cannot

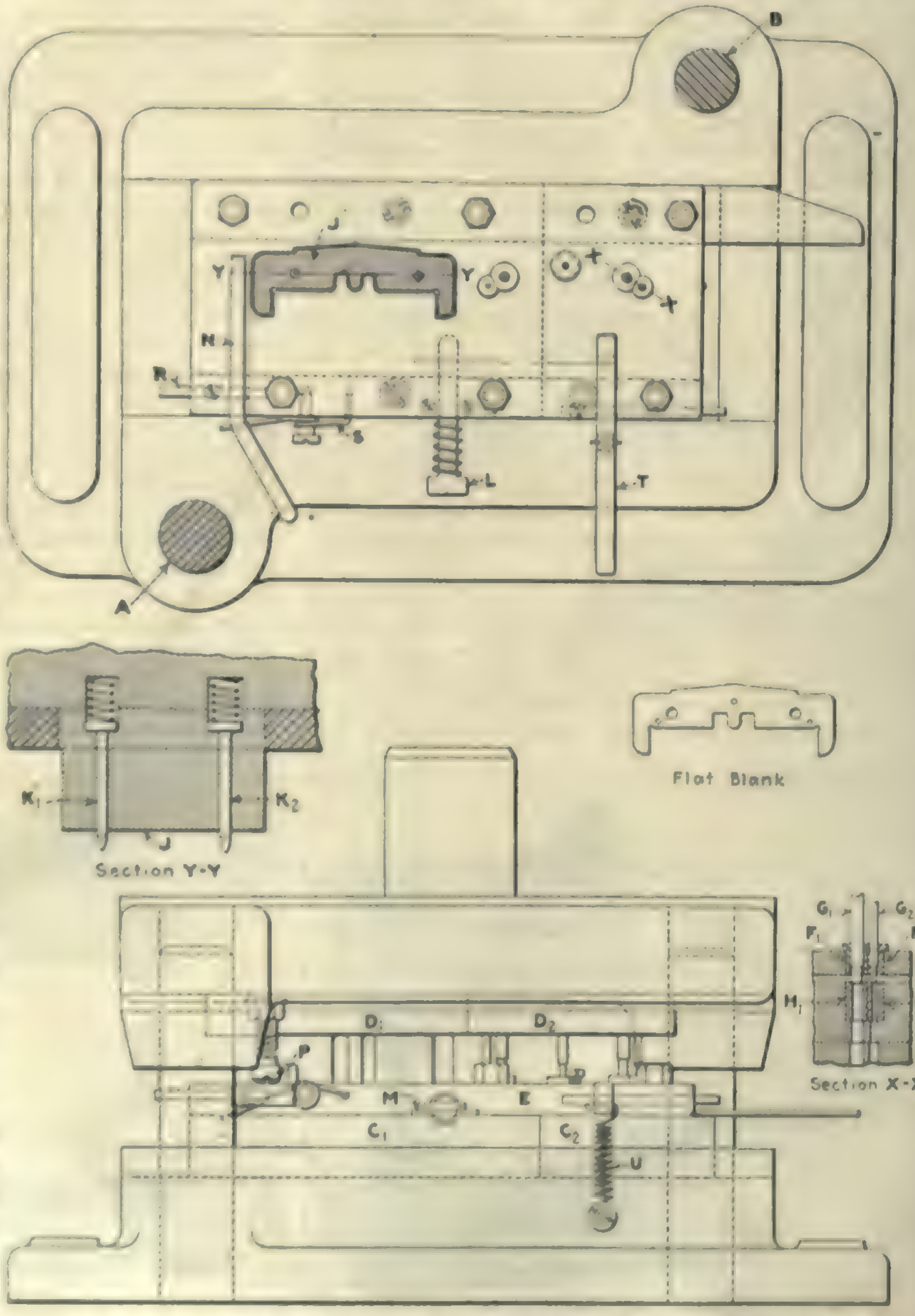


FIG. 2—PLAN AND ELEVATION OF BLANKING AND PIERCING DIE

be placed upon the fact that to make a die like this a paying proposition the wearing parts and points which must be held to size must be readily and cheaply replaceable. In this die round bushings pressed in are all that are necessary.

The forming die is also a pillar die and is sectional the same as the blanking die, in order to make wearing parts easily replaceable. It is built with a chute for feeding in the blanks and the gages are so placed that the formed blanks slide by and fall out the back. One blank is formed complete at each stroke of the press and two blanks are in the process of forming at one time. Figure 2 shows three blanks: one ready for forming, one partly formed, and one completely formed.

The blanks are laid upon plate *A*, Fig. 4, between guides *B* and are pushed forward by the operator, the plate being long enough to hold three or four blanks. The first blank, at the start, is just pushed over the edge of spring pad *C* and as the punch comes down it is formed and then pushed forward by the blank behind, which takes its place. Gages *D* then function as the stop and temporary locating medium. As the punch comes down, the sides and front point of the blank are whipped up. The sides are now away from gages *D*, and as the blanks are pushed forward the completely formed blank passes through and drops out of the die. Pilots are used for accurately locating the blank. The die goes to bottom so as to set the first form, which is made on die blocks *E*. The pad *C*, however, does not go to bottom.

The punch *G* is built of a solid piece of tool steel with four pilots *H*, two for each blank and four kickers *J*, two for each blank. The kickers are used for pushing the blanks off of the punch pilots.

Upon examination of the first form, it will be seen that the points of the blank are bent up and at an angle of 5 deg. This meant that these points could not lie upon the pressure pad *C*, but were obliged to extend out over it and be formed. This was accomplished by inserting the properly contoured block *E* on each side. The blank was engaged first by the central projection on the punch *G* and held square by the pressure pad *C* and accurately located by pilots *H*.

In the first form the points of the blank are bent down, and this meant that they would engage the blocks *K* and prevent being pushed through. In order to overcome this, kickers *L* were placed in these blocks, which raise the points up to their previous level and allow the partly formed blank to slide over. These kickers also serve to prevent the blank from being tipped over when the punch comes down, as the block is struck by the punch before it is gripped.

The pressure pad *C* had to be cut out so as to fill all the forming condition and have strong equally balanced springs. It is held from coming out by two filister head screws. The die is built up out of eight pieces, five of which have forming surfaces and are easily replaceable. Filister head screws set in from the outside are all that are necessary to hold them in place as the pressure in most cases is outward.

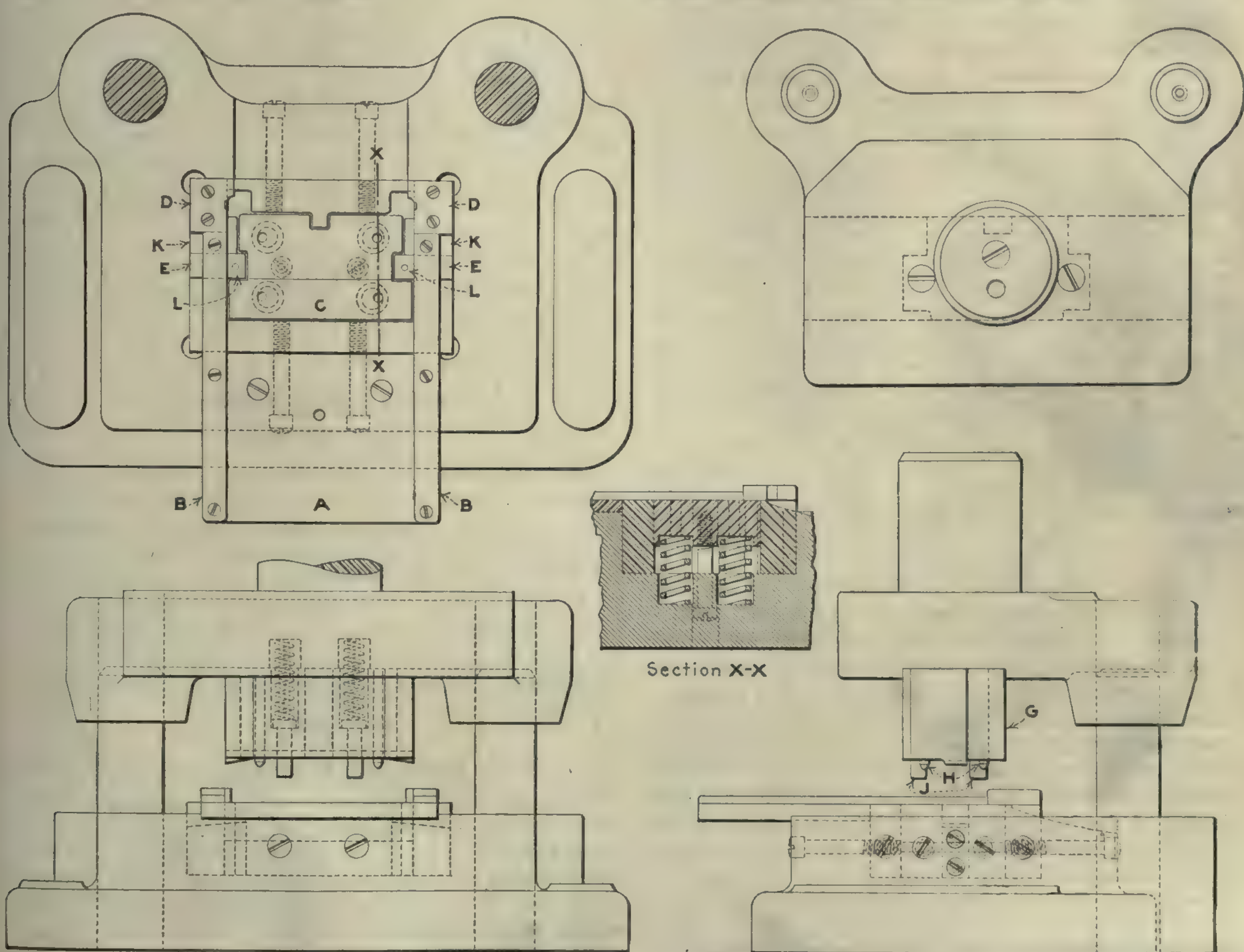


FIG. 4—PLAN AND ELEVATION OF FORMING DIE

The Foreman—Past and Future

By G. G. Weaver

On every side we hear of the need for greater production, the decrease in labor trouble, the reduction of costs, and upon investigation we find that the foreman is charged more or less with bringing about these necessary and timely conditions. The foreman, on the other hand, is positive that every person about the place indulges in that favorite indoor sport known as "passing the buck," which results in making him the "goat." The situation is worthy of a rather detailed consideration.

In the first place let us analyze the foreman's position so that we may have a fuller appreciation of his duties and obligations. The foreman occupies the same place in industry as the keystone occupies in an arched bridge. On one side are the workers and on the other side, the management, both demanding loyalty and co-operation. To the men he represents management and, as far as the men are concerned, his talk and his actions are management. To the management, he is the agent through which all the orders, desires and policies of the management are communicated to the working force. In other words, he is the medium or keystone through which the management functions.

Epoch-Making Period

We are now passing through an epoch-making period in modern commercial life, an era unparalleled for industrial and economic changes. These conditions are responsible in a large measure to the great war which was a nightmare to everyone, including the foremen engaged in war industries. There was a sudden demand made of the foremen for greater production, for the installation of new equipment and for the designing of new tools. Innumerable things had to be accomplished to meet the emergency. This great confusion, which tested the human endurance, was placed on the shoulders of the foremen, bringing with it strange difficulties, industrial unrest, new controversies, labor disturbances.

This state of affairs was no doubt due to the fact that untrained and inefficient workers discovered unlimited opportunities in position and wages, with the whole of the manufacturing world bidding for their services. In spite of the chaos and handicaps, the foremen were held responsible by the employers for increasing the production, meeting high standards of cost, and securing co-operation of the working forces, in addition to their regular routine duties. It is no strange coincidence that the foremen in many cases failed to meet the issue.

Must Study Foremen

The World War made employers realize two things in regard to foremen. In the first place too many duties which should have been handled by others in the organization have been delegated to the foremen. In other words, management, in the rush of affairs, failed to analyze the foremen's job. In the second place, management must devote more time and attention to the training of foremen, if it hopes to secure efficiency and harmony in its organization. As a result, many firms have re-arranged or re-assigned the duties which were formerly delegated to the foremen.

Many firms, the country over, are interested in giving training courses to their foremen to better enable them to cope with the problems which they encounter. Such courses of training are not designed or intended to improve the mechanical or technical skill of the foreman, but rather to teach them a better understanding of their position regarding the human factors which enter into their jobs.

Foremen who have taken such courses of training say that they have acquired a different idea of their job and of their relation to their men, and that these courses have given them the means to receive and give better co-operation throughout their organization as a whole. The foremen may be one of two things to his employer, either an asset or a liability.

The foreman who is an asset will: (1) Exercise a most human attitude to the employees without being weak; (2) be willing to assist the employees with their jobs and to instruct them; (3) be loyal to the management by properly representing them to the men; (4) give constant and exact supervision to the work as to quantity and quality; (5) display a willingness to co-operate with other foremen and other departments; (6) give assistance to the time study department in setting rates that are fair to the men and fair to the company; (7) make a constant effort to keep down the overhead expense; (8) prevent material and human waste; (9) be always eager to improve his ability by showing an interest in trade journals, lectures pertaining to civics, politics, modern methods of handling men, etc.

The foreman who is a liability will: (1) Fail to properly supervise his work; (2) use hasty judgment in handling his men; (3) lack interest in the men or a human quality in his relations to them; (4) criticize the management without complete knowledge of what he is talking about; (5) fail to co-operate with his associates; (6) be antagonistic to rate setting or time study; (7) misrepresent management to the employees; (8) fail to co-operate with the inspection and employment departments; (9) show indifference to the instruction of workers, and neglect to acquire leadership instead of being a driver.

The foreman has performed a big job and has overcome colossal difficulties. However, he cannot afford to rest on past laurels.

Penalties for Carelessness

By R. Grimshaw

I am out and out for penalizing carelessness. A man has no right to expose himself, much less his fellows, to danger. Therefore, when I see a man smoking in a garage I think he should not only be fined, for the benefit of his fellow workers, but handled a bit roughly by his associates. I am inclined to believe that his efforts to enlist the aid of the police (recruited from the working classes and themselves daily exposed and exposing themselves to danger) would be comparatively fruitless.

Utilizing Wall Space

There are few manufacturing establishments that utilize to the full, even if at all, their wall space and yet it affords excellent opportunity for affixing shelves, racks, piping, transmission, cranes and hoists, maps, plans, etc. By their use we succeed not only in economizing or supplementing floor space, but in saving time and wages otherwise spent in going after things which might just as well be before the nose.

Investigation of Steels for Gages

The Bureau of Standards program for the laboratory investigation of gage steels is as follows:

The chief properties desired in gage steels seem to be (1) resistance to wear, (2) minimum dimensional changes on hardening, (3) freedom from dimensional changes with time, and (4) machinability. To properly outline a program of experiments seeking to obtain these independent properties in the highest degree, it is essential to analyze each separately and determine the important factors contributing to it. Because the existing knowledge of many of these factors is very limited, only a preliminary analysis of the problem of determining their function is possible now.

With the progress of experiments on the fundamental factors involved, it should become clear what precautions are necessary and what the crucial experiments to be performed are, thus eliminating inconclusive and negative data in the principal series.

Amsler Abrasion Test

Resistance to wear generally accompanies hardness, a property necessary in gages to prevent distortion on handling. On this account, wear need only be considered in steels of the martensitic class, or those not far removed from it. Resistance to wear, however, is higher in harder steels than in soft ones and there is still a wide range of values possible for any given hardness. The ultimate criterion of this property is, of course, the length of service under uniform conditions, although this is impracticable for any extensive investigation. It is usually inconsistent unless a large number of specimens are used because of the difficulty of securing uniformity in its execution. Moreover, it is highly desirable to obtain a quick wear test.

For this purpose the Amsler abrasion test machine has been decided upon. This machine produces dry wear on the periphery of two disks by means of a combination of rolling and sliding friction. The test pair may be identical or one a standard and the other the test piece. The latter is often the best method as the true value of a good block would probably not be indicated when tested against itself. It is also desirable to use a hard standard to get faster action, but this does not reproduce service conditions as closely as a soft standard. The two methods must be compared.

Comparison of Results

After the technique of this test is worked out, it will be necessary to compare its results with those from service tests on identical metal. While there may be no close relation found between the two, the quick test should at least show steels worthy of a service test.

The preliminary work planned for the machine, to test its reliability, consists of running two carbon steels. SAE 1020 and 1090 respectively, hardened by Pratt & Whitney Company, and oil hardened "Ketos" steel. These disks will be tested against themselves and against hard and soft standards, both as hardened and as tempered. It is expected that data secured will show the possibilities of this test for further work.

When the above test proves satisfactory, the effect of other alloys of variations in constitution should be studied. Of particular interest is the effect of chromium and tungsten, individually, and also of austenite in the structure. Hadfield's austenitic manganese steel is very resistant to wear, and, although too soft for the present purpose, it is possible that conditions intermediate between martensite and austenite may afford a good combination of hardness and wear resistance. Such a combination offers a possibility of reducing internal stress, as will be noted later.

Dimensional Changes on Hardening

Changes in dimensions on hardening are caused by at least two independent factors, (1) thermal stresses and (2) the volume change of the transformation of austenite to martensite. The thermal stresses are inherent in any quenching operation and cannot be avoided. The undesirable feature of the distortion produced by them is its non-uniformity. We know that it can only be uniform in a symmetrically cooled body such as a sphere, unless elaborate precautions are taken. The stresses can, of course, be practically eliminated by using a steel of so slow a critical cooling rate that it will harden all the way through on cooling in air. Unfortunately, however, there is available no satisfactory commercial steel of this type having good machinability. It is essential therefore to consider means for avoiding thermal stress distortion in appropriate oil-hardening steels.

To study thermal stress distortion it is necessary to eliminate other factors contributing to dimensional changes. Of these the volume change of martensite formations is most important. For this purpose a steel austenitic and stable, at ordinary temperatures, is required. The principal sources of stress, temperature gradients on heating and on quenching, must also be studied independently.

Quenching Power of Baths

The quenching experiments will require a knowledge of the quenching power of the baths used. This information makes possible also another important determination, the critical quenching rate of the steels used. It is desirable to use as slow a cooling rate as will give penetration of hardening to the center. On the other hand, it is essential to use a treatment which completely hardens. This introduces another variable which affects the dimensions profoundly and is very difficult to control.

The other important source of dimensional changes is the volume increase of austenite transforming to martensite. While the volume change is constant for any steel and treatment, it is not possible to say whether or not the dimensional changes due to it vary between different points in the same specimen. It is quite possible that they do, as the transformation must progress through the soft metal when the thermal gradients demand, thereby producing stress between the transformed and the untransformed metal. The untransformed metal, austenite, is soft and readily deformed plastically, and distortion may easily occur. To investigate the source of distortion, the quenching stress effects must be eliminated, as is possible by using a steel austenitic at ordinary temperatures, but convertible to martensite above the temperature of liquid air. These experiments should be carried out on specimens of at least two ratios of length, for example, to diameter 4:1 and 1:1.

If this condition proves to be a serious source of distortion, methods of avoiding it must be studied. Two possibilities are evident; either the temperature of the quenching bath may be raised and the specimens slowly cooled in the bath, thereby reducing the stress between

the martensite and austenite; or alloy additions may be made which decrease the intensity of the volume change.

The changes in gages on ageing are quite irregular. Some steadily increase in length and others decrease, while some change erratically. Sudden changes in length and planeness are assumed to be due to stress effects while the uniform changes are very likely the result of slow changes in the constitution. Hardened steel is known to temper slightly at ordinary temperatures and this appears to be the constitutional change producing the dimensional changes. Martensitic steels decrease in length on moderate tempering and semi-austenite steels increase. It is quite probable, therefore, that the presence of a small amount of austenite in the matrix is responsible for the increase in length of gages. The magnitude of these factors should be determined by length and time measurement, starting as soon after hardening as possible, on blocks hardened to give maximum and minimum stress and definite ratios of martensite to austenite.

Omit Tempering

The ageing changes continue over a period of months, even years, so it is desirable, as far as possible, to shorten the length of time required to give definite results. This can be accomplished and the total effect magnified by omitting tempering. It appears safe to assume that a block which has good ageing properties untempered will have better qualities as tempered. It is essential to study the effect of tempering but the choice of tempering temperatures will depend more on wear tests than on ageing.

It is almost impossible to eliminate all time changes by the above method. It is important, therefore, to investigate artificial ageing, the usual method, of which, is both a temperature cycle and a stress cycle. The latter may be expected to develop any weakness in the block, but probably has little effect in establishing constitutional equilibruim. On the other hand, if the benefit is conferred by the temperature cycle alone, there appears to be no reason why it should be repeated. It may be possible to simplify and render more effective the ageing treatment by studying independently the thermal and stress cycles.

Machineability

This important property is not determined in the routine manner because of the difficulty of producing uniform tools and of determining the end point of the test. Since, however, the life of a tool depends largely on the temperature it acquires in cutting, the temperature developed in a tool under standard conditions appears to offer a reliable criterion of the machinability of the steel cut. It would be necessary to run the tests at speeds which would not dull the tool rapidly but this is not objectionable, most of the machine work on gages being in the nature of finishing. Such a test has the desirable feature of being simple, quick, and positive.

By investigating the four essential properties of gage steels, in the manner outlined here, it should be possible to determine the relative merits of the collection of commercial steels available, as regards each property. With this information available, it should be possible to develop compositions giving better combinations of the properties than any yet found and to select, at the same time, from the tested steels, the one which has the best combination of properties for a set purpose.

New Industries and New Tools

By Entropy

No one buys machine tools except for the sake of the profit which it is expected they will earn. Not many firms throw out old machine tools to substitute new ones. The cost of installation plus the low prices usually obtainable for the old machines make anyone stop, look and listen before doing anything of the kind.

But it is not very often that a new concern, just starting up, fits out with second-hand machinery. That is just the one time when they usually have plenty of money, and they buy their equipment before they discover how much capital is tied up in product in process of manufacture. Relief of the machine-tool situation then depends, not on any general improvement of existing business, but on the development of new businesses.

New business depends on invention or discovery. The automobile business was the salvation of the machine-tool industry while it was developing. To be sure, the automobile shops robbed the machine-tool factories of their best mechanics, but they also gave these shops the trade that kept them from the rocks.

Is there any hope for some fad that will call for the formation of new mechanical industries? If there is, and no matter what it is, it will inevitably react on the machine-tool situation. Is there to be some development of radio work that will make great demands on light machine shops, and help the bench-lathe and milling- and drilling-machine people? Is there to be development of airplane manufacture that will call on shops of the same class as the automobile shops?

Depends on Forethought

Is there to be some new mechanical musical instrument? Whatever it may be, we can rest assured that it will be something mechanical. Today everything that is material at all has become a matter of machinery. Our tables groan under the weight of books, papers and magazines, made possible by printing presses that required machine tools to build. Clothing, food, dwellings and shops are all machine made, and the machines made by means of machine tools. What is the next thing?

To be sure, no one knows what will come next, but this much is sure, that the builder who finds out what is coming and prepares to meet the demand is going to make more money out of it than the man who only wakes up because some dealer comes and insists that he supply the tail end of a demand that is already passing.

How can anyone get near enough to this elusive "next thing" to put salt on its tail? Only by keeping posted on events all over the world The new fad is as likely to originate in the brain of one man as another. If it should be demonstrated that there is life on Mars, the telescope makers would have to run day and night to supply the demand. If someone stumbles on a new light that is not accompanied by heat, those who make the machinery with which the light is made will have to hire storage vaults to hold their profits. The next invention to become profitable may already be hidden in the pages of the Patent Office Gazette, a safe and sure hiding place. Who is going to find it?

A Correction

In the article on Methods of Machine Tool Design the bore referred to on page 561, first paragraph, 17th line, should have been 20 in. instead of 10 in. as printed.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Planing a Helical Surface

By William Denton

There is a machine much used in slate quarries for trimming the slate. The machine has a cutter head quite like that of a lawn mower except that it is heavier and carries but one blade. It is very essential that this blade, which is of thin steel, should be firmly supported throughout its length by the iron of the cutter head and that it should conform to a true helical curve. The

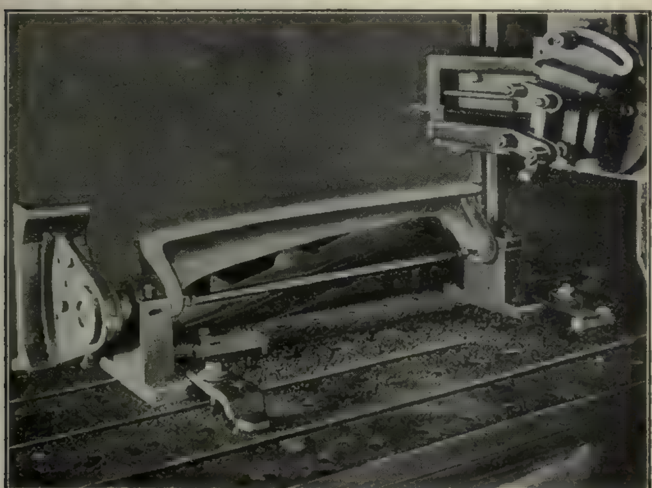


FIG. 1—FIXTURE FOR PLANING A HELIX

manner of planing the helix is shown in the illustrations.

To the back of the planer bed, opposite the operator's position, there are bolted two brackets to which is attached a taper bar very much like that used on a lathe for turning tapers, except that it stands in a vertical instead of a horizontal plane. A pair of centers are fastened to the planer table at the right distance apart to take the cutter head to be planed. To the "live"

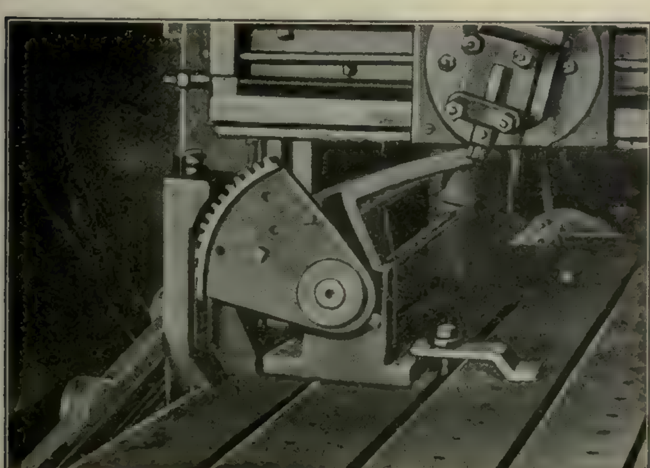


FIG. 2—END VIEW, SHOWING SEGMENTAL GEAR AND RACK

center, outside the bracket, is keyed a segmental gear that meshes with a short rack carried in an upright position by a slide that is a part of the "headstock" bracket of the centers.

In the lower end of the rack is a stud upon which swivels the block that slides in the dovetail groove of the taper bar and causes the rack to rise and fall as the planer table passes to and fro. Fig. 1 shows the fixture with a cutter head in place that has just been planed and in Fig. 2 may be seen the segmental gear and rack in extreme position. It is obvious that any desired helix within the capacity of the device may be obtained by merely adjusting the angle of the taper bar.

Home Made Crane to Serve Large Lathe

By Milton Wright

The crane shown in the illustration was made to serve a large lathe and was put up many years ago when it was not as easy to obtain machinery for this purpose as it is now. The central stud upon which the arm swings is attached to the beams that support the floor above, directly over the center line of the lathe. The arm itself is made of two pieces of iron of rectangular

OVERHEAD CRANE TO SERVE A LATHE

section attached to a casting which turns upon the stud and, at its outer end, to a two-wheeled truck running upon the semi-circular track, also supported from the floor beams.

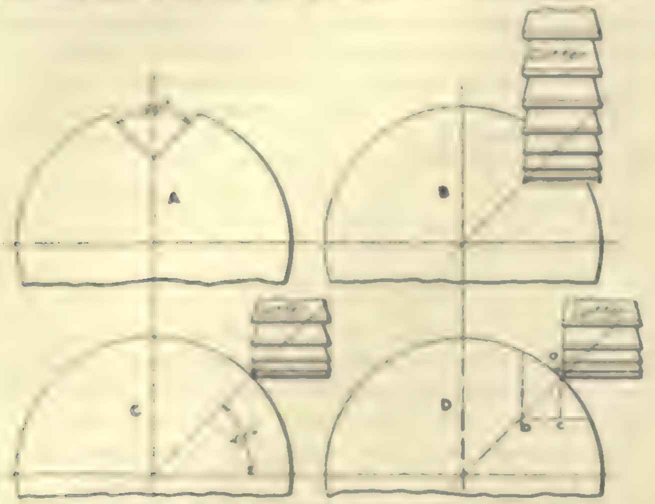
The arm with its two parallel members forms a track for the trolley from which the hoisting block is slung. As the length of the arm is about half the length of the lathe bed, a load may be supported over practically any portion of the length of the latter and, as the arm swings out to a right angle, the load may be conveniently deposited upon the floor or a truck at the rear of the lathe. The crane was built at the Bennington Machine Works and has been in service for many years.

Solving a Problem

By R. H. Kasper

The writer recently saw a workman overcome a difficulty in a rather ingenious manner. A disk required a 90-degree V milled in the circumference to a specified depth, as shown at *A*. In the absence of a 90-degree V-shaped cutter and with only a plain milling machine at hand, the workman decided to use a square cutter by cutting at a point off the center, as shown at *B*. The proper distance off center and the depth to be cut at first puzzled the man but, having a knowledge of simple mathematics, he proceeded as follows.

He first set the disk with the center line at an angle of 45 degrees with the milling machine table. He then set the table so that the corner of the cutter just touched the disk at the point of intersection of the center line with the circumference, as at *C*. With this as a starting point, he drew in his imagination the triangle *abc*, as shown in *D*. As the distance *ab* was given, it was merely necessary to solve for the length of the sides *ac* and *bc* by the formula $ab^2 = ac^2 + bc^2$.



STEPS IN THE SOLUTION OF THE PROBLEM

As the sides *ac* and *bc* are equal, the side *ab* squared will equal twice the square of either of the other two sides. To find the length of the sides *ac* and *bc* it is necessary to solve for $\sqrt{\frac{ab^2}{2}}$. The length of the side *ac* gives the distance which the milling machine table must be raised and, as *ac* and *bc* are equal, it also gives the distance which the table must be moved to one side in order to give the required depth to the V.

A Weight Actuated Prick Punch

By L. J. Gagnon

A simple and effective prick punch of the "automatic" type is shown in the accompanying sketch. The body of the tool is made of drill rod, properly hardened and ground all over. The cap button is screwed to the upper end, the sliding weight being made of a conveniently larger size of stock, knurled, hardened and blued, for the sake of appearance.

AN AUTOMATIC PRICK PUNCH

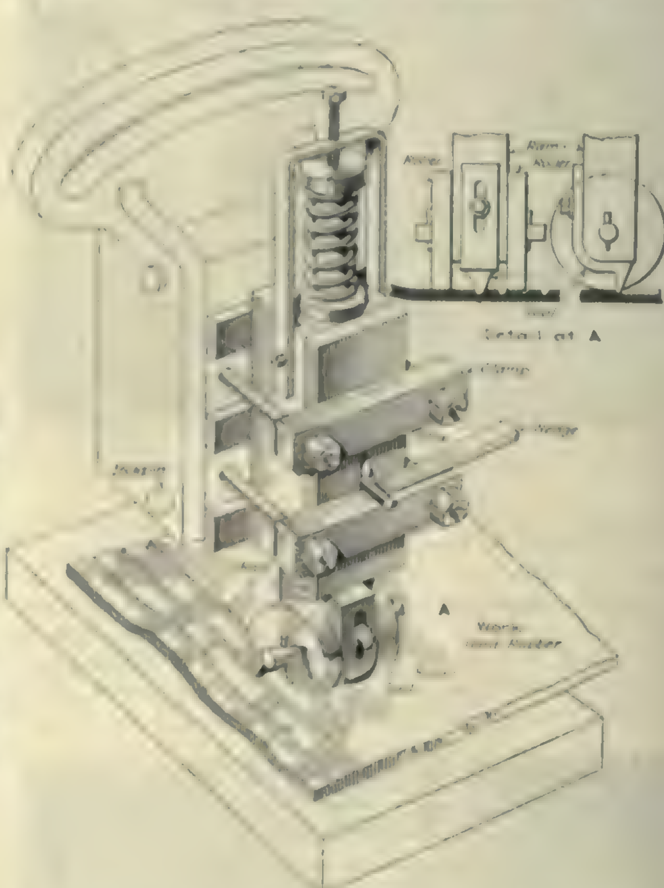
To use the tool the weight is held between the thumb and middle finger, with the index finger resting upon the cap button. The point is then located at the line intersection or other place that it is desired to mark and the weight released. This tool possesses an advantage over the spring actuated type of automatic in that the point will "stay put" and will not jump away at the instant of striking. There is no recoil. If a deeper impression is desired the weight may be raised and released several times.

Planing Vulcanized Rubber

By Bert Crouse

While working at the Youngstown Foundry & Machine Co., Youngstown, Ohio, we had a hard rubber plate 18 ft. long, 4 ft. wide and ½ in. thick in which grooves $\frac{1}{16}$ in. deep and ½ in. wide were to be planed the full length, covering the whole surface.

While the rubber was hard to cut with a regular metal cutting tool, the great difficulty was due to its irregular surface and its warped condition which prevented it from lying flat on the planer table. It was utterly impossible to get a good job by planing it in the regular way, as the tool would cut deep in the high places, so the device shown in the accompanying sketch was made. A cast-iron box was made to suit the toolpost and fitted with a ram which carried the tool. Two pressure rollers were attached to the ram and a coil spring mounted at the top of the ram sup-



RIGGING FOR PLANING VULCANIZED RUBBER

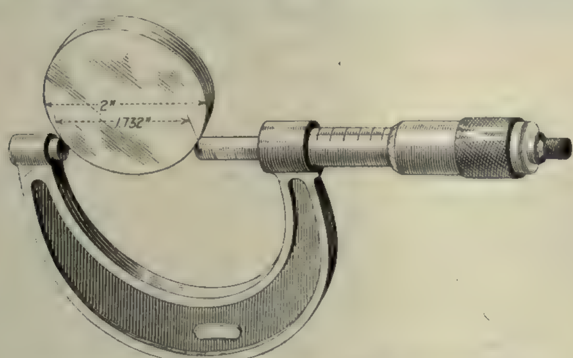
plied the tension to keep the rollers against the work. A stop-pin screwed in the ram midway of its length permitted it to move up and down through a slot. Pushing a wedge between the stop-pin and tool clamp at the end of cutting stroke would raise tool up for the return stroke, pulling wedge out at the beginning of cutting stroke would let tool down to cutting position. The apron was locked with a lock-pin as the pressure on the rollers tended to lift it.

This device enabled us to make a good job out of what seemed an impossibility.

Equal Divisions on Periphery of Disk

By Robert F. Smith

To divide circular work into more than two parts I find the method shown by the accompanying illustration to be simple and accurate and much more convenient



DIVIDING CIRCULAR WORK WITH MICROMETER

than using dividers for the same purpose. The disk shown was 2 in. in diameter by $\frac{5}{16}$ in. thick and was to be divided in three parts.

By reference to a table of regular polygons the length of a side may be found by multiplying the constant there given by the radius of the work. In this case the result is 1.732 inches. First scribing a starting point on the periphery of the disk by means of a try square, a micrometer is set to the required distance of 1.732 in. and the remaining two points determined by placing the tool against the work as shown.

A Small Reamer That Is Easy To Make

By F. B. Shoemaker

In tool work it is often necessary to ream small holes for which there are no standard reamers and the toolmaker is obliged to make them for the job. A reamer that is very quickly and easily made and will prove very satisfactory is shown in the accompanying sketch and is herewith described. If a hole is to be reamed to, let

A QUICKLY MADE REAMER

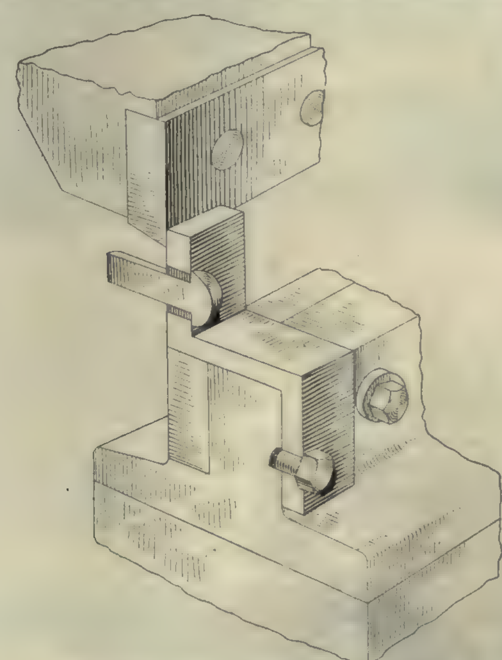
us say, a drive fit for a certain size of drill-rod, cut off a piece of the rod long enough to make the reamer. Put it in the chuck or collet of the bench lathe and polish down a short distance on one end, equal to one and one-half diameters, to a diameter 0.0005 in. under the original size, taking care to keep this part parallel.

Turn the piece around in the chuck and catch it by the new diameter. Then, with a file, taper it back for an inch or so of its length to a diameter of about 0.005 in. under the original size. From this point to the opposite end it should be made parallel and of the smaller diameter. Next, file or grind an angle of about 45 deg. across the cutting end, as shown in the sketch, and round off the sharp corner about a quarter of the way to allow the tool to enter the hole easily. In hardening, do not dip more than $\frac{1}{4}$ in. of the length and thus avoid warping.

Emergency Method of Cutting Rivets

By John J. O'Weil

Having about six hundred $\frac{3}{8}$-in. rivets to cut to length in a hurry, there being none of the proper length in the shop, and the only machine available being a shear, we rigged up the device shown in the sketch. A piece of wrought iron was bent as shown to go over the lower



CUTTING OFF RIVETS IN A SHEAR

shear blade and held in place by drilling and tapping one $\frac{7}{8}$-in. hole in the lower holder.

A hole through this wrought iron bracket accommodated a tool steel bushing of a size to take the rivets, the bushing being forced to place and set with the cutting face flush with the surface of the bracket, so that the upper blade would pass close to it. The entire time of rigging up and cutting the 600 rivets was less than three hours.

Distinct White Graduations

By P. A. Daschke

Clear white legible reading is accomplished on steel scales by brushing them over with Chinese white, allowing it to dry and wiping off the surplus against the graduations with a soft cloth.

Shaving Pinions in a Safety Punch Press

By Herbert Crawford

The gearing in the recording mechanism of the meter made by the Neptune Meter Co., Long Island City, N. Y., uses many small pinions. These are finished by the shaving process in the press and die shown in

FIG. 1—PRESS FOR SHAVING PINIONS

Fig. 1. The pinion, which has already been cut, is placed in the nest *A* which is fastened to the shaving die *B*, and forced through the die by means of the plunger *C*. This gives an excellent finish to the teeth and is very rapidly done.

To insure safety to the operator, the double hand control is used as shown in Fig. 2. This device requires both hands to be up and out of the way before the press can be tripped, so that there is no chance of getting them caught in the press.

FIG. 2—TRIPPING DEVICE REQUIRES BOTH HANDS

Extension for Twist Drills

By F. B. Shoemaker

A good scheme for extending twist drills when the extension may be larger in diameter than the drill, or to fasten straight shanked drills in the taper shanks of broken or worn out taper shanked drills is shown in the accompanying sketch. With a drill a size smaller than the one to be extended, drill into the end of the extension or taper shank parallel with its axis for a distance

EXTENSION FOR STRAIGHT SHANKED DRILLS

of about three times the diameter of the drill and then ream out this hole with the drill to be extended.

Next file a slot across the extension at right angles with its axis, with one side of the slot coinciding with the bottom of the drilled hole. The depth of this slot should be such that the bottom just reaches the center line of the extension. Now grind away one half the diameter of the drill shank for a distance equal to the width of the slot and drive the drill into the extension so that the flats overlap. Making the length of flat on the drill a trifle longer than is necessary and leaving a round corner, will add to the strength of the joint while making this flat slightly tapered will facilitate the driving and insure a tight fit.

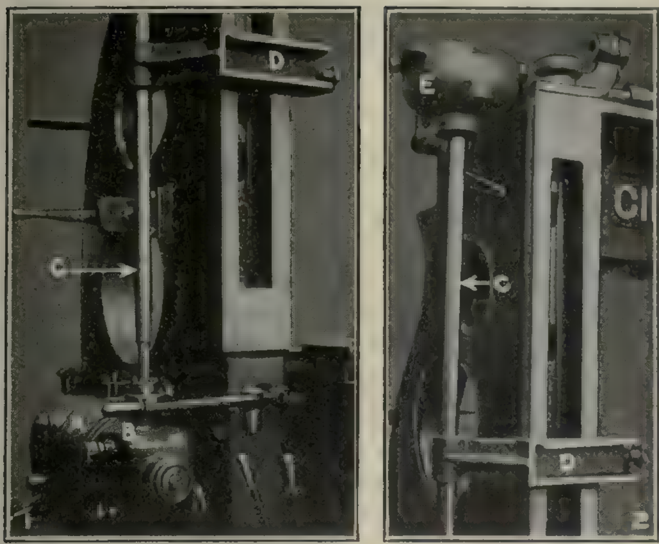
An Aligning Fixture That Aids in Assembling

By J. Bainter

Assembling operations on large machines can be greatly facilitated by the use of fixtures for properly holding parts while mounting them. Among a number of such fixtures employed in the plant of the Cincinnati Planer Co. at Oakley, Cincinnati, Ohio, one little device used in aligning the vertical feed shaft on a boring mill is worthy of note.

The parts of the feed mechanism of the 42-in. boring mill shown in Fig. 1 are assembled in the following manner. The feed box *A*, which has been previously assembled as a unit, is put on the side of the housing in the usual manner on the pad provided for it. Then, the reverse box *B*, in which are the gears for reversing the direction of the feed, is doweled in place. The reverse box is located at its proper distance from the finished surface of the housing by means of a special gage that can be employed for all sizes of machines. A straightedge is first laid on the finished surface of the housing, and a mandrel is placed in the large hole at the top of the box. Then, by using the gage, the proper position of the box can be easily determined.

The vertical feed shaft *C* is now put in place. In



FIGS. 1 AND 2—ALIGNING FIXTURE HOLDING VERTICAL FEED SHAFT IN PLACE WHILE ASSEMBLING

order to hold it in the correct position so that the top of it will be in proper alignment, the fixture *D* is clamped on the housing of the machine. With the fixture holding the shaft in place, the rapid traverse bracket *E*, see Fig. 2, at the top of the housing is doweled in place. This bracket contains the bevel gears used in driving the horizontal shaft at the top of the machine for the rapid traverse. The gears are put in place with the aligning fixture still mounted on the housing. Although the fixture is rather small and seems insignificant, its use enables very much more rapid assembling than is possible without it.

Limitation of Piston-Aligning Gages

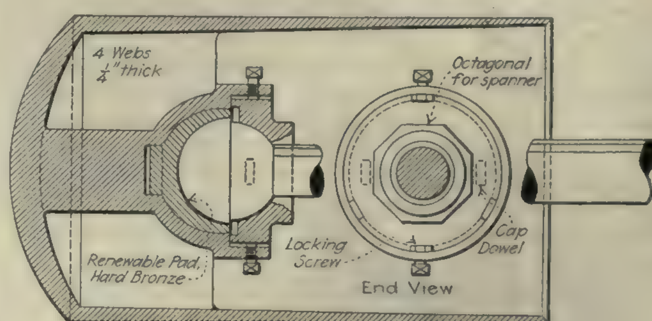
By J. T. Towlson
London, England

Piston-aligning gages are as common as dust in March, as are also the innumerable appliances for securing accurate 90-deg. fitting of the piston pin. Notwithstanding the truth of the above, one unfamiliar with details would be surprised to witness the amount of touching up, padding, and bedding in of the contiguous parts of piston accessories on the assembly bench. Why is this the case? I believe there is a reasonable answer.

Take, for example, the piston-aligning gage shown in the Shop Equipment News of the *American Machinist*, on page 982, Vol. 56. This gage will show only whether the piston lies at 90 deg. with the big end bore of the piston rod. Its limitation is that it will not show whether the tested part of the piston is the correct distance from the face of the big end of the rod. This test might easily have been made, if the gage had been provided with a micrometrically graduated collar fitting on a threaded part of the arbor. If the two faces of the big end of the rod are intended to be the same distance from the piston diameter, nothing is more simple than to test one side of the piston with the one face at the big end of the rod touching the face of the collar, and then to turn the piston rod round 180 deg. and try it again. Should the faces of rod and piston not simultaneously touch the straight edge and the graduated collar, the detail either becomes a reject or must be dealt with by the assemblies.

Mechanics accustomed to motor-engine building will readily agree that accurate jigging of a member will guarantee that such part is passable by the inspector. They will further agree that such jigging of one part only does not fill the bill. Other parts, of which the jigged part forms but a detail, unless jigged too, may be out of accuracy and, if so, one of the parts will require "facing to make it fit in." This is the cause of the congestion of work at the assembler's bench. Much more could be written in support of the above but limitation of space forbids. Just to complete the article as briefly as possible, a few remarks will be made with reference to the dispensability of piston aligning gages. Methods, designs and contrivances, religously believed to be indispensable today, will be obsolete and altogether dispensable tomorrow, while devices we believe to be new and original, or operations we believe to be impossible to perform, have probably been in constant use and practice for a long time in other shops. To come closer down to the concrete, is the common gudgeon pin, as applied to every internal combustion engine, indispensable? Is it the best device for the purpose of taking the explosive thrust of the piston and conveying it to the crank of the journal? Personally, I do not think it is.

In the first case, it is a most untractable member of the engine's make-up. It is a law unto itself and all parts must give way to it. No end of money has been expended on jigs and fixtures as a means of guaranteeing the necessary 90 deg. off the piston's geometrical center, and yet, notwithstanding such cost for tools, the smallest hard spot in the cast iron surrounding the hole will undo all the good provided by the expensive tools.

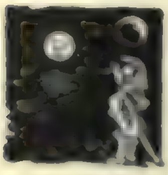


PISTON AND ROD WITH BALL JOINTS

In the second case, "the nicest affairs of mice and men oft gang aglee" and frequently well fitted gudgeon pins have got loose, moved end-wise, and badly score the cylinder. My idea is to knock out the troubles arising from intractability and abrasive danger by a change in design. I suggest a piston rod with a ball end as a substitute for the common wristpin. The sketch herewith shows the idea.

Such a device is tractable and yet, while able to perform its proper task of driving the crank quite as well as the gudgeon pin, it possesses none of its faults. No piston-aligning gage will be required and no more money expended on expensive jigs and fixtures for boring the gudgeon hole truly and no more occasion to leave $\frac{1}{16}$ in. or $\frac{1}{8}$ in. between the sides of the big end of the rod and the crank cheeks, as is often done. With the ball end the rod is tractable in all directions, while it also allows the piston to creep around in its cylinder, creating a glassy bore in the cylinder.

Editorial



ONLY one man ever stopped the sun and moon in their courses—and he had divine assistance. As well try to stop human progress and yet men have tried. They have spent valuable time in careful study of some form of human endeavor and have said, "This is the way to do the job, this and no other." But almost before they have said it somebody has found a better way and their words were wasted. Engineers, wise in industrial ways, have established standards with provisions for change as knowledge broadens and skill increases.

"Where do we go from here?" is a better slogan than "Here we are."

An American Counterpart of the East Indian Magician

THE MAGICIANS of India have long been noted for their ability to make a plant grow from the seed and flower before the eyes of the astonished observer. Just how this is done we do not pretend to know but it is no more wonderful than the deeds expected of American machine tool builders. Of course machine tools differ from the bush of the Indian magician in that they are made by men and by processes that are familiar and readily comprehensible. Nevertheless the time required to complete the modern planer or boring mill is not far different from that required for the maturing of many flowering plants.

The prolonged business depression and the consequent habit of buying for immediate needs only is probably responsible for the cautious attitude of purchasers of machinery of all kinds. It is no excuse however for the demand of the customer for delivery of complicated machinery in an impossibly short space of time. Almost every statistical service has been warning the business men and manufacturers of the country for months that the rising wave of prosperity would mean rising costs of equipment and difficulty in obtaining deliveries but in the face of these warnings the purchasers have delayed and procrastinated in the placing of orders which might well have been signed weeks or months ago. They are now feeling the pinch of demands which cannot be filled. Hand to mouth methods may be very well in a falling market or in a time when money is tight, but under present conditions there is no excuse for them. Instead of saving money they mean greater expenditure in the long run. Rush work and overtime are expensive luxuries.

At the recent convention of the American Gear Manufacturers' Association, one of the most progressive members of that body announced that he was rapidly getting in shape for the business he expected to get during five years of prosperity. Additional machinery has been purchased and more is on order and, as a consequence, his shop is in the pink of condition to accept the increasing business that is being offered. If all machinery users were as wise and aggressive as this man, the situation of the machinery builders and of the country in general would be far better than it now is and the next depression would be farther off.

Is Industrial Development Necessarily Ugly?

THERE IS A school of modern writers who delight in painting lurid word pictures of the filth and gloom surrounding the modern industrial plant. Their efforts have been so successful that the average reader of American magazines is convinced that all manufacturing plants, especially those in the metal trades, are unpleasant, demoralizing places in which to work. Unfortunately the descriptions are no exaggeration of the conditions existing in many shops.

On the other hand, we know of not a few machine shops that are kept as clean as a New England housewife's kitchen, shops that are pleasant to visit and pleasanter to work in, for the cleanliness is but an outward manifestation of the sound management within. The names of some of these shops will be found on our advertising pages, have been there for years, in fact. Their honorable and prosperous history is sufficient evidence that machine shops are not necessarily ugly and that clean, pleasant surroundings are an incentive to the men enjoying them to take pride in themselves, their work and their company. A liberal use of paint, soap, water, and elbow-grease goes far to raise the tone of any shop and brings returns, intangible though some of them may be, far in excess of the outlay.

Four Miles a Minute

THOSE who are interested in the progress of aviation, and that includes nearly everybody, cannot but rejoice at the strides which have been made in the past few months. Lieut. Doolittle's one-stop flight from coast to coast, Macready and Kelly's thirty-five hours in the air, and now the new records for speed by the planes entered by the army in the meet at Detroit are all notable. Averaging 206 miles per hour over a 156-mile course with several turns sets an entirely new mark for human travel. Approximately three and one-half miles per minute or over 300 feet per second, comes the nearest to annihilating space of anything yet accomplished. And even this was eclipsed in a straightaway flight at the rate of 248 miles per hour, or over 4 miles a minute.

We cannot overlook the fact that this great achievement is due primarily to that pioneer of practical aviation, Glenn H. Curtiss, for, without in any way detracting from the discoveries and achievements of the Wright brothers and others, it was Glenn Curtiss who won the first aircraft prize for a mile race in 1908 and a year later at Rheims brought home the Gordon Bennett trophy by flying 12.42 miles in 15 minutes, 56½ seconds. Curtiss also made the spectacular flight of 142 miles from Albany to New York so early in the game that it was necessary to stop three times for fuel and oil.

As if to crown his achievements, although he is still a young man, both the army planes which outdistanced everything in the air, are a result of the experience of Glenn Curtiss and his organization. They were not

only Curtiss planes with his designs of radiators built into the wings, but Curtiss motors as well. It is not often that a pioneer is able to keep pace with the development of a new industry in such a way and it is gratifying to see one who has been able to keep abreast of the times in such a rapidly developing science.

The pilots too, must not be overlooked. Without them the best planes in the world are of little value. The consistent performance of the two ships is noteworthy and gratifying. The winner, Lieut. R. C. Maughan averaged 206 miles an hour while Lieut. L. J. Maitland averaged 203, although one lap of the latter's flight was negotiated at the rate of 216.1 miles per hour. Maitland's power gasoline pump failed after the first lap and he drove the remaining distance by handling the ship with his right hand and pumping gasoline with his left. And a 375-hp. motor is hungry for gas all the time. Maughan was also under a heavy mental strain all through the race and both pilots deserve great credit for their performance.

From 49 miles an hour in 1909 to 248 miles an hour in 1922 is remarkable progress. Moreover, when we consider that the planes which accomplished both feats are from the hands of the same designer, we are impressed both with the short time required for aircraft development and the way in which a pioneer has kept not only abreast, but in advance of the times.

The Growth in the Use of Grinding Machines

THE USE of grinding machines has become so common in almost every line of machine production that we are apt to forget how young the process is as a real manufacturing possibility. It does not require a Methuselah in the machine industry to remember when grinding was an extra operation, used only on hardened surfaces, to correct the distortion due to heat treatment. It was a slow process too, removing a very small amount of metal and doing little more than making sparks and imparting a more or less smooth finish.

The development of better grinding wheels, better machines and the experience gained in the use of both has brought grinding into a very prominent position as a means of finishing either cylindrical or flat surfaces. Instead of being an additional operation, it now merely replaces finish turning, boring or planing and, in some instances, also eliminates the roughing out as well, as in the case of crankshafts. Many varieties of surfacing work are now done on disk grinding machines or machines using ring grinding wheels and at an astonishing rate. Much of this work was considered outside of the grinding field but a few years ago.

Among the newer developments in grinding are centerless grinding, form grinding and the removal of heavy cuts by surface grinding. These are three phases which men responsible for economical production will do well to study carefully. They seem destined to play an important role in the reduction of machinery costs.

The almost unbelievable results obtained with modern grinding wheels, the small amount of wear which enables form grinding to be done with unusual accuracy and the growing belief that even greater developments are under way, make it imperative that we study the possibilities of grinding even more closely than in the past. In too many cases, when grinding has not proved entirely successful, the fault lay with the machines or methods employed rather than with the process itself. Properly designed spindles in suitable bearings, in which both temperature and lubrication are considered, are essential to success. Correct wheels, feeds and speeds also are necessary. It is very easy to make a mistake as to what is right without a wide experience in similar work.

While grinding will not supersede all other methods of machining, it is likely to make still further changes in our methods of production. It is invading new fields and will continue to do so as we learn more about it. The production man who does not study grinding because of failures in the past, is sure to fall behind. Later knowledge, and the experience of others who have succeeded, should be earnestly sought after and applied. It is a study which will pay big dividends.

When Should Machine Tools Be Replaced?

THE QUESTION as to when a machine tool should be replaced is not often considered in a methodical way. Instead it seems to be taken for granted than one may let "nature take its course." If the machine has become unfit for further work there will certainly be somebody to notice it and demand will then be made for a new one.

In shops where machine tools are the chief means of production, such hap-hazard methods, or rather lack of methods, should not be tolerated. Instead, a deliberate attempt should be made to find out beforehand at what age a machine should be replaced. We are not referring to the substitution of a different kind of machine, or even of an improved tool, but simply to the degree of fitness left after a number of years of service.

It needs very little argument to show that neither should a machine be kept after it has passed its hundredth birthday, nor should it be discarded after a year's service. It is very evident that the point of greatest total economy lies somewhere between these extremes. This point may be different for various classes of machines, even for different makes of the same class, and further, it may be different for identical machines, used in different shops or for different purposes in the same shop. But, and this is the point, the economical life of every machine should be known, not to a day but accurately enough to make it the basis for action. It is a safe guess that, if this were done there would be replaced many machines which now lead the lives of invalids, pampered and doctored and demanding new expenses for repairs besides reducing and interrupting production.

Just Suppose

SUPPOSE you were proprietor of a shop with, say, a hundred men, and suppose these men felt that they had not been doing as much work as would have been possible. Suppose they speeded up, and studied their work, and co-operated and burned the midnight oil, just to increase production and to have the satisfaction of having fully earned their wages. Just suppose they did. Would you say to them:

"Why boys, this will never do. You are turning out more than twice as much work as I expected, and all for the same wages. No, really, this is not fair. I will have to double your wages, and maybe more."

Would you say this?

Oh, well! What is the use of asking foolish questions? But—

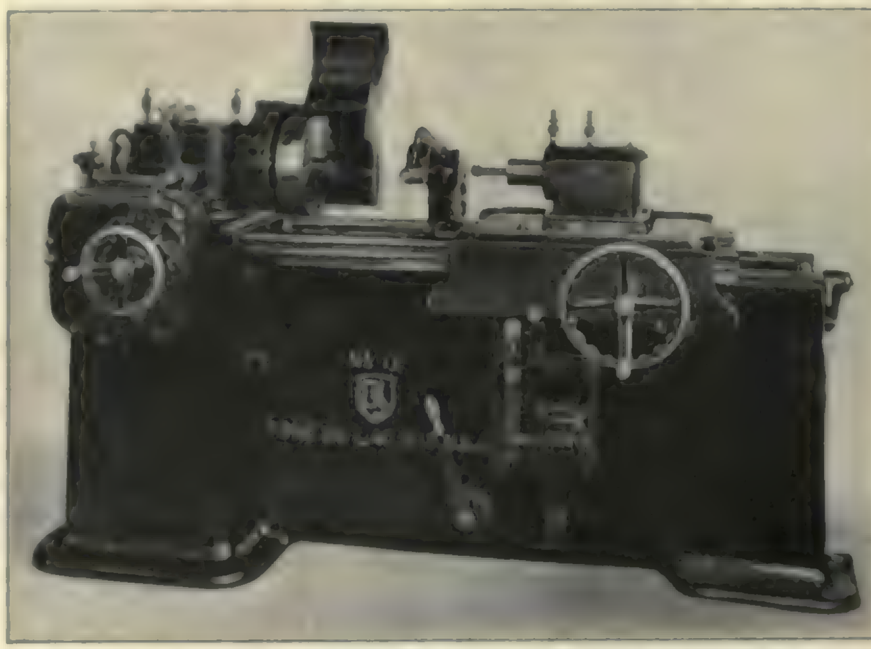
Just suppose.

Shop Equipment News

Giddings & Lewis Automatic Internal Grinding Machine No. 12

A grinding machine that is intended to perform automatically internal grinding operations on parts such as employed for automobiles and machine tools, so as to eliminate hand plugging by the operator, has recently been developed by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. A much lower degree of skill is required of the operator than is usual for internal grinding operations, as the machine itself grinds holes to a finished size with but slight attention from the operator.

The feature of the machine that enables its operation is an automatic gaging mechanism incorporated and correlated with the driving and feeding mechanisms. After the operator chucks the piece and starts the feed, the machine will grind to the finished size, automatically trip the carriage feed, and return the carriage to the rest position. Means is provided to care for wear of the wheel. The exact action of the gaging device will be described later in connection with the feeds of the machine. The bar gages used on the machine have a much lower cost than plug gages and their life is greatly prolonged because of the fact that they revolve at the same speed as the work and the mechanism employed for entering the gages in the work reduces wear to a minimum.



GIDDINGS & LEWIS AUTOMATIC INTERNAL GRINDING MACHINE NO. 12

The No. 12 machine, a front view of which is shown in the accompanying illustration, grinds holes from $\frac{3}{4}$ to 10 in. in diameter and up to 9 in. in depth. The total swing over the ways is 13 in., and the height of the spindle from the floor 44 in. The machine is motor driven and entirely self-contained, being equipped with push-button control. The motor is mounted on the back of the bed, which is of substantial construction and well ribbed to provide strength and rigidity. All parts of the machine having bearing surfaces are protected from dirt and abrasive material. The entire construction of the machine is rugged, so that continuous production should be obtainable.

The work head is mounted at the left of the machine on a circular bearing fitted to a cross-slide. Means of indexing the head quickly and accurately are provided, and tapers can be ground to an included angle of 30 deg. The work spindle runs in bronze bearings and is provided with six speeds. The speeds can be selected by turning the handwheel on top of the work head to any of the six indicated positions. Ball bearings are provided in the power transmission line from the motor to the spindle.

The drawbar for operating collet chucks is operated by a handwheel at the rear of the work head. A special three-jaw gear scroll chuck made by the Cushman Chuck Co., Hartford, Conn., is furnished as standard equipment. The chuck has a holding capacity of $\frac{1}{4}$ to $10\frac{3}{4}$ in. It is watertight and all parts are protected against grit. The body, which is filled with grease, is made of steel with all working parts hardened. The wheel carriage is of heavy construction, has large bearing surfaces on the ways of the bed and is guided by means of V's on both sides. The carriage is reciprocated hydraulically and the motor for driving the wheel spindle is mounted directly beneath the spindle and on the carriage, reciprocating with it, so that the life of the high-speed driving belt should be greatly prolonged. The wheel heads are tapered on the outside and are mounted in a corresponding taper in the wheel head housing and fastened in place by a locknut. In this way spindles can be easily mounted and removed. Each spindle runs in ball bearings in its own wheel head and separate steel pulleys are furnished with each spindle so that the correct wheel speed can be obtained.

The work is fed against the wheel at each end of the stroke, and two separate series of feeds are provided, ten for roughing and five for finishing. The carriage has a maximum travel of 20 in. and is provided with six traversing speeds.

Both sets of feeds are controlled by the use of two gages, a roughing gage and a finishing gage. In grinding the hole, when it reaches the size where the roughing gage can enter the work, the roughing feed is automatically disengaged. The finish feed automatically engages until the finishing gage can enter the

work, at which time the trip on the carriage automatically operates and returns the carriage to its rest position.

Coolant is handled by a directly driven centrifugal pump mounted within the machine, so as to force the lubricant through the center of the work spindle and on to the work. Means are provided for automatically cutting off the water supply when the wheel leaves the work and also for turning it on again when the wheel enters it.

The standard machine is motor driven by either a.c. or d.c. current. It requires a floor space of 7 ft. x 4 ft. 2 in. and weighs net 4,400 pounds.

Bausch High-Speed Multiple-Spindle Drilling Machine No. 2A

In order to apply the feed pressure directly over the center of the drilling area when a gang of drills is being used in one head, the center feed arrangement shown on the No. 2A drilling machine in the accompanying illustrations has recently been developed by the Bausch Machine Tool Co., Springfield, Mass. The construction maintains true alignment of the spindles and prevents the head from springing under the drilling pressure so that the drills do not align correctly with the bushings. Thus, the friction on the drills is decreased and the strain on the feed mechanism greatly reduced. Cramping on the ways is largely eliminated.

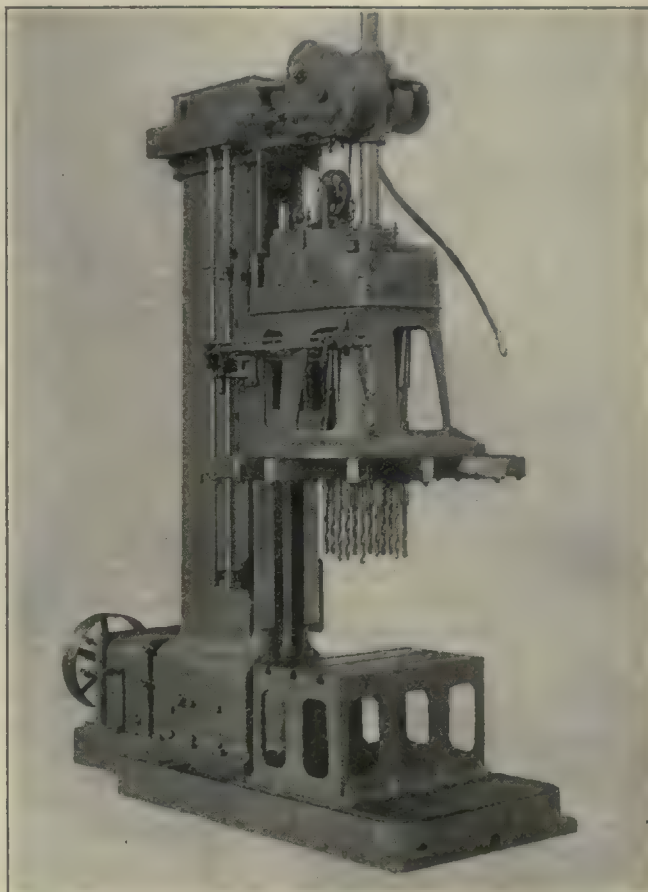
Heads of various sizes, both round and rectangular in shape, can be furnished. The head is of the type ordinarily employed on Bausch multiple-spindle drilling machines. It provides large vertical adjustment of the individual spindles and allows a minimum center distance to be obtained equal to the diameter of the spindles themselves. The head is provided with an automatic counterweight catch which prevents it from falling in case of accident to the cable.

The machine has a capacity in cast iron of twelve 1-in. drills, or the equivalent. Owing to the center feed construction, the distance from the center of the head to the face of the post is made greater than when the feed pressure is directly from the post, being 20 in. in this case. The width of the face of the post is 12½ in., and on it the head has a traverse of 25 in., the least distance from the spindle to the bed being 20 in. and the greatest distance 45 in. The bed is provided with T-slots and box or rotating tables can be furnished to suit the work to be done.

Four different methods of drive can be furnished, the first by means of a three-speed cone pulley, the second by a three-speed change-gear box motor-driven, the third by a three-speed change-gear box belt-driven, and the fourth by a direct-connected variable-speed motor. The main drive comes from the base of the machine directly to the head gears, so that the mechanism is simple. As illustrated, the machine is driven by a 5½-in. belt on an 18-in. pulley. Fifteen to 20 hp. are required for the operation.

The feed is accomplished by means of a heavy ram placed directly above the center of the drilling area. This ram is moved by a pinion which is connected through the change-feed gear box directly to the main drive of the machine. For each change of speed, of which there are three, there are three changs of feed, which vary according to different combinations from 0.0018 and 0.023 in. per revolution of the spindle. These speeds are standard, but feeds either faster or slower car be provided to suit special requirements. The head is operated by hand only when counterboring or in an emergency, or when adjusting the tools for height and alignment in the jigs. The pilot wheel for hand feeding is consequently located rather unobtrusively and is disconnected when not in use. In the illustration it cannot be seen as it is on the right side of the frame.

Roller bearings are used for shafts and ball thrust bearings wherever required. All driving gears are of steel. The column has a hole in the back so that small weights can be added or removed to properly adjust the balance of the head. An oil pump and oil tubes can be furnished, so that coolant can be employed. The grooves in the bed collect the coolant and supply it to the reservoir in the base.



BAUSCH MULTIPLE-SPINDLE DRILLING MACHINE

The ease of operation of the machine is the feature to which the maker calls especial attention. The quick approach and return of the head is operated by means of friction clutches in the feed gear box, so that the operator can by means of a conveniently located lever raise or lower the head at a fast speed. The head can come down at this fast speed until the drills actually touch the work, no care being necessary to prevent damage, since the friction clutch immediately slips when the drills strike the work. The power feed is then engaged, and upon completion of the drilling operation the head automatically returns at fast speed and stops at the starting position. This quick approach and return feature is not an attachment, but is built integrally in the machine.

The machine can be built for tapping in addition to drilling. In the tapping model, back gears on the head

are employed for reducing the spindle speed, these gears being engaged or disengaged while the machine is running, if desired. When performing a tapping operation, the operator first brings the taps down into the work by means of the quick approach. Further downward movement of the head is then controlled by the lead of the taps in the work. At a certain point, the direction of rotation of the taps is automatically reversed. After the taps have cleared themselves from the work, the operator engages the quick return and the head travels quickly to the starting position and stops, the spindles being automatically reversed and ready for the next operation.

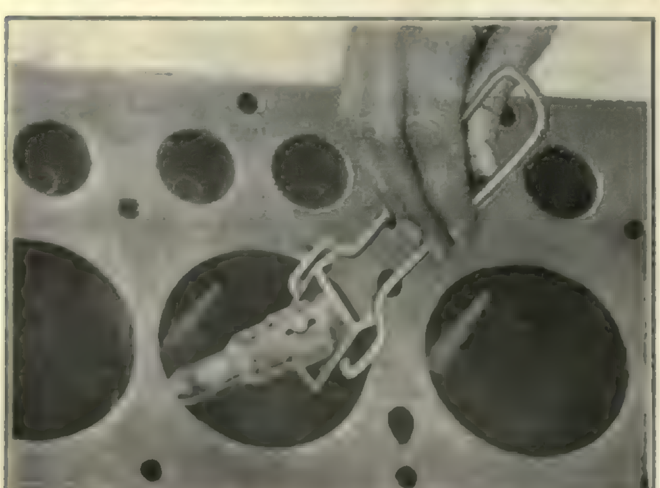
For performing counterboring operations an attachment operated by hand can be supplied. By means of a lever and gears the head is advanced very slowly and with great power. The attachment is employed especially for spot-facing and similar operations, back gears in the head being employed for reducing the spindle speed at the same time. The machine occupies a floor space of 3 ft. x 8 ft. 10 in., its extreme height with the feed ram in the up position is 12 ft. 3 in., while the height with the ram down is only 10 ft. 8 in.

Beard Self-Aligning and Centering Inside Micrometer Gage

An inside micrometer gage intended especially for measuring the diameters of automotive cylinders has been brought out by the L. O. Beard Tool Co., Lancaster, Pa. The method of using the tool for such work is shown in the accompanying illustration, the advantage of the device being that the measuring number is held at right angles to the cylinder walls.

The gage consists chiefly of the aligning base, the handle and the micrometer proper. Three sizes of the micrometer are regularly furnished, the ranges being, respectively, 2½ to 3 in., 3 to 3¾ in., and 3¾ to 4½ in. One turn of the screw advances it 0.050 in., and the barrel is graduated to 0.001 in. Figures indicating steps of 0.005 in. are placed on both the spindle and the barrel, those on the former member serving as a check for the reading. Thus whatever figure on the barrel is found opposite the zero on the spindle, will also be found on the spindle opposite the zero on the barrel. Both ends of the micrometer and the parallel edges of the base are hardened and ground.

When in use the micrometer is placed in the bushing of the aligning base, in which it is a sliding fit. A ring can then be placed on the rear end of the barrel to keep the base from falling off. The tool is inserted in the bore to be measured, the base pressed against this bore, and the spindle screwed out until both it and the barrel end touch the bore. The base holds the tool in the proper position for obtaining the exact diameter of the cylinder, as the micrometer is both centered in the bore and perpendicular to the axis. The micrometer is then locked by means of the setscrew to preserve the reading, and the aligning base slid forward on the barrel so that the tool can be titled and removed from the cylinder for reading.



BEARD INSIDE MICROMETER GAGE

Hartness Taper Threading Die

The Jones & Lamson Machine Co., Die Division, Springfied, Vt., has placed on the market a new design of its self-opening die for the cutting of threads of any taper from zero, as on cylindrical work, up to 2 in. taper per foot. Set for the maximum taper the die will cut threads 1¾ in. long, and proportionately longer as the angle approaches the minimum. It is especially adapted to the cutting of staybolt threads and may be used in tandem with another die in the rear for cutting the parallel-sided portion of the thread.

HARTNESS TAPER THREADING DIE

As shown in the illustration the die is open to its fullest extent and the former-pin is out of the guiding slot. To set it in closed position for beginning a thread the operator pushes forward the short handle on the die sleeve until the former pin is brought into the slot in the adjustable former, and then he withdraws the die to its extreme position by moving the pinion lever at the top.

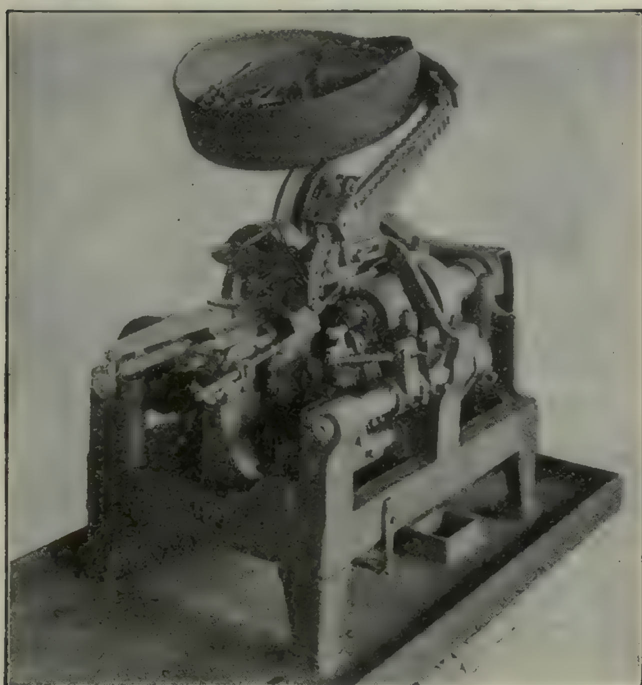
The die holder as furnished is intended to be bored in position in the machine with which it is to be used, thus bringing the tool into perfect alignment with the work spindle. The bushing in which the operating pinion has its bearing is eccentric, so that the pinion may be adjusted by a partial rotation of the bushing to compensate for any inaccuracy of alignment that may be manifest in the machine. Minor adjustments for diameter are accomplished by turning the knurled-head adjusting screw in the usual way.

The tool is made in two sizes. The No. 3 size will cut threads 1¼ in. in diameter at the large end, and the No. 6, threads up to 2 in. in diameter.

Cook Bolt and Capscrew Shaving Machine

The Asa S. Cook Co., Hartford, Conn., has recently placed on the market a new design of its bolt and capscrew head shaving machine. A single belt from the lineshaft drives a countershaft under the pan of the machine and from this countershaft all movements are derived, thus permitting the setting of a row of machines under and parallel to the lineshaft with just sufficient room between each machine to clear the belt.

Separate carriers are provided for the tools, one of which faces the shoulder under the head of the bolt or screw while the other is rounding or otherwise forming the end of the head, the cuts being taken simultaneously. These carriers are given a swinging movement about axes that are set at a slight angle to the center line of



BOLT AND CAP-SCREW SHAVING MACHINE

the machine, so that as the tools advance to the work they also draw slightly nearer together. This movement has the effect of clearing the tools immediately upon the finish of the cut and allowing them to withdraw without dragging. The carriers are independently adjustable.

The gripping device that catches each screw as it falls from the feed race has also been improved, gripping the screw by the shank end and steadyresting it as near to the head as possible without interfering with the shouldering tool, thus giving each piece a firm support close to the cut.

The hopper on this machine is constructed upon an entirely different principle than formerly employed. Instead of the usual revolving hopper this one is stationary and is supported by a hollow bracket, the upper end of which forms a bearing for a revolving shaft. To this shaft, at the point where it extends through the base of the hopper, there is keyed a four-armed spider —or "agitator," as it is called—which is caused to revolve slowly and keep the contained mass of bolts or screws constantly stirred up, so that an annular groove close to the side walls of the hopper is kept filled with the work. In the illustration all those bolts that may be seen lying close to, and as nearly as possible parallel with, the side walls are in this groove.

At the bottom of the groove is an annular ring, the upper surface of which is roughly serrated, and this ring is slowly and continuously revolved in conjunction with the agitator. The result of this combined movement is that the outer circle of bolts in the hopper is continuously moving forward toward the high side of the base, at which point the bolts are discharged into the feed race. It matters not which end of the bolt or screw is presented to the feed race, for as soon as a bolt enters the latter the shank end swings downward by gravity and the bolt is thenceforward supported only by the shoulder under the head.

It will be noted that the feed is at all times caused by the friction of the bolts lying upon the serrated surface of the moving ring (the arms of the agitator do not extend over the groove), so that there is no positive impulse and consequently no possibility of jamming. The rate of travel of the ring and agitator is very slow as compared with the movements of the machine, and may be varied by using different combinations of driving gears so as to keep the feed race full of work at all times.

The number of bolts in the hopper does not affect the feed, as the latter will completely empty the hopper and carry forward the last bolt as readily as the first one without hesitation or interuption. The duty of the hopper ends with the delivery of the work to the feed race; from that point forward the feed is by gravity only and the machine will continue to function until the race is exhausted.

The manufacturer is redesigning the entire line of bolt and screw machinery, which includes shavers, pointers, and die-threaders, and will equip all such machines with this type of hopper. The machine here shown handles bolts or cap-screws up to ½ in. in diameter by 4 in. long. Larger sizes are under contemplation.

Victor Receding-Chaser Collapsible Pipe Taps

The receding-chaser collapsible pipe tap made by the Victor Tool Co., Waynesboro, Pa., has recently been redesigned and improved. The basic principle of the design, such as described on page 915, Vol. 51 of *American Machinist* has not been changed, although the details have been altered somewhat.

Instead of using the ordinary tapered chasers for cutting a standard Briggs tapered pipe thread, and depending upon the length of the chaser to give the

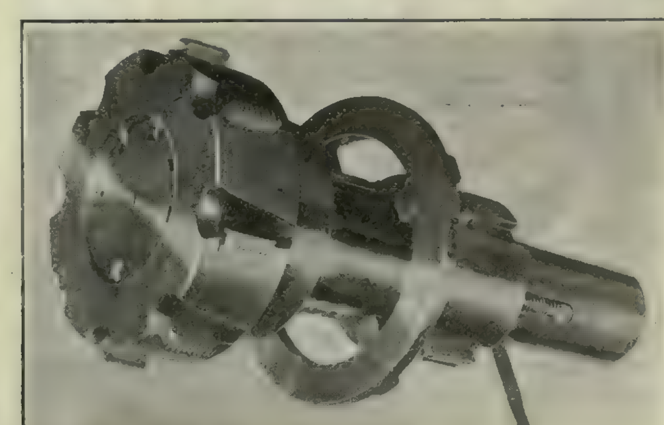


FIG. 1—VICTOR STATIONARY-TYPE COLLAPSIBLE PIPE TAP

proper length of the thread, short chasers are employed and are made to recede as the tap enters the work. A trip collar is set against the face of the work when the operation is started, and as the tap feeds in, it pushes back on the cam collar that controls the receding of the plunger on which the chasers are mounted.

The view in Fig. 1, which shows a stationary lever-operated type of pipe tap, illustrates the arrangement of the collar. Although formerly only one cam block was used, two blocks working in conjunction are now

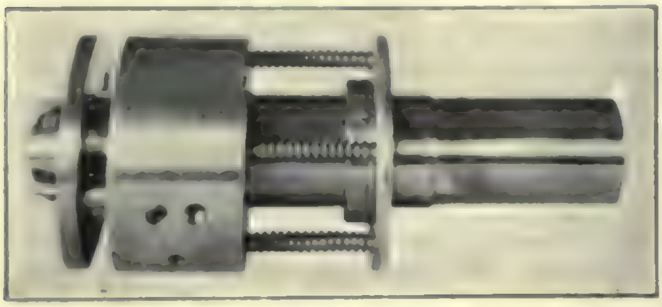


FIG. 2—VICTOR ROTARY COLLAPSIBLE PIPE TAP

employed so that the receding of the chasers is more positively controlled to give a more uniformly tapered thread. A tapered thread can be cut off at any length desired and have the taper uniform throughout its entire length. The design of the cam blocks has also been altered to make them more effective and positive.

A rotary type of collapsible tap, such as shown in Fig. 2, has also been altered in design. Instead of a detachable lever for setting the collars and chasers in position for cutting, a ring or collar has been substituted. Pressing forward on this collar by hand, or by means of an attachment on the tapping machine that comes in contact with the collar when the spindle is raised, the chasers can be set without stopping the machine. There are no projections from the cylindrical form of the tap, so as to safeguard the operator.

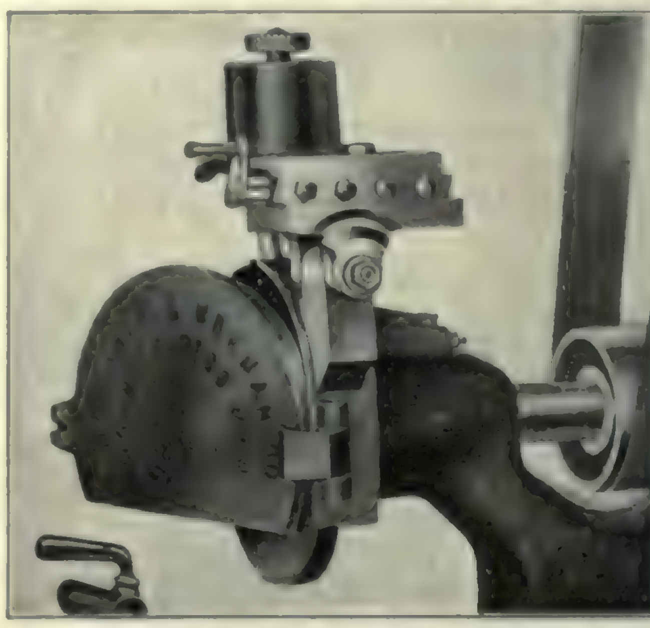
In both styles of the tap, means of adjusting the size with a range of $\frac{1}{16}$ in., either over or under the size are provided. Adjustment of the trip collar permits cutting any length of thread desired. The tap requires from one third to one half less power to drive than the ordinary tapered thread tap, it is claimed, because unnecessary bearing has been eliminated by the use of the short chasers and a tapered thread is cut in virtually the same manner as a straight thread. Interrupted thread chasers are used when tapping steel.

The tap is furnished in sizes from $1\frac{1}{4}$ to 12 in. It can be employed on such work as forged steel flanges and fittings employed for high-pressure work, as well as pipe couplings, casings, heads and other parts used in the oil field. Its adaptability is particularly evident when work of large diameter or extra length is encountered.

Wilmarth & Morman Angular Wheel-Truing Device

The accompanying illustration shows the angular wheel-truing device with which all surface grinding machines made by the Wilmarth & Morman Co., Grand Rapids, Mich., can be equipped. The device is intended for use in shops salvaging and reclaiming worn-out milling machine cutters, reamers and drills, as well as those making a specialty of cast stellite cutters and tools. By the use of this device, the wheel can be easily formed to correspond to the outline to be ground.

The illustration shows the wheel-truing device in position for dressing the wheel face parallel with the table. The diamond is fed to the wheel by means of the knurled knob at the top, while the crank is employed to feed the diamond across the face of the wheel. By means of the



WILMARTH & MORMAN WHEEL-TRUING DEVICE

graduated dial, the device can be set at the desired angle, the diamond carrying member being tilted to either side for dressing the wheel face at an angle.

The chief advantage of the built-in wheel-truing device lies in the fact that the wheel can be properly dressed without disturbing the set-up of the work. Time can be saved because of the adaptability of the device and the facility of operation.

Kingsbury Automatic Horizontal Sensitive Drilling Machine

The Kingsbury Manufacturing Co., Keene, N. H., has made further developments in its line of automatic sensitive ball-bearing drilling machines. The recent or No. 8 machine embodies a fully automatic feed and control very similar to that employed on the machines described on page 1066, Vol. 53, and on page 1060, Vol. 54, of *American Machinist*. Although these latter machines have vertical spindles, the No. 8 drilling head shown in Fig. 1 is ordinarily operated with the spindle horizontal. The principal difference between the recent model of the device and the No. 1 machine previously described is that a cam has been embodied in the spindle controlling mechanism so that difficult drilling jobs can be more effectively handled.

The No. 8 drilling head has a capacity for drills from No. 60 to $\frac{1}{4}$ in. in diameter. Its operation is as simple as that of a power punch press, as the operator merely places the work in position, clamps it, and then presses the trip lever. There are seven ball bearings employed on the machine, so that friction is reduced as much as possible to make the machine sensitive. The worm employed in the mechanism is of hardened steel, and the gear of phosphor bronze.

An automatically controlled pressure feed system is

employed for the purpose of eliminating drill breakage. The action occurs through the cam and the friction rolls or gears seen on the side of the device. The driven gear is mounted on a lever held in mesh with the friction driving roll or gear by an adjustable compression spring. The cam is cut on the inside of this driven gear. The follower roller is mounted on a gear segment which meshes with a gear segment clamped to the feed shaft. The arrangement is such that the cam

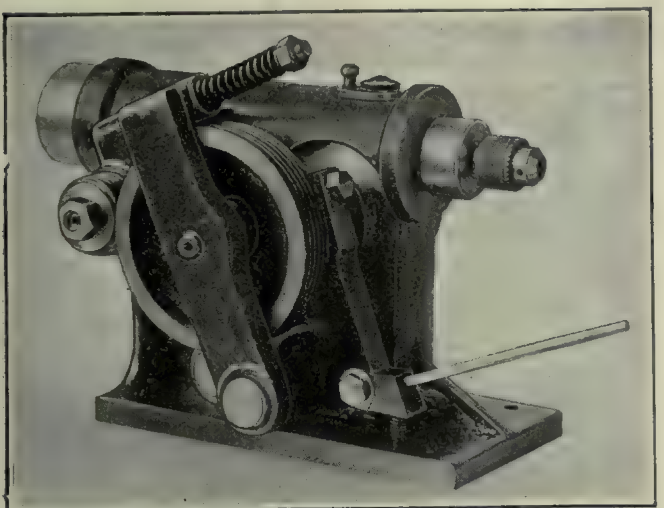


FIG. 1—KINGSBURY NO. 8 AUTOMATIC DRILLING HEAD

is revolved by the friction gears and feeds the spindle forward.

When the forward motion is resisted, as when the drill strikes the work, the follower roller is held momentarily and the rotation of the gears causes the cam to climb on the roller, thereby separating the friction gears, and permitting slippage. As the drill penetrates the work under pressure, the follower gives way,

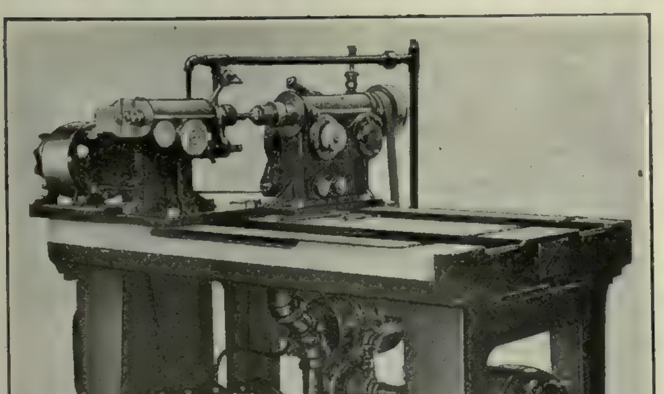


FIG. 2—KINGSBURY AUTOMATIC SENSITIVE DRILLING MACHINE

bringing the friction gears into contact again and causing the cam to revolve and again to separate the gears when further resistance is met. The motion is claimed to be so smooth and rapid that it cannot be detected as intermittent.

The standard cam employed gives a stroke of 1 in. to the spindle with a maximum feed of 0.011 in. per revolution. Thus the drill approaches the work and breaks through at a comparatively rapid rate, while the actual drilling feed depends on the pressure adjustment, the hardness of the work and the condition of the drill. Special cams can be used with one or two reliefs to permit of withdrawing the drill during the operation, so as to relieve the chips. The spindle has a total adjustment of 2 in. besides the 1 in. travel. It can rotate at speeds as high as 4,000 r.p.m.

The head can be driven by either a countershaft or motor, ¼ hp. being usually required. The spindle is 6¾ in. above the base, and the overall height of the machine is 9½ in. The length of the head when the chuck is in the back position is 14 in. The width is 7 in. and the net weight 50 pounds.

The head can be well employed in multiple for performing the same operation on several parts, or for performing different operations on the same part. In this way a semi-automatic machine for large production, such as when drilling oil holes, is formed. Fig. 2 shows a floor type of machine intended for cross drilling and burring chuck wrenches. The machine is equipped with a single No. 8 head, and with a special fixture which automatically clamps each wrench and then removes the burr from the work.

As many as four of these units can be mounted on the table if the production desired warrants this number. Thus one operator could care for all of them and the work could be progressing simultaneously in each. It will be noted that three small motors are employed, one for driving the drill spindles, one for the burring spindle and one for the lubricating pump. The three motors are connected to one motor starter at the left of the frame. Different arrangements of the work head and fixtures can be furnished to suit varying requirements.

Sigourney No. 0 High-Speed Bench Drilling Machine

The Sigourney Tool Co., Hartford, Conn., has brought out a drilling machine, designated as the No. 0 high-speed, bench-type, that is a departure in many respects from the regular line of Sigourney tools. As its name indicates, it is intended for bench service only, and is not provided with a column.

The machine is of the belt-driven type with two countershafts adjustably mounted upon the frame. Both belts are endless; the tension is maintained by moving the countershafts, both of which may be adjusted for center distance by turning conveniently located knurled-head screws.

The spindle, which is hardened and ground, is entirely enclosed and runs upon Norma ball bearings. There is no center hole in the spindle, but the lower end of the latter is fitted to the taper socket of a No. 1 Jacobs drill chuck that is regularly furnished as a part of the equipment. This chuck has a capacity ranging from 0 to $\frac{3}{16}$-in. diameter drills.

Both countershafts as well as the loose pulley are

mounted upon Hess-Bright ball bearings. The normal speed of the first shaft is 1,000 r.p.m., and from this speed are obtained spindle speeds of 2,000, 4,000 and 8,000 r.p.m. The machines are capable of much higher

FIG. 1—SIGOURNEY NO. 0 BENCH-TYPE HIGH-SPEED DRILLING MACHINE

spindle speeds, which may be obtained by increasing the speed of the first countershaft.

The illustration in Fig. 1 shows the machine ready to run, and Fig. 2 shows a section through the spindle. It will be noted that the driving pulley is mounted independently of the spindle and that both sets of bearings are independently adjustable by means of easily accessible ring adjusting nuts. All bearings are standard commercial ball bearings, parts for which may be procured from any dealer in this class of material.

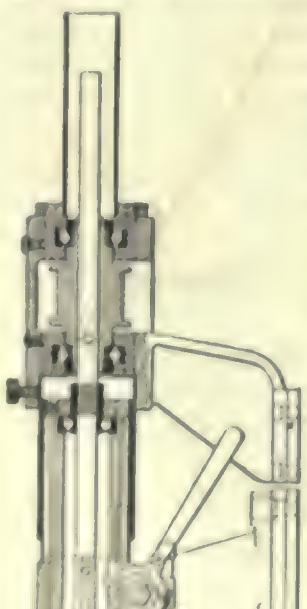


FIG. 2—SECTION THROUGH SPINDLE

The finished surface of the table is 7½x8 in. The head is adjustable vertically through a distance of 2½ in., and the maximum height from table to chuck is 3½ in. The vertical movement of the spindle is 1¼ in., actuated by the usual rack and pinion with lever handle. The machine will drill to the center of an 8½-in. circle.

A clamp stop on the pinion shaft limits the vertical movement of the spindle, and this stop has a knurled head adjustment screw and locknut by which accurate adjustments for depth of hole are obtainable.

The machine occupies a bench space of 12x20 in. and the net weight is 50 lb. Boxed for export the gross weight is 87 lb. and the space occupied is 4½ cubic feet.

"Motorbloc" Electrically Operated Chain Hoist

An electrically operated material-handling hoist, designated as the "Motorbloc," has been placed on the market recently by the Motorbloc Corporation, Summerdale, Philadelphia, Pa. The device is intended for use in the field of operation lying between that of the standard hand-operated chain hoist and that of the traveling electric hoist which requires substantial overhead and electrical installations. The hoist is readily portable and can be installed wherever electric current is available by merely attaching it to a convenient lighting or power circuit.

The Motorbloc consists of a standardized steel chain hoist, electrified by the application of a small heavy-duty motor, reduction gearing and a slip friction clutch, all of which are mounted on a malleable-iron supporting bracket to form a self-contained electrifying unit to which the pendant controller is attached. Although the device is regularly furnished as a complete hoisting outfit, the electrifying unit can be readily applied to standard chain hoists already in service, so as to enable the operation of hand hoists by electricity. In the accompanying illustration the unit is shown built on a Franklin-Moore all-steel suspension spur-geared chain hoist. For occasional use at points where electric current is not available, or in the event of the temporary failure of electric power, the hand chain can be quickly applied, and the hoist operated as an ordinary chain block.

"MOTORBLOC" ELECTRIC CHAIN HOIST

The mechanism is manufactured for use on chain hoists having capacities from ½ to 10 tons. It is stated to be rugged so as to stand up under continued service such as a portable apparatus of this nature is generally subjected to. However, care has been exercised to avoid stressing the chain hoist mechanism beyond the loads and speeds for which it was proportioned for hand operation. The armature shaft and worm are carried in heavy-duty ball bearings and provision is made for adequate automatic lubrication.

The pendant controller can be easily operated by the fingers of one hand, leaving the other hand free to guide the load. By this arrangement, one man can easily handle large loads. The operation of the mechanism is safeguarded by the use of a ring-oiled friction clutch which prevents over-running. At the same time, the mechanism completely protects the motor from overload without the necessity for an electric limit switch. The maker stresses such features as the compactness and balance, as well as the lightness and strength of the hoist. The weight of the one-ton size is 148 pounds.

Garrett "Millerette" Milling and Multi-Purpose Attachment

The Garrett "Millerette" or multi-purpose attachment for lathes, planers, shapers and drilling machines has recently been placed on the market by the Production Machine Tool Co., 629 East Pearl St., Cincinnati, Ohio. This device is built in three sizes for lathes from 12 to 24 in. swing.

The Millerette can be employed to convert a lathe to do the work of a milling machine with a dividing head. A large range of milling can be done, such as cutting

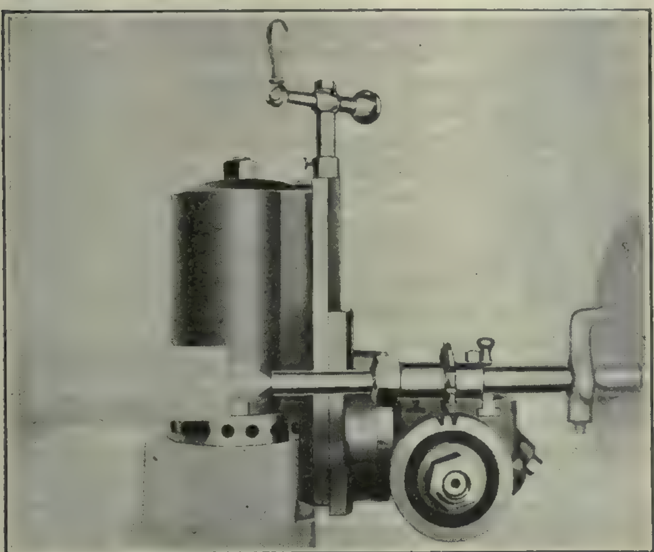


FIG. 1—GARRETT "MILLERETTE" ON LATHE

gears, both spur and bevel, surface milling, angle cutting and spline and keyway cutting. The device enables the small shop to do many classes of milling machine work on the lathe, and it saves setting-up time on special and single-piece jobs in the large shop.

The attachment fits the toolpost slot in the top slide of the compound rest of the lathe, as shown in Fig. 1, and can be as quickly clamped in position as the toolpost itself. The lathe supplies the power and carries the cutter on an arbor between centers. It also furnishes both longitudinal and cross feeds. In addition to the

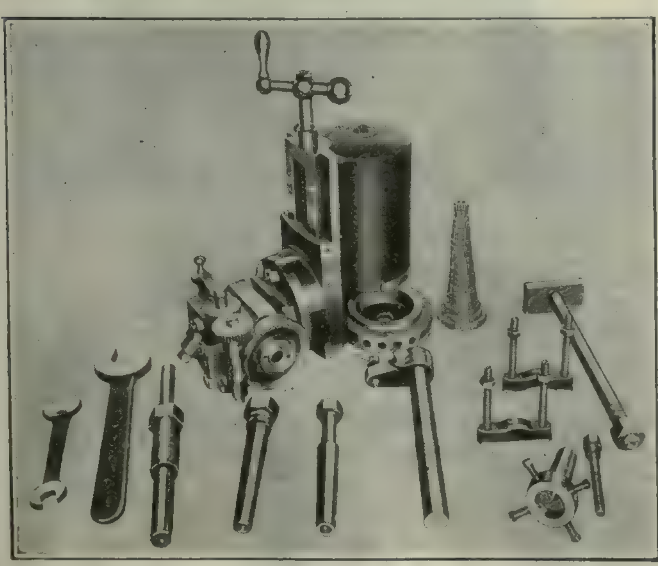


FIG. 2—PARTS OF "MILLERETTE" ATTACHMENT

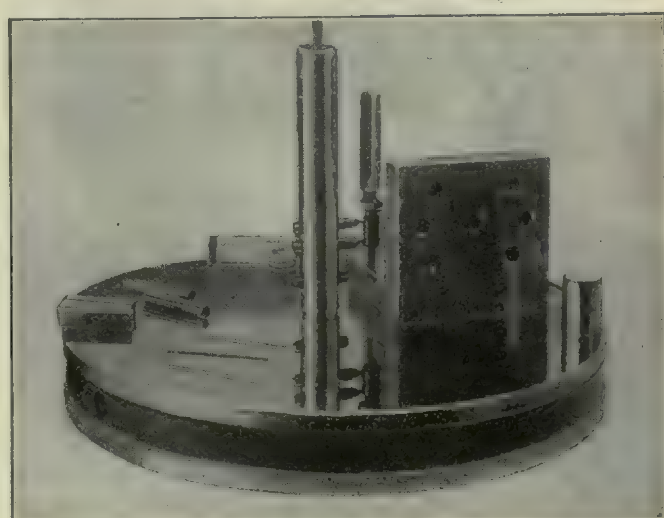
movement of the top slide and compound rest of the lathe, the down slide of the Millerette can be operated by a convenient handle. The device can be set at any angle, as both the down slide and index head turn on a swivel.

On a drilling machine the "Millerette" can be used to accurately space the holes to be drilled and to hold work requiring indexing. On planers and shapers it can be used as a dividing head. The index head in connection with the change gears furnished can be quickly set up, as only two gears are used at one time. The index plate shows the gears to be used and the required number of turns of the index handle to obtain divisions from 2 to 360. The parts of the device are illustrated in Fig. 2. Adaptability in operation and rigidity of construction are claimed for the attachment.

Van Keuren Hardened and Lapped Steel Surface Plates

The Van Keuren Co., 362 Cambridge St., Boston 34, Mass., has recently added to its line of measuring tools various sizes of hardened steel lapped precision surface plates. The accompanying illustration shows the highly finished mirror-like surface on a plate 10 in. in diameter, the reflections of the tools and the work placed on the plate being very evident. The plate is suitable for general use, as well as in the toolroom.

The lapped steel surface plates are stated to have a degree of precision far in advance of hand-scraped cast-



VAN KEUREN LAPPED STEEL SURFACE PLATES

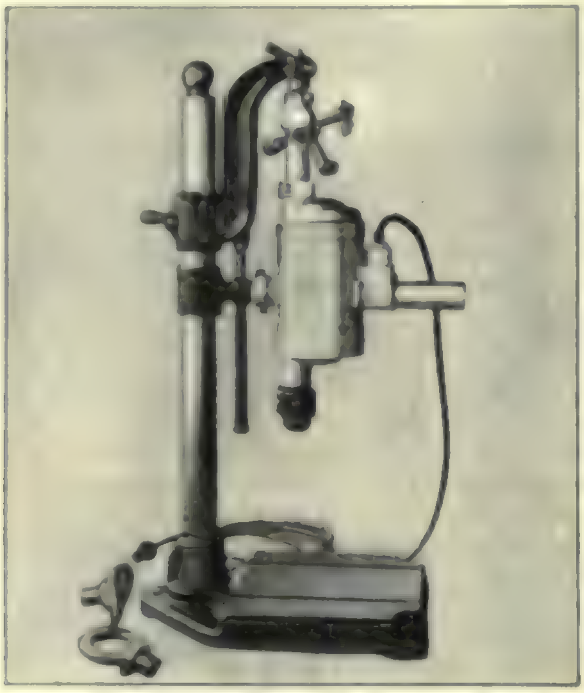
iron surface plates. They are free from the numerous hills and valleys arising from hand scraping. They are tested for planeness during manufacture by light waves. The plates are made in diameters of 5, 8 and 10 in. They are furnished with two handles which screw into the edges of the plate. A wooden box is furnished to protect the surface when the plate is not in use.

For such work as the inspection of small parts by passing them between a dial gage and a surface plate, for sine bar set-ups and for measuring work where precision gage blocks are used, the lapped surface plates have advantages over hand-scraped surfaces. Gage blocks may be wrung directly on the surface plate, and the hardened steel surface wears much longer than the cast-iron surface on the usual style of surface plate.

"Way" Portable Electric Drill and Bench Stand

The A. F. Way Co., Hartford, Conn., has just placed on the market a portable electric drill to be used in connection with a portable stand by means of which the tool can be converted into a bench or floor drilling machine.

The drill, which is a complete tool without the stand, may be used as a hand tool wherever the use of such a drill is required. The breast-plate and handle that may be seen in the accompanying illustration at the foot of the machine are instantly attachable to the drill by the same "union" couplings as are used to hold a drill to the stand. No tools are needed to attach or detach the drill from the stand and place the handle and breast-plate in position.



"WAY" PORTABLE DRILL AND STAND

The screw feeding mechanism is separate from both drill and stand, and may be used as indicated in the illustration, or may be left attached to the drill and used in conjunction with an "old man" in restricted spaces inside or under a machine in process of construction where there would be no room for the stand. Because of the right-angle mounting of the hand wheel, the feed may be used in very close quarters.

The motor, which is especially built for this tool, is of the universal type, running upon either direct or alternating current, and can be furnished for 110 or 220 volts. The motor frame and casing are of aluminum. An ample circulation of air is provided.

When mounted upon the stand the maximum distance from the chuck to the base is 14 in., and there is a quick vertical adjustment of 6 in. The machine will drill to the center of a 10-in. circle. The weight of the combined drill and stand is approximately 115 lb., and the weight of the drill separately is 21½ lb. The capacity of the chuck is ½ in. and the motor is stated to have ample power to drive a ½-in. drill in steel without overheating. All gears are of high-grade steel and heat-treated. The bearings are of bronze.

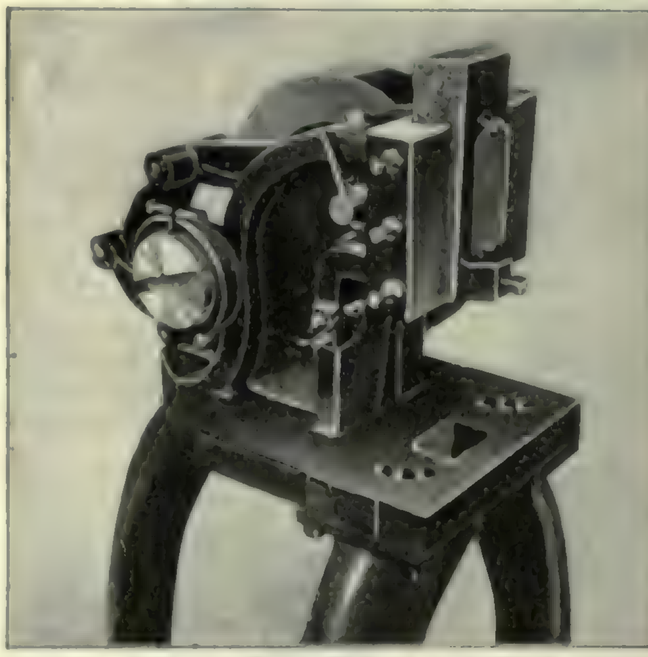
"Way" Combination Foot and Power Punch Press

The accompanying illustration shows a small press that by the changing of a single bolt, an operation which can be performed in a moment with no other tool than a screwdriver, can be converted into either a foot or power press. The machine has recently been developed and placed on the market by the A. F. Way Co., Hartford, Conn.

As a foot press it is of the pendulum type, actuated by a swinging foot-lever, or pendulum, which is permanently attached to the machine. A positive stop limits the downward movement of the ram. Changing the position of the bolt by means of which the pendulum is attached to the upper lever converts the tool into a strongly driven power press, actuated by an eccentric and the toggle levers at the rear. The change can be quickly made so that the machine can be utilized in the shop for two classes of work.

The stroke of the press is 1 in. A 2½ in. square hole through the bed allows for the passage of blanks through the dies. A surface 5 by 12 in. in size is available for attaching dies.

The vertical adjustment of the ram is by means of hardened steel packing blocks above and below the rounded end of the actuating lever, behind the movable plate to be seen in front of the ram. There are several of these blocks of different thicknesses so that they may be arranged in different combinations to give adjustment in increments of $\frac{1}{64}$ in. or less if desired. There are no screws under pressure in the ram movement.

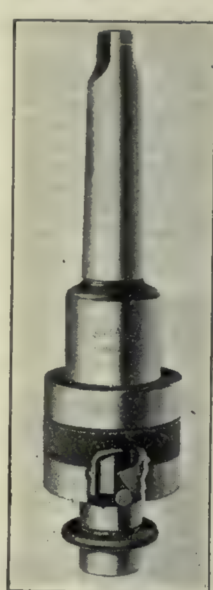


"WAY" COMBINATION FOOT AND POWER PRESS

The web flywheel is 12 in. in diameter, for a 2½ in. belt, and weighs approximately 65 lb. The clutch mechanism is actuated by the pendulum, which in changing from foot to power operation automatically becomes the trip lever or treadle. An adjustable brake stops the press in the up position upon release of the clutch. A slotted disk at the end of the shaft provides for the attachment of roll or other automatic feeds. The weight of the press is 325 pounds.

McCrosky Improved "Wizard" Quick-Change Collet Chuck

The McCrosky Tool Corporation, Meadville, Pa., has recently brought out an improved style of its "Wizard" quick-change collet chuck, the model being simpler and sturdier than the original one. The chuck consists of two main parts, one being a driving body having a Morse taper shank to fit the spindle of the drilling machine, and the other being a hardened slotted collar to hold the collet in the driving body.



McCROSKY IMPROVED "WIZARD" COLLET CHUCK

The accompanying illustration, in which the knurled collar is broken away, shows the bayonet locking slots in the collar that admit the driving lugs of the collet. The construction permits the operator to insert or release the collet with one hand without slowing or stopping the machine. Inserting the tool is accomplished by merely pushing the collet up into the revolving chuck, where the automatic latch instantly locks it.

Releasing the tool is brought about by pressing the knurled collar of the chuck so as to retard it, which action permits the collet to drop into the operator's hand. The chuck holds the same sizes and styles of collets that are employed with the former model.

Stewart Bearing Metal

The Stewart Manufacturing Corporation, 4535 Fullerton Ave., Chicago, Ill., has announced the development of metal for machine bearings. This Stewart bearing metal is an inseparable composition of copper and lead which can be remelted and cast any number of times under ordinary foundry conditions without segregation. The metal is especially adaptable for bearings where lubrication sometimes fails. Above 600 deg. F. the metal sweats lead and lubricates itself, and 1,700 deg. F. is the melting point.

On a segregation test, the metal was kept in a molten state 8 hours, cooled overnight and remelted in the morning. Three samples showed variation of less than 1½ per cent in copper content, it is stated. In a test where a 1⅜-in. shaft was run at a speed of 720 r.p.m. for one hour without any lubrication whatever, the temperature of the metal was raised to 1,000 deg. F. without scoring the shaft. Brasses made of the metal are claimed to have been in operation for three months in railroad service, where the ordinary brasses usually last from two hours to two weeks of service.

Stewart bearing metal is made in four degrees of hardness, to suit all operations and requirements. Grades B, C, D and E vary in Brinell hardness from 25 to 80, the latter being intended for heavy service. Standard bushings of the metal are made in 316 sizes, this range being calculated to meet nearly all ordinary requirements.

The metal is furnished in the form of tubes, which are finished all over and made in 13-in. length instead of the usual 12-in. length. It is claimed that this method reduces the waste very materially, because no machining need be done on the inside and outside as with the ordinary rough tube, and in general less waste results when cutting bushings whose lengths are integers of inches from a 13-in. tube than from a 12-in. tube.

Forbes & Myers Model 75 Electric Tool Grinder

Forbes & Myers, 172 Union St., Worcester, Mass., have recently placed on the market the Model 75 electric-driven tool grinder. The machine is similar in all respects to the Model 76 machine described on page 980, Vol. 56 of *American Machinist*, except for the fact that it is intended for single-phase current, while the Model 76 grinder utilizes multi-phase current.

The chief feature in the design of the grinder is that the motor has all the windings on the back side, and the front of the housing is flat. Thus, with the 6-in. wheels that are mounted on the motor shaft, three-fourths of a wheel can be worn away before the face is even with the front of the motor. The arrangement of the motor, guards, tool rests, ball bearings for the spindle and such points is the same as previously described for the Model 76 machine. If desired, the machine can be equipped with a cord and plug so that it can be operated from an ordinary lighting socket.

Two Gentle Reminders for Punctuality

By Frank V. Faulhaber

The plant that has experienced difficulty in getting its employees in on time might well consider the example set by one factory, which impresses the importance of punctuality upon its men from the very beginning of their employment. In the first pay envelope a man receives there is included a small card, with the printed motto: "Punctuality expresses earnestness of endeavor." If the new man's time card has indicated good time, there is added the encouragement in handwriting, "Keep it up!"

The new man who receives such encouragement will usually be impelled to report on time as often as possible, while to the man whose card signifies he is somewhat tardy there is thus provided a reminder that cannot but help get in its good work. The plant keeps close tab on the men's time reports and it has found that some of the tardy individuals are inclined to go out later than the others.

The executives realize, however, that it is wisest to get the men to come in on time, to go out on time, and thus to make for uninterrupted production. To those employees who seem to err there are given cards, via the pay envelope, with the suggestion: "A few early minutes are of more value than a few late ones." These two enclosures have worked wonders for the plant, bringing about better punctuality and willingly than might result from strict rulings.

There is an additional value to a brief notice in the pay envelope. It indicates to a man that he is a unit of notice rather than an overlooked cog in the plant. To the punctual employee it offers a word of appreciation, which is always welcome. The tardy employee cannot fail to realize that there is a warning, however slight, to buck up on time.

News Section

Plans Power Exposition and A. S. M. E. Convention

The National Exposition of Power and Mechanical Engineering to be held at the Grand Central Palace in New York from Thursday, Dec. 7 to Dec. 13, closing however on the intervening Sunday, is being planned in cooperation with the national societies interested in the economy of fuel and in the production and use of power generated therefrom.

The opening of the exposition in the Grand Central Palace will take place on the closing day of the annual meeting of the American Society of Mechanical Engineers, and time has been set aside in the A.S.M.E. program so that members desiring may attend the opening exercises.

In addition, the A.S.M.E. professional divisions on aeronautics, ordnance, and forest products will hold sessions of general interest to the engineering profession.

The American Society of Refrigerating Engineers is to hold its meeting at the Hotel Astor for three days commencing Dec. 5, and its members, as well as the members of the A.S.M.E. will be admitted to the exposition upon the presentation of their membership cards.

The exposition is fortunate in having an advisory committee that understands the importance of a greater popular appreciation of the engineering problems involved in the production and use of power. The committee is made up of Irving E. Moultrop, of the Edison Electric Illuminating Co. of Boston, chairman; Dexter S. Kimball, president of the American Society of Mechanical Engineers; Alexander G. Christie, chairman, power division, A.S.M.E.; Fred Felderman, national president, National Association of Stationary Engineers; Milan R. Bump, president, National Electric Light Association; N. A. Carle, vice president, Public Service Production Co. of New Jersey; E. B. Katte, chief engineer, electric traction, N.Y.C.R.R. Co.; Fred R. Low, editor, *Power;* David Moffet Myers, consulting engineer; Calvin W. Rice, secretary, American Society of Mechanical Engineers; and the managers, Charles F. Roth and Fred W. Payne, with offices in Grand Central Palace.

New A.S.M.E. Section Formed in Massachusetts

The newly formed Western Massachusetts section of the American Society of Mechanical Engineers has chosen as its chairman Charles L. Newcomb, works manager of the Worthington Pump & Machinery Co., Holyoke, and as its vice-chairman, George E. Williamson, executive engineer of the Strathmore Paper Co., Mittineague and Woronoco. The executive committee comprises A. L. Bausman, Springfield; F. O. Wells, Greenfield, and A. F. Blaisdell, Pittsfield. This section starts with a membership of about 200. It is affiliated with the Engineering Society of Western Massachusetts, representative of different branches of engineering, and out of which a number of sections or chapters of national engineering organizations are being formed, that members may become more closely in touch with the leaders in their respective engineering lines.

August Implement Exports Reach High Mark

Exports of agricultural implements from the United States during the month of August were valued at \$3,352,657. This is the first month in which exports of agricultural implements have reached the \$3,000,000 mark since July, 1921, and the value is the highest figure attained since April, 1921, in which month the exports in this line amounted to a value of \$4,081,333. During the three succeeding months, viz., May, June, and July, 1921, exports of implements were \$3,275,126, \$3,262,641, and \$3,266,860, respectively, but in no case did they equal those for August of this year. After July, 1921, exports of agricultural implements dropped very rapidly, going considerably below \$1,000,000 in both November and December of that year.

Exports for August, 1922, exceed those for the same month in 1921 by \$1,294,258. This is interesting, not only as showing an improvement in the demand for American implements abroad, but also because it is the first month since February, 1921, when the exports for any month have been greater than those for the corresponding month in the preceding year.

Esthonians Interested in American Machinery

Consul Albrecht, Reval, reports to the Department of Commerce that machinery and other products obtained from Germany at present are reported as being very frequently of inferior quality. Furthermore, it is stated that no assurances can be obtained as to price or time of delivery with reference to such goods, which generally are received at a much later period and cost considerably more than anticipated.

Indications are, the consul says, that American manufacturers might do business here with the local factories if the latter had fuller information as to their products, prices, terms of sale, and time required for delivery.

Except for one wood-working factory which placed important orders for American machinery as a result of a business trip of their representative in the United States, it is believed that none of the larger factories have ordered any machinery from America.

Ten Years' Progress in Management

As a part of the program of "Management Week" the American Society of Mechanical Engineers, the Society of Industrial Engineers and the Taylor Society held a joint meeting on Oct. 17 at the Engineering Societies Building. The title of the paper for the evening was "Ten Years' Progress in Management." It was received with a great deal of interest on the part of the large gathering and several engineers of note contributed to the discussion.

There was a distinct *American Machinist* flavor to the meeting inasmuch as the speaker, L. P. Alford, and the presiding officer, Fred J. Miller, both are ex-editors of this paper.

The object of Mr. Alford's paper was to report on the progress of management that has been made since the report of 1912, by a committee on the state of the art of industrial management at that time.

Among those who took part in the discussion were Myron H. Clark, of the U. S. Rubber Co.; Frank B. Gilbreth, of Frank B. Gilbreth, Inc.; John H. Williams, of Day & Zimmermann; Prof. Jos. W. Roe, New York University; and C. E. Knoeppel, of C. E. Knoeppel Co., Inc. Professor Roe read an English paper outlining the progress of management in that country and Mr. Knoeppel read abstracts from a German paper, showing the point of view of the Germans in regard to the development of management in that country and in the United States.

Dr. Stratton Elected to Head M.I.T.

Dr. Samuel Wesley Stratton, for twenty-one years director of the Bureau of Standards at Washington, was elected president of the Massachusetts Institute of Technology last week. He will assume the position on Jan. 1.

Dr. Stratton was born in Litchfield, Ill., in 1861, and was graduated in 1884 from the University of Illinois, where he later become professor of physics and electrical engineering. From 1892 to 1901 he was with the physics department of the University of Chicago.

Flinn Heads Engineers

Election of Alfred D. Flinn as Director of the Engineering Foundation, which is fostering organized industrial research on a nation-wide scale, was announced last week by Charles F. Rand, Chairman of the foundation. Mr. Flinn is the first incumbent of the new post, created by the foundation's Governing Board, composed of the Four Founder Societies of civil, mining, mechanical and electrical engineers.

He has been identified with municipal engineering enterprises in New York and Boston and was formerly a lecturer in Lawrence Scientific School of Harvard University.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

PRESIDENT HARDING, in his letter to Representative Mondell, published last week, said that "the national fiscal policy has been directed to arrest the rapid deflation which had set in" and that the business outlook is brighter "than at any time since the mistaken program of drastic deflation was adopted by those then in control of the government."

These statements read in connection with the reports from Washington that the President will not reappoint the man who was at the head of the Federal Reserve Board when the "mistaken program of drastic deflation was adopted" have been construed to mean that the Administration will not for the present oppose or attempt to check the credit expansion now in progress.

The logical result has been a continued advance in most commodity markets. Wheat is now about 15 cents above the lowest price recently recorded. Cotton has risen to the highest figure of the year. Rubber has sold at 23¾ cents, which is nearly 10 cents above the value when I first called attention to its subnormal cheapness in these letters. Sugar is up half a cent a pound, with every prospect of advancing further when the Cuban loan is arranged. Wool is firm and higher all over the world. So are silk, hides, leather, iron, steel, tin, tobacco and most basic commodities.

There has been a seasonal slackening in the demand for gasoline, as well as for lumber, brick and other building materials, copper still reflects Europe's inability to buy freely and a severe decline threatens a heavily overstocked egg market, but these are the only important exceptions to an upward tendency that is noticeable in nearly every department of domestic trade. That it is likely to continue is to be inferred from the fact that there has been no anticipatory buying as yet. Merchants are still cautious. Stocks are light. They have to be continually replenished and replacement orders are a sustaining and stimulating influence.

But notwithstanding the buoyancy of the commercial markets generally, bonds, including all Libertys, except the 3½s, are lower and the stock market has become spotted and irregular despite the fact that the 500 million Government bonds offered at 4¼ per cent were three times oversubscribed and the continued declaration of stock dividends by the Standard Oil companies and several other corporations that have taken similar action.

The money market meantime continues to harden and the gradual absorption of floating capital is indicated by higher rates for both call and time loans.

These developments all reflect what is called inflation by some and prosperity by others, but whatever it is called I see no reason to change my prognosis of last week, which was for a further and extended rise in commodity prices and a period of liquidation in most bonds and stocks except those of the railroad companies whose earnings will be increased by the activity of business.

I am not shaken in this view by the factitious activity of some of the highly speculative oil stocks and I am confirmed in it by Henry Ford's announcement that he has made a cut of about $50 in the price of all his cars. This may mean a war in the automobile trade that only the fittest will survive.

> **The graphic chart of business movement appears to indicate that a critical stage has been reached in the recovery from the depression of 1920-1921. Disturbing factors are beginning to appear. Rivalry to secure labor and materials is rapidly bidding up prices on commodities and wages. The situation calls for clear thinking to avoid disaster. Distinction must be made between an expansion resulting from steady, healthy growth and that sort of expansion which results from temporary hysteria and eagerness to reap big and quick profits.**

The automobile securities now listed on the New York Stock Exchange and the Curb represent values that run into the billions and any serious reduction in the profits of the motor trade is sure to be reflected by a decline in the motor stocks.

The incident is an apt illustration of the way in which markets that are "over bulled" may receive a blow from an unexpected quarter.

The other news of the week is not especially significant. The coal problem is being well handled. Production is large and the distribution is being fairly controlled. An acute shortage anywhere seems unlikely, but economy and forbearance will be necessary. The railway congestion is unrelieved and the steel industry is somewhat hampered by it.

The weekly statement of the Federal Reserve System shows a reduction of ½ of one per cent in the reserve ratio, which now stands at 75.2. Rediscounts show a gain of $24,000,000, as might have been expected from the increased activity at rising prices in the commodity markets. The gold on hand shows a reduction of $3,000,000, which is probably due to the efforts that are being made to put "yellow backs" into circulation.

Great Britain has paid $50,000,000 on account of the interest due on her debt to our Government.

Secretary Hoover's speech at Toledo has attracted much attention. In his opposition to the suggestion that we should forgive any substantial portion of the debt due us by the other Allies it is assumed that he spoke for the President.

The political fight in which Lloyd George is engaged is watched with much interest here, but its issue is not likely to have any immediate effect upon business in this country.

Economic conditions in Europe seem to be improved and sterling exchange advanced early in the week, although it weakened when the British Cabinet resigned.

Francs are lower and marks show no rallying power as the printing press continues to turn them out at the rate of about five or six billion a day. The total amount outstanding Oct. 14 is put at 375 billions, but the figures have ceased to be significant. It is reported that the German government will shortly issue gold notes or certificates against the 1,005,000,000 gold marks held by the Reichsbank and that these will be used to buy up paper marks at about present prices.

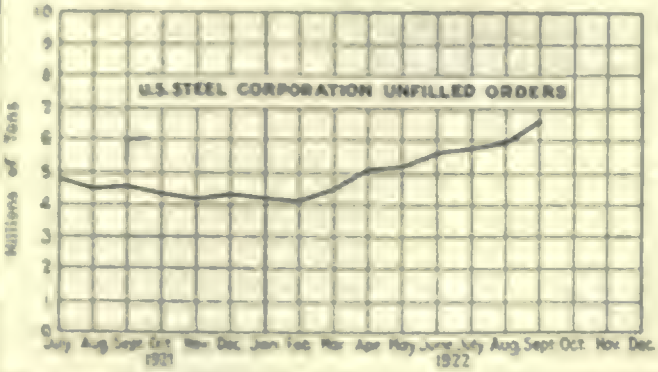
This is the policy followed by our own United States government during the Civil War when both gold and paper money were in circulation. It might work if Germany's credit was good enough to enable her to draw additional gold, but 1,005,000,000 marks, equal to only about $240,000,000, won't go very far and it is to be feared that the new currency if issued will be hoarded and soon disappear.

Conditions in Russia are rapidly mending if the news from there is to be credited, and in the Balkans and the nearer East there is an unusual approach to comparative tranquility. In Latin America also the outlook seems to be improving and the shares of the Argentine railways have advanced quite sharply in London upon the prosperity reported in the country they serve.

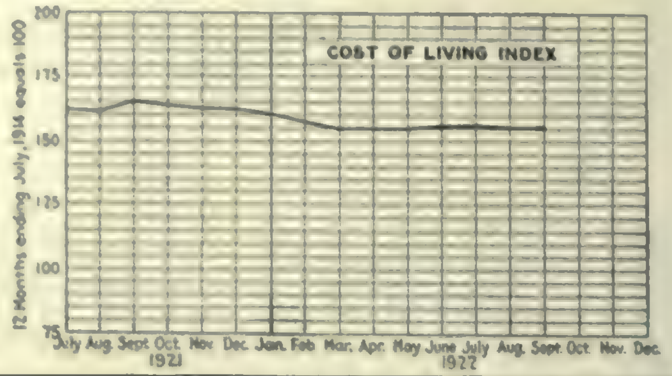
A higher barometer and clearing weather is in fact reported from all over the world and for the present at least the trade winds are favorable and it seems safe to carry a fair spread of canvas in foreign as well as domestic waters.

Replies received from a questionnaire recently sent out by the American Manufacturers Export Association to a large number of firms engaged in foreign trade carry a distinct note of optimism, and indicate a general increase in the size and number of orders from abroad.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the U. S. Steel Corporation on September 30, 1922, totaled 6,691,607 tons, as compared with 5,950,105 tons on August 31, of the current year. The September figure represents the highest point reached since February, 1921. This increase in tonnage over August, amounting to 741,502 tons is the largest increase recorded for any single month of the current year. The great demand for fabricated steel for construction purposes, coupled with heavy railroad buying accounts in a large measure for the increase.

Cost of living among wage earners' families in the United States on September 15 was 55.6 per cent higher than in July 1914, according to figures collected by the National Industrial Conference Board. Between August 15 and September 15 there was an increase of seven-tenths of one per cent. The changes in the budget within the month were slight increases in both clothing and food prices and a continued increase in fuel prices resulting from an unstabilized coal market. As compared with the high point reached in July, 1920, figures for September, 1922 represent a drop of 48.9 points or 23.9 per cent.

Metal product share markets, in keeping with industrial issues generally, held up well during September, the average price of ten representative issues being $77.23 per share as compared with $75.65 in August.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0295	$0.0285	$0.0273
Cold finished shafting	per lb.	0.0378	0.0373	0.0379
Brass rods	per lb.	0.171	0.1700	0.148
Solder (½ and ½)	per lb.	0.23	0.228	0.20
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	40-5% @50%	40-5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65-10%	50%@ 60-10%

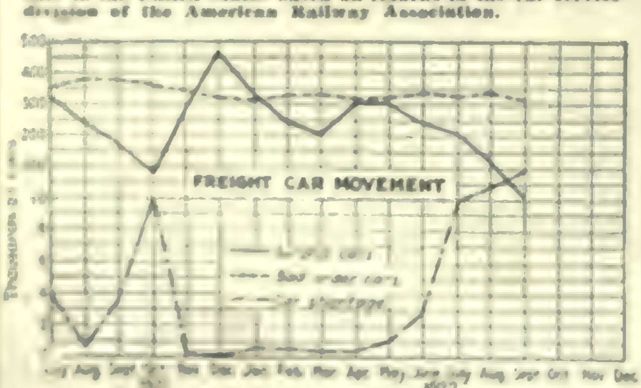
The agricultural implement industry shows marked improvement with an encouraging export demand. Electrical companies have, within the past three months, booked a very large volume of business, and a general betterment is reported in other issues.

Railroad rolling stock condition at the movement is the center of considerable attention and no little concern. The car shortage for the weekly period which began on August 23 and ended on August 31 was reported as 58,670 for American roads. By September 30, the shortage had reached 138,170 cars. The average for each weekly period of September amounts to about 100,000 cars. Car surplusage shows a corresponding decline from 70,455 cars on August 31 to 6,593 cars on September 30, an average for the month of about 21,000. Cars in bad order have decreased. On September 1, the total freight cars of all classes reported in need of repairs numbered 321,674 or 14.1 per cent of the total on line. By October 1, this class of cars had fallen to 291,654 or 12.8 per cent of the total.

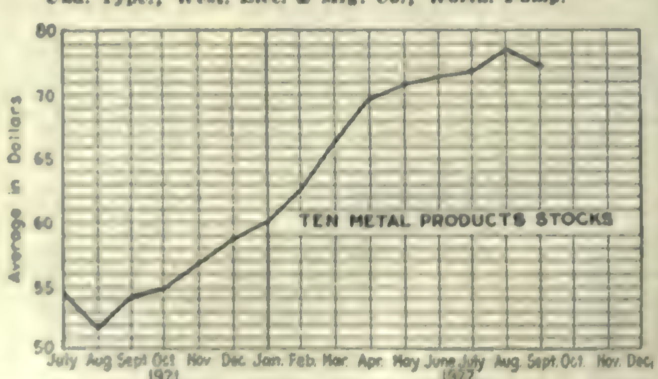
Reserve ratio of the Federal Reserve system for the week ending October 18 amounted to 75.2 per cent as compared with 75.7 per cent in the week previous. The Bank of England in the same period reports a ratio of 19.93 per cent, 19.97 per cent being the year's high point.

American foreign trade for September shows exports valued at $317,000,000 as compared with August of $301,804,618. Imports total $232,000,000 as against August total of $281,411,705, an excess of exports of $85,000,000.

Monthly average of car shortage, surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can.; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



S.I.E. Annual Convention

Beginning with registration on Wednesday morning October 18th, the Society of Industrial Engineers, at its ninth Annual Convention, carried through a large and important program that was concluded by the Friday evening meeting devoted to the subject of materials handling. In connection there was held an equipment exhibition at which machinery of various types, particularly interesting to managers, was shown.

Officers elected for the coming year were: President, Joseph W. Roe, head of the department of Industrial Engineering, New York University; treasurer, F. C. Schwedtman, vice-president, National City Bank, and George C. Dent to the office of secretary and business manager.

The subject of the entire convention was "Economic Industry—Fundamentals Necessary to Obtain Maximum Production with Minimum Waste of Effort and Cost." The individual subjects taken up were: Relation of Economics to Industry, Economics part in the Formation of a Policy of Business Administration. The Economic Background Necessary for a Business Executive, The Relation of Fatigue Elimination to Other Activities, The Budget and the Financial Forecast, The Importance of the Elimination of Waste to the Economic Structure, How Can We Reduce Production Costs? What Keeps Workers Contented? The Relation of the Economists to Business, Finance and Industrial Economics, The Measurement of Management, Industrial Accounting, Reducing Sales Costs, The Scientific Selection of People for Jobs, Economic Aspects of production, and Materials Handling.

Tests for Applicants

The Industrial Relations Division, under the chairmanship of Earl B. Morgan, Manager of the Employment and Service Department of the Curtis Publishing Company, had an extremely interesting session. Mr. Morgan pointed out the value of having a pleasant stage setting for interviewing applicants for positions. By putting the prospective employee at ease and treating them courteously, you can find out much more readily if they are the kind you can use to best advantage. Many a concern makes innumerable enemies by ill treating applicants for positions and this frequently reflects on the business in unexpected ways. Courteous treatment on the other hand makes a friend of the applicant even if there is no position for them. And firms with the reputation of fair treatment get the best employees, for the best employees pick employers as well as employers picking the employees.

Mr. Morgan is much more impressed with practical tests than with written examinations. Standard questions are soon learned by floaters and these, most undesirable workers frequently pass such tests higher than the men you want. He also decried the idea that there should not be honest and healthy competition for employees as well as for business. If a man is worth more to you than his present employer is paying him, both you and the man have a perfect right to get together.

Miss Louise Moore, Employment Director for the Dutchess Mfg. Company of Poughkeepsie, brought out a number of interesting points such as the desirability of watching the kind of people who work well together. One class in her vicinity is very rapid but not quite so accurate as another class which is less speedy. She finds good results in mixing these classes in different departments rather than having either predominate in any one place.

In the same way great care should be taken in sending workers to different foremen. Certain kinds of foremen get along best with men of one type, other foremen prefer entirely different kinds of men. In the past much stress has been laid on preventing labor turnover, which is of course very expensive. And yet it is even more important to get the different people sorted into their proper jobs, where they can develop if possible and where they can earn the most for the company and for themselves.

Several means of reducing production costs and keeping workers content were described by Messrs. J. A. Faust, Wm. Geiger, Chas. Cheney and O. L. Prible on Thursday afternoon. Perhaps the most strongly emphasized factor was the disastrous effect of cutting prices. Discussion on this point brought out the fact that the sentiment against this practice was unanimous.

Frederick E. Rein of Philadelphia speaking of the measurement of management showed conclusively how measurement was accomplished in the dairy industry. The discussion that followed indicated that there is considerable hope that some day there will be established a unit which will permit the measurement of management, and production as well, in all industries. There was no claim made that any such unit has been discovered but the conclusions expressed indicated that many are thinking along that line. It was recognized that the difficulties of measuring management are many when compared with the difficulties of measuring the accomplishments of individual workers. Suggestions were made that it would be advisable to give more attention to the measurement of the efficiency of supervision and indirect labor.

At the Friday afternoon session Ernest F. DuBrul, General Manager of the National Machine Tool Builders' Association, gave one of his clear expositions of economic fact and theory which have made him so popular a convention speaker. Among other things he brought out the difference between the demand catered to by manufacturers of consumer goods and that supplied by makers of producer goods such as machinery. The other speaker was Dr. Arthur J. Todd, Director of Labor, B. Kuppenheimer & Company, Chicago whose topic was "The Industrial Age."

Dr. Richards Inaugurated President of Lehigh

Before an audience of delegates from other colleges, alumni and undergraduates of Lehigh and friends of the University which crowded the spacious Packer Memorial Chapel, Dr. Charles Russ Richards, former Dean of the College of Engineering of the University of Illinois, was inaugurated president of Lehigh University, at its annual Founder's Day celebration held in Bethlehem, Saturday, October 14.

Implement Makers Discuss Railroad Situation

Enactment of a law placing railroad employees in a preferred class, with wages fixed periodically upon a slightly higher basis than those paid in other industries, but predicating the passage of such a measure upon making railroad strikes a felony and upon granting to the railroads a fixed rate of return upon their property values were among recommendations for a possible solution of the carriers' difficulties, made last week by W. H. Stackhouse of Davenport, Iowa, speaking at the twenty-ninth annual convention of the National Association of Farm Equipment Manufacturers, in Chicago.

"Such a measure should effectively protect the country from a repetition of the disastrous strike through which it recently passed, and usher in an era of comparative tranquility in so far as the nation's railroad transportation industry is concerned," Mr. Stackhouse maintained, especially "if employment would at all times be open to men and women of proper qualifications, regardless of their affiliation or non-affiliation with any organization whatever."

Speaking on "Industrial Freedom," he referred to the situations in the coal and railroad industries, pointing out the peril to the public in the use of force in industrial disputes and in the "dangerous method of securing special privilege through the medium of group legislation," under threats of political extinction.

The address of Mr. Stackhouse, the keynote speech of the convention, was received enthusiastically by the 461 delegates present and brought to a close one of the most successful conventions in the history of the association.

Other addresses during the convention were: The Transportation Problem of 1922, by C. H. Markham, president, Illinois Central R.R.; Our Mutual Problems, by R. H. Lathrop, president, National Federation Implement Dealers' Association; Rotation in Trade, by Guy H. Hall, Chicago; European Conditions, by G. A. Ranney, International Harvester Co.; The Present and Future of the Implement Industry, by F. R. Todd, vice-president, Deere & Co.; Depreciation, by T. F. Wharton, Deere & Co.; The Implement Trade Press, by L. C. Pryor, editor, *Farm Implements and Tractors;* Simplified Practice in the Implement Industry, by Wm. A. Durgin, Department of Commerce; The Dealer as an Asset, by Grant Wright, Eastern Federation of Implement Dealers; and, Agricultural Conditions in America Today, by James R. Howard, president of American Farm Bureau Federation.

Officers elected for the ensuing year were: President, J. B. Bartholomew, president, Avery Co., Peoria, Ill., and F. R. Todd, vice-president of Deere & Co., was elected executive chairman.

August Electrical Exports Show Slight Decline

Shipments of electrical equipment from the United States during August show a slight decline as compared with the previous two months, the decrease from the July total being approximately $300,000.

Death of John Bergone Foote

Those who attended the last convention of the American Gear Manufacturers Association can hardly realize that John Bergone Foote is no longer with us. He died suddenly Oct. 14, but four days after presiding as toastmaster at the A. G. M. A. dinner on the 10th. Born in Chicago in 1865 he attended the public schools until he was 14 and then went to work for the Chi-

cago Stamping Co. as a die setter. Following the metal stamping business he became foreman of the press and stamping room of the Cragin Manufacturing Co. at the age of 17, after which he turned his attention to lathe work, finishing the die and tool making trade when he was 21. From there he went to Norton Brothers which afterward became the American Can Co., as die and tool maker.

In 1887 and 1888 he was superintendent of the Cragin Manufacturing Co., leaving there to take charge of the machine shop of the American Can Company where he remained until 1893. He then became a designer and builder of special machinery for the Fisher Manufacturing Co., but the same year, 1893, entered a partnership with D. O. James to manufacture cut gears. A disastrous fire wiped out everything but the good will the next year and he then organized the Foote Bros. Gear and Machine Co. The building of that organization from a heap of ashes to a two million dollar concern was an achievement of which Mr. Foote was justly proud, and stands today as a fitting monument to his genius.

Ever since the organization of the American Gear Manufacturers Association, Mr. Foote was active in its behalf, being a director at the time of his death. His last work for the association was the preparation of a report on apprenticeship, in which he was deeply interested. In addition to his gear interests, he was also a director in the Barton Spider Web Re-Enforced Concrete System, President and Director of the Illinois Tractor Co., a member of the Society of Automotive Engineers, Illinois Athletic Club, the Oak Park Elks and treasurer of the Butterfield Country Club of Oak Park. He will be greatly missed, for he was always an active participant at all conventions.

Alabama Pig Iron Output Reaches Record

Pig iron production in the Alabama district, the Southern Metal Trades Association advises, is now on a basis of about 205,000 tons per month, the highest point in more than two years. It has increased steadily from month to month since the first of the year, and October melt will be the biggest month of 1922 to date. The outlook for 1923—the early part of it at least—is the brightest since the inflation period immediately following the World War when production was at the highest point in history all over the South. Furnace companies are well sold ahead and orders for early 1923 delivery are being received in far greater volume than up to this time in 1920 or 1921.

Prices also are continuing to climb steadily, some change having been noted each week for the past two months. Quotations are at $30 per ton for No. 2 foundry iron, though it is being purchased by the regular buyers at around $28.50. Quite a few sales at these prices have been made for 1923 delivery. No decline in prices is looked for in the immediate future.

The association also advises that iron and steel conditions are now generally better over the entire South than they have been in the past two and a half or three years, with the outlook giving promise of 1923 as a normal year. Furnaces are operating steadily outside the Alabama district with plenty of business to insure a steady activity.

Export business in iron and steel products out of southeastern ports also has been picking up considerably of late, and a considerable tonnage of miscellaneous products is going to Latin-America and to far eastern countries, principally machinery of various types.

Goodson Sees Great Opportunity Abroad

B. F. Goodson, president of the American Equipment Co., Detroit, Michigan, who recently returned from a tour through England and France, says that the industrial conditions there are in such a state that the manufacturers of the United States have an exceptional opportunity for capturing the foreign trade. He states that the labor element, which is very strong, has secured the passage of laws that provide for the payment of a weekly stipend to unemployed workmen, with the result that many of them only perform enough labor to retain their membership in the unions. Industry is practically paralyzed and conditions are growing worse instead of better. Mr. Goodson's statements are based on a study of conditions in the districts of London, Manchester, Birmingham and Paris, in each of which he spent some time.

Mr. Goodson also says that the German machine tool manufacturers are selling on terms of one-third c.o.d. and the balance to be paid in small payments extending over a period of two years. This is their bait to the South American countries and with which they expect to win trade away from the United States. Their prices are much lower than American prices and they are copying everything of value.

Business Items

The Skelton Shovel Co., Inc., Dunkirk, N. Y., is building a factory in that place to manufacture a complete line of solid shank one-piece shovels and expects to be in production by February, 1923.

The Traylor Engineering and Manufacturing Co., Allentown, Pa., has enlarged its plant in that city for the purpose of consolidating its truck and spring business.

The Peerless Machine Co., Racine, Wis., has moved into new and larger quarters at 14th and Clark Streets, that city, in order to accommodate the expansion resulting from the sales of its universal shaping saw.

The Clayton Manufacturing Co., Bristol, Conn., manufacturer of steel shears, etc., has recently increased the capital stock of the concern from $100,000 to $150,000.

The Fisher Body Corporation will begin work in Janesville, Wis., on a building containing 96,000 square feet of floor space, for the construction of from 100 to 150 bodies daily.

The U. S. Government will construct at Hoboken the largest pier at any port in the United States for the accommodation of the giant liner Leviathan.

The Chevrolet Motors Co. will erect a one-story building at Janesville, Wis., for the assembly of its cars, the plant to be 500 by 125.

The Atlantic Coast Line Railway has awarded contracts for double-tracking from Bennett, S. C., to Doctortown, Ga. The company placed an order for 30,000 tons of steel rails.

Pollard Bros., Chicago, manufacturer of steel bench legs, benches of all kinds, bar stock racks, lawn and porch furniture, have outgrown their present quarters and are moving to larger quarters. Their new address will be 3670 Milwaukee Avenue, Chicago, Ill.

The Westinghouse Electric and Manufacturing Co. announces the transfer of the Krantz works, Brooklyn, N. Y., to Mansfield, Ohio.

The Ford Motor Co.'s new Green Island plant, according to an announcement from Albany, New York, is expected to be completed during October and ready for the installation of machinery.

The Bethlehem Steel Corporation will spend immediately $15,000,000 on its newly acquired Lackawanna Steel Co. plant in Buffalo.

The Mack Trucks, Inc., for the third quarter of the current year will show net earnings of $1,315,633 after taxes and charges, or $3.64 per share on the common stock after preferred dividends.

The Automatic and Electric Furnaces, Ltd., London, England, announces that owing to the increased demand for the Wild-Barfield Electric Hardening furnaces, it has been compelled to seek larger quarters and on and after Oct. 1, the company's new address will be: Automatic and Electric Furnaces, Ltd., Elecfurn Works, 173-175, Farringdon Road, London, E. C. 1.

The American Locomotive Co. is planning the erection at its Schenectady

plant a large shop for the construction of mechanical parts of locomotives and for packing engines for foreign shipment.

The Central Foundry Co. plant at Holt, Ala., known as Plant No. 3, was damaged by fire this month, the loss amounting to more than $50,000, largely covered by insurance.

The Fleming Machine Co., Springfield, Mass., is increasing the production of its new valve grinder, which is equipped with two motors, with size reduced to two square feet and weight to 100 pounds. The output is about to be increased to ten a day. Sales agencies are being appointed in every state and numerous foreign countries.

The Spartan Saw Works, Springfield, Mass., has filed plans for a new factory building in Fisk Avenue, to cost $14,000.

The Gilbert & Barker Manufacturing Co., West Springfield, Mass., continues to operate three eight-hour shifts a day, including Sunday, in all departments, and it is stated that orders are sufficient to assure this plan of operation for the rest of the year.

The L. S. Starrett Co., Athol, Mass., having sold the bulk of stocks accumulated at the beginning of the dull season, has advanced its production schedule to four days a week, this applying to all departments except the hack saw works, which run on full time.

The New Home Sewing Machine, Orange, Mass., has posted a notice of an increase in wages averaging about 10 per cent in the various departments.

The Southern Sheet Metal Co., organized recently with W. M. Blecker as president, is planning the establishment at Chattanooga, Tenn., of a steel mill consisting of an eight sheet plant, and three sixty ton open hearth furnaces. The estimated minimum capacity of the plant will be 55,000 tons per year. The company will be capitalized at $1,100,000, and W. J. Lynch, vice-president, is now in Chattanooga conferring with capitalists relative to the establishment of the plant.

The National Cast Iron Pipe Co., of Tarrant City, Ala., plans to remodel and enlarge its plant, the work to be carried out within the next few weeks. Considerable new machinery is to be installed in the shops.

The Brown Instrument Co., manufacturers of pyrometers and other recording devices used in industrial plants, announces that a southern district office has been established at Birmingham, Ala. The Birmingham office is in the Brown-Marx building, the district being under the management of Charles L. Saunders. An ample stock will be carried at Birmingham to supply the company's trade in the southern territory.

The Roane Iron Co., of Rockwood, Tenn., a few days ago suffered a loss of more than $100,000, when fire of unknown origin swept the plant. The loss was largely covered by insurance and the destroyed unit probably will be rebuilt before the end of the year.

The Precision and Thread Grinder Manufacturing Co., 1 South Twenty-first St., Philadelphia, Pa., manufacturer of the multi-graduated precision grinder, thread lead variators and permanent alignment wheel trueing heads, which was recently acquired by A. T. Doud, president of the company, announces the appointment of William H. Frick as chief engineer in charge of engineering, development and service departments. D. F. Bruce, formerly with the McCambridge Co., as superintendent, has been appointed superintendent in charge of manufacturing and production.

The General Electric Co. for the three months ending Sept. 30 reports that orders have been 42 per cent greater than for the corresponding three months in 1921, according to a statement to the stockholders made public by Gerard Swope, president.

The Pittsburgh Steel Co. and subsidiary companies for the fiscal year ended June 30, 1922, shows in its report a net income for the year of $861,833.28, after charging off for depreciation and depletion $866,000, reduction of inventory values $65,000 and including in operating costs $1,547,000 for maintenance, repairs and replacements.

The Moon Motor Car Co. has declared a quarterly dividend of 25 cents per share on its common stock payable Nov. 1.

The Austin-Western Road Machinery Co., Chicago, has absorbed the Wilson Tractor Manufacturing Co., Ottumwa, Iowa.

The General Piston Ring Co., Indianapolis, Ind., is the new name for the company formerly known as the Teetor Manufacturing Co.

The Hillman-Ayers Manufacturing Co. has been incorporated in Kansas City, Mo., with a capital of $5,000, to manufacture, deal in and with, gas generating oil burners of every description, furnaces, heaters, parts, devices, accessories, machinery, tools, apparatus, novelties, metal products, fabricated goods, materials and fuel. The incorporators are: J. P. Hillman, W. B. Laughlin, A. A. Hillman, all of Kansas City.

The Allis Chalmers Manufacturing Co. has declared its regular quarterly dividend of 1 per cent on the common stock, payable Nov. 1.

The Binghamton Foundry and Machine Co., Binghamton, N. Y., is the name of the new company resulting from a merger of the Shapley & Wells foundry and the plant of McGill & Holford, both of that city. The new company has a capitalization of $250,000.

The Hupp Motor Car Corporation has declared its regular quarterly dividend of 2½ per cent on the common stock payable Nov. 1.

The Bridgeport Motor Co., Inc., manufacturer of marine motors and reduction gear equipment, etc., Bridgeport, Conn., has recently been reorganized. Henry H. Brautigan, general manager of the factory since 1900, has been made president and general manager of the new concern, and R. S. Hanover, of New York City, has been chosen secretary. The new company will have a capital stock of $100,000, and one of the new policy features will be the standardization of its product.

The Republic Iron and Steel Co. reports for the quarter ended Sept. 30, a deficit of $138,676, after taxes and charges. This compares with net profits of $86,382 in the previous quarter and a deficit of $1,398,410 in the third quarter of 1921. Unfilled orders on hand as of Sept. 30, of finished and semi-finished products totaled 199,431 tons, against 196,886 tons on June 30, and 69,577 tons on Sept. 30, 1921.

R. G. Haskins Co., manufacturer of flexible shaft equipment and portable tools, will move into larger quarters November 1 at 516 W. Monroe St., Chicago, Ill., which will give them increased store space for the display and demonstration of their machines as well as larger facilities for handling the routine of their business. A display room will be maintained where machines can be tested out on a great variety of actual operations.

The Western Iron Stores Co., Milwaukee, Wis., of which John Camm is president and general manager, is making extensive alterations and improvements to afford display facilities for greatly increased exhibit of machine tools and shop supplies.

American Radiator Co. has declared an extra dividend of 50 per cent in common stock on the common stock payable Dec. 30, to stock of record Dec. 15.

The Auburn Brass Foundry, Cranston, R. I., has recently been established by Axel W. and William Bergman, at 258 Wellington Ave., Cranston, to engage in the brass founders business.

The Connecticut Industries Co., Bridgeport, Conn., has recently been incorporated under the laws of Connecticut, to engage in the general manufacturing business, etc., with a capital stock of $100,000. The incorporators include Edward J. Kelly, Fairfield, Conn.; C. H. Sheehan, Bridgeport; and David S. Day, 886 Main Street, Bridgeport.

The Union Plane Co., New Britain, Conn., has recently been incorporated under the laws of Connecticut, to manufacture and deal in planes, tools, hardware, etc. The capital stock is $50,000, and the incorporators are: A. F. Corbin, 99 Vine St.; H. H. Wheeler, 28 Forest St.; and C. S. Newman; all of New Britain. Officers chosen are: president, A. F. Corbin; vice-president, C. S. Newman; secretary and treasurer, H. H. Wheeler.

The French Manufacturing Co., manufacturer of small tubing, etc., Waterbury, Conn., during the past week filed a certificate with the Secretary of the State of Connecticut, increasing the capital stock of the concern from $100,000 to $400,000, issuing 3,000 additional shares at $100 par value.

Personals

W. A. CREIDER has recently become affiliated with the Federal Machinery Sales Co., Chicago, and will cover the Milwaukee territory.

FRANK FRISCH has taken over the Milwaukee and Wisconsin territory, in addition to the Chicago district for the Courtland emery wheel.

T. G. REMSEN, formerly of Hill-Clark Co., has recently joined the organization of the Federal Machinery Sales Co., Chicago, Ill.

LOUIS W. BYRNE, formerly with Burton Griffiths and Co., Ltd., New York

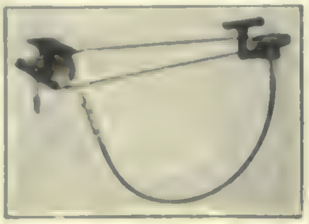
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Flexible Shaft Outfit, Type NK45

Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn.

"American Machinist," August 31, 1922



The outfit is intended primarily for driving screws. It is arranged for over-head mounting, but can be secured to the bench or wall. When the screw-driver is employed in the vertical position the bracket is ordinarily mounted on the ceiling, but for horizontal work it is mounted on the wall. The counter-shaft is equipped with tight and loose pulleys and with a lever-operated belt shifter. A ball bearing swivel connection can be furnished for high speeds. The style of flexible shaft and hand piece needed can be provided. The finder sleeve can be furnished to fit the screw that is being driven.

Sander, Disk, Portable, Motor-Driven, 9-Inch

Syracuse Sander Manufacturing Co., Inc., Syracuse, N. Y.

"American Machinist," September 7, 1922

The machine can be fitted with garnet paper disks for sanding wood and grinding brass and aluminum, as well as with emery cloth for iron and steel. It can be connected to any convenient light socket, being furnished with a motor to suit the type of current available. The disk is driven directly by a ½ hp. G.E. enclosed motor running at 1,725 r.p.m. and controlled by a tumbler switch. The table is equipped with a graduated angle gage. The head is mounted on a pedestal by a swivel joint. A canvas bag is attached to the table for catching the dust thrown from the disk. Table: size, 5½ x 10 in.; height, 38 in.; tilt, 45 deg. down, 15 deg. up.

Metal, Cutting, Non-Ferrous, "Diamond Alloy"

Kent-Owens Machine Co., Toledo, Ohio, maker;

P. H. Biggs, 1235 W. 9th St., Cleveland, Ohio, sales agent.

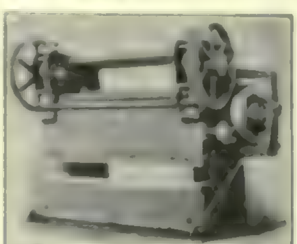
"American Machinist," September 7, 1922

The metal is composed of chromium, molybdenum and tungsten, producing a hard, fine-grained, homogeneous alloy. It possesses an unusual degree of resistance to wear, and heat resisting quality, and is also non-magnetic. It can be cast in permanent molds into milling cutters, end mills and reamers; and requires only a grinding operation but no heat treatment. It can be cast around a tough steel center, or can be welded to steel. The "Super" tool-holder holds the gradually tapered shank of the cutter bits made of the metal. It is made in nine different sizes, the section ranging from ¼ x ⅝ in. up to 1¼ x 2¼ in. in size. With a single-point bit, the tool can be adapted as a right-hand, straight or left-hand tool.

Brake, Press, Power, All-Steel

Cincinnati Shaper Co., Cincinnati, Ohio

"American Machinist," September 14, 1922



The strength and ease of operation are the chief features. The steel plates used for the frame and large members are electric welded [illegible]. The machine is made in [illegible] with the [illegible]. With the [illegible] bends can be made near the edge of the plate utilizing the full length of the [illegible] surface. The machine operates at a greater number of strokes per minute [illegible]. The flywheel is mounted on high-duty ball bearings [illegible]. The clutch is of the multiple-disk type operating in oil. The brake is built in capacities of from 80 to [illegible] tons and for working material from 16 gage to ½ in. thick.

Breaching Machine, Hydraulic, High-Speed

Oilgear Co., Milwaukee, Wis.

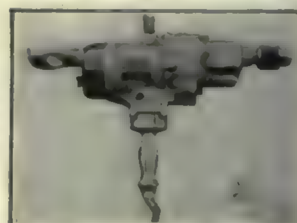
"American Machinist," September 7, 1922

A standard type-MD, variable-delivery pump delivers a steady flow of oil to a double-acting cylinder, whose piston rod is connected to a sliding head. The speed of piston travel can be changed by changing the pump stroke. The speed of the return stroke is adjustable independently of the cutting stroke. Automatic stops can be set for any desired length of stroke. Reverse is operated by a small push-button or by automatic control. The machine is driven by vertical belt from a lineshaft or by a motor. Pulling capacity, 16,000 lb. Speed range, 48 to 360 in. per minute. Stroke, 56 in. Motor, 10 hp. Floor space, 16 ft. x 26 in. Weight, 2,900 pounds.

Drill, Electric, Portable, Reversible, "Independent"

Independent Pneumatic Tool Co., Chicago, Ill.

"American Machinist," September 7, 1922



In the drill, the direction of motion is reversed mechanically. The reversing gear is equipped with a locking device which can be shifted to give three different motions. The locked constant forward motion is for drilling, reaming, stud driving, nut tightening and tube rolling; the locked constant reverse motion is for backing off nuts and backing out studs and tube rollers; and the neutral position allows the spindle to slip into the forward motion when the machine is pressed forward against the work and to slip into the reverse motion as the machine is withdrawn from the work. The reversing mechanism is adaptable to both electric and pneumatic tools.

Drilling Machine, Rotary-Table, Box-Column, 20-Inch

Rockford Drilling Machine Co., Rockford, Ill.

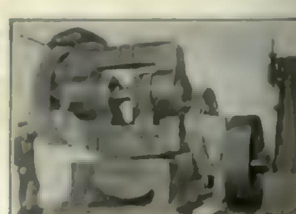
"American Machinist," September 7, 1922

The upright drilling machine is especially fitted for multiple-operation work on small parts. It is driven through a silent chain from an electric motor. The speed is changed by interchangeable pick-off gears and four changes of feed are provided by means of a gear box. A four-station rotary table having an indexing plunger worked by a treadle is applied to the regular table, and is indexed by hand after the locating plunger is pulled out of position. The table carries four two-jaw chucks, which are aligned under three work spindles, so that three operations are performed simultaneously.

Shear, Plate, 48-Inch

Reading Iron Co., Scott Foundry Dept., Reading, Pa.

"American Machinist," September 14, 1922



This shear has the capacity for 1-in. steel plate 48 in. wide. It is arranged for either steam engine or electric motor drive. The 11-in. diameter camshaft is equipped with an automatic releasing clutch. This clutch can be used either for stopping at every upstroke, thus leaving the shear open for inserting the plate, or else the machine can be operated continuously, at the will of the operator. Weight, 55,000 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

City, has been appointed sales manager of the Wilmarth and Morman Co., Grand Rapids, Mich., manufacturer of grinding machines.

H. L. SEVIN, of T. L. Dodd and Co., has been transferred from Chicago to Detroit, Michigan.

H. A. BRUCE, formerly connected with Packard Motor Car Co., and long identified with the machine tool industry, will represent the E. L. Essley Machinery Co. in the Michigan territory.

F. E. GEORGE, assistant superintendent of the Donora plant of the American Steel and Wire Co., has been appointed superintendent of that company's Farrell works.

LORENZ MAISEL, formerly interested in the Madison Tool and Stamping Works, has been appointed factory manager of the Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.

C. B. BURNS, formerly with the Fairbanks Co., has become associated with the E. L. Essley Machinery Co. in the Chicago district.

FRED M. DEVLIN has been appointed president of the Philadelphia Foundrymen's Association to complete the unexpired term of his father, the late Thomas Devlin.

RALPH WIRTH, formerly of the Toledo Press and Machine Co., and the Niagara Machine and Tool Works, will represent the E. L. Essley Machinery Co. as a special representative in its sheet metal machinery department.

CHARLES W. WILSON has resigned as vice-president and general manager of the Willys-Overland Co., Toledo, and returned to his duties as president of the Wilson Foundry and Machine Co., Pontiac, Mich.

SHERMAN A. HARDING has been appointed manager of sales of the Consolidated Machine Tool Corporation for the Pittsburgh district, in which district he has been serving as sales representative of the Betts Machine Co. for the past three years.

T. P. NEILSON, for some time past identified with the machine tool trade, has become associated with the E. L. Essley Machinery Co., in the Chicago district.

J. RUFUS CASSELL is now advertising manager of the New York Blue Print Paper Co., New York, N. Y. Mr. Cassell was formerly an advertising specialist for The John Service, Inc., New York City, and previous to that was connected with the Thomas Elevator Co., Chicago, Ill., and the Advertising Service Department of the McGraw-Hill Co., Inc., with headquarters in Chicago, Ill.

CAPT. ANDREW T. GRAHAM, naval inspector of machinery at Newport News, Va., has been ordered to Camden, N. J., as naval inspector of machinery.

COMMANDER FLETCHER L. SHEFFIELD has been assigned to duty as naval inspector of machinery at Newport News.

WALTER L. MILLER has been promoted to the position of chief of the foreign service division of the Bureau of Foreign and Domestic Commerce by Secretary of Commerce Hoover. The task of promoting the growth of American foreign trade, as well as supervising the activities of Government commercial agents in all foreign fields, will be under Mr. Miller's direction.

Obituary

JOSEPH BLACKWELL, one of the founders and principal owners of the Enterprise Machine Works, Los Angeles, Calif., died in that city October 6, aged 67 years. He was a native of New Brunswick, Canada, but for the past 30 years had resided on the Pacific coast.

SPENCER F. MOORE, chief engineer of the Collins Co., manufacturer of edge tools, Collinsville, Conn., died at his home in that place October 11, following an illness of a week due to an infection. Mr. Moore was born in Schenectady, N. Y., and was 36-years of age. He was formerly with the Westinghouse Machine and Electrical Co., and the Terry Steam Turbine Co., of Hartford, Conn.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machinery and tools—Poland. Agency desired. Quotations, c. i. f. Danzig. Correspondence, German or French. Reference No. 3899.

Saw milling machinery—India. Purchase desired. Quotations, f. o. b. New York or San Francisco. Payment against documents. Reference No. 3921.

Machines for making soda straws—Canada. Purchase desired. Terms, cash. Reference No. 3951.

Machines for making pulp board pails—Canada. Purchase desired. Terms, cash. Reference No. 3954.

Apparatus for heating and pumping water to 50-room hotel—Cuba. Purchase desired. Quotations f.o.b. New York. Reference No. 3963.

Brick and tile machinery, architectural terra cotta machinery, and kilns for same—New Zealand. Purchase desired. Reference No. 3964.

Industrial transportation machinery, chemical plant equipment, structural steel, and boiler plant supplies.—Norway. Purchase desired. Quotations, f. o. b. New York or Philadelphia. Reference No. 3966.

Cotton boot and shoe lining cloths, of good weaves yet reasonably cheap, about 36 inches wide; also white shoe duck cloths in standard stock widths—Australia. Purchase and agency desired. Quotations, c. i. f. Sydney, Melbourne and Adelaide. Reference No. 3967.

One elevator for 50-room hotel—Cuba. Purchase desired. Quotations, f. o. b. New York. Reference No. 3968.

Tin plates of best quality—Italy. Agency desired. Quotations, c. i. f. Italian ports. Terms, cash. Reference No. 3970.

Woodworking machinery for small furniture manufacturers, such as circular saws, dimension saws, and benches for same, panel planers (buzzers), boring and sanding machines, disks sanders, cranking machines, band saws, spindle molders, etc., required by small furniture factories—Australia. Agency and purchase desired. Quotations, c. i. f. Port Adelaide. Terms, cash against documents. Reference No. 3975.

American raw cotton, cotton piece goods, cotton yarn, cotton waste, hardware, metals, sundries, etc.—India. Quotations, c. i. f. Bombay. Reference No. 3979.

Pipe fittings—Norway. Agency desired. Reference No. 3984.

Trade Catalogs

Inclinable Open Back Power Presses. The Niagara Machine and Tool Works, Buffalo, N. Y. This company has just issued a new publication, known as Bulletin No. 58, in which its complete line of inclinable open back presses are fully described with specifications and detailed illustrations.

Examples of Turning on the Lodge & Shipley Manufacturing Lathe. The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. A new publication of thirty-five pages has just been issued by this company which contains a study of problems in the economical and efficient production of small and medium sized parts. The forepart of the publication is given over to a detailed study of the company's manufacturing type of lathe with six carefully selected illustrations accompanying the description. Pages 10 to 30 are given over to detailed illustrations of lathe operations on various pieces of material both in the first and second stages of completion. The time required for each operation is set forth in each case. Pages 31 to 35 are given up to line drawings of various other kinds of parts with the time required for machining. The general arrangement of the publication is excellent, the photographs, line drawings and information showing clearly the possibilities of the company's manufacturing type of lathe.

Portable Electric Drills. The A. F. Way Co., Inc., Hartford, Conn. This company has just issued a folder setting forth the special features of the Way portable electric drill under the title, "Introducing a Way for Drilling."

Drill Presses. The Sigourney Tool Co., Hartford, Conn. This company has just issued a new catalog containing complete details of its line of plain bearing drill presses in one, two, three and four spindle types, as well as its bench type. The publication contains specifications on each type.

Thermit Locomotive Repairs.—The Metal and Thermit Corporation, New York, has issued the fourth edition of its Thermit Locomotive Pamphlet No. 21, which is of special interest to all railroad superintendents of motive power, general foremen, blacksmith foremen and thermit welders. The new pamphlet contains many revisions since the last edition was published, chief among which are instructions for applying important improvement in practice in Thermit welding which have been developed by exhaustive research. The drawings and instructions illustrating and describing making Thermit welds in various parts of locomotive frames and other locomotive and railroad equipment have been completely revised since the publication of the last edition to conform to the improved practice.

Forthcoming Meetings

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Blue annealed steel sheets, base size, $2.50@$2.85 as against $2.50@$2.75 per 100 lb. f.o.b. Pittsburgh; black, No. 28, $3.35@$3.75 as compared with $3.35@$3.50, one week ago. Tin quoted in New York warehouses at 35c. as against 34½c. per lb., last week. Discounts reduced two points on both black and galvanized wrought-steel pipe, on Pittsburgh basing card of Oct. 19.

Declines—Easier fuel situation reflected in downward trend of pig-iron prices. Structural shapes and mild steel bars quoted at an average price of $2 per 100 lb., Pittsburgh; small tonnages, however, still as high as $2.10@$2.15. Maximum on plates. $2.25 per 100 lb., f.o.b. mill.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	37.17
Basic	29.50
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	31.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	33.50
Basic	30.00
Bessemer	32.50

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	9.0	6.0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.85	4.19	3.70	4.00
No. 12	[illegible]	4.14	3.75	4.05
No. 14	[illegible]	[illegible]	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	35.00
Lead (up to carlots), St. Louis 6.30; New York	6.75@6.87½
Zinc (up to carlots), St. Louis 6.65; New York	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.50	10.25	.....
Solder (½ and ½), (caselots)	25.50	23.50	20.00
Babbitt metal (83% tin)	34.00	44.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 9.65	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville		per net ton	10.50@11.00
Coke, prompt foundry, Connellsville		per net ton	12.00@12.50

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Chicago, Burlington & Quincy R.R., 547 West Jackson Blvd., L. N. [illegible], Purch. Agt.—21 machine tools for [illegible] scrap reclamation yard near Aurora, Ill.

Ill., Decatur — Standard Mfg. Co., 422 City Title & Trust Bldg. (light generators, etc.)—spinning lathe, about 14 in. swing to spin 24 gauge sheet brass (used preferred).

Kan., Wichita—Biltwell Factories, 1414-17 South Washington St., (furniture manufacturers)—drill press, lathe and other woodworking machinery.

Kan., Wichita—G. E. Osborn, 433 Wabash St.—small machine shop tools, grinder, wrenches, drill press, lathe and pulleys.

Ky., Somerset—Denton & Hamilton—16 to 18 in. shaper, Steptoe preferred (new or used).

La., New Orleans—The Cahn-Richards Tool & Supply Co., Inc., 709-711 Camp St., P. F. Richards, Vice-Pres.—lathes, drill presses, shapers, milling machines and all kinds of machinery.

Mass., Boston—Boston Sand & Gravel Co., 85 Broad St., P. F. Ayer, secy.—lathe, about 12 ft. long to take width of at least 20 in. (used).

Mich., Detroit—Dept. Purchases & Supplies, Marquette Bldg., G. J. Finn, Comr.—one portable motor driven cutting shear for Dept. Street Rys.

N. Y., Buffalo—D. Bunshaft, 55 Manchester Pl.—machinery, tools, etc., for proposed garage on Clinton St.

N. Y., Dunkirk—Leworthy Bros., Central Ave.—machinery, tools and mechanical equipment for garage and repair shop, to replace that which was destroyed by fire.

N. Y., Elmira—L. Clute, 215 Baldwin St.—machinery, tools and equipment for proposed garage and Ford service station at Horseheads.

O., Mansfield—The Ideal Electric & Mfg. Co.—24 in. shaper, milling machine and face grinder.

O., Spencer—Spencer Mfg. Co.—lathe, 2 drilling machines, 2 turret lathes, 2 milling machines.

Pa., Germantown (Phila. P. O.)—O. M. [illegible], Delmar and Morris Sts.—one power screw cutting machine.

Pa., Irvine—National Forge & Tool Co.—one 25 Colburn heavy duty drill press with compound table.

Pa., Pittsburgh—The National Tube Co., Frick Bldg.—10 or more heavy machine tools for Gary plant.

Pa., Pittsburgh—Pennsylvania R.R. Co., 1113 Pennsylvania Ave., W. G. Phelps, Purch. Agt.—receiving bids for 10 machine tools for Conway shops near Freedom.

Pa., Pittsburgh — Pittsburgh & Lake Erie R.R., South Smithfield St., C. M. Yohe, Purch. Agt.—90 in. wheel lathe, one 10 ton crane, four lathes, drill press, 24 in. shaper and grinder.

Pa., Scranton—J. Valverde, Walnut and Capouse Sts.—machinery and equipment for proposed $30,000 garage and repair shop.

Pa., Warren—R. Norris, c/o Warren Taxi Co.—repair shop equipment for proposed garage on Chestnut St.

Pa., Youngwood—The Robertshaw Mfg. Co.—equipment for proposed foundry and machine shop.

Va., Norfolk—The Virginian Ry. Co., T. Moore, Purch. Agt.—lathes and planers.

Va., Petersburg—American Spotless Co., 21 East Bank St. (manufacturer of street trash receptacles)—stamping machine for 20 gauge sheet iron.

Va., Petersburg—Andrews-Harris Boiler & Machine Co., A. Harris, Purch. Agt.—gear cutting attachment, Garvin head, also a 14 in. vertical boring machine.

Va., Petersburg—[illegible] Garage, 225 [illegible] St.—small lathe, drill press and cylinder grinder.

Va., Petersburg—The Crist Motor Co., 105 East Bank St.—small lathe.

Va., Petersburg—L. B. Curley, 426 Halifax St., (automobile repairs)—lathe and drill press.

Va., Petersburg—Lewis & Clayton, 116 West Bank St., E. M. Lewis, Purch. Agt.—electric drill.

Va., Petersburg—Peoples Motor Co., West Tabb St.—lathe and hand tools.

Va., Petersburg—Petersburg Fire Dept.—drill press, lathe and shaper.

Va., Petersburg—Smith & Temple, 27 and 37 East Bank St., (automobile repairs)—power press.

Va., Richmond—Auto Service Co., 1504 West Broad St., W. H. Wyatt, Purch. Agt.—lathe, drill press, emery grinding machine.

Wis., Ashford (Campbellsport P. O.)—J. Schill, (garage and repair shop)—automobile repair machinery, including drill press, gasoline storage tank and pump.

Wis., Chippewa Falls—The Chippewa Valley Auto Co., 16 River St., F. A. Bigler, Pres.—power and automobile repair machinery for proposed garage.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., (manufacturer of patented mechanical articles), C. A. H. Bahde, Purch. Agt.—one No. 2 milling machine, 3 drill presses, one 14 in. and one 16 in. lathe, and one 24 in. shaper.

Wis., Montfort—O. Yerke—automobile repair machinery for proposed garage and repair shop.

Wis., Rhinelander—The Wisconsin Regrinding Co., A. P. Schneidewind, Sheboygan Falls, Pres.—power machinery and one 18 x 96 in. crankshaft grinder for proposed machine shop, here.

Wis., West Allis (Milwaukee P. O.)—Highway Garage & Service Co., Hawley and Beloit Rds., W. G. Schenk, Purch. Agt.—repair machinery, including lathe and drill press.

N. S., Truro—H. Johnson—iron foundry and machine shop equipment.

Ont., Toronto—The Ford Motor Co. of Canada, 672 Dupont St.—machine shop equipment, lathes, etc., for proposed motor factory on Danforth Ave.

Machinery Wanted

Colo., Aurora—W. A. Heller—complete newspaper equipment.

Conn., Bridgeport—The Frisbie Pie Co., 362 Kossuth St.—equipment for proposed bakery at Hartford.

Conn., Bridgeport—The Huber Ice Cream Co., 800 Seaview Ave.—ice making machinery for proposed addition to plant.

D. C., Wash.—Bureau of Yards and Docks Navy Dept., will soon receive bids for refrigerating and ice making equipment for plant at hospital, Pearl Harbor, T. H.

D. C., Washington—Bureau of Yards and Docks, Navy Dept. will receive bids until Nov. 15 for coal and ash handling equipment for hospital at Tupper Lake, N. Y.

Fla., New Smyrna—The Volusia Cypress Co.—machinery and equipment for proposed saw mill, planing mill and lumber plant.

Ill., Chicago—Hines Lumber Co., 2431 Lincoln St.—saw mill machinery.

Ill., Lakewood — P. Robinson — shoe finisher, motor direct, belting and shafting.

Ind., Alexandria—Ziegler Mfg. Co., (manufacturer of screw machine products, etc.)—machinery and equipment for $20,000 addition to factory.

Ind., Logansport—The Logansport Radiator & Equipment Co., J. F. Diggin, Pres.—machinery and equipment for proposed addition to factory, to triple present capacity.

Kan., Eskridge—C. W. Walker—saw mill, saws and belting.

Me., Sanford—The Sanford Mills, Inc., (woolen mills)—machinery for 4 story, 80 x 150 ft. and 6 story, 80 x 150 ft. additions to plant.

Mass., Boston — Arlington Press Corp., 112 Castle St.—job press, Chandler & Price, preferred, 10 x 5 in. or 12 x 18 in. (used).

Mass., Boston—The Merrimack Clay Products Co., 185 Devonshire St.—equipment for proposed plant for the manufacture of clay and hollow tile products at Plaistow, N. H.

Mass., Caryville—Taft Woolen Co.—machinery for addition to picker house.

Mass., Fall River—Fyans, Fraser & Blackway, 83 Anawan St., (textile machinery)—one continuous dyeing machine.

Mass., Malden—Yale Knitting Co. (manufacturer of union suits)—machinery for addition to mill.

Mass., Milford—The Charlescraft Press, 43 Exchange St., J. E. Barnes, Mgr.—printing machinery and equipment.

Mich., Ann Arbor—Parker Electric Mills—machinery and equipment for proposed $700,000 flour mill at Somerset, Ky.

Mich., Detroit—The Chevrolet Motor Co., West Grand Blvd.—equipment for making and assembling automobiles, bodies, enameling tanks ,etc., for proposed factory at Buffalo.

Mich., Detroit—W. C. Dawson, 140 East Larned St.—complete equipment for woodworking machinery.

Mich., Detroit—The Pennsylvania R.R., 1368 Penobscot Bldg.—machine equipment for proposed engine house on 19th St.

Mich., Detroit—Ternstedt Mfg. Co., Artillery and Muster Aves.—miscellaneous machine equipment for addition to plant, for the manufacture and finishing of automobile hardware.

Minn., Bluffton—Bluffton Creamery Assn., H. G. Imdreke, Secy.—one 1,000 lb. churn, two 300 gal. cream ripeners, one 30 gal. starter can, one 24 bottle steam tester, one 30 gal. weigh can, one Torsion test scales, one wash sink, one 20 hp. horizontal boiler, one 15 hp. horizontal center crank engine and about 40 ft. of line shafting with hangers and pulleys.

Minn., Minneapolis—The Ives Ice Cream Co., 2nd and University Aves., S. E., A. H. Ives, Pres.—ice cream making equipment, including freezers, tanks, can washers, etc., for proposed addition to plant.

Miss., McComb—McComb Ice Co., V. G. Conner, Supt.—refrigerating machinery and equipment for proposed ice plant.

Mo., Kansas City—K. Prather, 302 Brotherhood Bldg.—tinner's tools, hand forming brake, rolls and compressor.

Mo., St. Louis—The Plateless Engraving Co., Victoria Bldg.—23 in. power paper cutter.

N. J., Camden—Camden Pottery Co., Mt. Vernon and Orchard Sts.—grinding machine, electric kilns and furnaces.

N. Y., Big Flats—H. B. Thomas—one concrete block making machine.

N. Y., Binghamton—Bd. Educ.—vocational equipment for proposed $350,000 school on Stan Ave.

N. Y., Elmira—M. Hutchison, 801 Winsor Ave.—one paper baling machine.

N. Y., Geneva—A. E. Meyers—sand digger and loading machine, gasoline driven (clamshell and boom type preferred).

N. Y., Penn Yan—Keuka Lake Ice Co.—machinery and equipment for conveying and handling ice, for proposed ice house.

N. Y., Rochester—Brighton Place Dairy Co., 1757 East Ave., refrigeration machinery and equipment for proposed plant.

N. Y., Rochester—A. W. Hopeman & Son, 575 Lyell Ave.—machinery and equipment for proposed fur tannery.

O., Caldwell—The Caldwell Collieries Co.—machinery and equipment for generating and hoisting plant at the Florence Mine, to replace that which was destroyed by fire.

O., Cleveland — Western Newspaper Union, 1270 West 3rd St.—model No. 1 linotype machine.

O., Columbus—The Columbus Auto Spring Co., 205 East Capital St., J. J. Puskar, Purch. Agt.—emery stand and blowers.

O., Columbus — Columbus Consumers' Supply Co., 315 North 4th St., (building supplies), R. H. Miller, Genl. Mgr.—full line of loading and unloading machinery for new branch yard at 1154 West Broad St.

O., Findlay—The Adam Axle Co.—$40,000 to $50,000 worth of machinery for proposed addition.

O., Youngstown—Commercial Shearing & Stamping Co., G. Ohl, Secy.—$30,000 worth of machinery.

Okla., Atoka—Atoka Press—newspaper equipment (used).

Okla., Tecumseh—C. Polaski—ice making machinery.

Okla., Tulsa—The National Refining Co.—machinery and equipment for 2 proposed electrical pumping plants.

Ore., Talent — The Talent Lumber Co., P. J. Neff, Medford, Ore., Secy.—machinery for proposed sawmill, here, 30,000 ft. capacity.

Pa., Ardmore—J. H. Clarke (contractor)—24 in. band saw with counter shafts, etc.

Pa., Bloomsburg—The Bloomsburg Paper Co.—machinery and equipment for proposed plant, to replace that which was destroyed by fire.

Pa., Canton—G. M. Coons Co.—additional machinery and equipment for sand and gravel plant.

Pa., Mahaffey—The Times—six column quarto newspaper press (used).

Pa., Mercer—Mercer Refining Co., c/o W. C. Hastings, Treas., Franklin, Pa., (oil refining)—pulleys and shafting machinery, hangers, belting chain and belt conveying machinery.

Pa., Phila.—The Adelphia Mfg. & Plating Co., Belgrade and Orthodox Sts.—additional foundry equipment for iron and brass.

Pa., Phila.—W. Boyle, 1141 Winston St. (printer)—one large paper cutter and one numbering machine.

Pa., Phila.—The Cocoanut Specialty Co., 1214 North Crese St. (manufacturer of confectionery)—shredding machinery, steam vats, packing machines, etc.

Pa., Phila.—Presbyterian Hospital, 39th St. and Powelton Ave.—complete laundry machinery and equipment.

Pa., Pittsburgh—M. K. Frank, 917 Frick Bldg., (iron and steel scrap)—1½ or 2 ton traveling electric crane to travel on single rail (new or used).

Pa., Pittsburgh—The Koppers Co., Union Arcade—air operated crane for the by-product plant of the Carnegie Steel Co. at Clairton.

Pa., Sharon—Maniscalco New Power System Co., M. & M. Bank Bldg.—special machinery for the manufacture of patented self generating electric motors.

Pa., Wallingford—The Sackville Mills Co. (manufacturer of textiles), M. E. Sack, Purch. Agt.—30 in. cloth folder machine.

Pa., Wilkes-Barre — Paradise Sweets, Inc., 24 West Union St., L. K. Salsburg, Dir.—candy and ice cream making equipment.

S. C., Conway — Horry Herald, H. H. Woodward, Purch. Agt.—six column quarto newspaper press.

S. C., Georgetown — The Times—30 in. standard paper cutter.

Tenn., Knoxville — The Appalachian Marble Co., Middlebrook Pk.—single head channeling machine.

Va., East Radford—The Journal—seven column chases, reglet case, leads, slugs and folder for newspaper.

Va., Glenallen — J. Frank Darling Co., (planing mill), J. F. Darling, Purch. Agt.—10 in. moulder and double service planer.

Va., Petersburg—J. E. Collier, 416 Short Market St.—nickel plating outfit.

Va., Petersburg—Nash Bros., 108 West Bank St.—power emery machine.

Va., Petersburg—Petersburg Builders Supply Co., 222 North Market St., A. Strailman, Purch. Agt.—planer.

Va., Richmond—Donnati Fiber Box Co., 3210 Williamsburg Ave.—machinery for the manufacture of fiber boxes, to replace that which was destroyed by fire.

Va., Richmond — R. E. Piper, 1522 West Broad St. (cornices and roofing)—cornice brake and large power shears.

Wash., Centralia — The H. H. Martin Lumber Co., H. H. Martin, Pres. and Genl. Mgr.—complete equipment for 100,000 ft. capacity saw and planing mill, prefer electrical drive for individual machines, logs up to 100 and 120 in. in diameter, must be handled by main saw and carriage.

W. Va., Princeton—T. M. Fry—ice cream machinery (used).

Wis., Green Bay—Knowlton Candy Co., c/o J. W. McNevins, 721 South Quincy St.—candy making machinery.

Wis., Madison—The Meyer Printing Co., 117 South Webster St.—printing presses, power driven, and equipment for addition to printing plant.

Wis., Madison—The State Bd. of Control, M. J. Tappins, Secy.—ice machine for proposed cold storage plant at Delevan.

Wis., Madison—Valvoline Oil Co., 815 East Main St.—oil storage tanks, pumps, etc., for proposed filling station.

Wis., Milwaukee—C. G. Forster, 62 27th St.—planing mill machinery.

Wis., Milwaukee—Northwestern Barrel Co., 76 South Bay St., (manufacturer of boxes and barrels), T. J. Verden, Purch. Agt.—2 or 3 band saws.

Wis., New Holstein—The New Holstein Canning Co., A. T. Hipke, Secy.—machinery for proposed canning factory.

Wis., North Milwaukee—E. Korth, Route 5, (carpenter and millworker)—band saw, about 32 in.

Wis., Oshkosh—R. A. Lutz, 1270 Knapp St.—machinery and equipment for new crushed stone plant.

Wis., Oshkosh—The Williams-Loper Co., 213 Harrison St.—special machinery for the manufacture of free-air stands, etc., for garages.

Wis., Sheboygan—The Northern Furniture Co., South Water St.—machinery, including power machinery, for proposed furniture factory at Tacoma, Wash.

Wis., West Bend—The West Bend Concrete Products Co.—machinery, including some power machinery, for the manufacture of drain tile and concrete products for proposed factory.

B. C. Powell River—The Powell River Co., Ltd.—machinery for proposed paper mill.

Ont., Kincardine—Kincardine Salt Wks.—$30,000 worth of equipment, piping, evaporators and special equipment for handling salt.

Que., Montreal—Dominion Steel Co., Canada Cement Bldg—$50,000 worth of equipment, to increase daily output of fence material from 60 to 120 ton, for Besco Wire mill at Sidney, N. S.

Metal Working Shops

Calif., San Francisco—J. Madison, 112 Market St., awarded the contract for the construction of a 3 story, factory on Harrison St. Pacific Meter Wks., 1123 Harrison St., lessee. Estimated cost $29,950. Noted Oct. 19.

Calif., San Francisco—A. J. Pahl, 37 Stevenson St., awarded the contract for the construction of a 2 story machine shop on Howard St. near 4th St. Estimated cost $25,000.

Calif., Stockton—H. S. Dawson, c/o G. Allen, Archt., 37 South Aurora St., is having plans prepared for the construction of a 3 story garage on North California and Oak Sts. Estimated cost $50,000.

Conn., New Britain—Landers, Frary & Clark, Commercial St., awarded the contract for the construction of a 6 story addition to its hardware and cutlery factory on Stanley St. Estimated cost $75,000.

Conn., New Haven—H. B. Ives & Co., 5 Artizan St., awarded the contract for the construction of a 4 story, 40 x 40 ft. and a 1 story, 30 x 80 ft. wing addition to its hardware factory. Cost from $35,000 to $40,000.

Conn., Norwalk—C. J. Mintz, 92 Washington St., South Norwalk, awarded the contract for the construction of a 1 story, 85 x 140 ft. garage on West Ave., here. Estimated cost $40,000.

Ind., Fort Wayne—The General Electric Co., Bway and Wall St., will build a 1 story, 150 x 150 ft. tank shop and garage. Estimated cost $30,000. Noted Oct. 12.

Ind., Lebanon—Cline & Hicks are having plans prepared for the construction of a 1 story, 60 x 100 ft., 40 x 40 ft. and 40 x 60 ft. paint and machine shops. Estimated cost $40,000. Private plans.

Ind., Lebanon—The Indestructible Wheel Co. is having plans prepared for the construction of a 2 story, 100 x 160 ft. addition to its factory for the manufacture of wire wheels. Estimated cost $60,000. Private plans.

Mass., Cambridge — The Auto Truck & Wagon Co., 141 First St., will soon award the contract for the construction of a 1 story, 85 x 100 ft. automobile body factory. Estimated cost $30,000. Private plans.

Mass., East Boston (Boston P. O.)—The Hersey Mfg. Co., 314 West 2nd St., awarded the contract for the construction of a 2 story plant for the manufacture of special machinery on E St. Estimated cost $25,000.

Mass., Somerville—J. W. Knowles, 660 Bway., awarded the contract for the construction of a 1 story, 90 x 150 ft. garage, etc., on Highland Ave. and Eastman Rd. Estimated cost $40,000.

Mass., Worcester—A. A. Wheeler, 159-163 Mechanic St., awarded the contract for the construction of a 2 story garage and service station. Estimated cost $100,000.

Mich., Detroit—The Pennsylvania R.R., 1368 Penobscot Bldg., is having plans prepared for the construction of a 1 story, engine and round house, including turntable, water tower, coaling station and handling equipment, on 19th St. B. V. Sommerville, 1368 Penobscot Bldg., Engr.

N. Y., Buffalo—D. Bunshaft, 55 Manchester Pl., plans to build a 1 and 2 story, 66 x 100 ft. garage on Clinton St. Architect not announced.

N. Y., Buffalo—The Chevrolet Motor Co., Buffalo, and West Grand Blvd., Detroit, Mich., is having plans prepared for the construction of a 1 and 2 story, 338 x 900 ft. automobile factory and loading platform on East Delevan Ave., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

N. Y., Buffalo—The Empire Drawn Steel Corp., 1133 Marine Bank Bldg., is having plans prepared for the construction of a 1 story, 70 x 450 ft. cold drawn steel factory on Germania St., capacity 36,000 tons annually. Estimated cost $100,000. Harding & Crea, White Bldg., Engrs.

N. Y., Buffalo—P. M. McGroff, Montreal, Que., plans to build a steel wire factory, here. Estimated cost $1,000,000. Architect not selected.

N. Y., New York—W. F. Harving, c/o J. P. Whiskeman, Engr. and Archt., 153 East 40th St., will build a 1 story, 135 x 150 ft. garage on Webster Ave. Estimated cost $75,000.

N. Y., New York—S. M. DePasquale, c/o S. J. Kessler, Archt. and Engr., 529 Courtlandt Ave., will build a 2 story garage on Webster Ave. and Moshula Parkway. Estimated cost $120,000

O., Cleveland—The Denby Wire & Iron Co., 5119 Euclid Ave., has had plans prepared for the construction of a 1 story, 40 x 105 ft. factory at 3005 East 81st St. Estimated cost $40,000. H. Denby, owner.

O., Cleveland—F. Svoboda, 5377 Bway., awarded the contract for the construction of a 2 story, 45 x 139 ft. garage on Bway. and Mumford Ave. Estimated cost $60,000. Peck & Horton (Ford dealers), 2261 East 14th St., lessee. Noted Sept. 21.

O., Findlay—The Adam Axle Co. plans to build an 80 x 200 ft. addition to its factory. Cost will exceed $50,000.

O., Salem—The Deming Co., Etna St., manufacturer of pumps, awarded the contract for the construction of a 1 story foundry. Estimated cost $50,000.

Pa., Enola—The Pennsylvania R.R., Broad St. Sta., Phila., awarded the contract for the construction of a 100 x 620 ft., car building shop, and four 1 story 16 x 31 ft., 16 x 61 ft., 100 x 424 ft. and 42 x 402 ft. buildings, for repairing cars, etc., here.

Pa., Oil City—The Oil City Boiler Wks., 351 Seneca St., awarded the contract for the construction of a 1 story, 60 x 75 ft. addition to its boiler plant.

Pa., Phila.—C. Kahn, Morris Bldg., awarded the contract for the construction of a 2 story, 21 x 200 ft. sales and service building at 1618 North Broad St. Estimated cost $75,000.

Pa., Phila.—The Nash Motor Co., 901 North Broad St., awarded the contract for the construction of a 5 story, 75 x 160 ft. sales and service station on Broad and Thompson Sts. Estimated cost $300,000.

Pa., Pitcairn—The Pennsylvania R.R., Broad St. Sta., Phila., awarded the contract for the construction of a 13 x 25 ft. oil house, and 100 x 620 ft., 16 x 31 ft. 16 x 61 ft., 100 x 424 ft., and 42 x 202 ft. buildings for constructing and repairing cars, etc., all 1 story, here. Noted Oct. 5.

Pa., Pittsburgh—The Harmony Creamery Co., 407 Liberty Ave., awarded the contract for the construction of a 2 story, 56 x 115 ft. garage on Reedsdale St. Estimated cost $40,000.

Pa., Pittsburgh—The Jones & Laughlin Steel Co., 3rd Ave. and Ross St., will build a 1 story, 100 x 150 ft. addition to its polishing plant on 2nd Ave. (Hazelwood). Estimated cost $25,000.

Pa., Pittsburgh — The Webster Ave. Garage Co., c/o A. Ricordino, 1010 Webster Ave., awarded the contract for the construction of a 2 story, 40 x 110 ft. garage. Estimated cost $40,000.

Pa., Youngwood—The Robertshaw Mfg. Co. is receiving bids for the construction of a 1 story, 30 x 65 ft. and 110 x 130 ft. foundry and machine shop. Amer. City Eng. Co., Peoples Bank Bldg., Pittsburgh, Archts.

R. I., Providence—The Olneyville Realty Co., Inc., 11 Plainfield St., awarded the contract for the construction of a 1 story, [illegible] x 115 ft. garage, etc. Estimated cost [illegible]. Noted Oct. 5.

Tenn., Memphis—The Louisville & Nashville R.R., Louisville, Ky., plans new round house near here, also switch tracks and car repair shops near coaling plant, at [illegible]wood. Estimated cost [illegible]. A. H. Scates, Supt., Memphis div. W. H. Courtenay, Louisville, Ch. Engr.

Wis., Chippewa Falls — The Chippewa Valley Auto Co., 16 River St., is receiving bids for the construction of a 2 story, 121 x 130 ft. garage. Estimated cost [illegible]. F. A. Hughes, Pres. R. J. Hancock, Laycock Bldg., Eau Claire, Archt.

Wis., Montfort—O. Yerke will build a 1 story, 33 x 60 ft. garage and repair shop. Estimated cost $10,000.

Wis., Oshkosh—The Williams-Loper Co., 233 Harrison St., awarded the contract for the construction of a 2 story, 45 x 80 ft. factory for the manufacture of air pressure tanks, etc., for garages. Estimated cost $[illegible].

Wis., Milwaukee—F. Kraning, 1147 Forest Home Ave., awarded the contract for the construction of a 3 story, 30 x 80 ft. addition to garage. Estimated cost $40,000. Noted Oct. 12.

Wis., Milwaukee—Leenhouts & Guthrie, Archts., 424 Jefferson St., are receiving bids for the construction of a 1 story, 120 x 120 ft. garage, for the Luick Ice Cream Co., 183 Ogden Ave. Estimated cost $60,-000. Noted Oct. 5.

Wis., Milwaukee—C. F. Ringer & Son, Archts., 432 Bway., are receiving bids for the construction of a 1 story, 50 x 150 ft. garage on 9th St., for the O. Jaeger Baking Co., 914 Central Ave. Estimated cost $40,000.

Wis., Rhinelander — The Wisconsin Regrinding Co. will build a 1 story, 50 x 90 ft. machine shop here. Estimated cost $10,000. A. P. Schneidewind, Sheboygan Falls, Pres. Private plans. Noted Oct. 5.

Ont., Toronto—The Ford Motor Co. of Canada, 672 Dupont St., plans to build a 1 story, 250 x 450 ft. motor factory on Danforth Ave. Estimated cost $500,000.

General Manufacturing

Calif., Pittsburg—The Pioneer Rubber Mills awarded the contract for the construction of a factory. Estimated cost $[illegible]. Noted June 29.

Calif., San Francisco—C. E. Lewis, 206 Sacramento St., awarded the contract for the construction of a 2 story, 25 x 120 ft. glove factory on Folsom St. Estimated cost $6,000. Noted Oct. 19.

Calif., San Francisco—MacDonald & Kahn, 130 Montgomery St., awarded the contract for the construction of a 2 story, 50 x 183 x 213 x 275 ft. office, studio and workshop building on Pierce, Steiner, Turk and Eddy Sts. Foster & Kleiser Co., billboard erectors and advertising experts, 287 Valencia St., lessee.

Calif., Tracy—The General Milk Co., of California, c/o A. J. Mazurette, Archt., 1002 H St., Modesto, will soon receive bids for the construction of a condensary plant. Estimated cost $75,000. Noted March 23.

Colo., White River (Meeker P. O.)—The Rio Blanco Carbon Co., 515 Symes Bldg., Denver, is having plans prepared for the construction of a 1 story, 12 x 16 ft. and 24 x 110 ft. and a 2 story, 20 x 40 ft. plant for the manufacture of carbon black, here. Estimated cost $60,000. O. D. Horton, 714 [illegible] Bldg., Erie, Pa., Engr.

Conn., Bridgeport—The Huber Ice Cream Co., 950 Seaview Ave., awarded the contract for the construction of a 3 story, 60 x 102 ft. addition to its ice cream factory. Estimated cost $100,000. Noted Oct. 19.

Conn., Hartford—The Frisbie Pie Co., 163 Kossuth St., Bridgeport, is receiving bids for the construction of a 2 story, [illegible] x 100 ft. bakery and warehouse, including portion for garage and [illegible], here. Estimated cost $50,000. Private plans.

Conn., Middletown—M. [illegible] & Sons, 60 Gray St., [illegible], are having plans prepared for the construction of a 1 story, 60 x 200 ft. addition to their silk mill, here. Estimated cost $40,000. Private plans.

Conn., Naugatuck—The Goodyear India Rubber Glove Co., 58 Maple St., awarded the contract for the construction of a 3 story, 60 x 110 ft. addition to its factory, for the manufacture of rubber goods. Estimated cost $75,000.

Conn., Waterford—J. and G. H. Bathgate, Jordan Mill, awarded the contract for the construction of a 2 story, 40 x 141 ft. addition to its textile mill. Estimated cost $50,000.

Fla., New Smyrna—The Volusia Cypress Co. plans to build a saw mill, planing mill and lumber plant. Estimated cost $100,000.

Ill., Chicago — E. E. McClellan, Archt., 7441 Cottage Grove Ave., is receiving bids for the construction of a 1 and 2 story, 200 x 200 ft. addition to ice cream factory, for the Victory Ice & Ice Cream Co., 15th St. and Keeler Ave. Estimated cost $100,000.

Ill., Chicago—The McDonald Loose Leaf Co., 633 Federal St., awarded the contract for the construction of a 1 story, 95 x 125 ft. factory at 1809-17 Summerdale Ave. Estimated cost $50,000. Noted Sept. 14.

Ind., Bedford—The Indiana Quarries Co. awarded the contract for the construction of a 1 story, 400 x 600 ft. stone mill. Estimated cost $400,000. Noted Sept. 14.

Ind., Elkhart—The Curtain Supply Co. awarded the contract for the construction of a 1 story, 172 x 400 ft. curtain factory. Estimated cost $100,000. Noted Oct. 12.

Ind., Fort Wayne—The Wayne Oil Tank & Pump Co., Anthony Hotel, awarded the contract for the construction of a 1 story, 50 x 320 ft. paint factory addition. Estimated cost $40,000. Noted Oct. 12.

Mass., Gardner—G. E. O'Hearn, 92 Oak St., awarded the contract for the construction of a 1 story, 50 x 210 ft. factory, for the manufacture of novelties, on Parker St. Estimated cost $40,000.

Mass., Worcester—The Queensbury Mills, Inc., Quinsigamond Ave., plans to build several large additions to its yarn plant. Architect not selected.

Minn., Minneapolis—The Ives Ice Cream Co., 2nd and University Aves., S. E., awarded the contract for the construction of a 3 story, 40 x 76 x 117 ft. addition, and for adding 3rd story to present 41 x 117 ft. building. Estimated cost $74,000. A. H. Ives, Pres. Noted July 13.

N. H., Plaistow — The Merrimack Clay Products Co., 185 Devonshire St., Boston, will soon award the contract for the construction of a 1 and 2 story, 200 x 600 ft. plant for the manufacture of clay and hollow tile products, here. Estimated cost $200,000. Morse & Chase, 25 Washington Sq., Haverhill, Mass., Archts. Noted June 29.

N. Y., Brooklyn—The Brooklyn Daily Eagle, Eagle Bldg., awarded the contract for the construction of a 6 story, 83 x 111 ft. publishing plant on Adams and Johnson Sts.

N. Y., Rochester—A. W. Hopeman & Son, 575 Lyell Ave., plan to build a fur tannery. Estimated cost $16,000. Architect not announced.

O., Caldwell—The Caldwell Collieries Co. plans to rebuild its generating and hoisting plant at the Florence Mine, which was destroyed by fire. Estimated cost $70,000.

O., Euclid—The Municipal Realty Co., c/o A. Bloom, Supt. of Constr., Hanna Bldg., will build a 1 story warehouse and lumber mill on Bliss Rd. and St. Clair Ave. Estimated cost $150,000. Private plans.

Ore., Talent — The Talent Lumber Co. plans to build a saw mill, 30,000 ft. capacity. P. J. Neff, Medford, Secy.

Pa., Bloomsburg—The Bloomsburg Paper Co. plans to rebuild its paper factory, which was destroyed by fire. Estimated cost $75,000.

Pa., Phila.—The Cocoanut Specialty Co., 1214 North Cresse St., will soon receive bids for the construction of a 4 and 6 story, 80 x 180 ft. factory, for the manufacture of cocoanut specialties, at Wayne Junction. Estimated cost $250,000. Lachman & Murphy, Drexel Bldg., Archts.

Pa., Phila.—A. A. Zimmerman, Archt., 85 5th Ave., New York City, will receive bids Nov. 1 for the construction of an 8 story, 150 x 256 ft. bakery for the National Biscuit Co., Broad St. and Glenwood Ave., here. Estimated cost $500,000.

Pa., Reading—The Central Abattoir Co., Chestnut St., awarded the contract for the construction of a 2 story packing plant. Estimated cost $175,000. Noted July 20.

Pa., Rikers (Punxsutawney P. O.)—The Buffalo, Rochester & Pittsburgh R.R., 20 State St., Rochester, N. Y., awarded the contract for the construction of a coaling station, 1,200 ton capacity, here.

Pa., Sharon—The Valley Packing & Provision Co., 114 Franklin St., awarded the contract for the construction of a 2 story, 54 x 108 ft. addition to its packing plant. Cost will exceed $10,000. Noted June 29.

R. I., Woonsocket — The Glenbrook Worsted Mills, Mason St., awarded the contract for the construction of a 1 story, 30 x 125 ft. addition to its plant. Estimated cost $25,000.

Tenn., Carthage — The Carthage Spoke Co. increased its capital stock from $50,000 to $100,000 for additions, machinery and improvements to plant. A. Bilbrey, Supt.

Tenn., Memphis—Clover Farm Dairy Co., 789 Union Ave., is building a 3 story creamery and ice cream factory on Orleans and Beale Sts. Estimated cost $80,000.

Tex., Deweyville — Peavy-Moore Lumber Co. plans to rebuild saw and lumber mill to replace the one which was recently destroyed by fire. Estimated cost $200,000.

Va., Richmond—The Fibre Board Container Co., 3200 Williamsburg Ave., manufacturer of boxes, awarded the contract for the construction of a 3 story, 50 x 150 ft. plant to replace the one which was recently destroyed by fire. Estimated cost $20,000.

Wash., Tonasket—The Standard Oil Co., Realty Bldg., Spokane, has had plans prepared for the construction of a 1 story, 40 x 60 ft. distributing station, including tanks, etc., here. Estimated cost $20,000. C. E. McKay, Realty Bldg., Spokane, Engr.

W. Va., Clarksburg—The Clarksburg Exponent Publishing Co. awarded the contract for the construction of a 2 story, 62 x 150 ft. printing plant on Hewes St. Estimated cost $50,000.

W. Va., Princeton—The Princeton Hosiery Mills Co. plans to build a 2 story, 50 x 150 ft. hosiery mill. Private plans.

W. Va., Wellsburg—The Hammond Bag & Paper Co., Box 467, awarded the contract for the construction of a 1 story, 125 x 350 ft. paper mill.

W. Va., Wheeling—The Interstate Oxygen Co. awarded the contract for the construction of a 1 story, 100 x 150 ft. oxygen factory, on 44th and Eoff Sts. Estimated cost $50,000.

W. Va., Wheeling—The Wheeling Box Co., 3007 Chapline St., will build a 2 story, 40 x 175 ft. addition to its box factory. Estimated cost $10,000.

Wis., Clyman — The Reeseville Canning Co., Reeseville, will build a vegetable canning plant, consisting of a 70 x 162 ft. warehouse, a 70 x 120 ft. machine room, a 64 x 90 ft. boiler house, all one story, also miscellaneous sheds. Estimated cost $75,000. Noted Oct. 12.

Wis., Granville—The Rauschenberger Tire Co., Akron, O., plans to build a 3 story, 150 x 175 ft. factory here, for the manufacture of auto tires. Estimated cost $150,-000. Architect not selected.

Wis., Green Bay—The Fort Howard Paper Co., South State St., awarded the contract for the construction of a 3 story, 100 x 140 ft. paper finishing plant. Estimated cost $100,000.

Wis., Horicon—The Allen-Spiegel Shoe Co., Belgium, plans to build a 2-3 story, 60 x 150 ft. shoe factory, here. E. W. Allen, Mgr. Architect not selected.

Wis., Menomonee Falls—Pure Milk Co., c/o A. E. Johnson, Pres., 722 41st St., Milwaukee, awarded the contract for a 1 story 42 x 80 ft. milk bottling plant, here. Estimated cost $20,000.

Wis., Milton—The Burdick Cabinet Co. awarded the contract for the construction of a 1 story, 80 x 160 ft. factory addition. Estimated cost $45,000. Noted Sept. 21.

Wis., Milwaukee—Waukesha Dairy Co., 342 6th St., awarded the contract for the construction of a 4 story, 50 x 78 ft. addition to its dairy. Estimated cost $50,000.

Wis., Park Falls—The Flambeau Paper Co. awarded the contract for the construction of a 2 story, 50 x 95 ft. pulp mill. Estimated cost $100,000. G. Waldo, Mgr.

Wis., South Milwaukee—The Burnham Bros. Brick Co., 88 Wisconsin St., awarded the contract for the construction of a 1 story, 85 x 100 ft. dryer plant, on Chicago Rd. Will build a machine building, power house and brick burning building in near future. Noted Dec. 15, 1921.

Ont., Hanover—The Peninsular Cord Tire Co. plans to build a new factory. Estimated cost $100,000. W. A. Oakley, Mgr.

Ont., London—The Corrugated Carton Co., York and Glenbe Sts., is having plans prepared for the construction of a factory. Estimated cost $60,000.

Ont., St. Thomas—The City Gas Comn. will vote on a bylaw Dec. 1 for the rebuilding of civic gas plant and the installing of vertical retorts. Estimated cost $100,000. W. A. McIntyre, City Hall, Chn. W. Miller, City Hall, Engr. Noted Sept. 14.

Ont., Sault Ste. Marie—F. W. Reese and T. J. Wilcox plan to build a gas plant. Estimated cost $200,000.

American Machinist

Volume 57 NEW YORK, NOVEMBER 2, 1922 Number 18

677

What's Wrong with the Railroad Shops?

Railroad Shop Practice Different from that of Other Machine Shops—Mechanical Departments Badly Handicapped by Poor Equipment—Lack of Contact with Other Shops

THERE ARE TWO kinds of machine shops, ordinary machine shops and railroad shops. If a man had worked in shops where heavy machinery was made, in shops where typewriters were manufactured, in machine-tool shops where tools were built in moderate quantities, in high-production automobile shops, he might think he knew the machine shop. He might have handled work where a split sixty-fourth was close enough and other work where a tenth of a thousandth was a common unit, and yet he would not know the railroad shop which is a law unto itself and different from other shops in almost every particular. Whether this needs to be so is a question, but that it is so is obvious at the first visit to one of these shops and becomes increasingly evident when one visits a number of them.

Not only is the practice of the average railroad shop different from established practice in good machine shops, but it is also unlike that of other railroad shops so that the first impression, that there must be conditions here which make a different practice necessary, is swept away. One finds good machine-shop practice in the railroad shops in spots, a bright spot in this shop, another one in that shop, still another in some other shop. All the bright spots are there if one takes all the railroad shops together, but there are very few in any single shop, leaving untold room for improvement.

The observations made by the *American Machinist* representatives who visited a number of railroad shops covered such items as buildings, equipment (machinery), tools, methods and control. Due to the fact that in some of the shops practically the entire working force was new, it was thought that due allowance would have to be made for the greenness of the hands, but conversation with the management brought out the fact that these new men were an agreeable surprise in that they did much better than was expected and in many cases produced more than the old hands who had gone out on strike. Railroad officials further stated that but a short time would be required to bring the entire force up to, and possibly above, the pre-strike level. Apparently this does away with the old idea that the railroad shop man is different from any other shop man, that his experience must be along different lines, and that the practice in a railroad shop must therefore be different from that in any other shop.

> That the practice in railroad shops is materially different from ordinary shop practice is readily understandable, but why is the practice in one railroad shop so widely at variance with that of almost every other railroad shop?
>
> Why is the equipment generally so archaic and inadequate? Why is the tooling so bad? Why are there so many makeshifts in evidence to the most casual observer? Why is individual output so low? Why is the purchasing department permitted to overrule the mechanical department as to the make of machine tool to be bought?
>
> Answer these questions and you know a large part of the reason why the railroads are having such difficulty in getting their bad order rolling stock in shape. It isn't all a question of machinists and labor unions by any means, as will be shown in this article and the ones to follow.
>
> The American Machinist has made a critical survey of the situation and presents its findings in a series of articles that will run for several weeks. They are unsigned because they represent the work and thought of the staff rather than the efforts of any one man.

This idea that the railroad mechanic is an entirely distinct species was held and perhaps *is* held quite commonly. It was the basis for the belief of the strikers that they could not be replaced. Of course the work in a locomotive repair shop is different from that in the shop where cash registers or automobiles are made. A certain amount of special knowledge and experience is needed in any shop to make things run smoothly. On the other hand, there is in all shops a great deal of knowledge applied every day which is not special to that particular establishment but which is the common knowledge of well-trained mechanics and engineers. Whether a piece of metal is to be shaped in a certain way for the purpose of applying it to a typewriter or to a freight car makes really no difference provided the respective pieces are the same, made of the same material, to the same limits and in the same quantities.

It was found that the equipment was good in spots only and that there was so little appreciation of the inadequacy of the equipment as a whole that the single machine or single operation here and there, which might be considered good, was shown off, evidently in the belief that here was something superior to ordinary shop practice whereas, as a matter of fact, it was merely above the level of the average in the railroad shop. One of the most striking discoveries was the number of very old machines. In one of the shops the master mechanic had been with his company and in its shop for 22 years and, in all that time, he had received only one new machine tool. Another thing equally surprising was the inadequacy of the tooling for some of the machines. Old and inadequate as these machines were, they were prevented by poor tooling from accomplishing even as much as they might have done.

Still another weakness exposed was the poor selection of equipment in many cases. There was an instance of what might be called a manufacturing department in one of the shops where brass parts were made to be used in the various shops and roundhouses of that line and where not a single brass working lathe was present, all the operations being done by ordinary engine lathes with geared headstocks. Here was a case where money was spent unnecessarily and the result was an equipment entirely unfit for the work.

It looked like the trail of one of the old-style grafting railroad purchasing agents, most of whom, fortunately, have passed out of the limelight. This case differed from the general run of instances of purchasing department inefficiency in that the equipment was more expensive than necessary. In the vast majority of cases, the recommendations of the mechanical department men, who knew what equipment they required to turn out the right kind of work, had been ruthlessly ignored and cheaper tools, hopelessly inadequate but coming somewhere near the specified requirements, had been substituted. The waste and inefficiency resulting from this method of purchasing is impossible to calculate but it must run into many millions.

Time Lost on Machining Operations

Control also was lacking, not the control of the operations in regard to the repair of locomotives but control of the individual machining operations. The idea seemed to prevail that all effort should be concentrated on expediting the repair of the engine, meanwhile forgetting all about expediting the individual jobs in the machine shop. While it is certainly better to gain one day on the engine as a whole than to gain the work of two days on the details, it is true also that, if this work on the details is expedited, there may be a chance to gain two days on the engine.

Still another thing was the utter lack of uniformity in the machine shop operations. There was apparently no system by which the management of the shops of the various railroads could get in contact with each other. We say "apparently," for we could see no results which might naturally be expected to come from such an interchange of ideas. As a matter of fact, the master mechanics do get together in convention and occasionally do visit each other but each one seems to feel that his own way of doing things is best and consequently nothing that might be called standard practice has been developed. A certain pride in tradition may explain the attitude of railroad shop men so far as their feelings toward each other's work is concerned, but no such feeling should exist where methods of other machine shops are under consideration.

Neglecting Lessons Taught by Manufacturing Shops

Unfortunately the chances of railroad mechanical department men visiting manufacturing shops are remote and they are handicapped to the extent that they have not the opportunity for seeing how jobs are handled in such shops. There may be differences in detail in the way manufacturing shops carry out their operations but unless such a shop comes somewhere near the average efficiency of other shops of a similar nature it is bound to die. In railroad shops this does not seem to be the case, and naturally so, because a railroad shop does not need to show profits.

In shops where production must pay for everything that goes on, bad conditions of tools, faulty methods and systems cannot persist very long without causing the financial failure of the company. But the railroad shop is merely a repair shop. The profits are made by locomotives, passenger and freight cars and the repair shop is nothing but an expense. At least that is the way it may impress the heads of the company because the good work the repair shop does cannot appear on the profit and loss statement. Fortunately the late strike has brought out the fact that the repair shop is a very essential part of the railroad system, just as essential as cars or locomotives. Nevertheless it may be that the idea that the shop is merely an expense and not a producing element is responsible for a great deal of the conditions the writers observed and the reluctance to spend money on the shops. That such policy is wrong would probably be conceded by any manufacturer except, perhaps, by a railroad company, which is also a manufacturer though it may not know it.

Misdirected Economy

Even where possibly five minutes were saved by taking exceptionally heavy cuts (and the word "possibly" should be doubly underscored, as will be shown later), as much as 30 minutes were lost because of the lack of handling devices.

Connecting rods are made in automobile shops. There are certain differences in these connecting rods and there are certain differences in the equipment of the various shops which make them. As a result one will find slight differences in the methods of manufacturing connecting rods in automobile plants, but after all there is very little to chose between the various methods as far as economy goes.

Connecting rods are also made in the railroad shops but there is the widest imaginable difference between the methods employed by one shop and those used by another. This difference is not merely one of method but of economy as well. When we see that in one shop the square block which must be removed in order to form the jaw at one end of the connecting rod is laboriously drilled out, in another shop milled out, in still another shop partly sawed and partly slotted and in still another slotted from beginning to end, we naturally ask why there should be such an enormous difference in methods, especially when the difference also means that in one place 5 or 6 times as much time is used for the operation as in another.

Lack of Tools

In one of the shops the question was asked whether the sawing out of the two long sides was ever considered and the answer was that the method was well known but that there was no saw capable of doing it. There was in that shop a milling machine which might have been used for milling out the block by means of the now well-known method of employing a helical milling cutter, but there was no tool suitable for the purpose. In short, the operation was done that way because the means for doing it were at hand and it was the old way of proceeding.

There is another method that few seem to know of, the method of cutting out the rod ends with the torch. Both the cost of equipment and the speed of operation of that method should recommend it for consideration.

In one shop a connecting rod was being surface milled on a planer-type milling machine. According to a statement from the shop authorities the machine was

not sufficiently powerful to do the work economically but it was exceedingly difficult to get the necessary appropriations for a new machine. Whether an attempt was ever made to get the appropriation was not stated but it may be taken for granted that it was. Accepting the fact that the machine was too weak, this was certainly no reason why a cutter much larger in diameter than necessary was used so that the number of revolutions per minute was lower than it might have been. This, in the case of a milling machine, means reduced production. Nor was there any reason why the cutter should be without rake or with so little chip space that even a light cut would have stalled the machine. The machine was first noticed about 11 a.m. when it was well under way and had milled a considerable portion of the connecting rod. At 3 p.m. it was still well under way but by no means near the end. There is, of course, some satisfaction in seeing an old friend again in the afternoon after one has made up his mind that he will have passed beyond recall in the forenoon. But whether this joy should be experienced with connecting rods seems doubtful.

An Analysis of One Job

Here, then, is a complicated condition. Machine too weak (though there were no visible indications of it), cutter too large and not properly shaped or ground, authorities that were not willing to furnish the proper machine or possibly entirely ignorant of the fact that such a machine was wanted.

Other little items were observed on this job. For instance, the cutter was so much out of round or possibly the arbor was sprung so much that only one-third of the cutter was doing work. With the same machine and the same cutter properly mounted about three times as much work might have been done. If, in addition, the tool had been properly constructed and sharpened, a still further advance might have been made in production. Question: Who is responsible for such conditions and why aren't they corrected?

While we were making some casual remarks about the condition of the cutter, its mounting, etc., the information was volunteered that there were a number of other cutters which might be examined. These cutters were found on a bench behind a post (not in the tool room but in the main shop) covered with dust and in all imaginable conditions of dilapidation. There were perhaps 10 or 12 cutters of which no two were of the same construction or style. Some had inserted blades, others were solid; some had the blades held in by wedges, others by soft metal cast in; still others by a screw which opened a slot midway between two adjacent blades. Nothing seemed to be known as to which construction was the best or why the various constructions were used. Some cutters had rake, others hadn't. Some were merely dull, others had large chunks broken out of the blades. Briefly it was a sickly looking job lot of expensive tools.

Reasons Without Logic

One of the reasons given to explain the absence of the best methods of machining is that after all the locomotive repair shop should first, last and all the time concern itself with the task of repairing the locomotive in the shortest possible period of time and that it is of much more importance to have the locomotive out of the shop and on the road again a day sooner than that several days be saved in various machining operations. Even if a little more time, and consequently money, is spent on the milling of the connecting rod it should be kept in mind, so the argument runs, that this connecting rod is not the final aim and so long as the connecting rod is ready to go on the locomotive when required there is very little reason for complaint. If on the other hand the connecting rod were finished in a minimum time but a day was lost in the getting ready of the locomotive there would be very serious reason for complaint.

This argument is uncontradictable except in so far as it offers no excuse for spending more time on the connecting rod than is necessary. If the superintendent, general foreman or master mechanic, whatever his title may be, needs all of his time and energy in seeing to it that locomotive are not delayed in the shop, there is still the possibility of having somebody else attend to the details and it certainly cannot be said that the locomotive would suffer if the connecting rod were made in less time and at less expense.

The Alibi Generally Used

This idea that everything must be subject to the main aim of getting the locomotive out of the shop seems to be used as a general alibi for all the detail work which is either done wrong or uneconomically. The example of the connecting rod was taken here because it is so easy to visualize the various machine operations which must be done on this piece. The idea of using a parting tool supported in a long slender bar, fastened to the ram of a slotter for the cutting out of the large chunk of metal at one end of the rod is so much at variance with the best present-day practice that it alone would be enough to justify the questioning of railroad shop methods.

That this same operation is done well and economically in other shops, also railroad machine shops, does not improve matters because it is an indication that there is no such thing as a separate and distinct railroad machine shop practice but rather that every shop seems to have developed its own practice and possibly, even probably, that this practice has not been developed but like Topsy has merely grown up.

Politics and the Personal Equation

Then, too, there is in most cases a lack of personal interest in the economical operation of the shop. In but few instances have the men any forceful personalities to be loyal to. It is easy to be loyal to a strong man whom you know, but difficult to be loyal to a mere name which means nothing to you except as so many letters in the financial columns of the morning paper. Neither can railroad shop managers who are notoriously underpaid inspire an enthusiasm which they do not feel. The uncertainty of continuous employment of the shop officials in the past has also had its effect. Railroad politics, usually beginning in Wall Street, have upset the morale in many a railroad shop. This is particularly true where the roads are financially weak, as it seems to be a habit of railroad management to change the whole personnel with the advent of a new president or receiver.

We have asked the question, "What's wrong with the railroad shops?" It is expected that the answer will be completed with the last article of the series. Before going further let us nail down the faults just disclosed:

Inadequate and inefficient equipment.

Ignorance of those responsible as to what is proper equipment.

Improper tooling.

Lack of control of machining operations.
Disproportionate subordination of machining operations to moving the locomotive from the shop.
Insufficient exchange of knowledge and ideas between railroad shops and manufacturing shops.
Inability of those responsible to see that the railroad shop directly affects profits.
Lack of proper work-handling devices.
Prevalence of conditions causing lack of personal interest on the part of shop men in economical operation of the shop.

(The second article will appear Nov. 16.)

Six Ways of Securing Co-operation and Interest From Your Men

By E. O. Kuendig
Factory Manager, The United Electric Company

(1) Always treat your men as human beings and give them a fair deal.

(2) If there should be any shortages in pay, instruct your paymaster to be courteous to the men when they complain and adjust to their entire satisfaction. Make them see clearly that you have done the right thing by them and, if they are wrong, be sure and convince them accordingly. Do not let them go away until they have seen exactly where they made the mistake. If the company is in the wrong and the shortage amounts to dollars, try and give it to them at once. Do not make them wait another pay before they get it. Of course, if it only amounts to a few cents it will be satisfactory I am sure to any workman to let it go until the next pay. I cannot dwell upon this point too strongly, because I have seen so many workman go away from a paymaster's office disgusted on account of not being given courteous treatment. In some cases I have heard them say, "Oh! the Hell with it, what is the use of telling the paymaster about the shortage, he is always right."

(3) Put your cards on top of the table and never do anything underhanded. What I mean is: If you have anything to tell a workman, or if you want to time a man to set a piece-work rate, come right out with it and don't beat around the bush.

One day a foreman came to me and said: "Mr. Kuendig, I would like to have the rate setter time John Doe. I want his job on piece-work, but I'm afraid John is one of those men that will loaf on the job if the rate setter should go up to his bench and tell him we are going to time him. Don't you think the best way would be to have the rate setter stand back of another machine and time him so John wouldn't know anything about it?" I was rather surprised at the foreman and told him so and also gave him to understand that we weren't doing business that way and told him that we would time John and let him know just what we were doing—explain our purpose, show him the stop watch and explain to him how to read it and try to get him interested before we started. It was amazing to see the attitude John took after we were through. In fact, he is now one of the best men to time and always works at his regular speed when we are setting a rate on the job on which he is working.

(4) Check over your payroll each week and make sure each employee is earning a living wage. In other words, see that his pay envelope contains enough money so that he can live and not just exist.

Instead of trying to get co-operation from your employees by spending money on advertising literature, etc., to tack on the shop bulletin boards, put the money in the employee's envelopes and they will be with you forty strong.

(5) Do not try to kill a man by expecting him to overwork himself so that when he gets home he has no "pep" left. Make your motto "A Fair Day's Work, at a Living Wage," so that when he goes home after work, he can work in his garden, if he has one, or take the children out for a walk. By doing this you gain the good will of his wife and family and your employees will like to come to work instead of doing it grudgingly. There is nothing worse than to have your employees come to work because they have to. If you can get them to come because they want to you have won your point and will get the fullest co-operation on all problems.

(6) Always speak to your employees when making your rounds through the factory in the morning. Don't wait for them to speak first, but make it your duty to beat them to the greeting Never let them get the idea that you think you are better than they are.

In closing I wish to say that if the methods outlined above are carried out, you can rest assured that your employees will be with you at all times and help you to solve your troubles whenever you call on them.

Cutting Down Production

By A. W. Brown

This action of cutting down production, with its corresponding reduction of the working force, is sometimes inevitable, but usually undesirable, not merely that it drives up the overhead percentage, but because it also involves the probability, when full time is resumed, of having to break in new workers to fill the places of those laid-off employees who have found work elsewhere. There is also the distress likely to be caused to the workers and their families.

In general, the humane manufacturer lays off those who have no dependents; and as between any two having none, giving the preference in regard to staying to older men who might find it more difficult to change place of residence or of occupation than younger ones would.

This method of choice does not always make for efficiency in the end, but humanity also has its claims. There are, however, cases where even men having dependents should be laid off among the first. I refer to those who have proved themselves either inimical to the management, or unadaptable to the work and methods in vogue.

Whether to shut down one department altogether, or to lessen production in all, is not always optional with the management. It is important, however, that those who would get the best results from any production organization keep in mind the expensive process of any labor turnover as well as the moral effect of constant changes on their employees.

Some Printing Press Shop Methods

A Crank-pin Drilling Fixture—Pneumatic Presses for Taking Off and Replacing Crank Disks—A Crank Planer Job and a Crankshaft Straightener

BY FRED H. COLVIN
Editor, *American Machinist*

THE driving mechanism of the Chandler and Price printing press has a substantial shaft with a disk at each end. These disks carry crankpins which must be in line with each other. One of the disks, the larger of the two, has a cam groove cut on the inside and is a press fit on the shaft. The other is smaller and is a snug push fit.

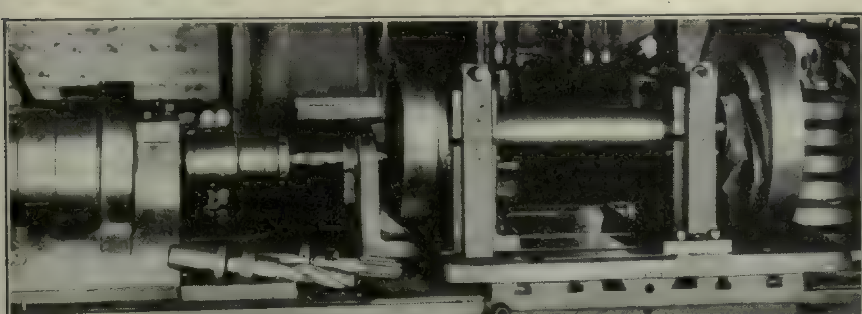
The disks are located by keys and, after being assembled on the shaft, the crankpin hole is bored and reamed in the smaller one in the fixture shown in Fig. 1. The shaft is held in temporary bearings, the disks located by a suitable index and the drill guided by a bushing in a bracket at the end of the fixture. This fixture is mounted on an old New Haven lathe which has been fitted up especially for this purpose. The crankpin hole is drilled and then reamed to size, quick-change holders enabling the tools to be handled rapidly. The hole in the large disk is drilled in a previous operation, a suitable pin in the hole already drilled locating the position of the hole in the other disk.

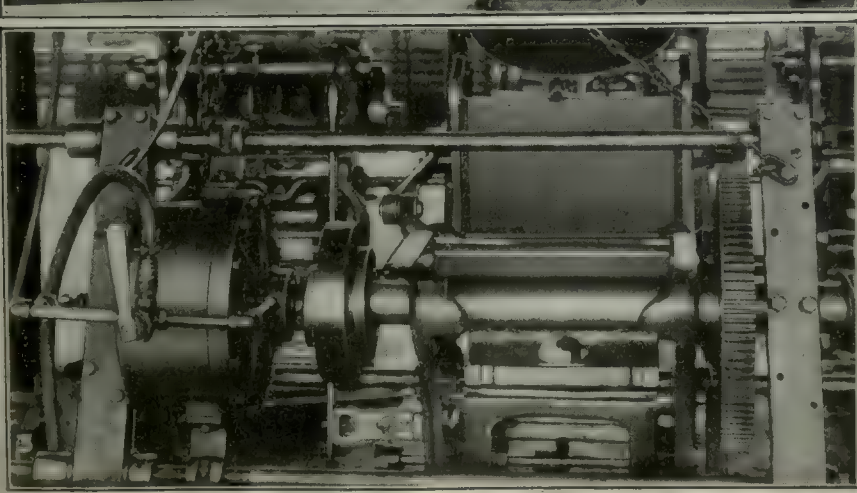
The next step is to remove the small disk to allow for assembling in the press frame. The disk is pulled off by the special pneumatic puller shown in Fig. 2. The puller is suspended from a chain hoist and guided by the arms *A* and *B* on the rods at each side. Air pressure is controlled by the three-way cock *C*. This view shows the crankpin hole in the large disk at *D* as it rests on the floor block. Another air press forces the small disk in place on the shaft in the final assembly, as shown in Fig. 3. The large disk has had gear teeth cut in the meantime as shown at the right. The forcing press is portable so as to be easily handled by the chain hoist. It is swung over the printing press so that the ram on one end, and the stop in the cross-bar on the other are centered with the shaft. Then air pressure forces the disk in place and it is on to stay. After this, the rest of the assembling goes on to completion, although little more remains to be done.

A Crank Planer Job

The planing of the bed of this press is done on the crank planer, as shown in Fig. 4. The bed has a swinging motion, the fulcrum being at the end of the legs. The casting is located and so lined up that the sides of the bed, which form the roller tracks, will be square with the holes for the shaft in the ends of the legs. The ends of the legs are squared up by means of the gage *A* and the portion of the bed being planed to receive the chase is squared with the bosses through which holes are afterwards bored, by means of the bar *B*. The width of the bed between the raised tracks for the rollers is gaged by the measuring rod *C*. This is rather an unusual job and the crank planer has been found very well adapted to it.

Crankshafts will spring at times and in order to straighten them easily and quickly the pneumatic press





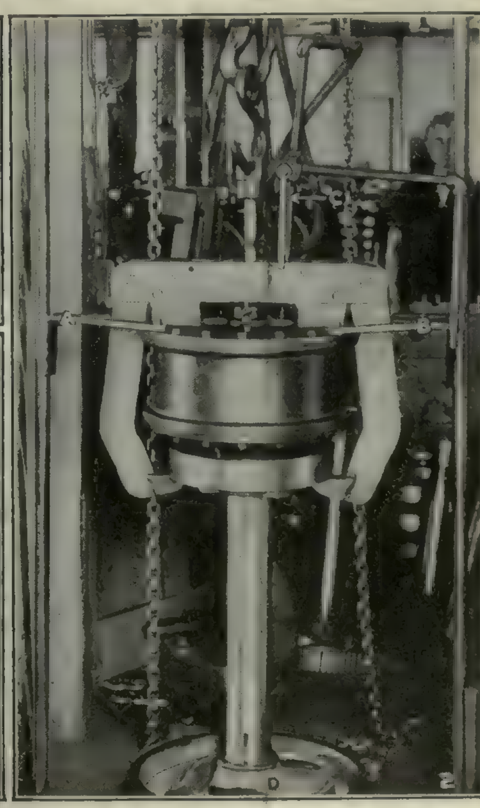


FIG. 1—DRILLING CRANK PIN HOLES. FIG. 2—REMOVING CRANK PIN DISK. FIG. 3—ASSEMBLING THE GEAR SHAFT

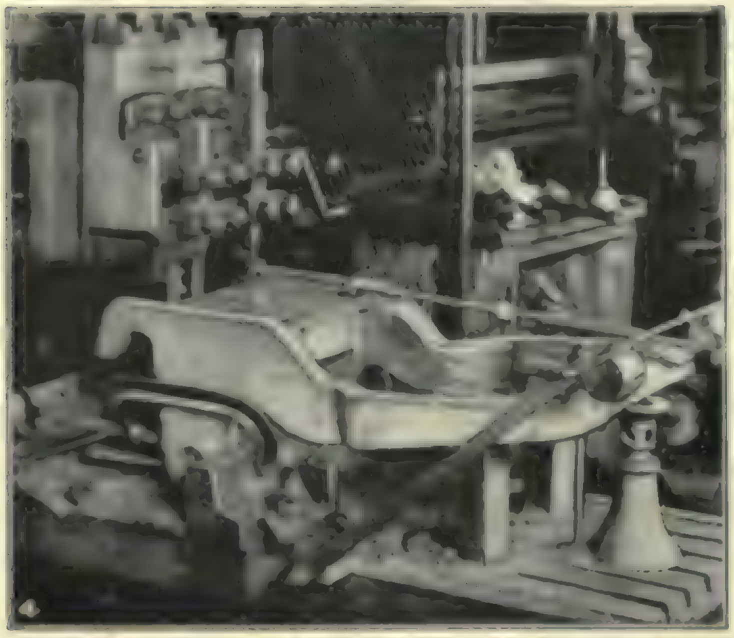


FIG. 4—PLANING THE BED. FIG. 5—AN AIR STRAIGHTENING PRESS

shown in Fig. 5 has been built especially for this work. Here again an old New Haven lathe forms the bed for the operation. The press is mounted on four wheels which fit the outer ways on the lathe and enable it to be easily moved to any position. Cross-bars under the bed, together with the four rods, take the thrust. The shaft is mounted between centers but the stress of the bending is taken by the two adjustable supports, *A* and *B*, which can be easily moved to any position on the bed by sliding them on the inner ways. This arrangement makes a very convenient straightening press and the method can be easily adapted to other work.

Coming Management Methods

By Entropy

When we were beginning to furnish munitions for the World War we found ourselves in such keen competition for all kinds of skilled and unskilled labor that most firms of any size organized departments primarily for the acquisition of workmen. These departments, however, soon found that it was cheaper to try to keep the labor they had than to secure new workmen only to lose them to some equally enterprising representative of another shop. From this grew the art of employment management, so-called.

When business gets much better than it is at present, there will be a rush to do this same thing over again. We have not the ready means of recruiting labor by the ship-load from foreign lands as we had previous to the war and therefore only a slight demand for labor over that at present in existence is inevitably going to place it at a premium and continue the constant accusations of "stealing" help and the same keen and unscrupulous enticing of workers from one field into another. This usually results in transferring a floating labor body from one center of departure to another, never stabilizing it anywhere.

Are employers going to see the futility of this lack of management and are they going to adopt means for training the local population to do their work and treat it well enough so that the desire to roam does not prevail? If they do it will be because the idea is sold to men higher up in the organization than most employment managers have been. It will be because superintendents, general managers and presidents see the necessity and direct that their shops be run in accordance with that idea.

It becomes simply a matter of dollars and cents. How far will a thousand dollars go when invested in wages? Will it go further if invested in improved working conditions? Will it go further in an athletic field? How about shorter hours or longer hours and overtime pay? Is good foremanship a good investment? Does it cost more, or less, to lead men rather than drive them? All these questions and many more will have to be answered by someone who has his finger on the pulse of the finances as well as on the sentiments and ambitions of his workmen.

This is a job for the business management. It is inseparably tied up with cost accounting, planning and distribution of work, with efficiency, and it will ultimately have to be handled in connection with all these and other branches of management. We are dealing, on the one hand, with dependable figures, as to tonnages, power costs, and handling of materials, all of which can be established with fair certainty that they will be where we left them when we shut down last night. On this hand we deal with human beings whose temper and temperament, hopes, fears, and health, both mental and physical vary from moment to moment and require the services of the most expert of psychologists.

These psychologists will have to include boards of directors and managers even more than employees in the personnel offices. We will have experts in human engineering just as we have experts in mechanical, or electrical engineering, men who will advise, not the employment manager, but the general manager. All these things suggest a new era in management, a time when boards of directors will consider gravely the questions which during the last days of hectic business were left to chance or to untrained men in the employment office.

Industrial Standards in Germany

Work of Establishing Standards Is Under Direction of Central Committee—Has Been in Progress for Four and One-Half Years—International Co-operation Desired

BY H. O. HERZOG

STANDARDIZATION in Germany dates back to the second half of the last century. It had existed, as in other countries, to a certain degree before that time but was restricted to a limited number of articles. Its applications were few and far between and were, in the main, the result of custom, which in the course of time has caused some standards to be more or less generally adopted as a matter of expediency. Such cases were the standardization of structural steel, sheets and wire, which originated in 1873 and has since been in constant progress. Standardization of pipes followed in 1882, restricted to cast iron pipes, while in the case of wrought-iron pipes the English standards prevailed. The latter were followed in many cases, the foremost of which is the British Whitworth screw thread.

The greatest progress was made in the standardization of railroad material, where conditions were most favorable; the railroad management being centralized in a few hands. Although energetic pioneer work was not lacking and foreign progress acted as a spur, standardization by deliberate and systematic action was slow and strictly tentative. Germany has always been peculiarly reluctant to take the initiative in such matters. This attitude must be ascribed to the strongly pronounced leaning toward an international treatment of the problem. Purely national standardization was and is still considered an incomplete solution. German engineers have been eager to co-operate with other nations, but were averse to proceeding alone. The most striking instance of this attitude is probably the establishment of the metric screw thread, of which Germany was the originator.

For such reasons standardization as a prominent problem of industry has remained considerably behind the developments in the United States and England. No pressing need was felt for its furtherance, and the reluctance to take independent action checked individual efforts. A strong impulse has evidently been lacking. This impulse was supplied by the exigencies of the war which, as in other countries, taught the country a sharp lesson in the matter of quantity production. Imperative necessity has overcome the latent resistance; furthered by the fact that international procedure had become a mere remote possibility. The long deferred problem of standardization was then seriously taken in hand.

The initiative was taken by the War Office Department of Arms and Ammunition, which entrusted its execution to the Society of German Engineers. Under the leadership of the latter a standardization committee was formed for the machine-building industry, in which a number of other associations, like the Society of German Machine Tool Builders, of Tool Makers, the Association of Wood Working Manufacturers, Steam Engine Manufacturers and others, were represented. This committee commenced operations in direct and most intimate relation with the government offices, and was primarily subservient to the needs of the war industry. The first step taken was to make a survey of the standards which had grown up in various works and get the latter into contact, with a view to bringing about an interchange of experiences. The first actual work taken in hand was the standardization of cylindrical and taper pins, drills, keys, and temperatures. This Standardization Committee soon spread out into an organization comprising the whole industry, which was formed in December, 1917, under the name of Standardization Committee of the German Industry.

> THE standardization work of Germany is keeping strictly within the scope of standardizing parts and units, measurements and dimensions. The Committee is averse to venturing upon the field of standardizing aggregates. No pressure is exercised upon any industry for adopting the new standards, but it is hoped that in the course of time this adoption will gradually proceed of its own accord. Summing up the present situation, it can be said that the industry as a whole is receptive and the necessity for thorough standardization is recognized as a principle everywhere. It is felt, however, that the progress is somewhat slow, and that an energetic propaganda is needed for speeding it up.

The organization has since then been considerably enlarged, and reflects now in its elaborateness the inherent thoroughness of the German. It is composed of a head committee whose function is to supervise and direct the work along broad lines, while the actual work is carried out by managing committees which are formed, one for each specific task, and of which there now exist a large number. The head committee comprises representatives of government offices, like the Post Office, the Navy, National Economic Ministry, Ministry for Public Works, Ministry of Finances, War Ministry, the Patent Office, the Physical and Technical Institute, the Polytechnic High Schools, the National Testing Laboratories, and those of a great number of manufacturing associations.

All groups of industry in which standardization work is carried on are represented. It is presided over by a board consisting of prominent men of the industry, of the railroad administration, and several government officials. It maintains a permanent office, where the chief function is to remain in constant contact with a large body of advisers recruited from producers, consumers, government offices and scientists.

The proceedings are conducted in the following way: After deciding upon the standardization of a certain article, on the initiative of the committee or on suggestions from outside, connection is established with the groups already mentioned—producers, consumers, officials and scientists—with a view of procuring material to work upon and to arrive at a definite primary understanding. Then the work is passed on to a managing

committee elected for this purpose. The principle underlying the procedure is to systematize the information received, so far as is practicable, special care being taken to insert new standards if the demand for such exists. The opinion of the industry on proposed standards is invited in the fullest possible way.

After being completed it is, by publication in a journal, submitted to public criticism for a specific period. After this period has expired, the comments received are scrutinized, and thereafter it is the chief task of the managing committee to find a suitable compromise between the conflicting criticisms and counter-suggestions submitted. The result is then passed on to a consulting committee consisting of a number of prominent men of industry and technical scientists. The members of this consulting committee are carefully chosen to exclude any possibility of private interests playing a part in its deliberations. The approval of the committee finally decides upon the proposed standardizations.

Committee Active

A great deal of work has been completed during the four and a half years of the committee's existence. It comprises nearly all parts of industry; machine building being predominant. The starting point of the new organization was to lay down fundamental diameters, a matter concerning the industry as a whole. As the decimal system made it impossible to adopt pure arithmetical progression, considerable difficulty was encountered at first. It was found necessary to circularize a large number of manufacturers in order to find out the most customary diameters and those little used. Upon the replies received a system has been built up, which, adhering to arithmetical progression as far as possible, avoids decimals by rounding out figures according to prevalent customs. A preference for certain diameters and aversion to others could easily be observed and this was the means of guiding this work towards a basis for the ultimate determination of standard diameters.

Amongst the work for machine building completed may be mentioned the following:

Mathematical formulas, sizes and execution of drawings, temperatures, figures, diameters, tapers, radii, screw threads, fits, bores, shafts.

Standards of machine-building material: copper, brass, bronze, cast iron, steel castings, drawn and rolled steel.

Hardness tests, Brinnell method.

Keyways, drill jigs, drills, counterbores, thread-cutting tools, grinding disks, cutting tools, measuring tools.

Long List Completed

Handles, spigots, handwheels, keys, chains, ball bearings, cranks, bushings, rivets, pipes of mild steel, lubrication rings, bolts, nuts, spanners, washers, stuffing boxes, gears.

The standardization committee is often confronted with an overwhelming number of existing sizes. Following a line of compromise, the elimination achieved is not radical but constitutes a decided progress. This may be seen from the following instances giving the number of standard sizes which existed prior to standardization and those remaining after:

	Sizes Before	Sizes After
Keys of [illegible]	[illegible]	44
[illegible] of 30 to 200 m.m. diameter	78	17
Clamp and flange couplings	124	14
Hanger bearings	146	46
Pedestal bearings	33	14

The standardization of threads has this year been concluded. Inquiries of numerous firms have disclosed the remarkable fact that the Standard International metric thread has made comparatively little progress and has not been able to replace the Whitworth thread, not to speak of numerous other thread systems used.

Original Idea Abandoned

The original intention to make the adoption of the S.I. metric thread general has been abandoned in view of the strong leaning of the industry towards the Whitworth thread, and efforts have been concentrated towards eliminating the other threads in use. At the present stage of standardization two recognized threads for machine building remain, the metric thread with an angle of 60 deg. and the Whitworth thread with an angle of 55 degrees. Of the great number of special threads only a few have been retained, like the saw-tooth and buttress thread and the round thread (wire thread).

The following data show the economy achieved by the now concluded standardization of threads:

	Before	After
Thread systems	10	2
Kinds of threads	274	72
Tools:		
Thread gages	548	144
Taps	822	226
Dies	548	144

The S.I. metric thread in diameters of from 1 to 150 m/m. and the Whitworth thread from ¼ in. to 6 in. are now completely standardized. The Whitworth thread coincides with the standards of the British Engineering Standards Committee. Another large task was the standardization of forged and machined screw bolts. Starting with heads round, square and hexagon, points and nomenclature, the standardization of bolts is now almost completed and has brought about a considerable reduction of existing sizes.

Further Progress

As an indication of further progress, recently made, may be added the standardization of pipes by bringing the existing standards into harmony and establishing standards for high, medium and low pressure. Formerly the flanges and their screws were different for the various pressures, while after the standardization their dimensions are adjusted according to the size of the pipe, independent of the pressure.

In several lines of industry, as in motor-car manufacturing, and the electrical industry, standardizing work is carried on by independent committees formed by the respective manufacturing associations; but even in such cases where the work is decentralized provision is made for connection with the head committee in order to eliminate interference. The desire, already mentioned, of German engineers for co-operation with other nations, chiefly England and America, in the matter of standardization has never been quite effaced, and has, with the restoration of peace, almost regained its former force. The viewpoint that isolated standardization in the various countries stands in the way of an international treatment of the subject has, however, been abandoned and the theory adopted that the former has to precede the latter in order to create a basis for it.

This thought was strongly emphasized in a conversation your correspondent had with Mr. Hellmich of the Society of German Engineers, in whose hands the permanent work of the organization rests, and who wishes it to be pronounced emphatically that German

engineers have no intention whatsoever to establish German standards with a view to use them as a weapon in international competition. They strongly hope that the parallel work going on in the various industrial nations will ultimately lead to concerted action based upon the existing national standards. The German Standardization Committee is glad to perceive that this idea is finding full understanding with similar organizations; proof of which is the connections that have already been established. Such connections, of an official nature, exist already between the German Standardization Committee and most others; as the American Engineering Standards Committee, the Canadian Engineering Standards Association, the Austrian Standards Association, the British Engineering Standards Association, the Standards committees in Holland, Italy, Sweden and Switzerland.

In a few instances where such is not yet the case, personal relations have been taken up. An exchange of approved standards is taking place between existing standardization committees. The standardization sheets, which are in themselves strictly standardized and made up alike with the sole difference of language, make comparison easy. As a first step towards closer co-operation, this exchange is said to have been entirely successful. Any further steps in this direction will be heartily welcomed by the German Standardization Committee.

The standardization work of Germany is keeping strictly within the scope of standardizing parts and units, measurements and dimensions. The committee is averse to venturing upon the field of standardizing aggregates. The reception of their work by the industries is said to be satisfactory although it can be seen that in cases where tradition is strong the introduction of new standards meets with considerable resistance. Such resistance must be contended with, however, as it could not be expected that manufacturers will go to the expense of adjusting themselves at once to new standards. No pressure is exercised upon any industry for adopting the new standards but it is hoped that in the course of time this adoption will gradually proceed of its own accord. Summing up the present situation, it can be said that the industry as a whole is receptive and the necessity for thorough standardization is recognized as a principle everywhere. It is felt, however, that the progress is somewhat slow, and that an energetic propaganda is needed for speeding it up.

Automatic Electric Temperature-Regulating System for Furnaces

By I. William Chubb
Editor European Edition, *American Machinist*

The firm of Adolphe Saurer, Arbon, Switzerland, which build commercial vehicles for practically all the countries of Europe, have in their heat-treatment department a system which automatically controls the temperature of the furnaces by varying the position of the dampers. Coke is used as fuel and the same system will obviously apply to coal-heated furnaces. Where gas, oil or electricity are employed, however, a somewhat different scheme will be necessary. The appliance can be set so that the desired temperature, once obtained, can be maintained for any length of time with an accuracy ± 1 per cent at low temperatures and $\pm .75$ per cent for high temperatures.

Fuel Consumption Minimized

The system controls six furnaces working equally well whether the temperatures in these furnaces are the same or differ, and the firm state that the heat remains so steady without special attendance that the recorders trace horizontal lines. The fuel consumption being proportionate to the average temperature, is minimized and the furnaces can be worked with a smaller number of attendants, but the chief merit of the temperature-regulating device is that as far as it goes it guarantees the correct heat-treatment and thus ensures the high quality of materials required in the finished product.

In Fig. 1 is illustrated the exterior of the mechanical part, the heat being varied by controlling the draught in the chimney with a slide, which is itself controlled by the electric regulating device to be described. This view shows a horizontal shaft, which carries a double-arm lever, with one end connected by a rod to the chimney damper. To compensate for the weight of the rod and fittings, a counterweight is carried on the other arm and the housing contains two magnets the function of which is to rotate the shaft enough to raise or lower the regulating damper.

The control system is illustrated in Fig. 2. From the thermo-electric pyrometers placed in the furnaces, current is taken to an ordinary galvanometer A, the switch device B enabling any one of the six thermocouples of the six furnaces to be connected up so that the galvanometer will indicate the temperatures of the furnace put in circuit. At C is a similar galvanometer except that, instead of the temperature scale, it has two parallel arc-shaped troughs filled with mercury and concentric with the axis of the needle of the instrument. Both troughs are contained in a block of vulcanite, one trough being divided at the middle into two portions by a mica partition. The glass pointer of this galvanometer is provided at the free end with a U-shaped platinum wire, connecting when necessary one trough with the other. Normally the U piece does not dip into the mercury, above the surface of which the needle plays freely.

By means of a switch D the pyrometer of any furnace

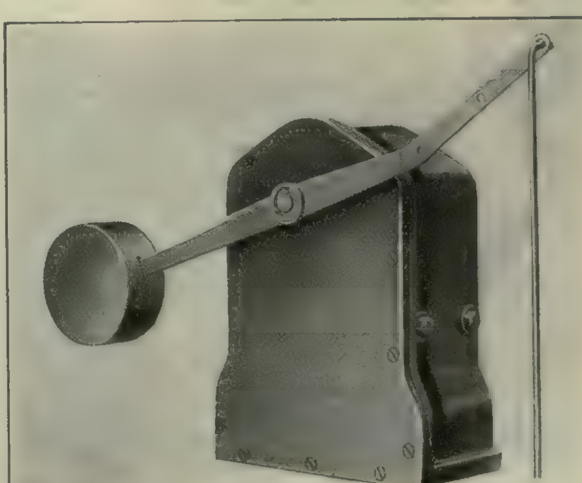


FIG. 1—DAMPER ACTUATING ROD AND MAGNET HOUSING

can be connected to the contact galvanometer *C*, the needle of which will travel to a certain point depending on the temperature. At intervals the wire hoop visible at *E* is caused momentarily to press the galvanometer indicator downwards, the platinum wire then dipping into the mercury if the temperature is incorrect. By this means a circuit is closed which, according as the temperature is too high or too low, that is, according as the pointer dips into the mercury trough to the right or left, will permit a heavy current to pass, to excite the electro-magnets in the housing (see Fig. 1) and cause the damper to close or open.

The switch *D* is operated by the motor *F* so that the six furnaces are connected up in turn. The motor also serves to press the hoop *E* downwards, the power required for the motor being in the order of 0.02 hp. It is arranged that there is no voltage on the circuit when the platinum hoop dips into or emerges from the mercury and consequently, as the platinum contact is not subjected to wear or dirt due to sparks, its life is practically unlimited. The speed of the motor and the gear ratio have been chosen so that the regulation of all six furnaces requires about 3 min. The temperature of each furnace is therefore controlled every 3 min. and when, by the limits mentioned, it is higher or lower than is required the damper can be adjusted.

If the furnace temperature is correct, the needle of the galvanometer seats itself directly over the mica partition, preventing contact between the two mercury troughs. While the position of this partition is determined by the construction of the galvanometer, adjustment of any desired temperature is made possible by inserting in the pyrometer circuit of each furnace a suitable resistance so that the galvanometer needle is over the mica partition at the required temperature, whatever it may be. Fig. 3 illustrates the size resistances of the lower part of the apparatus. In front of each is a scale for temperatures from 170 deg. to 1,090 deg. C. Each scale carries a device for adjusting the resistance, together with a pointer which indicates the temperature.

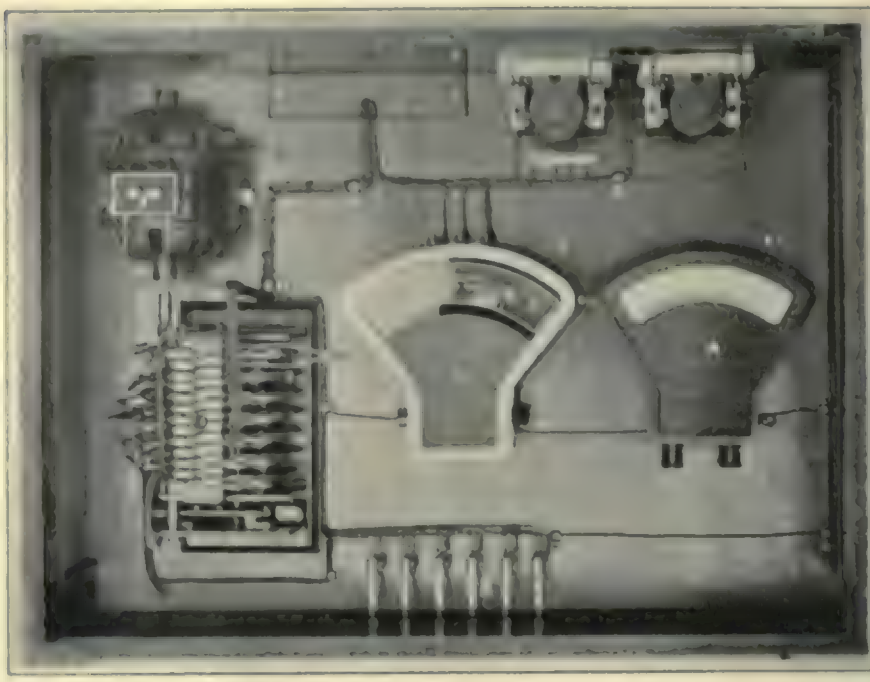


FIG. 2—GALVANOMETER CONTROL PANEL

FIG. 3—GALVANOMETER CIRCUIT RESISTANCE UNITS

Cutting Oils vs. "Soap Water"

By H. B. Egg

In an endeavor to learn what is the best practice in using cutting lubricants, the writer visited a number of high class shops, hoping to profit by their example. I returned with lots of information, but little satisfaction. Below are tabulated the results of my investigation, omitting names:

	Our Shop	1st Shop	2nd Shop	3rd Shop
Milling machines	Water	Oil	Water	Water
Gear cutters	......	Water	Water	Oil
Hand turret lathes	Water	Oil	Water	Water
Automatic screw machines	......	Oil	Oil	Oil
Drills	Water	Water	Water	Water
Cold saws	Oil	Oil	Water	Water
Threading lathes	Water	Oil	Oil	Oil
Thread millers	......	Oil	Water	Oil
Hack saws	Water	Water	Water	Water
Broaches	Oil	Oil	Water	Water
Engine lathes	Dry	Oil	Water	Dry
Boring mills	Dry	......	Water	Dry
Grinders, (Production)	Water	Water	Water	Water
Grinders, (Drill)	Dry	Water	Dry	Water
Grinders, (Cutter)	Dry	Water	Dry	Dry

Under the name of "water" are included all of the various emulsions and compounds using water. The different kinds of oils used was amazing, ranging from lard oil to *near* lard oil mixed with varying proportions of paraffin oil. One shop kept down the cost of its oil by mixing with it a big percentage of kerosene.

Our rule had been to use water where much heat was developed and where the sizes were not held to close limits, or anywhere else if we felt like it. We used oil on forming operations and on tools which we wanted to keep sharp a long time. For tapping, we used machine oil or any old thing handy, and the other shops visited did not have anything on us in that respect.

It appears to us that shops buy cutting lubricants or coolants from the most convincing salesman and continue to use his brand until a more persuasive talker pays a call. There should be a more scientific method of selection.

Methods of Machine Tool Design

Further Continuation of the Subject of Cam Feeds for Machine Tools—Beginning of the Analysis of a Screw Machine Drum Cam

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

THE timing of cams aims at a construction by which all the cams used will co-operate without interference and without loss of time. Merely avoiding interference would be easy by allowing a sufficient amount of time between the successive operations of various cams to make sure that the functioning of one has completely ceased before the work of another one begins. In doing so, however, one would sacrifice a certain amount of time which might well be saved by a careful analysis. Such an analysis should be undertaken every time a new job is put on a given machine. The designer of a special machine, arranged for one operation only, has practically the same task before him as the man who arranges an existing machine for a new job. When a standard machine must be designed, the problem is somewhat more complicated. Even with a special machine the timing of cams is somewhat more complicated than the arranging of a standard machine for a new job.

Some of the operations performed by an automatic machine require a variable amount of time, while other operations always require the same period. Instances of the first kind are the turning, or boring, or reaming on an automatic screw machine. Instances of the second kind are the stock feed, indexing, and shifting of belts. Conditions are still further complicated by the fact that, though the indexing might always take place at the same speed, the machine may be so arranged that the index speed cannot be kept constant. As a rule, such operations as indexing are carried out on the high speed (if there is one). In some machines this high speed is constant, in others it is variable. As illustration of the various possibilities, we cite the following examples:

Fixed Ratio Between High and Low Cam Speeds

In the original Spencer machine there was a fixed ratio between high and low speed of the cams. This ratio was established through the differential gearing in the feed pulley. With a given machine this ratio could not be cnanged. If it was desirable to reduce the feed, or rather, lengthen the cycle, for a certain piece of work, the feed pulley was run at a lower speed so that all operations were carried out at a slower rate. Indexing, stock feed, shifting of belts, all was done slower, not because it was desirable to do so but because it was necessary to have a slower cutting feed or perhaps because a piece was longer or of harder material.

At other times it might be desirable to shorten the time for a complete cycle and this was done, of course, by giving a higher speed to the feed pulley. Here we would run up against another difficulty. It was not possible to reduce the cycle below a certain point, because increasing the feed had also increased the speed of indexing and it would be imposible to index at too rapid a rate. As a result, it was often necessary to take more time for a complete cycle than was actually needed for the cutting operations, simply because some of the idle operations could not be carried out with the proper speed of the feed pulley.

In machines like the Cleveland machine, the high speed is constant, whereas the various feeds are adjustable entirely independent of the high speed. High speed and feeding movements, however, are tied together in one cam and there is no possibility that any of the cams can get out of time with any of the others. On the type of machine represented by the Brown & Sharpe screw machine we find a different set of conditions. It would be possible here to arrange this machine so that one operation might interfere with another, for instance, by wrongly setting the dogs, or by the failure of one of the idle operation cams to act at the proper time. In this machine the cam which gives the forward and backward motion to the slides and turret runs at a constant slow speed, that is, its speed is constant during the job, though it may be changed for the next job. The movements of the cams for idle movements run at a speed which is always the same regardless of the speed of the main cam.

Problem of the Automatic Screw Machine

For the reason that there are so many different combinations possible, it is exceedingly difficult to indicate a system by which cams can always be timed properly, unless we reduce the movements of the various cams to one common unit. This unit is the revolution of the work spindle in the automatic screw machine. In some other machine it might be a stroke or a reciprocating tool. In still other machines it might be some other function again.

Confining ourselves for the present to the automatic screw machine we would say that it requires so many turns of the spindle to complete the first cutting movement, so many for the second, so many for the third, etc. We would determine the high speed by the maximum speed we would dare to give to the parts operated upon; for instance, the speed of indexing. From this high speed we would calculate the number of seconds required for each of the idle movements as well as for the different returns, and we would then reduce that number of seconds to revolutions of the work spindle, so that we would obtain the total number of revolutions of this spindle for one complete cycle. We will illustrate this by a concrete example and assume that the following conditions exist:

- The machine has a constant high speed for cams.
- The various feeds are made by the different slopes given to the cam.
- The cams can be given various speeds for the feed movement by change gears.
- All cams are geared together.
- The work revolves at 300 r.p.m.
- First operation requires stroke of 1 in., feed of 0.010 in.
- Second operation requires turret feed of 1 in., drilling feed of 0.006 in., and feed of cross slide for forming of 0.0025 in.

For the author's forthcoming book.

Depth of forming is ⅜ in.

Third operation requires length of stroke of ¼ in., feed of 0.005 in.

Fourth operation requires a length of stroke of 1 in., feed of 0.015 in. and a cross feed for cutting off of ½ in., feed of 0.002 in.

Fig. 170 is a diagram in which all these various movements are laid out, each one for itself and without regarding any of the other movements which may take place at the same time. The lower bar takes care of the turret motion, the second bar takes care of the cross-slide movement, the third one of the index, the fourth of the opening and closing of the chuck, the fifth of the stock feed.

Duration of Cutting Operation

As the first cut is 1 in. long and the feed is 0.010 in. per revolution, 100 revolutions will be required for this cut. In a similar manner we figure that the second, third and fourth cut taken by the turret tools will require 166⅔, 50 and 66⅔ revolutions respectively. We also find in a similar way that 150 revolutions are required for the feed of the forming tool and 250 revolutions for the cut-off tool.

In regard to the index, we will assume that it was found that one second is required to complete the various operations necessary for one indexing. These operations include the withdrawal of the locking pin, the moving of the turret, and the replacing of the locking pin. As one second of time corresponds to five revolutions of the spindle, and as we have assumed four stations of the turret, four times five revolutions of the spindle will be required for all of the indexing

FIG. 170. DIAGRAM OF SCREW MACHINE OPERATIONS

movements. We will further assume that ¼ of a second was found practical for the opening and closing of the chuck and that ½ second is required for the stock feed and another ½ second for the return of the feed shell. This will give us 2 × 1¼ revolutions for the opening and closing of the chuck and 2 × 2½ revolutions for the stock feed. In this manner we have obtained the chart of Fig. 170. Though we have taken care of all of the elements which our operation requires, we have neglected to consider the time which may have been spent on account of the peculiarities of the cam.

Our machine is a special one and we can assume any slope of the cam which we may deem desirable. We will assume a slope of one to three for the feed and forty-five degrees for the return. We will further assume that the cam roller is 1½ in. in diameter. Laying out Fig. 171, in which *AB* is the cam slope for feeding and *BC* that for return, and placing the roller at the points *A* and *B*, we notice that the distance traveled by the roller along a horizontal line is more than the base of the triangle of which the height is 1 in. This little distance A_1A_2 must be added to the time required for the feed of 1 in.

We will now lay out Fig. 172 which shows all of the feed and return strokes side by side. This diagram shows us something which was overlooked, namely, that the slopes cannot be the same, except when the feed per revolution of the spindle is the same. We see that operations *2* and *3* have a gentler slope than operation *1*, but that operation *4* has a much steeper slope. This operation *4* happens to be a reaming operation in our case, so that a steep slope is permissible. However, in some other case we might have been compelled to make the slope of operation *4* more gentle, say one in three,

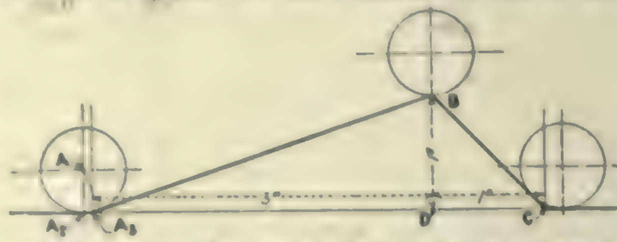


FIG. 171. CAM LAYOUT FOR FEED AND RETURN

and in that case the slopes of the other three operations would have been gentler than shown in this diagram.

It also brings before us at once something else which we have so far neglected, namely, the advance of the tools. It may well be that the tools are set in such a manner that only a very short advance is required, but as a rule this is not the case and for our illustration we will assume that the final position of the turret at the end of the feed stroke is always the same regardless of what was the amount of the feed. We will further assume that, for the sake of safety, we have

FIG. 172. DIAGRAM OF FEED AND RETURN STROKES SIDE BY SIDE

allowed one extra inch of advance in all cases; so that we would have for operation *1* one inch advance, one inch feed, and 2 in. return; for operation *2* the same; for operation *3*, 1¾ in. advance, ¼ in. feed, and 2 in. return, whereas the fourth operation will be the same again as the first two. This makes our diagram as shown in Fig. 173.

It would be possible to calculate the extra distances which we have to allow due to the curvature at the point where two parts of the cam join but this would involve a large amount of calculation and we will find it to be easier to determine these amounts graphically. With this in view we have laid out Fig. 174. In this diagram the length of the cam is the distance from *A* to *B*, which we find by measurement to be 30½ in.

Without going further with this cam, we now start the consideration of the cross-slide cams. Looking at our schedule of the various operations performed by the machine, we find that the forming takes place at the same time that the second turret tool operates. This turret tool requires 166⅔ revolutions of the spindle, whereas the forming tool requires only 150 revolutions. Thus, if we can start both operations at the same time, we will find the cross-slide ready to return before the turret tool is in that condition. This will give us a

FIG. 173. DIAGRAM WITH ALLOWANCES FOR EXTRA ADVANCE

chance either to start the cross-slide tool somewhat later, to finish with it somewhat earlier, to give a dwell to the cross-slide tool at the end of its forming operation, or to have a combination of these things.

When we look at the second cross-slide operation, we find that it corresponds to the fourth turret tool operation. This fourth turret tool requires only 66⅔ revolu-

tions for its completion, whereas the cutoff tool requires 250 revolutions. Before deciding how to arrange the relation between these two, we must consider what these operations mean. It stands to reason that the reaming operation must be finished before the cutoff operation is completed. It also stands to reason that the reaming tool must be completely out of the hole before the finished piece drops off, so that the fourth operation not only must be finished but the turret must have returned before the cut-off is completed.

other action at *C*, we might have interfered with the return of the cross-slide. At *D* we notice the same thing we have noticed at *A*, namely, that we are still on the advance of the cross-slide when the feed of the turret has started. This means that we have to shift the upper diagram to the left. When we make a shift sufficient to start feed of cross-slide and turret at the same time, we will find that the entire operation of the turret, its feed and return, are completely finished when we are still on the feed of the cross-slide. In other

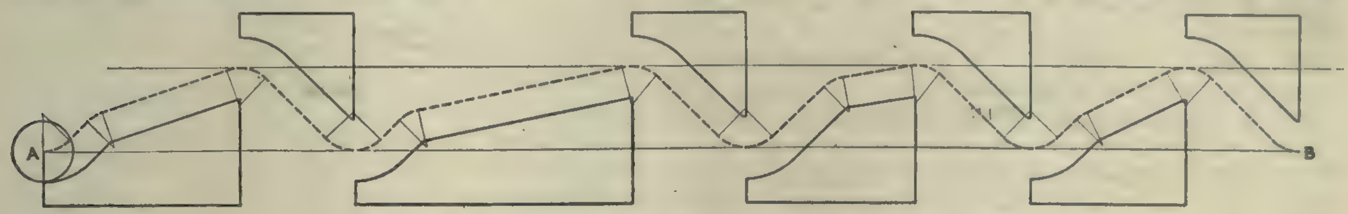


FIG. 174. GRAPHICAL DETERMINATION OF CURVATURES

Looking at Fig. 174, we see at a glance that the total distance required for feed and return on the fourth operation is less than the distance required for the feed only of the second operation and, as this latter feed corresponded to 166⅔ revolutions of the spindle, realize that the entire reaming operation with its return can be accomplished in less than 166⅔ revolutions and, therefore, will be completed within the time required for the cut-off.

Control of the Cross-Slide Tool

We now construct Fig. 175, which shows the center-line of the roller movement of Fig. 174, and immediately above a similar center-line for the roller movement of the cross-slide tool. We will imagine that these latter tools are controlled by a cam just like the one we are constructing. As a rule this latter assumption is not correct and we are making it here merely to simplify our first analysis. We notice that the feed begins in the lower diagram at the line *AA*, but that we are still at the advance in the upper diagram. To correct this we can do one of two things: We can either place the upper diagram further to the left—in other words, start the advance of the cross-slide tool a little earlier —or else place the lower diagram somewhat to the right—in other words, start the feed for the turret somewhat later. This instance shows how necessary it is to combine the diagrams for the various cams, because, merely looking at our original schedule, it would have seemed that we would have a surplus of time for the forming operation.

Nevertheless, it is well to look at things before making a picture of them. Though our conclusions were faulty, the thoughts which led up to them were necessary, because without them we would not have constructed Fig. 175 for a check and we would not have found the true condition of affairs. We see at the line *BB* that we are still on the feed of the cross-slide after we have started the return of the turret, which means either that a part of the return of the turret would be on the slow motion or else that we must make the shift mentioned before. At the line *CC* we notice that we are still on the return for the cross-slide when we are on the dwell of the turret. If we had started some

words, we see that the return of the turret takes place on the low speed and that even then there is time to spare. It will therefore be possible to make the return line for the turret at a more favorable angle than 45 deg., and that without loss of time.

We have estimated the time required for the remaining operations in seconds and reduced them to revolutions of the spindle, that is to say, we figured one second for the index and said that this is one-sixtieth of 300, or five revolutions. When we said that the first turret operation required 100 revolutions we could determine how much of the circumference of the cam would be required for this operation because the slope of the cam was known. The return, also, was easily determined because the amount of cam required for this function depended entirely on the amount of return and the slope of the return cam. When it came to determining the amount of space to be allowed on the cam for the period of indexing, we had no such data and we attacked this problem from a different angle.

Cam Space for Indexing

To make the problem we have before use somewhat clearer, let us imagine that the diameter of the complete cam drum is 10 ft., which is, of course, a very much exaggerated figure. Let us further imagine that this cam drum makes 60 r.p.m. when it runs at its high speed. Then its circumferential speed is practically 30 ft. per second. We have found from Fig. 174 that a length of about 2 in. of the cam drum is required for the return of the turret. As 2 in. is $\frac{1}{180}$ part of 30 ft. (the circumference of the drum) it would take only $\frac{1}{180}$ part of a second to return the turret. This shows clearly that we are not free to assume any diameter or any speed of the cam drum. We will therefore select some figures which are more nearly practical,

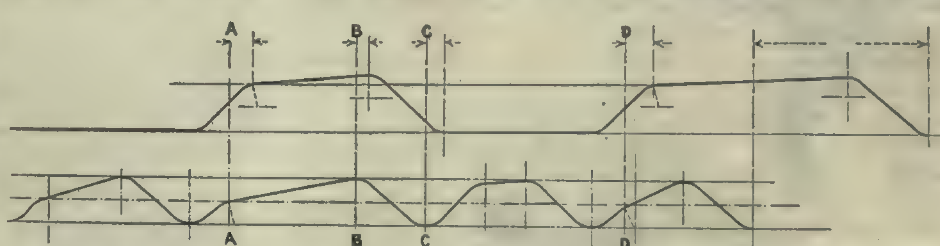


FIG. 175. COMBINED DIAGRAMS FOR TURRET AND CROSS-SLIDE

though we cannot be certain that we shall be able later on to apply these same figures to the problem before us.

Let us suppose that the cam drum is 18 in. in diameter and that the fast speed will permit the drum to revolve once in 6 seconds. We would then have a circumference of practically 54 in. and a circumferential speed of 9 in. per second. The return of the turret would then be accomplished in a little less than one-quarter of a second. Even this seems to be too high for a machine of a size such as the one before us. In order not to do any further guessing, we must determine a safe speed for the return of the turret and we will assume this to be ½ second. We will, therefore, have a circumferential speed of practically 4 in. per second. It should be noted that this return speed of the turret depends largely on the size and construction of the machine and attention should be given to the following rule:

It is better to select a return speed which is slightly too low than one which is slightly too high.

The effect of too high a return speed is excessive wear, danger of breakage, and tendency to loosen machine parts and spoil work. By reducing the estimated return speed from ½ second to ⅓, which is a speeding up of 50 per cent, we increase the momentum of the moving parts 125 per cent and we gain in time four times the difference between ½ and ⅓ of a second. Considering that the total time for our job is practically a minute and a half, a saving of ⅔ of a second is such a small percentage of the total that it is not wise to take any risks to accomplish this small saving. When the total time for the complete cycle is very small, in other words, when the idle times form a large percentage of the total time, then it would be good policy to try to save every little part of the return and other idle movements.

Determining the Size of the Cam Drum

Having determined that the circumferential speed of the cam is 4 in. per second, we find now that we must allow an idle space on the cam of 4 in. for each index (because the index requires one second), 1 in. for the opening of the chuck, 1 in. for the closing, and 2 in. for the stock feed and also for the return of the feed shell. Thus the total length of the cam will be 30½ + 4 × 4 + 2 × 1½ + 2 × 2½ plus as much as may be required for the shifting of the two cam grooves of Fig. 175 and minus such parts of the cam as we may find can safely overlap each other. To determine this amount we lay out the diagram 176. In the space between the outer two concentric circles we place the length of cam required for the turret motion. In the next band, spaces required for the cross-slide motion; in the third, for indexing; in the fourth, for the open and closing of the chuck; and in the fifth, for the stock feed; and we measure all of our distances on the outer circles.

In reality it makes very little difference what diameters we select for the outer circle, the cam drum, but if we select a very small diameter, say 6 in., the length required for the various spaces would make it necessary to go several times around the circle and, of course, this would be confusing. As we found in our preliminary considerations that an 18-in. drum is not very far from the correct size, we will select a size sufficiently greater than 18 in. to make sure that we do not have to go around more than once. The diagram of Fig. 176 is based on a diameter of 24 in.

We start the diagram at *A* and lay off a length *AB* required for the advance of the turret, and we do this by reducing the linear advance to the number of degrees required for such a length on a 24-in. circle. We then lay off *BC* which is the length required for the feed, and *CD* for the return of the first turret tool. Our schedule shows that the index follows, and we lay this

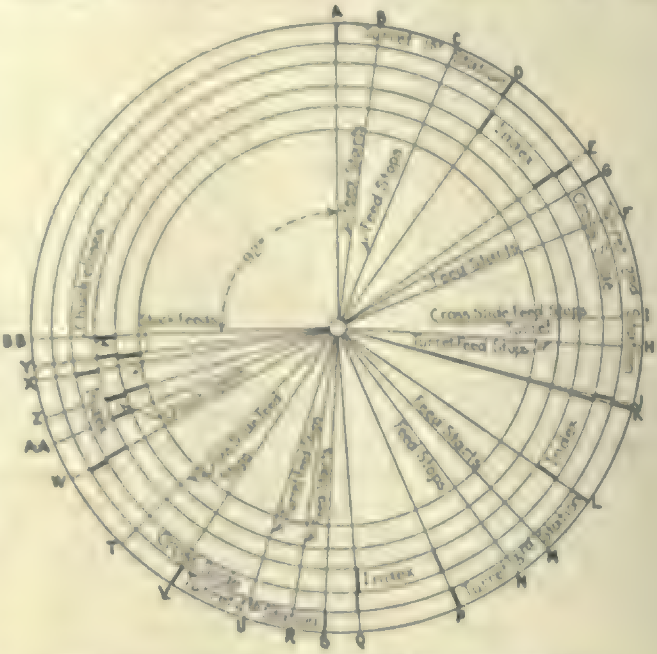


FIG. 176. CIRCULAR DIAGRAM OF TURRET AND CROSS SLIDE OPERATIONS

amount off on the outer circle, again reducing to degrees, but indicating the function on the third band. *DE* is the space required for this operation.

On the second turret operation, which, as we have seen, is combined with the forming operation of the cross slide, we will arrange matters in such a way that both tools start *feeding* at the same time. We have already seen that we would lose time unless we did so. As the advance of the cross-slide is greater than that for the turret tool, we lay off the distance *EF* for this advance and then we go back the distance *FG* for the advance of the turret tool. At the line *OF*, then, the feed starts for both tools. The length of time of feed for the turret tool is greater than that for the cross slide. *FH* represents this amount of time, whereas *FI* is the length of cam required for the cross feed. On the other hand, the return for the cross feed is longer than that for the turret and we lay out *IJ*, return for the cross feed, first; and *HK*, return for the turret, next.

Saving Time on the Indexing

Here we should call attention to the fact that it may very well be possible to start the index before the return of the cross slide is completed and it would be necessary to investigate this for every machine or every job for which we lay out the camming. If the swinging turret tools, while indexing, do not interfere with the retreating cross-slide tool, we can save some time or space, or both, on the cam by starting the index before the cross-feed tool has completely returned. As we are often cramped for space on a cam drum, such investigation should always be carefully made. In our case, which is imaginary, we have no data to make such an investigation and we will therefore start the index at

K. This index occupies the space from *K* to *L*. We go again through the regular performance of laying out the advance *LM*, the feed *MN*, and the return *NP*, after which we index once more from *P* to *Q*.

On the fourth turret position we have again the condition that the advance for the cross slide is greater than that for the turret, and once more we will arrange matters so that both tools start *feeding* at the same time. And so we lay out the distance *QR* for the advance of the cross slide, and then work back to *S*, at which point the advance begins for the turret. The feed for the cross slide takes place from *R* to *T*, whereas the feed for the turret ends at *U*. It would be possible to make the return of both tools stop at the same time, but this would mean that the return of the turret tool would be quite slow. Ordinarily this would be an advantage but as, in our case, this tool is a reamer, it is advisable to return it as quickly as possible; and so the movement of the turret would be completed at *V*, while the movement of the cross slide will end at *W*. Once more the index takes place from *W* to *X*.

Element of Time

Before laying off a new distance for a new function we should make it a point to see whether this new function can take place at the same time as the previous one. In this case there is no reason why the chuck could not open while the index takes place. Even the stock feed can take place at the same time, but as it might be possible that we want to stop the feed either against a turret tool or against a separate stop provided for that purpose, we will arrange matters so that the stock feed is completed some little time after the turret has indexed. We therefore select the point *Y*, slightly beyond *X*, for the end of the stock feed, turn back a distance *YZ*, and then a distance *ZAA* for the opening of the chuck.

Fig. 176 shows a distance *YBB* for the closing of the chuck which, of course, must take place after the stock has been fed out. It does not show a distance for the return of the feed shell and this is not necessary because this return can take place at any time during one of the other operations. We find, then, that 92 deg. of our circle are unoccupied, so that, if we want our diagram to conform to the cam drum, we must select a smaller diameter. This diameter would be $\frac{360 - 92}{360} \times 24 = 18$ in. approximately. This final diagram should be laid out because it will be the record for the cam construction and will give all the information later if changes in set-up are required. It is not shown here because it is not necessary for our purpose.

Other Facts Made Evident by Fig. 176

This diagram also tells us certain things to which we have not paid attention so far. It shows that the cam should run at high speed from *A* to *B*, slow from *B* to *C*, fast from *C* to *F*, slow from *F* to *H*, fast from *H* to *M*, slow from *M* to *N*, fast from *N* to *R*, slow from *R* to *T*, and fast again from *T* to *BB*. As *A* would occupy the same place as *BB* in the complete circle, we combine the first and last fast movement which then will be from *T* to *B*. If we make our diagram on paper in which the circle is divided into 360 deg. and if the disk on which we set the dogs for slow movement is also divided into degrees, we can make a fairly accurate initial setting of the dogs without any trial.

By doing some experimental work we can determine exactly the point at which the shifts from fast to slow and slow to fast take place for each dog and make a mark on that dog so that, when this mark is set on, let us say, line 85 of the dog disk, the trip from fast to slow or vice versa will actually take place at this point 85. This does not relieve us of the necessity of watching the dog carefully to see whether the trip takes place exactly at the point where we expected it, but it does do away with a great deal of guesswork and expedites the setting up of a job materially.

Reasons for Using Circular Diagram

It might seem that it would be just as easy, and perhaps somewhat easier, to lay out the final diagram on a set of parallel lines such as Fig. 170, and that the total length of such a diagram would then represent the circumference of the drum which we must use. This is true and the only reasons why the writer prefers the circular diagram are, in the first place, that it gives a better picture when the diagram is completed, and in the second place, that it is a somewhat safer method. It is often the case that some of the operations are accomplished not by a drum cam but by a disk cam or some other contrivance.

Such a mechanism must be laid out by itself and the result of such an investigation will naturally be the knowledge that it takes so many degrees of that other kind of cam for the operation. This number of degrees remains, then, the same whatever may be the diameter of our main cam. Let us say that in the schedule we examined we found that the indexing is done by a special cam which requires 30 deg. of the main cam for its completed function. We would have made every sector for the index a 30 deg. angle. If we had found that only 270 deg. of the total cam are occupied, we would then have reasoned as follows in order to obtain the actual size of cam required:

Clearance

We would have said that there are four indexes each of 30 deg. or 120 deg. altogether, which will leave 240 deg. for the other operations. In diagram 176 the index occupied a length of 4 in. or an angle of 19 deg., so that all the other operations occupied $268 - 76 = 192$ deg. This number 192 would have been the same whatever space were required for the index, so that, if the individual indexings required 30 deg. each, there would have been a total of $120 + 192 = 312$ deg. occupied in our diagram and 48 deg. would have been blank. The size of the drum would have been then $\frac{192}{240} \times 24 = 19.2$ in. Laying the diagram out with parallel straight lines would not have shown this relation and would easily lead to mistakes.

In order not to introduce more elements than are absolutely necessary, clearance was omitted in diagram 176. As a matter of fact there should be a small amount of clearance whenever we change from one function to another, for instance, between return of turret and index. This clearance may be in the form of an additional amount of return stroke and even if we should start the index a moment before this stroke is completed there would still be no danger of interference. It may also be done by starting the index a short distance after the completion of the return stroke.

The diagram also shows us that the fast speed of the cam must be such that a distance of 4 in for the index will be traveled in one second, from which the number of revolutions of the cam can be calculated. It further shows us that the distance *BC*, for instance, is traveled during the time the spindle makes 100 revolutions, or one-third of a minute. As we know the angle between the lines *CO* and *BO* we can calculate the number of turns per minute the cam should make on the slow speed end, if the slow speed of this is determined by change gears, we can set up at once for the proper speed. Before going further with some of the problems we will meet in laying out cams it will be well to look at the second element of a cam feed, namely, the roller.

Vacations With Pay

By E. A. Terrell

The following shows how we handle the vacation problem at our works: We have laid out a program of fifty working weeks of six days each per year. The remaining two weeks are devoted to vacations. One of these we arrange to include Christmas and the other to include the Fourth of July. At the present time we do not give vacations at any other periods of the year.

The details of the operation of the plan are simple. Each man in our shop works twenty minutes extra each day, making one hundred and twenty minutes or two hours overtime per week. At the end of the week we pay him for his regular time and place to his credit, in the savings account, the amount due him for overtime. This savings account we consider a reserve for vacation pay. At the end of twenty-five weeks we have placed to his credit, provided he has worked regularly, the total amount due him for fifty working hours. At the time the vacation is given we give him his regular pay envelope and in addition, withdraw from the reserve fund the amount due him for vacation pay.

On our books we charge the payroll account at the end of the week for the amount drawn to pay the current wages. In addition, we also charge the payroll, in a separate entry, with the amount due for vacation pay, crediting the individual accounts of the various workmen with the portion due each. A check is then drawn from our checking account for the total amount due on vacation pay. This check is deposited in the savings account "Reserve for Vacation Pay." By referring at any time to the individual accounts of the workmen we can tell exactly how much is due each of them, and in the event one of our men leaves us before the vacation period arrives, we can readily determine just what we owe him for his overtime and make an adjustment on a few moments' notice.

In the event that one of our workmen should be absent for a day or so during the week, we place to his account the same amount of vacation pay as though he had been present all week, deducting the time lost from his pay for the current week. This eliminates petty entries in connection with the system. We work exactly the same system in connection with the office and sales forces, everybody taking a vacation at the same time. We find that the plan works exceedingly well, requires no complicated accounting, and enables us to know just exactly how much time we will lose during the course of a year.

Drafting Room Efficiency—Discussion

By H. S. Kartsher

In his article entitled "Drafting Room Efficiency," published on page 302 of *American Machinist*, Mr. Sorentrue described a system for recording the results of checking which keeps the drawing comparatively free from defacement by the checker. There seems to be a diabolical craving on the part of the average checker to send the drawing back to the draftsman full of battle scars, presumably because the checker feels that the more errors he points out the better he is filling his job.

From the standpoint of the draftsman, however, the effect of such criticism is very discouraging. After he has taken pains to produce a neat, clean cut drawing, he experiences a certain feeling of personal injury when a strange pencil is used on his work, whether it is at the hands of the checker or because the "big boss" offers some "suggestions." Somewhat similar is the sensation when a new shine is stepped on in the street car, hardly a matter big enough to mention and yet the resentment is induced.

But to return to checking, there are two distinctly different methods used by large firms where there is a considerable amount of checking to be done. Both methods permit the checker to vent his feelings with the colored crayon, to scatter notes or criticisms around at will, and at the same time to keep the original drawing in exactly the same condition as when it left the draftsman's board. The first method is employed by firms who check after tracing. A rough, light blue print is made and two colored pencils are used, a yellow pencil for the check marks and a red pencil for the errors or points that require changing. The red crayon stands out and calls immediate attention to the offensive points.

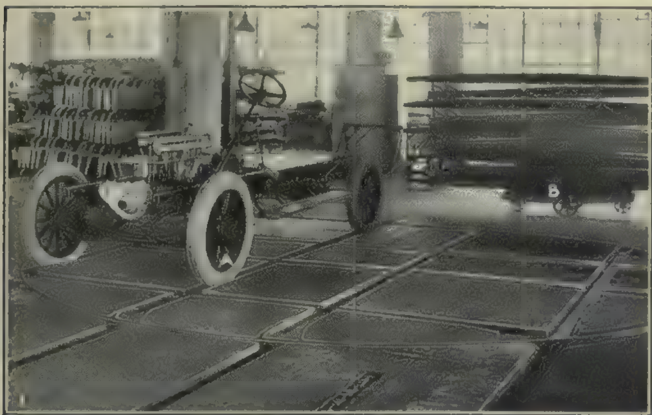
The second method is used by firms who check before tracing. The original drawing is tacked down on the checker's board and a piece of cheap tracing paper tacked over it. Two center lines fix the relative location and checking proceeds as usual. When the draftsman tacks the papers on his board for correction he leaves the two lower corners loose and, after locating the error, throws the tracing paper back and makes the correction. It will be seen that these two methods have all the advantages previously stated. The only disadvantage is the slight cost of the extra paper, which is negligible when compared with the time, labor and feelings saved.

Developing the Worker

By R. Grimshaw

It is a poor non-commissioned army officer who cannot or does not make a soldier out of the greenest "rookie," and who, given men who have served one year, cannot turn them out better soldiers after another year's supervision, instruction and inspection. So with the "non-com" in the industrial army, Sergeant Foreman; he should develop his workers systematically and constantly, so that each month finds them more willing, more interested in the work, and more efficient.

That is why he was made foreman. That is why he was made foreman in the first place. The day when the ideal foreman was an autocratic bully has long since passed. The man for the job now is the thinker in the shop.



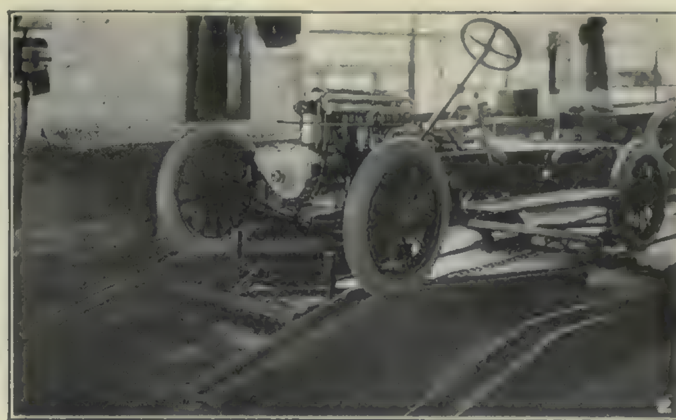


FIG. 1—INCLINE FOR RAISING AXLE FROM TRUCK. FIG. 2—DOUBLE TRACK TURNTABLE

Handling Methods in Automobile Assembly

Runways, Inclines and Turntables in the Franklin and Reo Plants—Conveyors and Other Devices Which Reduce Labor and Handling Time

BY FRED H. COLVIN
Editor, *American Machinist*

AS THE different units are assembled and an automobile nears completion, it becomes an increasing problem to handle the work rapidly and economically. The chain belt conveyor has become almost universal in automobile plants and there are many varieties of its application, a few of which, as used by Franklin and Reo, are shown herewith. After the wheels have been put on the axles, the Franklin is carried on small four wheeled trucks at each end, as seen at *A* and *B* in Fig. 1. These trucks are moved along on tracks sunk in the floor, by means of the chain shown between the tracks.

At the end of the runway is an inclined track, raised sides being provided to automatically keep the wheels in line. As the front wheels roll up this incline, the front truck is raised off the truck, and passes freely between the inclined tracks and also off the conveying chain. The rear truck continues to push the chassis until it too, is disengaged by the incline and the chassis is free to go to the next assembly department, while the trucks are returned to the beginning of the assembly line. The incline referred to is at the end of a long building and the next move starts the chassis across the end of the building. A turntable is provided, therefore, as shown in Fig. 2. The interesting feature of this turntable is the two tracks to accommodate both assembly lines at once when required.

Another assembly line is shown in Fig. 3. Here the motors, mounted on their temporary frames, go down the line on the left and are placed in position in their chassis which are on the next track. The motors are shown going down one track and the finished cars coming back on the other. The sequence of operations on these assembly tracks depends upon how many cars

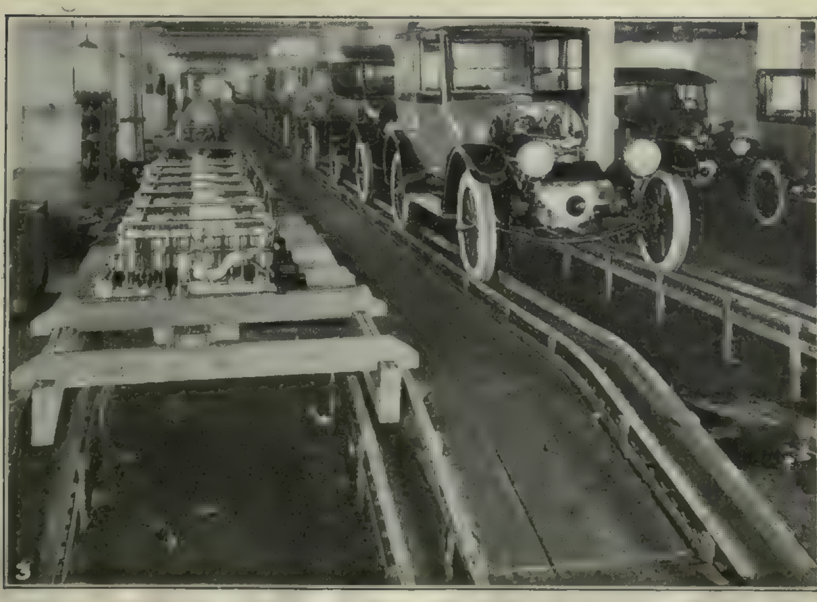


FIG. 3—ELEVATED ASSEMBLING TRACKS. FIG. 4—REO SPEED WAGON ASSEMBLY

are going through the shop per day. The exact routing and the use of the assembly tracks can be readily varied to suit different rates of production. These illustrations were taken before the new Series 10 motors began to go through the shop.

Figs. 4 and 5 are from the Reo plant, the first view showing a line of "speed wagon" chassis going down the assembly track. The conveying chain is very similar to that previously shown but it will be noted that only one rail is grooved, being found sufficient to keep the cars in line. The substantial overhead runway for

FIG. 5—READY TO LEAVE THE ASSEMBLING DEPARTMENT

hoists should also be noted. It enables a motor or other part to be easily handled either in or out of the car whenever necessary. The final end of a similar line of passenger cars is shown in Fig. 5. This view also shows clearly the single grooved rail, as well as the conveyor chain in the center.

A Shop Man's "Just Suppose"

(Written by a shopman after the style of our editorial feature of the same title.)

Just suppose you were a machinist and a member of a machinists' union, just an ordinary fellow, and you were out of work and applied for a job at a large plant where they needed machinists. Before being hired you were asked to sign a paper saying that you did not then belong to any union and that you had no intentions of joining one.

Nonsense, you say. Well, but—

Just suppose.

Or

Just suppose you were working in a shop and during the lunch hour you started talking to another member of your union on union ideals, not radical stuff, and the following day you were fired—with no reason given. You suspected that there was a private detective (?) in the shop employed by the firm to find out who the union men were. Or just suppose that you were this detective with a good job in the shop and about 20 or 30 dollars a week extra for writing just a little report each night on what took place in the shop that day. Don't you think you would be tempted to stuff your reports to make good on your job and continue to get the easy money?

Of course, this could not happen, but—

Just suppose.

Machine Shop Bulls—II

BY JOE V. ROMIG

One day a little old man was brought into the shop by the employment clerk, for an interview with "Reds," our foreman. Reds looked him over thoroughly and started to shake his head negatively.

"Only a chance to make good is all I ask, mister," was his plea and Reds agreed to take him on giving him work on the lay-out plate.

When he started next morning Reds gave him a big sheaf of blueprints and showed him the pile of castings lying on the floor, which he was to lay out for the drill presses. Now it happened that Bill, the regular layer-out, was absent on a week's tear and had locked up all his tools and templets, leaving nothing as a help for his successor.

Reds, to his dismay, also saw the old boy take out of his inside coat pocket his one and only tool, an old three-joint, 2-ft. rule. Turning away he left the old layer-out to his fate, thinking he'd leave him alone long enough to get a stake and then bounce him at noon. Imagine his astonishment when, at 11:30 a.m. old man Williams, the new layer-out, came asking what was next in the work line.

Reds had planned his next move to be his dismissal, but was curious to see just how the old boy had worked him and so went along down to the lay-out plate to see his finished work. Here he found all the work neatly arranged, carefully and accurately laid out and done in less than half the usual time.

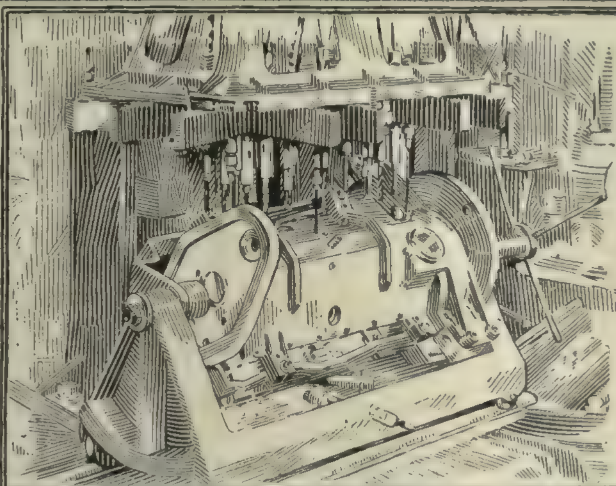
Reds could not help but marvel at the little old boy's work, and breaking away from his usual harsh manner, grabbed the old boy's hand and shook it heartily, saying, "Mr. Williams, I am glad to know you, and I sure am glad to see an old timer like you, make good in a shop so full of these wise looking, know nothing machinists, as I have here. Say," he continued, "they don't make our kind of machinists today, any more, the all-around kind I mean. All we get now-a-days is the damned specialist, etc."

Noticing that his new man had no lunch with him, and suspecting him to be in rather straightened circumstances, he handed him a dollar bill with the suggestion of a little lunch house down the street and a good dinner.

After he had eaten his own lunch he went down to the plate and was shown the improvised tools of the new man, by the admiring workmen who had watched the little old boy pull one over on the Boss. Small pieces of bent and pointed wires were his dividers, nails in Bill's trammel stick were his tram points, a broken tip of an old round file was his center punch, and last, he was shown the surface gage, which was a block, a stick and a nail, complete though simple in its entirety.

Williams worked out the balance of the week, the boys all loaning him tools, which he used at their suggestion and always was sure to thank them for when returning them. When pay day came he shyly asked Reds for all of his money, explaining that he must now be on his way, and thanking Reds for the stake which he had been so kind to give him, and wishing him good luck in the bargain.

Reds regretfully complied with the old boy's request, but they parted as life long friends, these two old-timer, all-around mechanics. And it can be said right here, "They don't make any of our kind any more, only specialists," is pretty nearly the truth.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Progressive Blanking Dies—Laying Out to Avoid Waste of Stock—Bending Dies—Importance of Grain—Relation of Blanking and Bending Dies

WE HAVE discussed plain blanking dies in the previous articles. In this type of die a simple blank is cut out and nothing else done, yet it is often desirable to punch or slot the blank. This last is frequently done by combination of two or more operations in the same die, which is called a progressive blanking die. Such a die differs from a plain blanking die in that a hole or slot is punched out of the stock before the blank is produced, after which the operation of blanking is done in the same manner as previously described. It is called a progressive die because the hole and the slot are made in progressive order. A system of this sort is used for a great variety of work.

In designing a progressive die there are several points which must be carefully considered.

(1) Thickness of stock. This affects the length of the punches used and their spacing. The arrangement should be made so that the blanking punches strike the work before the piercing punches do, in order to relieve the pressure on the machine and make the cutting action easier. A pilot must be arranged on the blanking punch in order to locate the work accurately. The distance between the ends of the blanking and piercing punches should be equal to the thickness of the stock.

(2) Layout of blank. The method of laying out a blank for a progressive die is similar to that used for blanking dies. The space allowed between blanks and around them is governed by the thickness of the metal which is being punched. The arrangement on the strip should be such as to economize and get as many blanks out of a strip of stock as possible. The piercing and blanking punches should be set well apart in order that there will be plenty of metal in the die, so that it will not tend to break away and will be strong enough to resist the pressures applied.

(3) Spacing of punches. When there are a great number of holes close together in a given piece of work this condition often makes it necessary to use several progressive operations in order that the punches shall not be set too close together. It is not generally advisable to have more than three steps in the progression in order that the die may not be too long. It is often possible to build progressive dies in sectional form in order to make the machining operations easier. Also, the up-keep is somewhat better in case of accident or breakage.

In Fig. 467 is shown an example of this type of die for producing the washer shown at *A*. A diagram which illustrates the method of laying out the stock and which shows the order in which the operations are performed is shown at *B*. The hole is first produced at *C*, and after this the blank is cut out at *D* as the stock is fed through the die. The layout of the stock for progressive dies is very similar to those previously described under the head of blanking dies. The distance between blanks, as indicated at *E*, is the relation between the two holes produced. The distance around the blank is equal to the thickness of the stock, and the amount of stock between blanks is in the same proportion.

We have mentioned the importance of the length of punches in relation to the thickness of the blank which is being produced. The punch shown at *F* for producing the hole and the punch *G* used for blanking do not

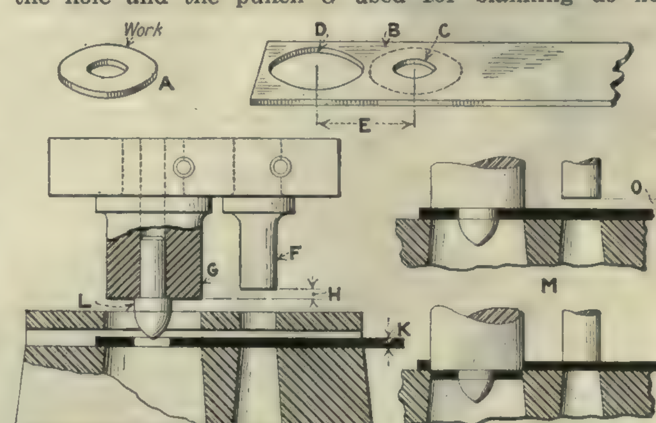


FIG. 467—PRINCIPLES OF PROGRESSIVE DIES

enter the work at the same time but are spaced a distance apart as shown at *H*. This dimension is generally made equal to the thickness of the stock *K* for blanking dies for $\frac{1}{16}$ to $\frac{1}{4}$-in. stock. This gives the blanking punch time to go through the stock before the piercing punch strikes it, thus relieving the amount of pressure re-

quired on the press and also making it easier for the die.

The punch *G* is fitted with a pilot *L* which enters the previously punched hole in the stock, thus centering it before it is blanked. This prevents any inaccuracies which might result from an improper method of stopping the stock. The pilot is provided with a round nose

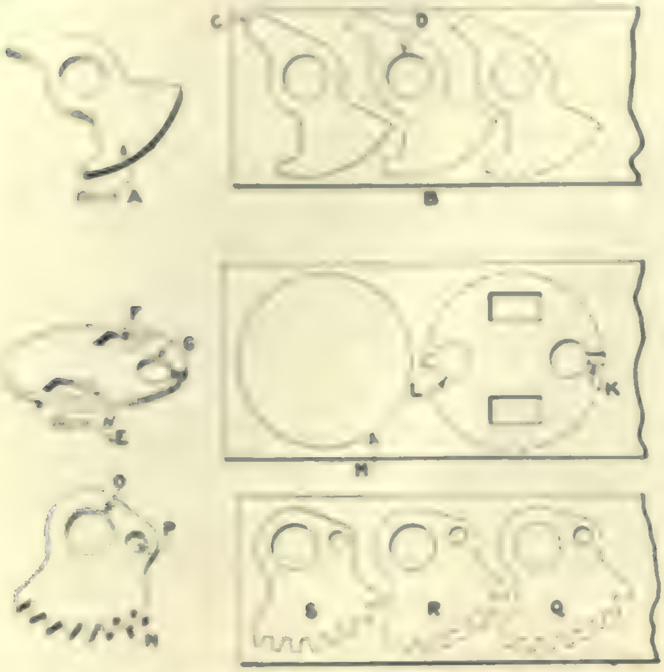


FIG. 468—EXAMPLES OF PROGRESSIVE LAYOUTS

as shown and its action is evident. The hole in the punch *G* into which the pilot fits extends entirely through the punch. This is done so that the pilot may be knocked out and replaced when necessary. The diagram at *M* shows the action of this type of die very clearly, the blanking punch having just come down on the stock and the pilot having centered the work by entering the hole previously made. The piercing punch still remains above the stock a distance *O* equal to the thickness of the stock.

In the diagram at *N* the action is shown after the blanking punch has produced the blank, which is being carried down through the die. At this time the small piercing punch has just come in contact with the work and its further movement will evidently produce the small hole. It is important in designing a pilot for a blanking punch that there should be a straight section on it equal to the thickness of the stock being punched, in order to insure an accurate location.

Layouts for Progressive Blanking Dies

In order to show the application of the principle to progressive blanking operation, several layouts are illustrated in Fig. 468. The part shown at *A* is a lock segment, a number of which are required in a certain piece of mechanism. The layout for stock is shown at *B*. The hole is produced at *D*, while the blank is punched at *C*. The layout of the blank is such that the greatest economy of stock can be made.

In the example *E* a piece of somewhat different shape is shown having various holes and slots at *F*, *G* and *H* as indicated. The hole *G*, it may be noted, runs out to the edge of the stock, and it is customary in a case of this kind to extend the punch a trifle beyond the blank diameter as shown at *K*, in order that a clean edge will be made. This is an example which illustrates the importance of having the die openings as far apart as possible. If the opening *K* were to be placed as shown by the dotted lines at *L*, the opening between this hole and the blank diameter *M* would be so close that the amount of stock in the die between the holes would not be heavy enough to withstand the pressure when blanking. This point is very important and the designer should always bear it in mind when making a layout.

Progressive Blanking for a Gear Segment

Another segment is shown at *N*, and it can be seen that there is a large hole *O* and a small hole *P* to be produced in it. These holes are close together, but it is not advisable to locate the punches in the same manner. It would be better to use one more step in the progression and make the two piercing operations as shown at *Q* and *R*. The small hole is first punched at *Q*, and then as the stock is fed along the large hole is pierced at *R*, after which the finished blank is produced at *S*. It is occasionally necessary to design a progressive die with as many as four steps in it, although it is advisable to group the punches in such a way that not more than three steps will be required. This point has been mentioned previously.

Among the examples of plain blanking dies several

FIG. 469—PRINCIPLES OF DIE DESIGN, SHOWING METHODS USED TO AVOID WASTE OF STOCK

were given in which no allowance of metal between blanks or around the edges was necessary. So also in progressive dies the same conditions are occasionally found. For example, the edge of the stock may be used as the side of the blank, or the blanks themselves may be cut off so that no metal is allowed between the parts. Fig. 469 shows two examples of this kind. At

A is shown a progressive blanking die for stamping hacksaw blades. The stock *B* is fed into the die through the stripper as shown. It is pushed forward by hand and located in its starting position by means of a starting finger *C*. This finger is more in the nature of a temporary stop which is used only when placing a new strip of stock in position, and the proper starting relation is required with the edge of the stock. By pushing the finger forward the location is obtained for the first operation, and after the pressure is released the spring forces the stop out of the way so that the stock can pass by this point.

Stamping Out Hacksaw Blades

The first operation in this die is the piercing of the two holes at *D* and *E*. In the proper positions in the die so that they will come directly under the punches, two small piercing dies are inserted. The purpose of this construction is to permit easy removal for replacement purposes. It will be seen that the positions of these piercing punches is such that one blank is skipped when first setting up the work. This is done in order to avoid bringing the piercing punches too close to the edge of the die.

The stock is fed forward after punching until it stops against the surface *F* on the block *G*. As the punch is carried down, the blank is formed and passes through the die in the usual manner. In this example only one side of the punch is guided in the die, so that it is necessary to back up the other side in the manner shown by means of the block *G*. This is clearly indicated in the sectional view. This method prevents the punch from springing out of place as it might do if the cutting action were all on one side of the punch. This condition is illustrated graphically in several examples.

At *K* the punch has just struck the work and forced it down on the die. At *L* the pressure is applied, and

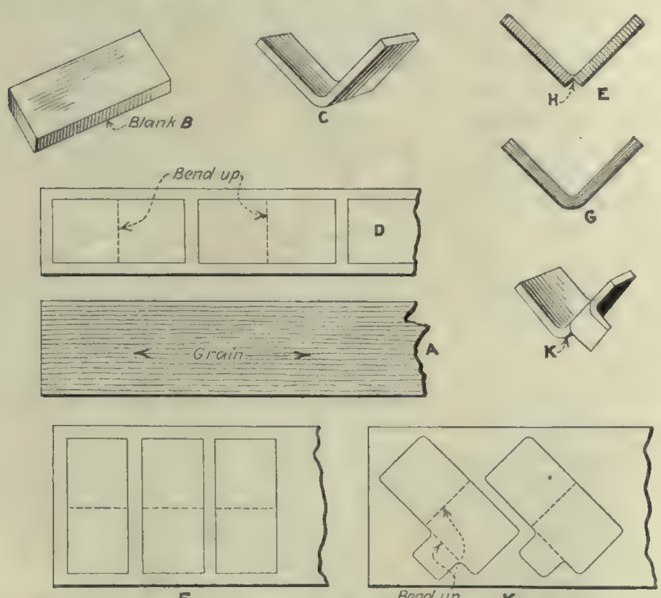


FIG. 470—IMPORTANCE OF GRAIN IN METAL FOR BLANKING OPERATIONS BEFORE BENDING

as the action is all on one side, the punch springs over in the direction indicated by the arrow. In order to avoid this action a hardened block may be placed as shown at *M*. This block is so arranged that it takes the thrust resulting from the action of the punch only on one side of the work. There are some cases when it is necessary to design a special punch like that shown at *N*. Here the punch enters the die and the heel *O* bears against the back of the die at *P*. Then as the punch proceeds down in the work, this portion acts as a guide so that there is no chance for spring in the punch.

A layout of stock for blanking hexagon nuts is shown

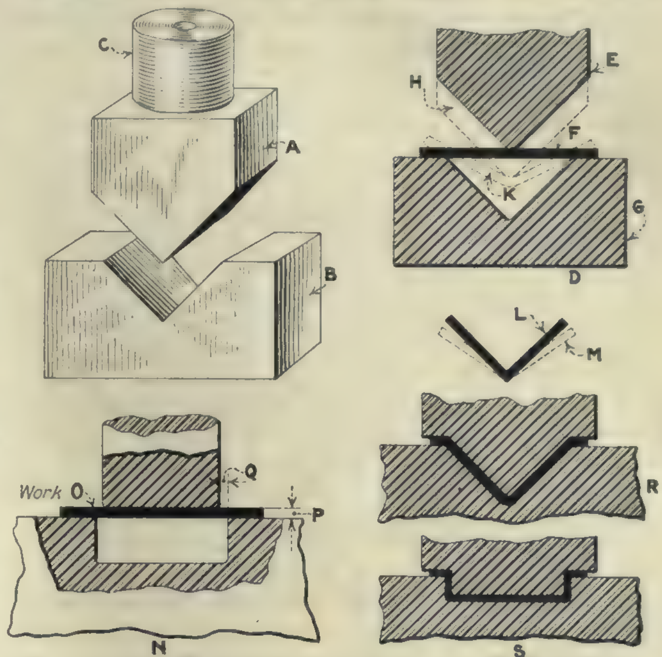


FIG. 471—SIMPLE BENDING OPERATIONS

at *Q*. The edges of the stock are used for one pair of sides of the nuts, and the method of production is similar to that with the other progressive dies shown. The punch *R* produces a hole while the punch *S* forms a blank. The layout shown at *T* indicates that the only scrap produced in this blank is the amount indicated at *U* by the cross-sectioned area.

The important points in connection with the design of bending dies will be taken up and illustrated by means of diagrams, as they can be more clearly shown in this manner. It must be remembered that when making a layout for a blanking die which is to be followed by a bending operation in which the work is shaped to some irregular form, the layout must be quite different from all the examples which have previously been shown, because the blanks for forming work when a bend of 90 deg. or so is required, must be laid out so that the bend will come across the grain of the metal as nearly as possible, in order to prevent the possibility of breaks or cracks while bending. In sheet-metal strips the grain of the metal always runs lengthwise of the stock, as indicated at *A* in Fig 470.

Bending Dies

In order to bring out the point a layout is shown at *D* in which the blank *P* is to be formed to the shape shown at *C*. The grain of the metal would appear as shown at *G* in the end view after the bend, if the layout were made as shown. On the other hand if the stock had been laid out as shown at *F* and then bent as at *E*, the grain of the metal, which runs crosswise of the piece, would cause it to fracture as shown at *H*. It is not always necessary to follow this rule absolutely as some metals will stand bending better than others, but when any strain is to be brought to bear on the work after it is bent it is much better to keep this point in mind when laying out the blank for a bending operation.

Occasionally the shape of the work is such that an excellent layout may be made if the blank is turned at a 45-deg. angle like that shown at *K*. This is sometimes possible, and it has been found that a 45-deg. angle bend will seldom break unless the material is very fragile. An angle of 45 deg., however, seems to be about the limit at which the work can be turned, and it is not desirable to exceed this amount when making a layout.

Several simple diagrams of bending operations are shown in Fig. 471. At *A* and *B* are shown, respectively, a punch and die for bending the part *C* previously illustrated in Fig. 470. Dies of this kind are very simple in their construction and do not require very accurate workmanship while fitting. The die is usually mounted in a cast-iron shoe held on the bolster of the press, while the punch is held in the ram by means of the shank C. The diagram at *D* illustrates the method of bending a piece of work. The punch *E* comes in contact with the work *F*, which has been located on the die *G*. As the punch descends it takes the position indicated by the dotted lines at *H*, so that the blank is forced up on each end as shown at *K*.

When bends of this kind are being made, there is usually a certain amount of spring in the material, the amount of which is dependent to a great extent on its quality. If a piece is to be bent to 90 deg., as shown at *L*, it is likely to spring back after the bending operation until it takes the position shown by the dotted lines *M*. It is advisable, therefore, in designing a die of this kind to provide for such a contingency by decreasing the angle an amount which is usually determined by experiment. Occasionally it is found necessary to change the angle as much as 10 deg. in order to overcome the spring of the material.

In the example *N* a punch and die are shown for

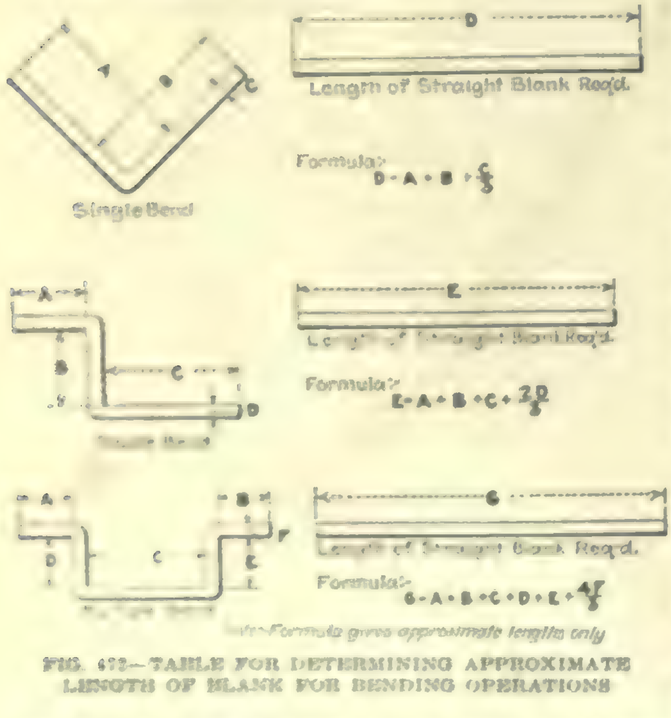


FIG. 472—TABLE FOR DETERMINING APPROXIMATE LENGTH OF BLANK FOR BENDING OPERATIONS

bending the U-shaped piece at *O*. Here the thickness of the stock *P* is the amount allowed between the punch and die all around, as shown at *Q*. It is evident that this amount will be necessary in order to permit the stock to pass by the sides of the punch. It is advisable to leave an additional amount of a few thousandths of an inch in order to compensate for variations in the thickness of the stock.

The punch and die shown at *R* are used for punching a U-shaped piece having two straight edges on the top. This is similar to the example illustrated at *A* except for the straight edges. Here also it would be necessary to make an allowance for the spring of the material. In the example *S* a punch and die are shown for a U-shaped piece of similar style having straight corners. These examples are given in order to illustrate the number of bends which can be made at one time in a bending die.

It is difficult to approximate the straight length of a blank required for a bending operation. The exact size cannot be determined by means of a formula. For this reason the bending die is usually made first, and after the correct length has been determined the blanking die is made to suit.

Rules for approximating the length of blanks required when bending operations are necessary are given in Fig. 472 The formulas given will serve very well for laying out blanking dies when a bending operation is also used. The exact size can be gotten only by obtaining a blank of proper length as determined by the bending die, and using this piece as a guide for the blanking operation.

How Do You Figure the Cost of Tool Work in the Shop?

By A. W. Forbes

We hear frequent statements that it costs more to do tool work in the shop than to send it outside. Also we encounter statements to the contrary. When the tool work is done by men particularly hired for the purpose it is a simple matter to figure the cost, but in our case it is not so easy. No one is engaged here for tool work but most of the tools, with the exception of those regularly carried in stock by the dealers, are made by the regular production force.

It is necessary to have a production force sufficient to handle orders as they come in, especially as a large part of our product is special machines made for particular jobs. They are usually wanted in a hurry. This leaves frequent periods without work. Some of this time can be spent in making stock parts, but they require a considerable amount of material and so tie up more capital in purchases than is desired. As a matter of fact, we spend a considerable portion of this time in tool making.

Now how shall we figure the cost of this time? If the men were not engaged in tool making, it would be necessary to send them home, which has many bad effects because, in the long run, it is the pay per week rather than per hour that counts. In some cases, it might be necessary to pay as much for the 30 hours per week actually worked as for a full week. It is reasonable, therefore, to claim that all the time should be charged against the production jobs and tool making figured at no labor cost.

Most of us, however, would not go so far as this. But, in a case like this shop, I do not think that it is reasonable to charge even the full wages paid to the tool work, while the production work should bear the full amount of overhead and a little also for waiting time which the tool making utilizes.

Ideas from Practical Men

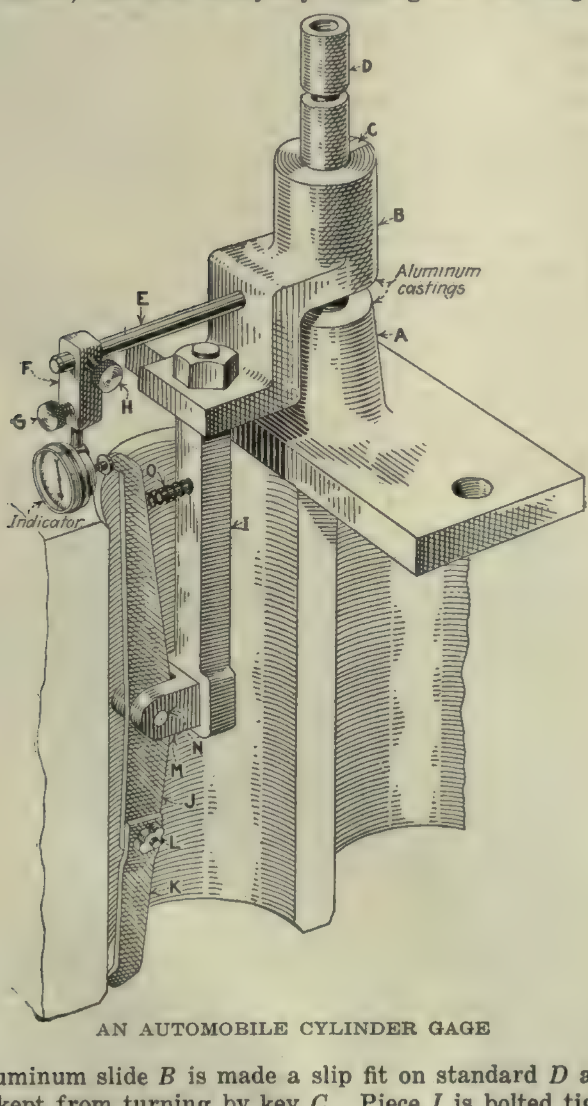
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Cylinder Gage

By H. A. Peters

The testing fixture or gage shown here is used for testing the perpendicular trueness of the bores of an automobile cylinder block. Any variation in this respect of the bores would mean either the wearing down of the piston bosses, the wearing of the piston pin bearings or the cylinder bores.

Referring to the diagram, the aluminum base of the gage *A* has a hardened and ground standard *D* pressed into it. This standard *D* is hollowed out to lighten it, as shown, and has a keyway running its full length.



AN AUTOMOBILE CYLINDER GAGE

Aluminum slide *B* is made a slip fit on standard *D* and is kept from turning by key *C*. Piece *I* is bolted tight in slide *B* at one end and has a forked piece *M* pressed into it at the other. This forked piece *M* holds gage arm *J* and allows it to pivot on pin *N*. To allow for adjustment the gage arm *J* is made of two segments, *J* and *K*, which are clamped together by means of the nut *L*. At the indicator end of arm *J* a tension spring *O* holds the arm in tension.

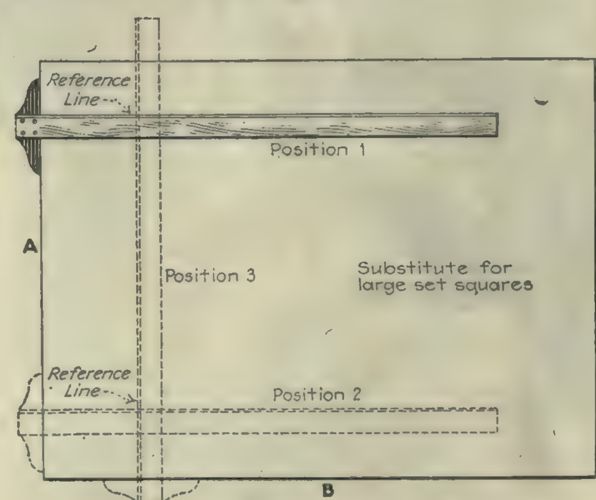
Block *F*, which holds the indicator in place with thumb screw *G*, is a slip fit on rod *E* and can be locked in position by means of thumb-screw *H*. To operate the gage, the base *A* is clamped to the cylinder block in a suitable position, the smaller gage arm *K* is then adjusted until it bears against the cylinder bore while the other end *J* bears against the indicator as the diagram shows. Variations of 0.0005 deg. can be ascertained by this gage.

A Drafting Room Kink—Discussion

By W. Roland Needham
Goodmayes, England

Referring to the article under the above title by Edward Heller which appeared on page 972, Vol. 56, of the *American Machinist*, it has occurred to the writer that those who do not possess or do not care to go to the trouble of making the little device described by Mr. Heller can secure reasonably accurate results without it.

For less frequent use than is contemplated in the original suggestion the alternative as per the accompanying sketch may be preferable.



SUBSTITUTE FOR LARGE TRIANGLES

With the T-square in position 1, mark where required a short line which crosses the junction between bevel edge of square and paper. Thus, as is indicated in the figure, part of the line is on the square and part on the paper. Now move square to position 2 and mark the paper by reference to the line on the square bevel. Then as shown by position 3, join the markings on the paper.

Of course, in case the edge *B* of the board, as well as that at *A* is finished true, and each is truly square with the other, even this simplification is unnecessary.

Old Lathe at the Bennington Machine Works

By Milton Wright

An interesting old lathe that dates from the period before the Civil War is shown in the accompanying photographs. It is an excellent example of home product, made at a time when the wits of the "old man" were often matched against market and transportation difficulties as well as the regular shop problems. Some time in the 40's the late Olin Scott established at Bennington, Vermont, a machine shop and foundry to do general jobbing and build machinery for the paper mills to be found in that section of New England. Though the founder has long since passed away the shop is still doing business in the original buildings under the name of the Bennington Machine Works.

As first established, the limit of capacity of the shop was represented by a lathe that would swing at most but about 42 inches and the proprietor soon found that this was too small to handle the large wheels and cylinders that came his way. He, therefore, set about building a bigger one from materials already at hand. Structural steel shapes were not then as readily available as they are now, so the foundry was called upon to furnish cast-

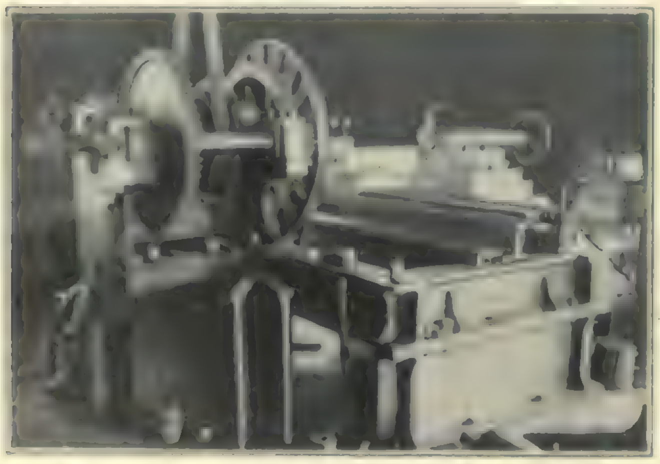


FIG. 1—HEADSTOCK OF HOME-MADE GAP LATHE

ings with which to build up the machine. Size was no barrier in the foundry. Most of the large molding was done "in the floor" and if the floor was not big enough there was all out doors available. The skill of the old time molder enabled him to make most any ordinary kind of a casting, including gears, without much in the way of patterns.

A bed plate upon which to build the head-stock was first cast. This was set in place on a solid foundation at the end of, and in line with, the bed of the smaller lathe before mentioned, but not attached to it. The head-stock was built up from this plate with the spindle parallel to, but considerably above, the spindle of the other lathe. The "carriage" consists of a slide-rest mounted upon suitable angle castings bolted to the bed plate and these castings can be arranged in any position desired by changing the bolts. The slide-rest is operated by a screw and has a cross travel the entire width of the lathe. The longitudinal travel is limited to the length of the slide, which is about twelve inches, and if longer cuts are required parallel to the spindle the rest must be reset.

A view of the head-stock is shown in Fig. 1, which also shows the manner of mounting the slide-rest. In Fig. 2 may be seen the entire lathe, showing how the tailstock

FIG. 2—VIEW OF LATHE FROM TAILSTOCK END

is mounted on the bed of the smaller lathe. The tailstock has two main parts, one sliding upon the shears of the smaller lathe and the other one fitted to it. To turn long work upon centers the upper part of the tailstock is removed and the headstock of the smaller lathe raised upon raising blocks to line with the large spindle. The lower part of the tailstock with the slide resting upon it thus becomes the carriage of the combined lathe.

The lower part of the tailstock may be run out to project over the end of the smaller bed if desired, much like an ordinary gap lathe. The capacity of the lathe is about 7½ ft. swing in the gap and about 16 ft. between centers when used for smaller diameters. The record job was a fly wheel 7 ft. in diameter and weighing about 5,000 pounds.

To Make a Wooden Chuck Hold Tightly—Discussion

By M. E. Duggan

Referring to an article under the above title by Charles G. Spicer, page 419 Vol. 57 of the *American Machinist*, Mr. Spicer's method for reverse chucking is new to me. "There is," he says "no better method for this purpose than the one here described." As to this I can hardly agree with him, in fact "no better method" does not fit in when describing the things done in the pattern shop, foundry, core room, or machine shop. Pattern makers in general, however, will welcome any method or device that will make easy the reverse chucking of small pieces or patterns in the wood turning lathe.

"Take a piece of wood of suitable size and fasten it to the faceplate," suggests Mr. Spicer. Right-here he knocks the whole job into a cocked hat. What is wanted is a "something" or a "method" that will eliminate this piece of wood because, in many instances, it takes a longer time to find the piece of suitable size, cut it on the band saw, fasten it to the iron face plate in the lathe and turn it to the required shape and dimensions, than the time required to turn and shape the piece itself.

The little iron face plate with its tapering shank to fit the hole in the lathe spindle, and with the "hole" and "counter-sink" in the center to receive an ordinary

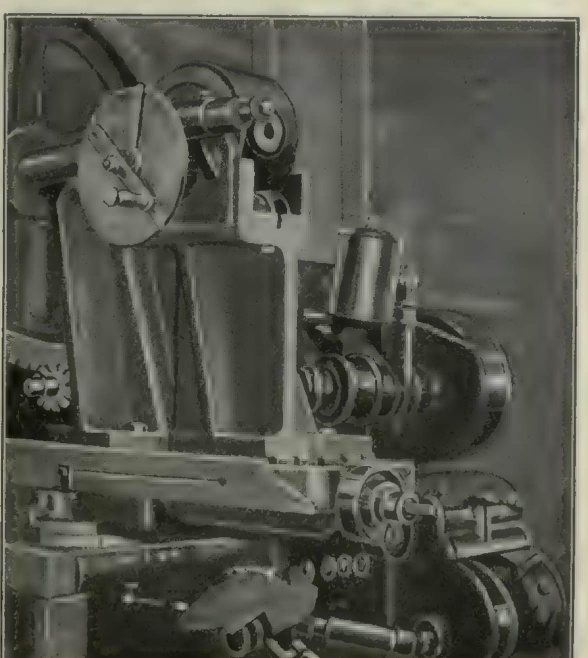
every-day-woodscrew, is part of the equipment of the wood turning lathe installed in every pattern shop. Now, with this little chuck I can turn and reverse chuck a piece about 14 in. diameter by 3 in. thick. But to do this I generally use my own outfit, because the tapering shank is a correct fit in the hole in the lathe spindle; the screw, a No. 16, is a press fit and true in the center hole in the face plate; and the threaded end projects $1\frac{1}{4}$ in. beyond the face plate. This No. 16 screw will grip and hold the wood equally as strong as two smaller wood screws.

The chucking is done in the following way: If the piece to be turned is $1\frac{1}{4}$ in. or less in thickness, I drill a $\frac{3}{16}$-in. hole half way through the piece. I put a backing collar of wood on the screw and face this off until the screw protrudes—say $\frac{5}{8}$ in. for a piece $1\frac{1}{4}$ in. in thickness. The piece to be turned is mounted on the screw, turned, and finished. Now comes the reverse chucking. A hole is drilled in the finished piece in the following way: A center is made in the turned piece by bringing the tail center against the wood. A $\frac{3}{16}$-in. hole, which is the diameter of the screw at the bottom of the thread, is drilled in the center of the piece. The piece is then taken off the screw and reverse chucked, on the $\frac{3}{16}$-in. hole. If the work is done in a mechanical way the piece should run true.

Cutting Large Gears in a Small Milling Machine

By W. C. Schellenberger

We recently had occasion in our shop to convert a number of power presses from belt to motor drive and the way we did it was to cut teeth in the periphery of each fly-wheel and drive direct from the motor shaft. There were 9 of the wheels in all and they ranged in diameter from 24 in. to $36\frac{1}{4}$ in. in outside diameter with teeth from 176-6 pitch to 143-4 pitch. The largest wheel weighed over 700 lb. As the largest wheel was the greatest problem we figured upon this one first and made our plans accordingly.



CUTTING A LARGE GEAR ON A SMALL MILLING MACHINE

The only machine available in the shop for the work was a No. 2 LeBlond milling machine, which we rigged up to cut the teeth from the under side of the wheel, as shown in the illustration. We made two pedestals to support the wheels in bearings, seeing to it that they were high enough to swing the largest wheel and leave sufficient space beneath it for the cutter. A third pedestal was made to support the dividing head. The two main pedestals took all the weight and the thrust of cutting so as to relieve the dividing head of all duty except that of spacing.

As practically all of the wheels required an odd number of teeth for which there was no index plate available, we were obliged to make up special plates in advance. Though the job required a deal of rigging up, the actual time of cutting was a surprise. With a spindle speed of 35 r.p.m. and a table feed of $\frac{1}{32}$ in. per rev. we were able to run a cut over the width of the wheel in $2\frac{1}{2}$ minutes. The entire time of cutting the largest wheel was but $7\frac{1}{2}$ hours.

Safety Gate for Railroad Crossing

By J. Bainter

At the plant of the Cincinnati Planer Co. in Oakley, Cincinnati, Ohio, a railroad siding that comes in from the front of the plant runs parallel to and quite close to the side wall on its way to the unloading platform at the rear of the building. In this wall there is a door through which the truckmen most frequently pass on their way to a storage yard for castings. Since a truckman coming out of the shop cannot see up or down the railroad track until he has actually passed the door, there is always present the danger of accident from locomotives or cars that are being switched into the siding.

GATE FOR GUARDING RAILROAD CROSSING ON A SIDING AT THE CINCINNATI PLANER CO.

To protect the workman, a safety gate was made which would automatically guard him from harm. As can be seen in the accompanying illustration, the gate is simple enough. It is mounted on a post at the side of the door toward the front of the shop, and consists chiefly of a long bar that extends entirely across the railroad track. The outer end of the bar is normally supported on another post and rests in a V, from which it can be readily pushed.

When a car is backed into the siding, it comes from

the right and strikes the extended bar so as to push the gate shut. Should a truckman be coming out of the door just at that time, he is merely pushed back and held by the gate from walking further and on to the track. Since there is plenty of room so that he is not pinched between the gate and wall, there is but little danger of injury to him, such as would certainly occur if he walked directly in the path of the moving car.

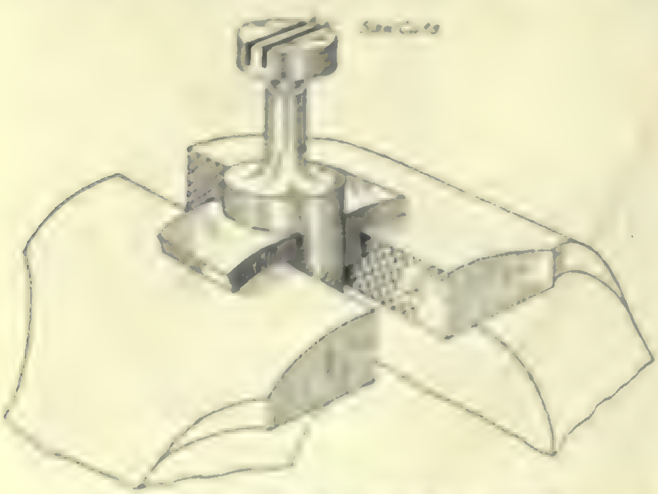
The gate stays in its closed position until the locomotive has spotted the car at the platform and left the siding. It is then placed in the open position, so as to be ready for the return of the locomotive for removing the car or bringing another car. The gate has been quite satisfactory, and it has given a considerable feeling of safety to the men that must use the exit on the railroad tracks.

Machining Woodruff Keys

By R. McHenry

In a jobbing shop it is often necessary to make one or more Woodruff keys. The job may require them to be of bronze, machine steel, tool steel or other material and perhaps of greater or less than standard thickness. In any case, I find machining them in a lathe to be the most satisfactory method.

First, a piece of round stock, slightly larger in diameter than twice the raidus of the key to be made, should be chucked so that an inch or so will project from the chuck jaws. The stock should then be turned to a diameter equalling twice the radius of the key, or in other words to the diameter of the keyway cutter. Next



MAKING WOODRUFF KEYS IN A LATHE

make a deep groove with a parting tool at a distance from the end of the stock slightly more than the thickness of the finished key.

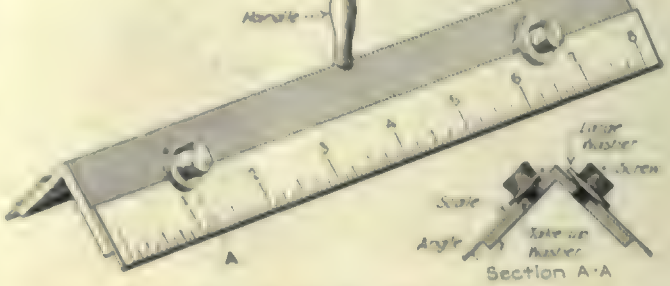
More cuts are now taken until the rod is necked out, as shown in the sketch, leaving sufficient room for the anvil of a micrometer. The inner side is carefully faced off smooth with a side tool and the disk is then reduced to thickness by facing the outer end of the stock, measuring the thickness with the micrometer.

After chamfering the edges of the disk with a fine file, the stock is removed from the chuck and held upright in a vise. Two hacksaw cuts parallel to the axis of the stock will now produce two finished keys that need only a trifle of burring with a file to be ready for service.

Novel Scale Holder

By P. A. Daschke

Designers and others engaged in laying out accurate work find it advantageous to have a number of variously graduated scales on hand. By means of the holder here shown scales of different graduations can readily be held, the holder thus forming a triangular scale rule in itself. In this way the graduated sides are brought



HOLDER FOR DRAFTSMEN'S SCALES

close to the work; a distinct advantage in laying out accurate measurements. As the scales become worn, new ones can easily be inserted or replaced with others of different graduations.

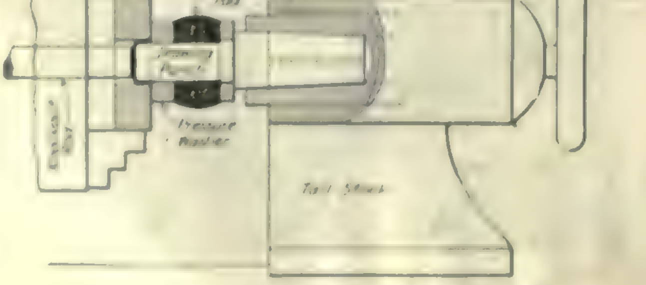
Procure any suitable metal angle, tap it on each side for two small machine screws so that the scale projects a trifle beyond the leg of the angle. Provide two small take-up washers the thickness of the scale, two large clamping washers and two round or knurled head machine screws for each side of angle. By this method of fastening the scales do not become mutilated. A small stock handle may be placed in center of holder to facilitate handling.

A Drawing Job in a Lathe

By S. A. McDonald

In a small jobbing shop, which did not include a punch press in its equipment, a lathe hand constructed the lathe die, illustrated in the sketch, to draw up some cups from 0.0312 in. brass, 1 in. in diameter by $\frac{5}{16}$ in. deep.

He first turned up a piece of cold rolled steel to fit the tailstock of his lathe and the other end he turned to the diameter of the inside of the cup. Two washers were then turned up, one a driving fit on the punch and the other a sliding fit with one face polished to act as a pressure ring. Out of some sheet rubber he made the pressure pad. Next he chucked a piece of cast iron,



DRAWING SHELLS IN THE LATHE

faced one side and bored a hole to the outside diameter of the cup, rounded the corner, made a circle on the face for locating the blank and gave the face and hole a high polish. His punch and die were now ready for work.

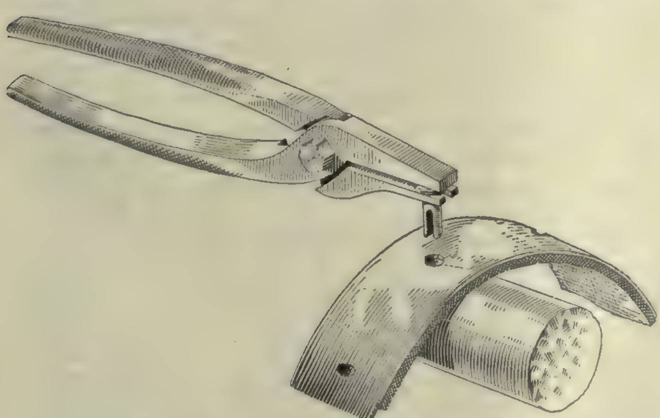
By locking the spindle with the back gears and clamping the tailstock, he converted his lathe into a screw press. The size of blank was determined by trial and was cut out with shears. Locating the blank by the scribed circle, the tailstock was screwed out so that the pressure washer gripped the blank, compressing the rubber pad until the punch drew the blank into the die. On withdrawing the punch the rubber pad stripped the cup from the punch and, by using a knockout bar through the lathe spindle, the cup was knocked out of the die.

The boss was so pleased with the results that he had the lathe hand make up a blanking die in the same way. The remarkable thing about the whole job was that the lathe that made the cups was the only tool used in making the die.

Tool for Holding Split Rivets

By G. A. Luers

Where a great many split rivets are used, as in the relining of brake bands, the tool shown in the accompanying sketch will prove of great value as a time economist and will also save the temper of the workman by eliminating the bruised fingers which are bound



PLIER FOR SETTING RIVETS IN BRAKE BANDS

to ensue if he tries to hold the rivets in the ordinary way while starting them into the band with his hammer.

The tool is made from an ordinary pair of flat-nosed pliers by grinding down one jaw to about $\frac{1}{16}$ in. in thickness and then filing a slot in the thin jaw to take the body of the rivet. The rivet is then grasped as shown and started in the hole by striking the heavy jaw of the pliers directly over the head of the rivet. The tool is of equal advantage in the upholstering department for setting upholstery nails.

Soliloquies of Old Mac

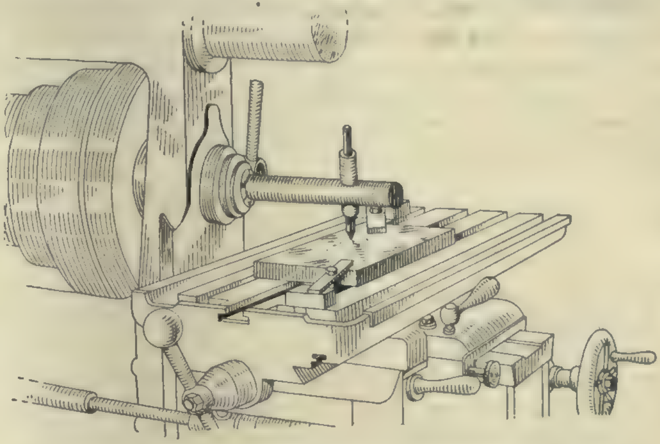
Turpentine is the best lubricant to use on a drill when drilling holes in flat springs or similar pieces of hard steel. Take a shallow pan (the cover of a tin can is convenient) fill it with turpentine and lay the work in it. You can then drill through the whole business and throw the cover away.

Handy Laying Out Tool

By Joseph Cole

A very satisfactory method of laying out flat work is to clamp it to the table of a milling machine where it can be moved in either direction by operating the feed screws. It is necessary, of course, to provide means for holding the prick punch in a fixed position while moving the work. The accompanying illustration shows a simple tool made by the writer for holding a prick punch for laying off dies on a milling machine table.

The tool consists of a piece of tool steel turned on one end to fit the collet of the milling machine and at the



LAYING OFF WORK ON THE MILLING MACHINE

other end it has a hole bored at right angles to its length. Into this hole is driven a ground and lapped bushing, holding a sliding prick punch. The use of this tool is obvious to those who could use it. The sketch tells the rest.

Device for Handling Small Work on Milling Machine

By R. A. Follensby

The sketch shows a device made by the assistant foreman of a milling department for the purpose of picking up thin pieces from the vise of the milling machine. When these are covered with chips and oil they are quite difficult to get hold of with the fingers and, though this tool is very simple and may be made in a few minutes' time, it increased production on the job by

DEVICE FOR PICKING UP WORK FROM THE MILLING MACHINE VISE

about 10 per cent because of the ease of handling. A description of the device is unnecessary. It is made of thin spring steel and the shape should be made, of course, to fit the job in hand.

Editorial

TO KEEP an employee when he has become too old or feeble to be really useful shows human sympathy. To keep a machine when it is old or out of date shows lack of business sense. On the other hand, nobody would think of throwing a good machine into the discard because it has slipped a cog or caused some other kind of trouble, while firing a man because there is temporarily something wrong with his headstock or because he is set for the wrong speed is still quite common.

What's Wrong With the Railroad Shops?

THERE IS a general impression that now that the railroad shop strike is over, the problem of maintaining railway rolling stock in good running order is practically solved. People seem to think that all that is necessary is for the shops to work a little harder to catch up with the repairs that were delayed by the strike. Unfortunately many of the higher-ups in railroad circles share this feeling which is entirely unjustified by the facts.

Any engineer or shop man who has ever visited a railroad shop cannot have failed to take away with him the impression of a journey back into the dark ages of machine shop practice. Archaic machine tools, inadequate equipment, poor tools, obsolete methods, ingenious but expensive makeshifts can all be found in any railroad shop. Who is at fault? This is a question that is hard to answer definitely because of the many departments involved and the inter-relation of the various shortcomings.

The labor union rules that limit output and circumscribe the duties of each craftsman are responsible for a small part of the trouble. The remarkable vitality of traditional methods in performing certain jobs and the lack of knowledge of current practice in other machine shops go hand in hand as an indictment of shop management. On the other hand must be considered the necessity for better tools and equipment. With those provided in the average railroad shop by pinchpenny and shortsighted financial management, it is a living wonder how the mechanical department manages to do as well as it does.

The purchasing department, which is frequently permitted to overrule the specifications of the manufacturing department, must shoulder the blame when it procures cheap substitutes that do not meet the requirements. Back of that is the headquarters policy that permits such an uneconomic and inefficient practice to be continued. Going one step farther, we come to the insanely drastic bureaucratic regulation which has done its level best to starve the railroads to death until very recently. If you examine this pyramid of errors, you find that it is so constructed that alibis are easy to construct for every one concerned. Unfortunately, alibis don't repair locomotives. Neither do they excuse incompetence, ignorance nor sloth.

With these conditions clearly in mind, the editorial staff of the *American Machinist* has conducted an investigation with the purpose of pointing out the mistakes that can be corrected and suggesting ways of correcting them. The first article appears in this issue and the others will follow at short intervals. A good many toes are going to be stepped on before the series is ended, but it is our hope that the criticism will be taken in the spirit of constructiveness that prompts it and that a general improvement in railroad shop methods, management, and equipment will be effected by a clear vision of what is actually going on.

Machines Versus Immigrants

UNDER THE above title the *New York Tribune* says some very true things on a subject which has been in our mind for some time. We had planned to editorialize upon it but when we saw it so well handled in the daily press we decided to let an editor whose opinions can hardly be said to hold any bias for machinery builders, as might be said about our own, tell the story. Note particularly the last paragraph.

"The new automatic phones mean a better, temperproof telephone service for the customers. They mean, in the end, a loss of jobs to many operators. They mean a saving in operating cost to the companies. These are the first direct effects of this new machine —effects of a kind that has been happening decade by decade in every direction for over a century now.

"For a long while laborers fought the new machines, seeing only the jobs lost. That was natural enough. Only slowly has the truth been perceived and accepted that by machines the total product of man is enormously increased and thereby shorter hours and a higher standard of living are made possible. Upon the temporary hardship of jobs lost and readjustment compelled rises the whole structure of our modern civilization, eight-hour day, bath-tubs, "movies," newspapers, what not.

"There is one other important aspect of this continuing substitution of machines for hands and brains. The restriction of immigration now in operation is felt to be sound by every American who cares for the future of his country. But there is constantly raised the problem of how the country is to obtain sufficient labor if the European source is thus closed. Part of the answer lies in just such machines as the automatic phone. To be sure, it is overall labor of the roughest kind that is most urgently needed. The phones will not release ditch diggers or road builders.

"But the movement toward automatic machinery is a continuous one and its speed depends largely upon necessity. Our subway trains are now operated by two or three men. The old ticket chopper is a figure of the past. In the B. R. T. trains one man announces the stations in all the cars by megaphone. The electric irons and the mechanical dishwashers have not solved the whole kitchen problem, but they are on the way. What we can feel with every confidence is that the

product of our labor is no fixed sum. Each year it grows whether the total number of laborers grows or not.

"We must expect shiftings. Above all, once machinery has reduced the man power needed in a going industry the superfluous workers must shift into other lines. Otherwise the whole gain of machinery to society is utterly lost. The uneconomic situation in the mines today is largely due to just such a refusal to shift. But granted time for these readjustments there is no reason why the labor needs of the country cannot be met without letting down the immigration bars. Let us have hordes of machines rather than hordes of foreigners difficult to assimilate and holding a peril to the whole structure of our country."

Telling Workmen the Truth About the Company

SPEAKING last week before the Mechanical and Industrial Engineers in Chicago, the following statement was made by John Calder: "Comparatively few employers realize as yet the wonderful potency of just telling their people the truth about any situation. Wage-earners are square and they want to be fair, but they must be shown."

That education is the salvation of the world applies particularly to industry and, the sooner employers realize the fact, the sooner the industrial modern Sword of Damocles—labor troubles—will be eliminated. Knowledge is an eagerly sought and highly prized possession and even the slightest knowledge that contains a ray of hope for the betterment of his economic status is eagerly grasped by the worker. This fact has been a sinister weapon among radical leaders while the employers have failed to recognize it. Just why the employers have been so slow in realizing that ignorance is at the base of most of the ill feeling shown by employees is hard to understand. Perhaps they need a little educating themselves.

The writer of this editorial has seen several workmen estimating the manufacturing cost of the product upon which they were working, leaving out entirely the item of overhead as it was something that so far as they knew had never existed, and showing that the company was making a profit of several hundred per cent while, as a matter of fact, it was under ten per cent. Any employer who will take the trouble to make an investigation will find that those who know the least about the cost of operation are usually the ones who make the most trouble.

The interests of the employer and the employee are identical. Manufacturing and other enterprises are operated for the common good—to enable the worker to achieve economic independence by the fruits of his labor, and to return a fair interest on the money with which the industry was established. When the worker has been shown that he is getting a fair share of the profits, then the entire organization will pull together in peace and harmony and the problem of the age will have been solved.

When buying ceased and prices began to tumble, Swift & Co. called their employees' committee in and showed them the books, as a result of which the committee recommended a general decrease in wages of 15 per cent. Those employers who are searching for a permanent solution of their labor problems will not underestimate the value of this example.

Are You Going to Vote This Year?

NEXT TUESDAY is Election Day. Although the principal prize is not at stake this year there will be plenty of other contests worth watching. The Republicans will try to read an indorsement of the present Administration into the results of the voting, the Democrats a sign of discontent and an augury of hope for the big fight two years hence.

Indications are that the vote in many sections of the country will be light, a sad commentary on the sense of duty of the average citizen. Are you in the indifferent class? Did you forget to register or was it too much trouble? If so, you should be the last one to object if the wrong man wins in your community and you are sentenced to another period of futile protest.

In this day and generation when the forces opposed to law and order are gradually growing more confident and insolent, it is the solemn duty of every law-abiding citizen to go to the polls and cast his vote, even if he takes no more active interest in political matters. Many people feel that the political bosses are so firmly intrenched that it is a waste of time to vote. They overlook the fact that under our form of government a boss is in power only so long as the indifference of his opponents permits.

Cutting Oils vs. Soap Water

A SHORT ARTICLE by H. B. Egg appears in this number under the above title. Apparently the writer is not satisfied with the knowledge as to *what* is being done; he seems to want to know *why* it is being done. This spirit of wanting to know, of wanting to have every-day practice based on some fundamental principle is to be recommended. If more people would show this dissatisfaction with the blind following of other people's action, if more mechanics would open their eyes and see, not merely the outer surface but also the inner working of things, the mechanical arts, and especially machine shop practice, would be on a much higher level than they are today.

Even the combined observations of all good mechanics, however, would not be sufficient to settle such an important question as the one put by Mr. Egg. Such problems should not be solved by experience, but by experiments, though of course, the experience of many people will greatly help to reduce the amount of experimentation required. Here is a subject worthy of the attention of Engineering Colleges, of Universities and other institutions of learning and research.

Just Suppose

JUST suppose that you were one of the faithful, square deal railroad shop machinists who stuck to his job and kept on running the same wabbly old boring mill your father had run before you. And suppose that accuracy with that machine was only obtained through a combination of good luck and the skill of long experience.

What would you say if the foreman came up one day and told you that a new boring mill has been ordered and that you were to run it when it arrived? Of course such things only happen in story books, but—

Just suppose.

Shop Equipment News

Sundstrand Stub Lathe

A machine intended especially for turning such work as automotive pistons and designated as a stub lathe has recently been placed on the market by the Rockford Tool Co., 2400 Eleventh St., Rockford, Ill. The machine can be applied to production work on many other jobs, such as turning automobile wheel hubs, gear blanks, steering knuckles, pulleys, bushings and ball joints. The swing over the carriage is 8 in., while the maximum

FIG 1—SUNDSTRAND STUB LATHE

capacity between the centers is 12 in. One operator can run two machines simultaneously, and on many jobs three machines can be operated by the same man.

One of the most noticeable features of the design, as can be seen by referring to Fig. 1, is the fact that the carriage ways and the headstock are one casting. In this way great rigidity is obtained, as is necessary under the heavy cuts that are taken. The bed is well ribbed and braced. It is so designed that chips fall from the carriage into a pan provided for that purpose, and ample room is allowed as a clean-out space at the back of the machine.

The spindle is of large diameter and runs in phosphor-bronze taper bearings that are lubricated by wick feed from an oil reservoir supplied from sight-feed oil cups. The front spindle bearing is 6 x 4½ x 3½ in. in size and the rear bearing 3¾ x 4 in. The take-up device for both bearings is adjusted by means of a single nut at the rear of the spindle. The nose of the spindle is 4 in. in diameter and has two threads to the inch. The hole through the spindle is 1 ¹⁵⁄₁₆ in. in diameter, while the taper hole is 2 ¹¹⁄₁₆ in. in diameter at the large end and tapers ¾ in. per foot. The spindle is driven by means of a bronze wheel and worm provided with ball thrust bearings. The gears regularly furnished with the lathe give spindle speeds of 40, 50, 65, 85, 110 and 145 r.p.m. The spindle is 44 in. above the floor. Provision is made for mounting an air cylinder and a quick-acting draw-back device.

The tailstock is very heavy and is clamped to a large overhanging arm supported by means of a stud protruding from the bed. This arm is 3½ in. in diameter and is so arranged that the tools can be clamped on it for doing operations such as facing and boring the open ends of pistons and center drilling. Adjustment can be made by means of a rack and pinion, the rack being cut on the top of the overhanging arm. A No. 4 Morse taper is employed in the tailstock spindle, which is 2¾ in. in diameter.

A large diameter screw having a lead of 1½ in. per revolution of the hand wheel is provided in the tailstock. The spindle is of sufficient diameter to prevent springing, and it has a longitudinal adjustment of 5 in. The tailstock spindle bearing is split for its full length and held in position by screws that may be adjusted to care for wear that occurs.

The arrangement of the carriage is worthy of note. It is 18 in. long and has bearing for its full length on the 8-in. face on the front side of the bed and on a 4-in. angular surface on the top. Its extreme travel is 8 in. An angular gib at the bottom of the carriage is provided to take up wear, and adjustment can be made from the front of the machine. The front toolslide has stop screws underneath it for adjustment of the tool and the slide is of sufficient width so that several tools can be clamped on at one setting.

By referring to Fig. 2 the arrangement of the rear tool may be seen. This tool is mounted on a slide having a cross travel of 4 in., as well as ample sidewise

FIG. 2—REAR VIEW OF STUB LATHE

adjustment. The front and the rear tools can operate simultaneously, so that multiple machining operations can be quickly performed.

The feed is driven from the spindle by a chain and pick-off gears located at the headstock end of the machine. The standard gears furnished provide feeds of 0.020, 0.030, 0.038, 0.050, 0.066 and 0.090 in. per revolution of the spindle. The feed arrangement to the carriage and the rear tool is driven through worm gearing with the worm submerged in oil. To engage the feed the worm is lifted to the wormwheel by a handle located at the front of the machine.

The wormwheel is keyed on the pinion shaft which drives the carriage, so that no gearing is required in the apron. On this shaft is a hand wheel measuring 15½ in. in diameter. To trip the feed a mechanism consisting of a dog on the carriage operates the feed lever and automatically disengages the worm from the wheel. It is stated that very accurate stopping of the cut can be made.

Power is transmitted from the motor through a short 4-in. belt. A 5-hp. motor running at 1,800 r.p.m. is regularly furnished and is fastened on a pivoted frame or plate inside the bed and entirely out of the way of the operator. An adjustment is provided for the tension of the belt. A friction clutch pulley is located at the back of the machine and mounted on roller bearings, with the starting handle conveniently placed for the operator when he is in his proper position at the front of the machine.

An oil pump driven from the main drive friction pulley is provided. The tank for the cutting lubricant is located in the bed below the chip pan. The machine requires a floor space of 46½ x 33½ in., a small space in consideration of the capacity of the machine. The net weight with the motor is 3,000 pounds.

Blount "Special" Combination Bench Grinder and Buffer

A plain-bearing, motor-driven combination grinder and buffer of the bench type, designated at the "Blount Special," has recently been placed on the market by the J. G. Blount Co., Everett, Mass. The tool is suitable for light work in garages, repair shops and other places in which grinding and sharpening operations are required.

The motor with which the machine is equipped is a standard Westinghouse single-phase motor giving ¼ hp. at 1,800 r.p.m. It can be supplied either for single-phase alternating current of 110 or 220 volts and 60 cycles, or for direct current of 32, 110 or 220 volts. The ground spindle runs in wick-oiled bronze bearings and carries a 6 x ½ in. grinding wheel and a 7 x ⅜ in. sewed buffing wheel.

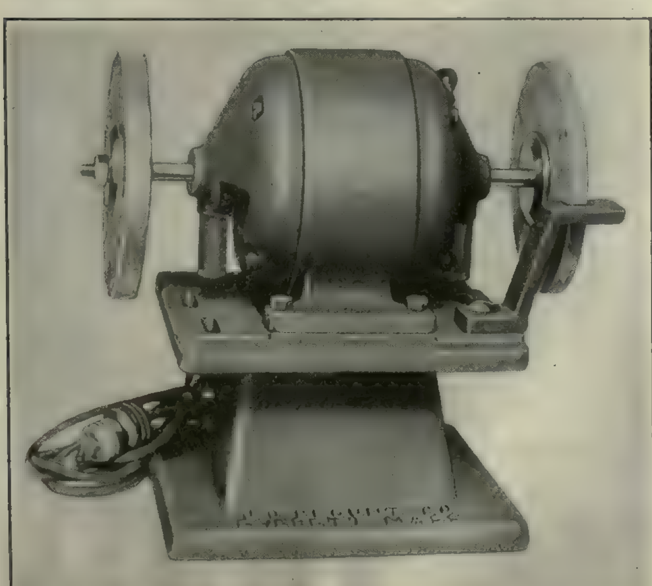
The base of the machine carries a cast-iron toolrest, and is slotted so that guards can be fitted for the wheels. If it is desired to use the machine as a small power unit, a 2-in. V-belt pulley can be furnished on the spindle between the flange and the motor bearing. A flexible cord and plug are furnished so that the machine can be attached to the nearest circuit, and yet be readily portable. The weight of the machine is 42 lb. net, and 60 lb. when boxed for shipment.

C.L.P. Portable Electric Drills

A line of portable drills has recently been placed on the market by the C. L. P. Electric Co., 62 Dey St., New York, N. Y. Although larger sizes of drills will be added, at present ¼ and ⅜ in. sizes are made.

The casing of the drill is of aluminum. The weight of the ¼ in. machine is 6 lb., while that of the ⅜ in. is 14 lb. Universal motors are used in both machines, and can be furnished for either 110 or 220 volt current. The armature runs on ball bearings. A fan is provided for air cooling the motor, the intake being at the rear end. The cable connection to the drill is simple, so that the cable can be removed without disturbing any inside connections. The units of the drill are so arranged as to be easily assembled and dismounted.

The drill is equipped with a three-jaw Jacobs chuck that is threaded to the end of the spindle. The chuck can be removed without disturbing any part of the drill. Extension spindles can be supplied for drilling in inaccessible places. Because of the offset position of the spindle, holes can be drilled close to a corner. The spindle has a ball thrust bearing and bronze radial bearings. The oil holes through which the gears and



BLOUNT "SPECIAL" BENCH GRINDER AND BUFFER

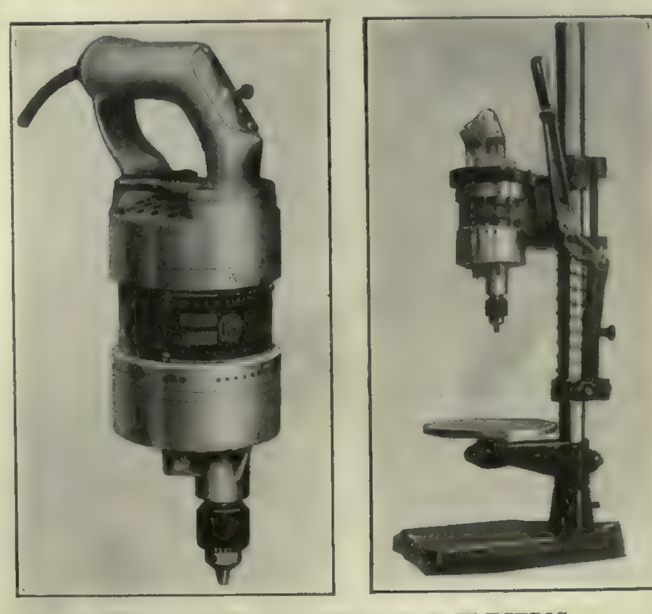


FIG. 1—C.L.P. ¼-IN. PORTABLE ELECTRIC DRILL AND STAND

lower bearings are lubricated are provided with self closing devices so that the oil is retained and dirt is prevented from entering.

At the left side of Fig. 1 is shown the ½-in. machine. It will be noted that the large handle at the rear of the motor is equipped with a switch that stays in either the on or off position, and yet is so placed that it is always within easy reach for starting or stopping the motor. On the right side of the illustration is shown

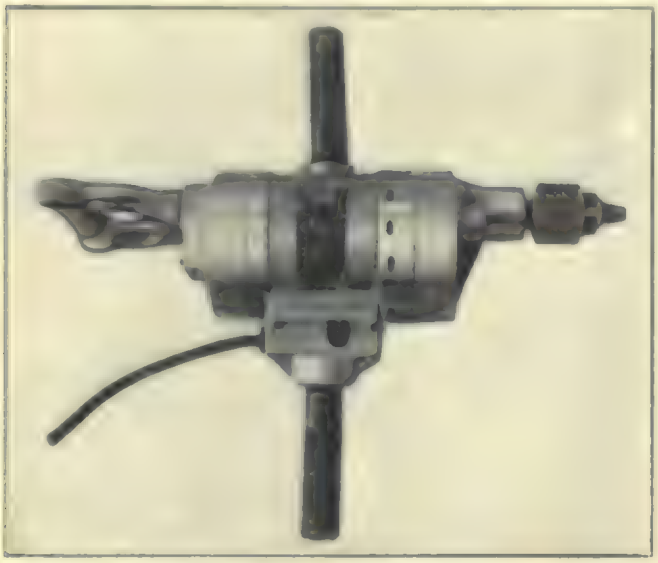


FIG. 2—C.L.P. ¾-IN. PORTABLE ELECTRIC DRILL

the stand that can be furnished when it is desired to do precision drilling on a bench. The usefulness of the tool is thus greatly enlarged.

The ¾-in. drill is equipped with two side handles as well as a grip handle, as can be seen in Fig. 2. The switch is placed in one of the side handles and is completely encased in a fiber covering. Each machine is furnished with a plug and 10 ft. of cable.

Starrett Spring Depth Gage

The L. S. Starrett Co., Athol, Mass., has recently placed on the market the No. 48 spring depth gage that is shown in the accompanying illustration. The chief feature of the device is the fact that the spring in the barrel automatically forces the rod downward and the clamp screw locks the rod in position. The gage has a capacity up to 3 in., its principal use being the measuring of the depth of drilled holes.

The gage has a base 2¼ in. long and the rod itself is ⅜ in. in diameter. The base and the contact point of the rod are not lapped, but are tempered and ground. The contact end of the rod is square instead of convex, in order to make it easier to manipulate when measuring from a plane surface to a very narrow shoulder.

STARRETT SPRING DEPTH GAGE

Sigourney No. 1 Bench Drilling Machine with Plain Bearings

The Sigourney Tool Co., Hartford, Conn., has added to its line of sensitive drilling machines the No. 1 bench-type machine shown in the accompanying illustration. This machine is similar in design to the concern's ball-bearing, high-speed drilling machine, but is intended for slower speeds. Except for a ball thrust bearing to take the drilling pressure, the parts run upon plain bearings of bronze. The normal capacity is for drills up to 5/16 in. in diameter, although larger can be carried. A chuck is employed for holding drills up to 5/16 in. in diameter, although for larger sizes taper-shank drills are used.

The spindle is not enclosed. It has a taper hole to take a No. 1 Morse taper shank. The vertical movement of the spindle is 2¼ in., actuated by a rack and pinion with hand lever. The spindle is balanced by a coil spring concealed in the case of the spindle bracket. A clamp stop is provided to regulate the depth of the hole drilled.

SIGOURNEY NO. 1 PLAIN-BEARING BENCH DRILLING MACHINE

The head may be adjusted vertically upon the face of the column through a distance of 6 in., and the maximum height attainable under the chuck is 8¾ inches. The table is 10½ by 14 in. in size. The machine will drill to the center of a 13-in. circle.

The tight and loose pulleys are 6 in. in diameter and are intended to run at a speed of 450 r.p.m. Three changes of spindle speed are available through the three-step cones and belt. All pulleys are balanced. The belts are endless and the machine is shipped with belts in place, ready for use. An overhead countershaft can be furnished, although ordinarily none is used because the machine is run direct from the lineshaft.

The net weight of the machine is 170 lb. Boxed for export shipment it weighs 200 lb. and occupies a space of 20 cubic feet.

Pratt & Whitney Duplex Hand and Automatic Centering Machines

A double-ended centering machine for handling at high speed work on small shafts and similar parts has recently been placed on the market in both the hand-operated and the automatic types by the Pratt & Whitney Co., 111 Broadway, New York, N. Y. The hand-operated machine, which is illustrated in Fig. 1, is intended especially for shops where a variety of work is handled and where it is desirable to make quick adjustments for all sizes within the capacity of the machine.

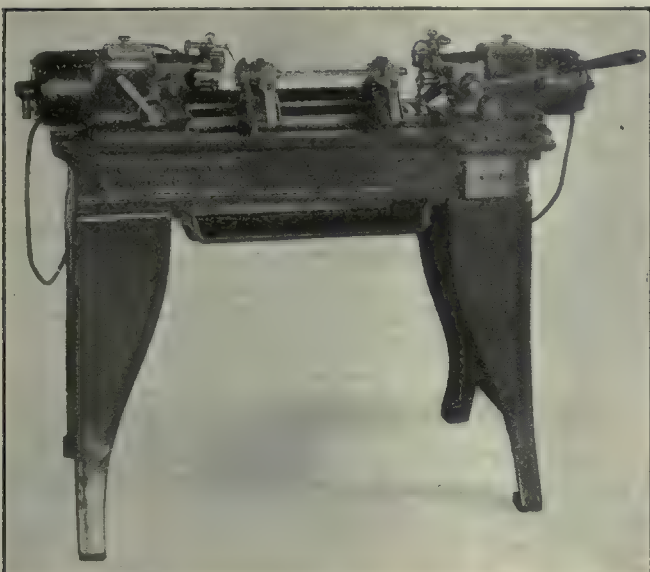


FIG. 1—PRATT & WHITNEY HAND CENTERING MACHINE

While the machine is normally equipped with opposed drill heads for centering both ends of the work in one operation, it can be supplied with only one head in case the parts to be centered are longer than the capacity of the doube-ended machine. The right-hand head is permanently attached to the bed, while the left-hand head is adjustable to suit different lengths of work, or it can be removed entirely for performing work on long pieces.

Both heads are normally operated together by the hand lever on the right-hand head. The drills are fed in by hand until they contact with both ends of the work, which is placed loosely between the jaws of the vise so that it can shift endwise. When contact is secured at both ends, both jaws of the vise are tightened at the same time by a lever operated by the left hand of the operator. The holes are then centered by further pressure applied on the lever in the right hand.

The drill spindles are mounted in sliding bronze bearings and provided with ball thrust bearings. They are each driven by a constant-speed motor, geared to provide drill speeds of either 1,200 or 1,800 r.p.m. The spindles can be locked in place for changing gears or removing drills, a small knob on the top of each head serving this purpose.

In order to hold the depth of drilling to the dimension desired, adjustable stops are provided which are mounted on the head and bear against the ends of the work to limit the forward movement of the spindles. In case it is necessary to have the center holes the same distance apart regardless of slight variations in the length of the work, adjustable stops are positioned to engage lugs on the drill heads, so that the spindles have a predetermined forward movement.

The motors are of $\frac{1}{4}$ hp. for either 110 or 220 volt alternating or direct current. They operate at 1,700 r.p.m., are totally inclosed, and in the alternating-current type are suitable for either 1, 2 or 3 phase. A switch is furnished so that the motors can be connected directly to the line.

Two quick-acting self-centering vises take all sizes of work up to 2 in. in diameter, and from 3 to 18 in. long. They are adjustable along the length of the bed, and are operated simultaneously by one lever. For heavy work up to and including 4 in. in diameter, adjustable V supports are used. Locking screws maintain the adjustments, and one of the supports has a clamp lever to hold the work in place.

After the work has been centered, it is deposited in a removable metal tote box at the rear of the machine. The oil drains from this box to the tank and is conveyed to the drills by means of a plunger pump. This pump is connected to the hand feed lever, and oil is supplied to the drills only while cutting is going on, without special attention from the operator.

Although special collets can be furnished for extra sizes of drills, two sets are normally included in the equipment. One is $\frac{13}{64}$ in. in diameter for M, L and E drills, and the other $\frac{3}{16}$ in. in diameter for A, B and C drills. For work over 5 ft. long, an outboard support can be furnished. The machine requires a floor space of 4 ft. 6 in. x 2 ft. 6 in. The net weight with the complete equipment is 600 pounds.

On the automatic machine, a front view of which is shown in Fig. 2, an automatically operated feeding mechanism working in conjunction with a magazine is employed. The work is clamped mechanically, so that after the set-up has once been made it is only necessary to keep the magazine supplied with work and take away the finished parts. The work is removed from the

FIG. 2—PRATT & WHITNEY AUTOMATIC CENTERING MACHINE

FIG. 3—REAR VIEW OF AUTOMATIC CENTERING MACHINE

magazine by transfer slides, placed in the vise, clamped, centered and then released into the work box independently of the operator.

The drill heads themselves and their driving motors are similar to those employed for the hand-operated machine. The feed of the spindles is automatic, and is operated by the same cam that operates the transfer slides. This cam is driven by a small motor similar to the motor driving the spindles, and a set of change gears provides the means of adjusting the drilling time to suit the nature of the work. Fig. 3 shows the third motor mounted on the back of the machine and the arrangement of the magazine and other parts.

During the centering operation the drills are automatically withdrawn twice so as to clear them of chips and allow oil to enter the drilled holes. Each spindle has a maximum feed movement of ¾ in. which may be reduced by a regulating lever to ⅛ in., with any variation between to suit the size of the drills and the nature of the work.

The machine may be run through its cycle of operations by hand to check the set-up, a crank being employed for this purpose. The method of holding the depth of the hole uniform is very similar to that employed on the hand-operated machine. Stops can be mounted to bear either on the ends of the work or on the drill heads themselves, depending upon the requirements of the drilled holes.

The magazine and work supports are mounted on the head castings so that it is only necessary to move the heads along the bed to accommodate various lengths of work. This length when both ends are to be centered varies from 2½ to 18 in. Work from ¼ to 1¼ in. in diameter can be accommodated.

The work is supported by V-shaped jaws during the centering operation. These jaws are provided with adjusting screws so that they may be set to any desired diameter, while an automatic compensating arrangement takes care of minor variations in the diameter of the work. The transfer plates on the slides remain in contact during the drilling and serve to clamp the work in the jaws. Different transfer plates to take care of various diameters of work can be easily mounted, and four sets of plates cover the range of the machine. By an adjustment of the V jaws, it is possible to drill holes out of center on one or both ends, such as might be wanted for driving pins used in grinding operations or for short oil holes. Facing or chamfering tools may be used in place of the drills when necessary, so that the scope of the machine can be enlarged.

Oil is supplied to the drills by a geared pump running at a constant speed. The tank is located underneath the bed and the oil drains into it from all parts of the machine. The work box can be taken off for cleaning and for removing finished work. The work pieces are ejected directly into the box when it is in place; but when the box is removed while the machine is running, a deflector hinged on the bed can be latched in position to catch the work.

Complete equipment such as furnished with the hand-operated machine and including change gears, wrenches and collets, is supplied. With all equipment the net weight of the machine is 1,020 lb. The floor space is the same as that of the hand-operated machine.

"Wiard" Interlocking Milling Cutters

The milling cutters shown in the accompanying illustration are the "Wiard" interlocking cutters which have been developed and placed on the market by the American Standard Tool Works, 402 Owen Bldg., Detroit, Mich.

The cutters are made from drop-forged high-speed or carbon steel, and are so constructed that they can be used singly or in sets. When more than one is employed, the sides of the teeth of one cutter fit into corresponding grooves in the side of the mating cutter. Cutters can thus be ground in pairs, with the advantage that when the sides of the teeth become dull, the cutters can be changed to bring the opposite sides into play so that full wear will be obtained from every cutting edge. The chief features of the cutters are the ability to use all of the cutting edges, to employ the cutters singly or in combination interlocked with each other, and to maintain the width of the slot milled by a set of the cutters.

"WIARD" INTERLOCKING CUTTERS

Individual sections can be used as ordinary side milling cutters if desired. As the cutters become narrowed by grinding, a pair can be spread apart so as to maintain a given dimension. The cutters are made in standard sizes for diameter, and of such widths that practically any standard or special size can be obtained by using the cutters in combination.

Davenport Bevel Gear Testing Machine

A machine for subjecting to a running test spiral bevel gears and pinions of the style employed in the differentials of automobiles, has recently been placed on the market by the Davenport Machine Tool Co., Inc., Rochester, N. Y. The machine has sufficient capacity for handling all sizes of gears made for such work. Tests for determining the bearing obtained on the teeth, the quietness of running and the center distance at which the best bearing and the least noice occur, can be made on the machine.

The machine, a front view of which is shown in Fig. 1, is rigidly constructed so that accuracy is obtainable, and it incorporates a number of devices to promote rapidity of operation. There are two headstocks, one for holding the gear and the other for the pinion. The pinion is rotated by power, and a brake is incorporated to retard the speed of the gear, so that load can be applied. Both spindles are equipped with Hess-Bright ball bearings on each end, with an arrangement for keeping the oil in the bearings at a constant height.

Both of the headstocks have large bearing surfaces on the bed, and dovetail slides with taper gibs extending their entire length. Provision is made for tighty clamping the headstocks to the bed by means of bolts passing into blocks in T-slots in the bed. These bolts are close to the bearing surfaces, so that the headstocks and the bed are rigidly secured while the test is going on.

Due to the fact that there is usually but little adjustment required of the left-hand headstock on which the crown gear is mounted, this headstock is clamped down by a lever attached to one of the hold-down bolts with an adjustable connection to the second bolt, so that the bolts can be tightened equally at the same time and with one movement.

Since the right-hand headstock is moved considerably each time a pinion or gear is changed for testing, provision has been made for quickly operating it by air pressure. An air cylinder mounted on the back of the machine serves to draw back the slide a sufficient distance. The pinion or gear can then be changed and

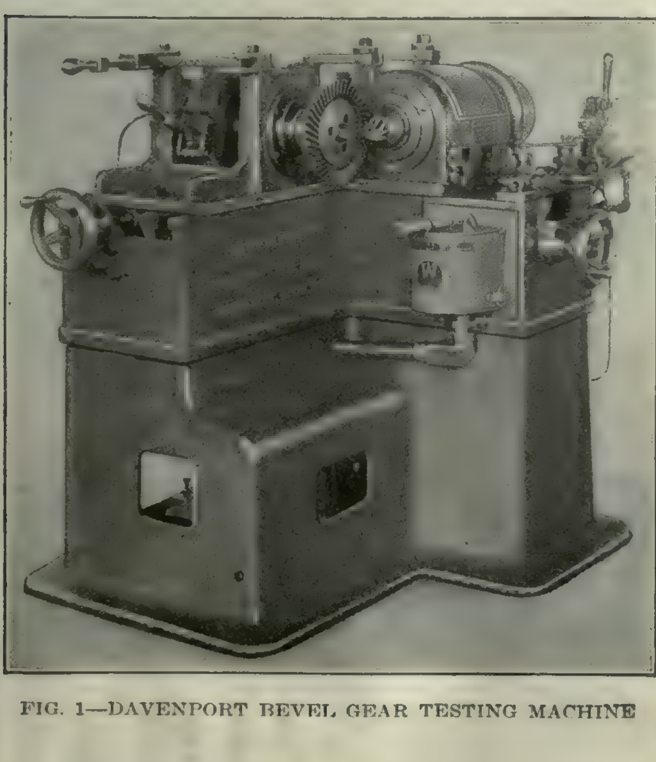


FIG. 1—DAVENPORT BEVEL GEAR TESTING MACHINE

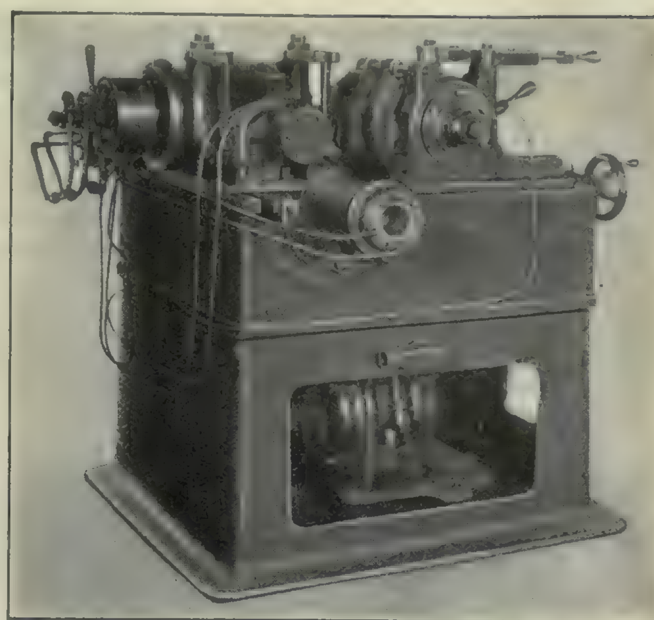


FIG. 2—REAR OF DAVENPORT GEAR TESTING MACHINE

mounted to mesh again in exactly the same position at which the last gears were tested. Other positions can be obtained, of course, as controlled by the handwheel with a graduated dial which is located underneath the right-hand headstock. Due to the fact that this headstock is moved so often, provision is made for clamping it by means of an air cylinder. An air chuck is fitted to the machine for quickly clamping the pinion.

The three valves on the front of the machine are, respectively, for clamping the work in the spindle, for moving the slide so that the pinion and the gear mesh, and for clamping the right-hand headstock. Thus moving back the slide and releasing the pinion, as well as reclamping the pinion and bringing it in place, can be very quickly accomplished.

By referring to Fig. 2, which shows the rear of the machine, the arrangement of the air cylinders can be seen. The position of the driving motor, which is of 3 hp. and driven by either alternating or direct current, can also be observed. Its position in the base permits a saving in floor space, as well as protects the motor. The motor is so mounted that the correct tension of the belt is maintained as the slide moves back and forth. It is controlled by a switch so that the spindles can be driven in either direction.

The exhaust from the air cylinders is piped to the brake band on the crown-gear headstock so as to cool the brake when a load is being absorbed. If preferred, water may be circulated through the brake for cooling purposes.

The machine occupies a floor space about 4 ft. square, and has a net weight of about 1,500 pounds.

Box "Load Lifter" Electric Hoist

A small electrically operated hoist intended for continuous service has recently been placed on the market by Alfred Box & Co., Inc., Philadelphia, Pa., under the name of "Load Lifter." Although the hoist is only 11 in. wide and 28 in. long, it is made for heavy duty such as is ordinarily encountered where continuous service is necessary and where the operator does not take the greatest care of the equipment.

The accompanying illustration shows the hoist mounted for trolley suspension. The frame is so made that the hoist may be turned through 90 deg. so as to hang parallel with the rail, a wrench being the only tool required. The trolley is adjustable to run on I-beams from 5 to 9 in. in size. Hook suspension may be used when the trolley is not required. The hoist is built in one size only and is rated to lift loads of 1,000 lb. on a two-part line at 20 ft. per min., or 500 lb.

BOX "LOAD LIFTER" ELECTRIC HOIST

on a single-part line at 40 ft. per min. The hoist has a drum which will accommodate nearly 80 ft. of rope, so that long lifts can be made even when a two-part line is employed.

The mechanism is completely enclosed, so that dirt and dust cannot get in and oil can be retained. Since the motor and controller are totally enclosed, the hoist may be installed in practically any position without danger of injury to the mechanism. Self-aligning S.K.F. bearings are used in the motor, and Hyatt flexible roller bearings at other points. All gears are forged steel and heat-treated, the teeth being of the stub type. The bearings are cast integral with the frame of the hoist, so that permanent alignment is maintained. All shafts are manganese steel.

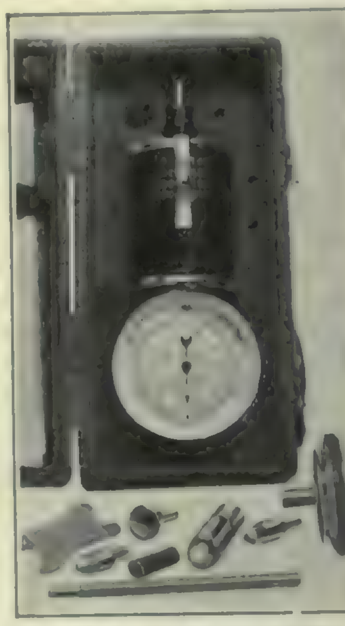
A multiple-disk load brake and a band brake on the motor shaft are both provided for holding the load in position. All parts are lubricated from one point by a combination of splash and force-feed systems. Oil must be poured into the hoist at only one point about every six months.

The controller is of the drum type and has non-arcing fingers. A terminal block is built in the controller to facilitate wiring. The hinged cover aids inspection. The controlling handles are mounted on a double lever so that they are easily accessible.

Coats Hand Tachometer

A hand tachometer recently placed on the market by the Coats Machine Tool Co., Inc., New York, N. Y., for obtaining a reading directly in revolutions per minute without watch-timing, or in circumferential feet per minute without calculation and irrespective of the pulley diameter, is shown in the accompanying illustration. The tachometer is of the pendulum or governor type and is equipped with a damping mechanism to prevent vibration and to make the instrument "dead beat." It is stated that the device is not affected by magnetic or electrical influences or by moisture or temperature changes.

The tachometer is equipped with a single spindle and arranged for either three or four ranges of speed for speeds from 30 to 1,600 r.p.m. It can be operated in either direction. A mechanically operated level is provided on the dial to indicate when the instrument is in exact horizontal alignment with the shaft to be tested. However, the tachometer may be used vertically or in any other position with equal accuracy. The device is small so that it can be easily handled, and weighs only one pound.



COATS HAND TACHOMETER

The dial is provided with two scales. The inside scale reads from 3 to 12 and the outside scale from 1 to 4. The first and third speed ranges that are marked on the body of the tachometer should be used in connection with the inside scale, and each figure should be multiplied by either 10 or 100. The second and fourth speed range works in conjunction with the outside scale, and each figure should be multiplied by 100 or 1,000, respectively. Various types of couplings for contact with the shaft and an extension spindle are provided, as can be seen in the illustration in front of the case.

For obtaining surface speeds, a "cutmeter" wheel 6 in. in circumference is employed. This wheel can be held in contact with a moving surface so that the number of lineal feet of travel per minute can be read on the dial. When the center of the shaft is inaccessible, a thread can be run over a pulley and through the groove on the cutmeter wheel to obtain the circumferential speed.

Personal Insurance

Nowadays, prominent insurance companies issue blanket policies at such low rates that, if for no other reason than to aid in keeping down the labor turnover, it would pay a management to take out policies on certain employees at its own expense. The greater the turnover, the more desirable is such action. It may have but little effect as regards the younger employees and those having no dependents, but, on the others, it is a good bond.

News Section

S.A.E. Production Meeting Widely Attended

Successful beyond expectations was the first production meeting of the Society of Automotive Engineers which was brought to a close after a two-day session in Detroit on Friday evening, Oct. 27, with a dinner at the Hotel Statler.

Interest of a national character was evident from the large gathering of executives of the automotive industry, embracing not only production but sales, administrative, service and engineering departments as well. Nearly every phase of manufacturing allied to the industry had representatives present and the consensus of opinion at the close of the sessions indicated that the meeting had been productive of a great deal of value.

Keen Interest Shown in Papers

The session of Thursday, Oct. 26, was taken up by four papers of importance. E. Karl Wennerlund discussed The Group-Bonus and Its Application, describing a system of labor and production control having advantages over the piece work, premium and flat-wage methods, in that it eliminates a large part of the complicated factory cost system.

Messrs. P. E. Haglund and I. B. Scofield described, in a paper entitled, Cylinders from the Ore to Finished Part, the methods and processes followed in Ford cylinders at the River Rouge plant. F. A. Mance of the Studebaker Corporation talked on Tool Allotment and Costs as applied to the operations in that company's operations.

New Methods of Processing Splined Shafts, was the title of a paper read by J. A. Ford in which the machining of splined shafts to precise limits without grinding received careful study and set forth valuable experience resulting from shop experiments.

The sessions of Friday, October 27, was no less interesting. A. J. Baker of the Willys-Overland Co. offered suggestions of value to production men, tool supervisors and superintendents in his paper on Selection of Machine Tools. The experiences of the Packard Co. in matters of production were related by Messrs. H. J. Crain and J. Brodie in their joint paper, Some Experience from a Production Note Book. K. L. Hermann's paper, Production Errors in Gears, bore evidence of an exhaustive investigation of gear tooth variation and its effect on gear noise. William Dunk of the Franklin organization discussed problems met in the production of air-cooled engines and R. K. Mitchell in his paper, Machine Tool Efficiency, dealt of the error of purchasing expensive special machine tools to perform operations readily accomplished on standard machines, stressing the overproduction with resultant frequent idleness of the former.

The afternoons of each day were set apart for inspection visits to the River Rouge plant, Dodge Brothers, Packard Motor Car Co., Cadillac and others. The banquet of Friday evening was presided over by Harold Emmons, with addresses by Pierre DuPont, president of the General Motors Co., A. B. C. Hardy, president of the Olds Motor Co., and Kettering Bachman.

Ethan Viall Returns to the American Machinist as Ohio Editor

Arrangements have been made whereby Ethan Viall, former editor of the American Machinist, will serve the interests of the subscribers and advertisers in the Ohio territory. Mr. Viall, who is well known to readers of the American Machinist through his ten years service on the editorial staff, has given up his business interests and settled in Cincinnati at 7474 Lower River Road, Fernbank. He will devote half his time to editorial work reserving the remainder for the completion of several technical books which have been under way for some little time.

Personnel Association Opens 1st National Convention

Industrialists, educators and personnel experts representing the country's largest business and manufacturing enterprises will engage in a three-day national forum, beginning Nov. 8, at Pittsburg, under the auspices of the National Personnel Association. Centering around the numerous discussions, addresses and committee reports, covering a wide range of administrative effort, will be the problem of "the human factor," now of outstanding importance in this and other countries.

The Pittsburgh gathering will mark the first annual convention of the Association which has taken over the activities of the National Association of Corporation Training and the Industrial Relations Association of America.

Among those who will read papers and address the sessions are: Michael Pupin, professor of electro-mechanics, Columbia University; Magnus W. Alexander, National Industrial Conference Board; H. M. Jefferson, Federal Reserve Bank of New York; Dr. E. K. Strong, Jr., Carnegie Institute of Technology; C. S. Ching of U. S. Rubber Co.; Dean R. L. Sackett of Pennsylvania State College; C. R. Dooley of personnel department, Standard Oil Co.; Dr. E. S. MacSweeney, New York Telephone Co.; Dr. R. S. Quimby, Hood Rubber Co.; Dr. F. L. Rector, National Industrial Conference Board; Paul E. Wakefield, Carnegie Steel Co;. E. K. Hall, vice president, American Telephone and Telegraph Co.; and F. L. Bishop, dean of the University of Pittsburgh.

Exporters Discuss Allied Debts at Convention

Passing resolutions endorsing the constructive policy of President Harding on the merchant marine and recommending that an international conference of business men be called together at the invitation of the U. S. Chamber of Commerce to discuss the inter-allied debt, the American Manufacturerrs Export Association brought its thirteenth annual convention to a close at the Waldorf-Astoria on Thursday evening, Oct. 26, after a two-day session.

The chief feature of the convention was the discussion of the inter-allied debt problem which took place on Wednesday evening, Oct. 25, with Sir George Paish as the chief speaker. Lewis E. Pierson, chairman of the Board of the Irving National Bank, presided and other addresses on the problem of debt cancellation or adjustment were made by George Ed. Smith, president, Royal Typewriter Co., Julius H. Barnes, president, U. S. Chamber of Commerce and Gerard Swope, president, General Electric Co.

At the banquet in the evening Alba B. Johnson of Philadelphia acted as toastmaster and addresses were made by A. C. Bedford, chairman of the board, Standard Oil Co.; Sir George Paish and Don Frederico Alfonso Pezet, Ambassador from Peru, all of whom urged settlement of debts on a reasonable and economic basis.

At the close of the business session on Wednesday, Oct. 25, Col. Myron W. Robinson was re-elected president for the ensuing year. Two new vice presidents were also elected at this session. They were W. H. Robinson of the J. H. Heinz Co., Pittsburgh, Pa., and E. P. Thomas, president of the U. S. Steel Products Co., of New York.

The morning session of Thursday, Oct. 26 was marked by a discussion of the Ship Subsidy Bill, Homer L. Ferguson president of Newport News Shipbuilding and Drydock Co., presiding. Edward C. Plummer, commissioner, U. S. Shipping Board and Hon. George W. Edmunds of Philadelphia spoke.

Meeting of Electric Steel Founders

The chief executives and the operating officials of the companies comprising the Electric Steel Founders' Research Group recently held a 3-day meeting at Wernersville, Pa., at which exhaustive progress reports were presented on researches being conducted by the organization into annealing; core practice; facing practice; furnace practice, and the elimination of slag from castings. It is stated that there has been gratifying progress in each group investigation and that the improved volume of business in the industry at present affords better opportunity for the prosecution of certain researches than when operations were curtailed during 1921.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

THE Secretary of Agriculture, Mr. Wallace, delivered an address last week in which he was very emphatic in demanding lower freight rates for farm products. As it is unlikely that the Secretary of Agriculture would have spoken so forcibly without the approval of the President, his speech is perhaps the most important news of the week in its relation to domestic affairs.

The appeal for lower rates voiced by Mr. Wallace came just as the Pennsylvania, the Norfolk & Western and some other railroads announced the resumption of pre-war dividends, and since cheaper transportation for goods and passengers is not consistent with increased dividends unless the costs of operation can be reduced by consolidation it is not surprising that the railroad combinations for which the Esch-Cummins bill provides are again being seriously discussed. The old plan under which the Northern Pacific, the Great Northern and the Burlington would be operated as one system is again being discussed, it is reported that the New York Central will take over the Western Maryland, and many other amalgamations are being suggested.

As they take shape it will probably be discovered that many railway securities now selling at big discounts have a value hitherto unrealized. This explains the relative firmness of railway shares in the securities markets, which have been otherwise spotted as a somewhat lower range of values for both bonds and stocks.

The Liberty issues have continued to reflect the hardening of the money market and even Secretary Mellon's new 4½s are below the issue price. Taxable bonds have of course taken their cue from Government securities. They, too, are cheaper. The automobile stocks are distinctly lower, chiefly as a result of the Ford cut in prices, and the rest of the list has been rather droopy despite the continued declaration of stock dividends by some of the oil companies and the flagellation of the market by those who have hoped that a stimulation of activity would reattract speculation.

Commodities, on the other hand, have been firm and in many important staples an advance over last week's prices has been recorded. Cotton and cotton goods have been conspicuously strong. So have wool and woolen goods. Rubber has held some of the advance recently recorded. The tendency in the cereal markets is still upward. Coffee, tea and rice have been relatively firm. Cuban cane sugar has again advanced. A statistical scarcity until the new crop is available is indicated, as the unsold stocks in Cuba have dwindled to only 75,000 tons.

Among the metals copper is the only laggard. Iron, steel, zinc and tin are all in good demand at full prices. It may be that some of the staple commodities are nearing a price level at which consumption will be checked, but this is doubtful for optimism is general and in the cities at least there is no unemployment. Good wages are to be had by all those who are willing to work.

The theory of gold inflation to which I have previously referred is becoming generally accepted as explaining the contrasting strength of the commodity markets and the weakness of the security markets. The latest authority of distinction to accept this theory is the Harvard Committee on Economic Research. Its chairman predicts steady and advancing prices for the next decade because an annual increase of $150,000,000 in the world's stock of monetary gold for the next eight years is indicated. Sir George Paish of London who is over here on a lecture tour is talking in the same strain and many conservative merchants and financiers who were formerly disposed to "pooh pooh" what they called the college professor's view of economic questions are now coming to realize that the purchasing power of gold as expressed in other commodities is declining and will probably continue to decline as long as the United States remains the only important country in the world using the gold standard and thereby attracting hither most of the new gold produced.

> The outstanding problem of the moment before American business men is that of the inter-allied debts. It is idle to suppose that our present prosperity can long continue if the countries abroad cannot buy the great quantities of American agricultural products which they have purchased in the past and of which they stand in need at present. And buy they cannot, if they are unable to sell their own produce.

To say that the purchasing power of gold is declining is but another way of saying that the value of commodities as expressed in terms of gold must advance and that the prices of securities must decline, for the value of the latter is only that of gold.

Premising the correctness of this theory a further advance in commodities and a decline in securities, especially bonds, seem to be indicated. But it is not to be expected that any of the markets will progress continuously in one direction. Reactions will occur from time to time and for such reactions intelligent business men should prepare themselves. No rule that will be universally applicable can be formulated and common sense, assisted by close observation, must still be used in navigating the uncharted channels of business.

When everyone has accepted the theory of gold inflation it will probably be found that its effect has been discounted.

My reports from abroad are that the use of the American dollar as an unofficial medium of exchange is increasing throughout continental Europe, and the decline in francs, lira and other continental currencies is attributed chiefly to the eagerness to exchange worthless paper money for a currency of integrity that is payable in gold.

Chancellor Wirth's proposal that the German government should declare itself bankrupt has caused some consternation among the thoughtless, but with marks selling at 2½ cents a hundred the bankruptcy of Germany would seem to have been unofficially confessed and it is to be remembered that the bankruptcy of a Government does not necessarily imply the bankruptcy of its people. The truth of this observation is attested by the reports of improved business in Europe now being received.

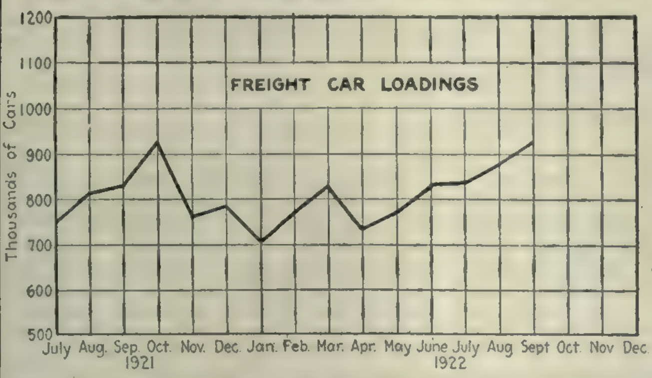
At a meeting of the American Manufacturers' Export Association, Dr. Julius Klein, a Government expert, expressed himself most optimistically in regard to conditions in Europe and a friend of mine who is a large dealer in naval stores told me that he had sold 5,000 barrels of rosin to Russia last week, being paid in dollars.

The weekly statistics are not especially significant. The reserve ratio of the Federal Reserve System shows a gain of 2.4 per cent. It now stands at 77.6 as compared with 75.2 a week ago. The improvement is probably due to the liquidation of credit incident to the distribution of the Government bonds recently brought out. The gold held shows a reduction of nearly $2,000,000, which probably reflects the continued disbursement of gold certificates or "yellow backs" by the banks.

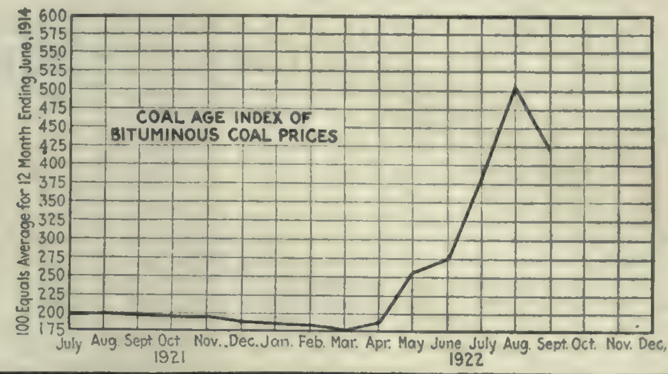
The correspondence between Representative Frear and Secretary Mellon in regard to the stock dividends recently declared by the Standard Oil companies may foreshadow some legislation that will be designed to make stock dividends taxable.

President Harding's advocacy of a change in the law or an amendment to the Constitution that will close the door to tax exemption and restrict the issue of tax-exempt securities is another evidence of the disposition to widen the incidence of the income tax law that should not be ignored. It may have a very important effect upon the entire security market. Generally speaking, however, there seems every reason to expect a continuance of commercial activity during the winter.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



FREIGHT CAR LOADINGS, which began an upward movement in June have continued to mount rapidly upward during September. For the weekly period ending Sept. 2, a total of 931,598 cars were loaded. On Sept. 30, 998,381 cars were reported, the average for the month being 936,386, as against the August average of 887,000. Coal, grain and merchandise loadings continue heavy, with increases in each, and a serious car shortage has developed, reaching 156,309 cars on October 14.

Bituminous coal prices, as indicated by *Coal Age* index, continued their downward movement during September, the average for the month being 412 as against 507 in August, with spot prices for the same periods standing at $5.08 and $6.14 respectively. The month has shown no active demand, buyers being disposed to postpone placement of requirements in the face of declining prices.

Automobile production for September shows a marked seasonal decline from August output, 186,562 passenger cars and 18,843 trucks being turned out as against 249,225 and 24,200 respectively in the previous month. The September total of 205,405 is the lowest since March of the current year but well above the output for the corresponding month of last year in which a total of 178,317 cars and trucks were produced.

Share markets continued their upward movement during September, although the advance was not quite so marked as in July and August. The average of 50 stocks, 25 rails and 25 industrials moved up to 87.85 as against 86.66 in August. The high point during the month was reached during the week ending Sept. 9, on which date the average was 89.47. The critical situation which developed in the Near East weakened the market in the latter part of the month but with a passing of this cloud there has come a recovery. Earnings of high grade rails and industrials continue excellent and regular dividends seem indicated for a considerable period.

Skilled metal workers are scarce and rates are high. In the New York district tool makers are being paid 75, bench hands and lathe hands 60 cents per hour. Philadelphia reports a range of rates which is wider and somewhat higher, toolmakers receiving from 60 to 90, bench hands 50 to 85 and lathe operators 50 to 90. The Detroit district range for toolmakers is between 75 and 80, bench hands 50 to 55 and lathe operators 70 to 75 cents per hour. Cleveland reports show toolmakers' rates ranging between 50 and 75, bench hands between 40 and 60 and lathe operators between 35 and 65.

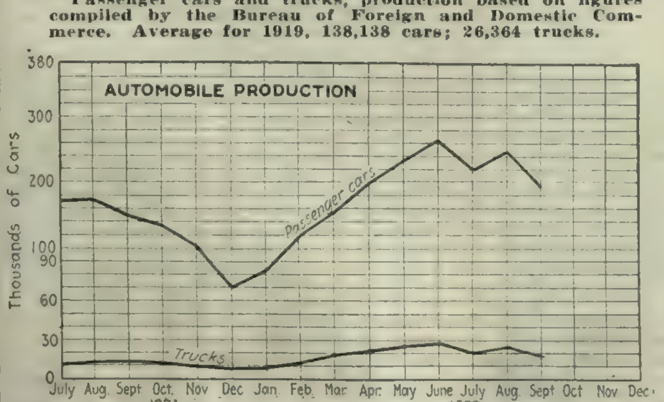
Iron castings per pound, based on prices quoted to *American Machinist*, Oct. 27, for 100 flywheels, each of 275 pounds weight and of plain pattern show an average of about 4.9 cents for four cities. New York was highest with 7 cents, and Cleveland lowest with a quotation of 2.4 cents, Chicago and Detroit coming in between, the former quoting a range of 4 to 5 cents and the latter a price of 6 cents per pound.

Comparative Prices of Shop Supplies

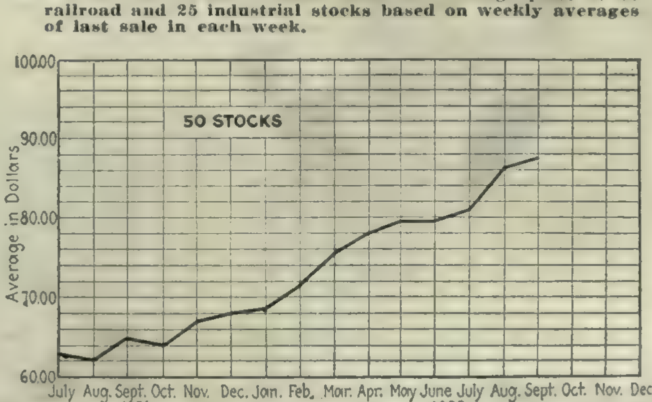
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0285	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0373	0.0379
Brass rods.....	per lb........	0.171	0.1700	0.148
Solder (½ and ½)	per lb........	0.23	0.228	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.575	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Business Conditions in England

Slow Recovery in Machine Tool Trade—Shipbuilding Outlook Brighter—Textile Machinery Builders Show Prosperity

By OUR LONDON CORRESPONDENT

THE early Autumn has disappointed a number of engineering firms who had expected something better, possibly because the late Summer had not proved so bad a friend to trading as had been anticipated, or perhaps because the Fall of the year and the Spring are commonly supposed to lead to a fresh outburst of activity. Once again enquiries became numerous in the machine tool trade and many firms are again living on hopes.

The small tool trade, if not of normal dimensions, is still not without bulk, though it is to be feared that in some instances the prices obtained have not been remunerative. Everyone is asking, not for the first time, when the machine tool industry will recover, and as this industry has truthfully been described as the handmaid of the rest, it may be well to try to estimate the immediate future of the various branches of the engineering industry generally.

Price and Wage Trend Uncertain

It is fairly evident that some few people are waiting to make sure that prices have really reached a minimum. Whether this is the case in any particular instance depends more largely than usual, because of the restricted demand, on the costs, which certainly show a tendency to decline but not to the extent of other factors that make up price. For instance, apart from national taxation, local rates form a heavy burden on industry and usually do not yet approximate to the decline in prices already manifest. There are makers of machine tools who declare that any change in prices will have to be in an upward direction, if business is to be profitable.

As to engineering wages, few employers will willingly attempt further lowering. The third cut has been made, so that within the last two months or so the weekly rates have dropped by 16s. 6d. It is true that on the shipbuilding side, where the new work commenced during the first half of the year was less than 90,000 tons, a movement has been made for a further reduction of 10s. a week—thus removing the whole of the war bonus. On the other hand, engineering workpeople engaged on textile machinery production have applied for an advance of £1 a week. This, it may be mentioned, is somewhat against the general policy pursued by the chief engineering trade union, who desire wages to move steadily over the whole industry and not to be controlled section by section. Then, again, the view is held that prices of materials have declined to the limit of the present and the immediate future and that should there be any improvement in demand the effect must be an increase of price. Consequently, at any rate in machine tools, the best value likely for some time is now available for the purchaser.

From what has been said in these columns it will be gathered that the textile machinery side of engineering remains in a prosperous condition. This has been true for two or three years, but it is highly improbable that the enquirer will now be met, as he has been met in the past, by a quotation of three years' delivery. It would seem rather that the export orders which have kept this section of engineering in such a happy condition are being worked up; on the other hand, it is with confidence anticipated that the home demand will improve.

It is a fact that from the manufacturer to the repairer of textile machines and details a state of full activity prevails, and even a well-known firm of chain makers has to some extent entered the field. Some indication of the position is given in the report, recently issued, of Dobson & Barlow, Ltd., Bolton, the profit declared for the year 1921-1922, amounting to £266,512, as against £93,626 for the twelve months previous and £91,253 the year before that. The latest dividend is at the rate of 30 per cent and £135,000 is carried to reserve, which amounts to £300,000, the issued ordinary capital being £200,000.

> British industry has been passing through the most severe depression ever recorded in its history. Depending almost entirely upon its overseas trade, the world depression has affected its industrial and economic life in a manner which is difficult to estimate. Here and there bright spots are beginning to appear and a settlement of the question of interallied debts will do much to establish equilibrium and place the nation once more in the front rank of America's customers abroad.

Electrical Firms Show Improvement

Probably electrical engineers are in the next position of prosperity, though it will not have escaped notice that the Coventry works of the English Electric Co., are closing down, leading to the discharge of some 800 men. Until the last few years this particular works has been engaged on the production of ordnance and certain small tools, and when the combination of electrical firms named was effected it was understood that the main purpose of these shops was to undertake heavy machining for the works in other parts of the country. Still, in the electrical industry a considerable scope remains in connection with power houses and traction, and if prices can be adjusted the prospects cannot fairly be described as unpromising.

In shipbuilding the outlook is brighter than it has been. A few orders have recently been placed on the Clyde and elsewhere but it is understood that they have in several instances been contingent on the further wages reduction. Ship-repairing has not been in so bad a case. The marine engineering branch is almost as slack as any other, and the directors of Parsons Marine Steam Turbine Co., for example, report great difficulty in obtaining orders for marine turbine installations; they show profits of £34,198 against £42,581 in the preceding 12 months. The indications of improvement in agricultural engineering are not specially marked.

In the automobile world the dead season is of course being entered. Much, some people think too much, is being hoped from the very definite price reductions, not only of motors themselves but also of such details as tires, petrol, etc., and the general tendency is shown by the introduction of a 20 hp. Rolls-Royce car to take its place alongside the higher-power vehicle.

Seasonal Decline in Autos

A Coventry firm recently paid 40 per cent, but losses continue to be reported. The Vulcan Motor & Engineering Co., a Southport section of the Harper-Bean combination, for example, followed the payment of 30 per cent free of income tax for five successive years with a loss of £434,261 in 1920 and one of £421,205 in 1921: the total loss however is reduced by excess profits duty remitted and reserves written back to the total of £454,560. The report of the Star Co., Wolverhampton, shows a loss of £58,453—ascribed to the abnormal conditions of trade and depreciation of stock—so that once again no dividend is paid. The Ford Co., it is understood, have acquired land near Southampton, where, it is stated, the buildings will cover about 20 acres, the output being 200 cars a day as against 160 at Trafford Park now. Southampton is, in fact, to become the distributing centre not only for Great Britain but also for Europe. The commercial vehicle side is clearly in a depressed condition and, as in the case of pleasure cars, to a marked degree debentures and similar papers have necessarily been taken as payment by suppliers of material.

To take another large market for the machine tool industry, the railways have for some time stopped buying. But it is generally thought that this arises from caution and not from faliure to recognize the need for further and more modern plant in the form of machine tools. Our numerous small lines must in the course of little more than a year sort themselves out according to plan into four large amalgamations, divided mainly geographically. The process is under way and in several instances has made rapid progress. It is anticipated with some confidence that as soon as the amalgamations are completed, and the engineers of the various lines know exactly the position, the machine tool trade will

be called on. The amalgamations are of course to be effected in view of economy, and it is quite possible that some of the small shops, and even the larger works, belonging to the different lines will find their occupations gone. On the other hand, the need for improved methods of machining is quite well recognized, and it is in this direction that the machine tool man will turn most hopefully in surveying the future. But any demand is hardly likely to show itself for some months. Railway rolling stock builders are reporting increased profits. Hurst, Nelson & Co., Motherwell, show a profit of £106,575 as against £94,230, and Kerr, Stuart & Co., Ltd., indicate net profits at £62,824.

For the present the radio industry languishes. Two exhibitions have been held in London, one almost on the heels of the other, and they have been well attended, particularly by schoolboys and youths. But broadcasting arrangements are incomplete, and the license fees to be paid to the postmaster-general are not yet settled.

Tool Builders Enter New Fields

The machine tool industry remains very poorly occupied and the possibility is that, provided satisfactory arrangements can be made as regards the building, the next exhibition to be organized by the Machine Tool Trades Association will be held in 1925 rather than 1924. Two or three relatively small firms can be mentioned as being fairly well engaged; they are concerned with special tools for textile machinery makers. As for many months past, makers of standard tools in quantities are the firms least likely to receive orders. Little that is definite is available regarding the financial position. One firm, at any rate, after about paying its way for the two previous years, according to its latest report made a loss during the past 12 months of some £6,000 on trading transactions totalling about £55,000. The individual members of the machine tool industry, in fact, have had to look in other directions for business and have turned their hands of late—to mention some instances—to the production of small engines for agricultural purposes, to printing machinery and to cleaning appliances for tennis balls. Armstrong, Whitworth & Co., Ltd., are now manufacturing road rollers, steam- and oil-driven, and other road-making machinery, the Openshaw works thus again taking up a branch of engineering initiated there nearly 70 years ago by Joseph Whitworth, who built a road sweeper on the conveyor and hopper principle.

As it has been stated, the weekly wages rates of engineering workmen have been reduced by 16s. 6d., and employers and employed have been in conference over systems of payment by results, but without agreement, that is without agreement as regards the ordinary machine shop. Certain of the trade unions of foundry workers and pattern makers have accepted the proposals of the employers, who have now intimated to the other engineering work people that they consider themselves free to introduce such systems as they find necessary. They agreed at the termination of the last dispute not to introduce anything of the kind for at least one month. This of course applied to proposed new schemes, as piece-work in certain districts is exceedingly common.

A joint investigation committee of employers and trade union representatives indeed has been considering the whole subject, having, according to a preliminary statement, inspected in detail 32 engineering and shipbuilding organizations in the United Kingdom, 11 in Belgium, 4 in Germany and 7 in Holland, and it is understood that the advisability is being considered of visiting America for the same purpose. An agreed statement of a private character has been drawn up, but some at least of the details have been made public, from which it is gathered, in comparing outputs on time and piece work rates, that the fitting of certain water-tight shutters took 490 hours in one case on time rates and 150 hours when the pay was by results. Similarly a ship built on time rates took 2,601 hours, while a similar ship on the payment-by-results system was finished in 1,151 hours. Riveters on time dealt with 176 rivets as against 722 rivets on piece, and so on. Individual rather than collective systems of payment by results seem to have proved the better. The investigation arose out of the demand about three years ago for a 44-hour week, now seemingly forgotten.

The figures issued of national revenue and expenditure suggest that the Budget forecast can be borne out, provided of Course Great Britain keeps clear of war. For the first six months the revenue amounted to nearly 404 million pounds, the total decrease being lower than was estimated. In the same period the expenditure was rather less than 347½ million pounds, proportionally a still larger decrease, the revenue thus showing a surplus over expenditure of nearly 56½ million pounds. Without going into details it may be said that the revenue figures suggest the complete breakdown of the excess profits duty, less than a million pounds having been received on this account out of a total of nearly 28 millions which, it was estimated, would be received for the complete fiscal year. Officially reported unemployment continues to decline somewhat, while the cost of living shows a slight decrease.

Hoffmann Bearings to Be Made in America

The Norma Company of America, Anable Avenue, Long Island City, N. Y., has acquired the American patents and business of the Hoffman Manufacturing Co. of Chelmsford, Essex, England, makers of "Hoffmann" roller, ball and thrust bearings. The line of "Norma" Precision Ball Bearings will now be supplemented with "Hoffmann" Precision Roller Bearings.

The "Hoffmann" Roller Bearing has long held, abroad, the same repute which high-precision standards have given the "Norma" Ball Bearing in America. For the past year the Norma Company has thoroughly investigated the American market for roller bearings of this high quality, and has found a distinct demand for high-grade units.

The Norma Company will erect a new plant for the manufacture of "Hoffmann" products in America. Meantime, they are being imported and sold under the regular "Norma" engineering service.

Ryerson Celebrates 80th Anniversary

Eighty years ago, on the first day of November, there arrived in Chicago from Pittsburg, Joseph T. Ryerson, the accredited agent of Wood, Edwards and McKnight. It was during that period in America's economic development known as the fifth stage, the period in which a great westward movement of population took place.

The population of the then gateway to the west was about 6,000 with a few buildings of brick and more of a rude frame structure, nearly all ranged along the water front.

Here in 1842 Joseph T. Ryerson laid his foundation. He rented a little store and started in the iron business with a small stock from Pittsburg. The steady westward movement and the ever increasing population of Chicago compelled him, two years later, to buy land and build a two story structure on Lake Street. By 1852 the location, due to the spread of the dry goods district, became unsuited to the iron business. A site was purchased on South Water Street on the river. Here, until the great fire in 1871 reduced it to ashes, the business grew and prospered. By March, 1872, one year later, it had been rebuilt on Clinton Street and business was again under way. Ten years later the premises was again enlarged, and when, in 1883, Mr. Ryerson died, the administrative direction of the business, already grown to no mean size and now known as Joseph T. Ryerson & Son, fell upon the shoulders of his son, Edward L.

Steadily through depressions and panics it has grown until today the small frontier iron store, started in 1842, occupies a ground area of 19 acres in Chicago alone. Linked to this central point in the system have been added the plant of the W. G. Hagar Iron Co., St. Louis, Mo.; a warehouse in New York, a plant in Detroit completed just prior to America's entrance into the war and the warehouse of the Ferguson Steel and Iron Co., Buffalo, purchased in 1919.

The business stands today as a happy outgrowth and a monument befitting the restless energy so characteristic of America's early pioneers. The celebration of its 80th anniversary, coming as it does on the threshold of a new era of sound prosperity, is an event of which the company's executives may well feel proud.

Engineers Discuss Management

Management in all its various phases was discussed by managers of national reputation at the two "Management Week" meetings held at the Auditorium Hotel in Chicago, Oct. 18 and 20. The following papers were presented: Application of Scientific Management, by A. M. Simon, American School of Correspondence; Management and the Human Factor, by John Calder, Supt. of Industrial Relations, Swift & Co.; Personal Aspect of Management, by Hugo Diemer, LaSalle Extension University, and What Is Management Control, by W. H. Leffingwell, Pres., Leffingwell Ream Co., Management Engineers, New York City.

Organization Changes of the Dodge Manufacturing Corporation

Among the changes that have recently taken place in the organization of the Dodge Manufacturing Corporation, Mishawaka, Ind., we note the following:

President, Melville W. Mix; vice-president, W. B. Hosford, treasurer, Charles Entsch; assistant treasurer, W. L. Chandler; foundry superintendent, Harry Bell and Mr. Mix's son, publicity manager, have retired.

It is understood that Mr. Mix sold his interest for $1,500,000 and that Messrs. Hosford and Bell have been given life pensions.

Charles F. Morse, a well known corporation attorney of Chicago and Mayor William W. Dodge, of Mishawaka, holder of the controlling interest in the company, have been elected president and vice-president, respectively.

Business Items

The Dover Machine Co., Pawtucket, R. I., manufacturer of machinery, etc., during the past week changed the name of the concern to the Henry A. Goodrich Co., and have moved the plant to East Providence, R. I., where they will be better equipped.

Peters & Russell, Inc., of Boston, Mass., has been incorporated and organized under the laws of Massachusetts, to deal in all kinds of buffing and polishing wheels, machinery, etc. The capital stock is $50,000, and the officers chosen are: Paul A. Peters, president; Frank H. Russell, 75 Park St., West Roxbury, Mass., treasurer; and Donald L. Whittemore, director.

The American Pipe Tool Co., 123 South Jefferson St., Chicago, is the name of a new concern recently organized by W. H. Gabel, formerly general manager of the Crown Die and Tool Co. of that city. The company will engage in the manufacture of a line of pipe tools and is introducing at the present time the "American" portable pipe vise stand.

The American Adjustable Chase Co., Inc., 43 Water St., Torrington, Conn., was incorporated and organized during the past week under the laws of Connecticut, to engage in the general manufacturing business. The capital stock of the company is $75,000, and the incorporators are: Daniel F., William A. and John H. Burns. Daniel F. Burns has been chosen president; John H. Burns, secretary, and William A. Burns, treasurer.

The Gulf States Steel Company for the quarter ended Sept. 30, 1922, reports net operating income of $240,287. Net income, after taxes, depreciation and other charges, amounted to [illegible].

The Consolidated Tool Works, Inc., 296 Broadway, New York City, announces the following appointments in its sales personnel: Wm. H. Thompson, formerly with the Union Hardware Co., Torrington, Conn., will be its representative in New York City; Charles Albertus, formerly with the American Safety Razor Co., Brooklyn, N. Y., will represent it in New Jersey; Howard A. Postley, formerly with the Knickerbocker Manufacturing Co., Belleville, N. J., is appointed to represent it in the New England States, and Wm. L. Rubin, formerly with the Jacobs Scale Co., New York City, is appointed its representative in New York, Pennsylvania, Maryland, District of Columbia, and parts of West Virginia and Ohio.

The Bethel-Player Co., Westboro, Mass., has been formed for the purpose of marketing the Fraser automatic grinder, tapping machines and metal products. Mr. S. Player was formerly production manager of the Taft-Pierce Manufacturing Co., and later general manager of Warren F. Fraser Co. J. N. Bethel was also long associated with the Taft-Pierce Co. and sales manager of the Warren F. Fraser Co.

The Packard Motor Car Co. reports September earnings amounting to $900,000 with $16,000,000 cash and marketable securities on hand.

The Lima Locomotive Works directors have declared a dividend of $1 a share quarterly on the new common stock without par value, thus placing the stock on a $4 annual dividend basis.

The Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., is now under the direction of A. T. Doud, president of the company, who purchased the capital stock formerly held by members of the Hudson Motors Specialty Co. of Philadelphia. The two companies are no longer affiliated. Mr. Doud has been in charge of the Precision and Thread Grinder Manufacturing Co. since the early part of July, 1922, but the deal was not consummated until the latter part of September.

The Seaboard Air Line Railway Co. has been granted authority to issue $2,560,000 of equipment trust certificates, the proceeds to be used to purchase three freight locomotives, 1,250 wooden boxcars, 900 steel underframe boxcars, 850 underframe drop bottom gondola cars, and 100 all-steel phosphate cars.

G. E. Osborne of Wichita, Kan., will open a machine shop at 433 Wabash Ave., in that city Nov. 1, where he will conduct a general machine shop business and install modern machinery.

The Biltwell Factories, Wichita, Kan., has taken over the Western Furniture and Manufacturing Co., located at 1414 S. Washington Ave., in that city and will install various new machinery and machine tools. C. W. Rogers is manager.

The National Enameling and Stamping Co. has broken ground at Granite City, Mo., for its new $1,500,000 plant. The plant will contain six sheet mills and one jobbing mill.

The Rudolph Jiffy Tool Co., Eau Claire, Wis., is the name of a new company recently incorporated in that city to manufacture a line of mechanics' tools and auto specialties.

Alvord Reamer and Tool Co., Millersburg, Pa., announces the appointment of C. C. Strout in the capacity of vice-president, in charge of sales. Mr. Strout was formerly connected with the Victor Saw Works, as Western Sales Manager, and with the Safety Wrench and Appliance Co., as general sales manager. This company also announces the formation of a service department in connection with their engineering department, under the direction of A. M. Lindsley, chief engineer, which will function by supplying consulting service in connection with special tool equipment.

The Allis-Chalmers Manufacturing Company reports net profits after Federal taxes for the quarter ending June 30 of $299,796.

The Burdick-Atkinson Corporation is the name of a new concern recently established at Hamburg, N. Y., to manufacture wire springs for use in automobile upholstery. John S. Burdick, the incorporator, is president and general manager and associated with him are Frederic R. Atkinson, vice-president; Franklin R. Brown, treasurer and Harry Burdick, secretary.

The White Motor Co. is reported to be planning the establishment of a branch factory at Chattanooga for the manufacture of trucks.

The Western Specialty Manufacturing Co., capitalized at $32,000, filed articles of incorporation in Vancouver, Wash., recently. The company will manufacture automatic lock-nuts. The incorporators are C. F. Kletsch, C. R. Catlin and B. E. Hawley, all of Kelso. The principal place of business of 'he firm will be at Vancouver.

The American Machine and Foundry Co. directors have declared a stock dividend of 200 per cent, payable Nov. 15, to stock of record Oct. 19.

The Trexler Co. of America, manufacturer of auto accessories, has taken over the Wilmington plant of the Artillery Fuse and Standard Arms Co.

The Decker Manufacturing Co., Brockport, N. Y., manufacturer of power spray outfits, has been sold to E. H. Norton, who has been associated with the company as salesman. Mr. Norton will continue the business.

The Hartford Tap and Gage Co., Hartford, Conn., has changed its name to Hanson Tap and Gage Co.

The Dolman Manufacturing Co., is the name of a new corporation recently incorporated at Springfield, Mass., to manufacture a line of small tools, the first of which, the Dolman screw driver, has recently been placed on the market. The organizers are Guy W. Donahue, William F. Pollock and Chester C. Jackman, all formerly associated with the Victor Saw Works, Inc., Middletown, N. Y.

Personals

PETER PARKE, chief engineer of the Pullman Co., has been transferred to the department on improvements and economy covering investigations into modern methods and machinery.

E. W. TEST of the Michigan city plant of the Pullman Co. has taken over the duties of Peter Parke with the title of general mechanical engineer.

EDWARD T. PETERSON, formerly of the organization of the Treadwell Engineering Co. has been appointed chief engineer of the Birdsboro Steel Foundry and Machine Co. Birdsboro, Pa.

MAYOR ALBERT PETER, until recently with the Chain Belt Co., Milwaukee has been appointed chief engineer and works manager of the Milwaukee Air Power Pump Co.

E. W. SMITH has been appointed general superintendent of motive power of

the Southwestern region of the Pennsylvania Railroad with headquarters at St. Louis, Mo.

H. H. COLBUS has joined the sales staff of the Down Tool Works, Inc., Fleetwood, Pa., and will represent the company in the Philadelphia district.

G. C. BAUMAN, formerly with the Rich Tool Co., Chicago, has accepted a position as superintendent of the Ward Tool and Forging Co., Latrobe, Pa.

JOHN E. SNYDER of J. E. Snyder and Son, Worcester, Mass., vertical drilling machine builders, returned recently from a trip to England and the continent.

NELSON C. JOHNSON, secretary of the Foster, Merriam & Co., manufacturer of hardware, etc., Meriden, Conn., has recently been chosen the treasurer of the company also. Mr. Johnson succeeds John A. Ross, who resigned his position as treasurer during the past week.

CHARLES C. RAMSDELL, vice-president of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., was recently presented with a 30-years' Service Pin in honor of his thirty years of service in the Gilbert & Barker organization. Mr. Ramsdell entered the employ of the firm in August, 1892, and has worked his way up from New York salesman to the present position.

R. I. CASE, until recently associated with Eccles & Smith Co., San Francisco, machinery dealers, has been appointed manager of the machinery department of the Berger & Carter Co.

CHARLES E. STAHL, vice-president, assistant general manager and sales manager of the Connecticut Telephone and Electric Co., manufacturer of telephones, systems, tools and electrical goods, etc., of Meriden, Conn., during the past week resigned his positions with the company. Mr. Stahl has been with the firm for the past ten years.

HENRY A. TREMAINE has been elected president and general manager of the Grant-Lees Co., manufacturer of motor car and truck transmissions.

REGINALD W. MILLARD, president of the Foster, Merriam & Co., manufacturer of hardware, etc., Meriden, Conn., has recently resigned his position with the company. Mr. Millard is succeeded by Howard E. Boardman of New York City as president, Mr. Boardman having been chosen at a directors' meeting held during the past week.

F. E. BOOTH has been appointed sales manager of the motor bearings division of the Hyatt Motor Bearing Co.

VAL A. BROWNING, son of John M. Browning, inventor of the machine gun bearing his name, arrived in this country recently from Belgium where he is consulting expert for the Fabrique Nationale, Heerstal, Belgium, and will pay his father a visit in Hartford, Conn.

R. H. BECKER, formerly connected with the machine tool building and sales department of Joseph T. Ryerson and Son, is now with the Milwaukee Machinery Co., 93 West Water St., Milwaukee, Wis. He will have charge of machine tool sales in part of the Milwaukee and southern Wisconsin territory.

Obituary

A. J. BEATON of the Beaton & Cadwell Manufacturing Co., manufacturer of metal novelties, air valves, etc., died at Norwood, Mass., Oct. 21, at the age of 74 years. Mr. Beaton was also at one time connected with the A. J. Beaton Co., and the Beaton & Corbin Co., both of New Britain.

CHARLES GLOVER, president, the Skinner Chuck Co., New Britain, Conn., and one of the best known manufacturers of screws in the country, died at his home in New Britain Oct. 25 after a long illness. Mr. Glover was 75 years old and was prominent in industrial circles throughout the eastern states. He was a former president of the Corbin Screw Corporation, a director of the American Hardware Association and a director of the New Britain National Bank.

Book Reviews

Statistical Abstract of the United States for 1921. Compiled by Edward Whitney. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. Price 75 cents (paper cover).

The forty-fourth number of the Statistical Abstract of the United States, for the year 1921, contains 942 pages, including a complete index.

The publication is an exhaustive compilation of statistical information embracing every branch of the governmental service. A total of 497 separate tables are contained in the volume setting forth up-to-date data on a great variety of subjects.

Some idea of the scope of the work may be gathered from the following sub-titles appearing in the contents pages:

1. Area, Climatic Conditions and Position.
2. National Parks, Reservations and Public Lands.
3. Irrigation and Drainage.
4. Population.
5. Vital Statistics.
6. Immigration and Passenger Movement.
7. Education and Vocational Rehabilitation.
8. Farms and Farm Property.
9. Farm Animals and Products.
10. Farm Crops.
11. Fisheries.
12. Minerals and Products.
13. Manufacturers.
14. Industrial Accidents and Fatalities.
15. Commercial Failures.
16. Public Roads and Motor Vehicles.
17. Postal Service and Telegraphs.
18. Railroad and Express Companies.
19. Freight Rates and Commerce.
20. Merchant Marine.
21. Commerce of Noncontiguous Territory.
22. Consumption Statistics.
23. Prices.
24. Money and Banking.
25. Obligations due the U. S. Government.
26. Revenue and Expenditures.
27. Insurance and Fires.
28. Public Debt.
29. Wealth and Taxation.
30. Army, Navy, Civil Service, Pensions, etc.
31. Statistical Record of the Progress of the U. S.
32. Commercial, Financial and other Statistics of the World.

The book is an excellent reference guide and forms a valuable supplementary aid to the various newspaper almanacs.

Modern Workshop Practice. By Ernest Pull. Sixth edition, rewritten and enlarged. Cloth; six hundred and seventy-one 5½ x 8 in. pages, 552 illustrations. Published by D. Van Nostrand Co., 8 Warren St., New York City. Price $5.

This book was written by the workshop superintendent of the London (England) County Council School of Engineering and Navigation for the use of students in technical institutes and candidates for examination and entry into the Royal Navy as engine room artificers. Various types of machine tools and shop appliances are illustrated and described and some little instruction given in their use.

As a whole, the practical informatio contained is but little more than that given in first class advertising matter of tool builders. Regarded as a catalog of machine tools and their accessories, the book may be fairly complete from an English point of view, but it fails to meet the American standard in that class of publications. The book having lived through six editions, however, it must have some popularity among British mechanics.

Trade Catalogs

Drafting Tools. E. Lawrenz, 2533 McClellan Ave., Detroit, Mich. A new bulletin has just been issued by this manufacturer describing his line of "The Normal" drafting tools to which has been added a set of bow compasses.

Triplex Machines. The Triplex Machine Tool Corporation, 18 East 41st St., New York City. This company has just issued an interesting circular describing fully its Triplex machine, a small machine of 500 pounds weight, which is adapted for turning and boring, angular and vertical milling, horizontal milling, thread cutting and drilling. The circular contains illustrations showing the various operations.

Coxe Stokers and CEC Service. The Combustion Engineering Corporation, Broad St., New York City. This company has just issued two new publications. The larger bulletin on the Coxe stoker covers particularly the performance of this stoker on Western and Mid-Western bituminous coals. A number of test reports, each accompanied by corresponding curves are included. These tests show interesting results and because they are complete in every respect they will be of considerable value to the engineering world. A number of successful installations in some of the biggest and most important plants in the Middle West using this type of stoker on bituminous coal are shown in this bulletin. The "Service Bulletin," while it is issued by this company, will be of value to all stoker companies. At the present time it is necessary for stoker manufacturers to render gratuitously, service of a very costly nature. This booklet presents the stoker manufacturers' side of the question and shows why a proper charge for real stoker service would not only be fair to the recipient but would be to his advantage.

Forthcoming Meetings

National Personnel Association, First Annual Convention, November 8, 9 and 10, at Pittsburgh, Pa. Secretary at 20 Vesey St., New York, N. Y.

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922. New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Reduction of two points in wrought-steel pipe discounts in New York and Cleveland warehouses, following recent mill advance of $4 per ton. Steel plate demand for car, tank, ship and boiler construction, in excess of production. Plates quoted at minimum of $1.90, with maximum at $2.25, or an average price of about $2 per 100 lb., f.o.b. Pittsburgh. Shapes quoted, however, at $2@$2.10 and bars at $2@$2.15, f.o.b. mill. Tin market active; quoted in New York warehouses at 37c. as against 35c. per lb. Lead, 6.95c. as compared with 6½c.@6¾. last week, and zinc firmer at 7½c. as against 7¼c. Zinc sheets up ½c.; solder and babbitt metal 1c. per lb. in New York, during week. Cleveland advances antimony ½c.; babbitt metal 1c. and old metals, non-ferrous, ½c. per lb.

Declines—Copper market softer but inquiries better; quoted at 14½c. as against 14¾c. per lb. in New York. Coke prices lower; decline expected in pig iron. Cast-iron washers down $1 per 100 lb. in Cleveland. Linseed oil quiet; down 3c. per gal. in Chicago. Improvement in demand for lard oil and lubricants but prices unchanged.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. wide x 24-in.o.d., hub not cored, good quality gray iron, weight 275 lb.:

New York	5¼
Chicago	[illegible]
Cleveland	2.4
Detroit	6.0

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	[illegible]	4.29	3.80	4.10
No. 16	[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	[illegible]	4.70	4.20	4.70
Nos. 22 and 24	[illegible]	4.75	4.25	4.70
Nos. 25 and 26	[illegible]@3.70	4.80	4.30	4.75
No. 28	[illegible]@3.75	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35@3.85	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.95	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.25	5.30	4.80	....
Nos. 22 and 24.	3.90@4.40	5.45	4.95	5.40
No. 26	4.05@4.55	5.60	5.10	5.55
No. 28	4.35@4.85	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{1}{16}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.50
Tin, 5-ton lots, New York	37.00
Lead (up to carlots), St. Louis	6.45@6.50; New York, 6.95
Zinc (up to carlots), St. Louis	7.05@7.10; New York, 7.5

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.75	10.25	.....
Solder (½ and ½), (caselots)	26.50	23.50	20.00
Babbitt metal (83% tin)	35.00	45.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.75	12.00
Copper, heavy, and wire	11.75	12.25	11.50
Copper, light, and bottoms	9.75	10.25	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York		Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½		\$0.12	\$0.11½
Cotton waste, mixed, per lb.	.065@.10		.09	.08
Wiping cloths, 13½x13½, per lb.	.16		32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20		48.00 per M	.13
Sal soda, 100 lb. lots	2.80		2.40	2.65
Roll sulphur, per 100 lb.	2.85		3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93		1.01	.94
White lead, dry or in oil	100 lb. kegs.		New York, 12.75	
Red lead, dry	100 lb. kegs.		New York, 12.75	
Red lead, in oil	100 lb. kegs.		New York, 14.25	
Fire clay, per 100 lb. bag			.80	1.00
Coke, prompt furnace, Connellsville	per net ton		\$8.00	
Coke, prompt foundry, Connellsville	per net ton		10.50@12.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ⅝-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net)	\$5.00	\$3.90	\$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Danbury—J. W. Leahy, 29 Crosby St. (machine worker)—one [illegible] in. and one 1½ in. model B Cleveland automatic screw machines.

Fla., Marianna—Consolidated Motor Co., L. Williams, Secy.—machine shop equipment.

Ill., Chicago—The Chicago & Northwestern Ry. Co., F. G. [illegible], Purch. Agt.—one 42 in. drill press; one 1[illegible] in. drill press; two 18 in. engine lathes, 6 ft. between centers; two 2[illegible] in. engine lathes, 6 ft. between centers; two hollow hexagon turret lathes, Warner & Swasey No. 2 A universal or equivalent; one centering machine for 3 in. stock; one large quick work power hammer with set of dies; one spot welding machine, equal to No. 254 Thompson Welder Co. machine to weld No. 22 to No. 3 B. & S. gauge iron and steel; three double dry grinding emery wheel stands with 2 x 18 in. wheels and 1½ in arbors; also three power hack saws, Marvel No. 4.

Ill., Chicago—J. A. Dunn Co., 2911 South La Salle St. (manufacturer of chairs)—one Stanacr, dowel turning machine (used).

Kan., Wichita — Garry Sales Co., 315 South Market St., T. H. Cooper, Purch. Agt.—complete equipment for garage, including drill press, lathe, emery stand, hangers, bearings, shafting, pulleys and small tools.

Mass., Boston—J. L. Gleason & Co., 241 Franklin St., (electrical contractors), J. L. Gleason, Mgr.—several electric drills for shop work (used).

Mass., Boston—G. G. McLaughlin Mfg. Co., 24 Washington St., N. (machine shop)—one 12 in. four sided moulder (used).

Mass., Boston—M. Strauss, 53 Merrimac St. (sheet metal worker)—automatic punch, [illegible] shears, squaring shears and [illegible] drill (used).

Mich., River Rouge—Whitehead & Kales Co. (structural steel)—spacing machine, punch, angle shear for large sizes.

Mo., St. Louis — Lubrite Refining Co., 1512 Arcade Bldg.—pipe cutting machine, from 1 to 6 in. capacity, with die, belting and shafting.

Mo., St. Louis—Western Screw Products Co., 3217 South B'way.—automatic and hand screw machines, engine lathes, carbonizing outfit, oil extractor, drill presses, nut tappers, McKenzie chip and product separator and computing scales (new or used).

N. Y., Buffalo—J. H. Aspden, 312 Niagara St.—machinery and equipment for automobile repair and machine shop on [illegible] Park and Woodside Aves.

N. Y., Buffalo—Birk-Nolman Motor Co., 1079 Hertel Ave.—machinery, tools and equipment for proposed $30,000 garage and [illegible].

N. Y., Buffalo—A. J. Hansen, 14[illegible] Goodell St.—equipment for automobile repair shop.

N. Y., Buffalo—M. Katz, [illegible] Sq.—machinery, tools and equipment for automobile service station and repair shop at 1443 [illegible].

N. Y., Buffalo—H. H. [illegible], 17 Virginia [illegible]—shop equipment.

N. Y., Buffalo—C. S. [illegible], 1149 [illegible]

[illegible]

O., Columbus—The [illegible]

O., Columbus—The [illegible]

Pa., Ambridge—H. H. Robertson Co.—[illegible] machine for 18 gauge [illegible].

Pa., Pittsburgh — Guibert Steel Co., Diamond Bk. Bldg. (steel fabricating), E. R. Bechtel, Purch. Agt.—punches, shears and boring machinery.

Tenn., Knoxville — The Cherokee Motor Co., 314 State St., C. Reed, Pres.—equipment for proposed addition to garage and service station.

Tenn., Union City—W. Warmuth (sheet metal worker)—one set of power sheet bending rolls.

Tex., Columbus—Gimmer Tanner Gravel Co.—machine and forge shop equipment to replace that which was destroyed by fire.

Va., Richmond—Night & Day Service Co., 900 West Broad St., C. B. Hatch, Purch. Agt.—lathe and drill press.

Va., Richmond—Thompson Auto Repair Co., 509 West Marshall St.—lathe and drill press.

Wis., Kiel — Hingess & Bessler, c/o A. Hingess—automobile repair machinery for proposed $45,000 garage at Chilton.

Wis., Milwaukee—J. P. Meehan, 266 27th St. (garage)—drill press and air compressor.

Wis., Milwaukee—Thust Machine Co., c/o L. N. Biron, 206 Mitchell Bldg.—machine tools for the manufacture of glueing and wrapping machines for making paper boxes.

Wis., Wausau—D. J. Murray Mfg. Co., 1002 3rd St., (manufacturer of saw mill machinery), D. L. Bellinger, Purch. Agt.—drill press, lathe, grinders and small tools (used preferred).

Ont., Guelph—B. Tolton & Son, 173 Woolwich St.—garage and repair shop equipment to replace that which was destroyed by fire.

Ont., St. Thomas—City Gas Dept., E. H. Caughell, City Hall, Engr.—one 16 in. x 8 ft. lathe, screw cutting; one 20 in. drill, back gear, self feed; one 10 x 14 in. shaper.

Machinery Wanted

Ala., Birmingham — Western Newspaper Union, 213 North 17th St.—Cottrell or Omaha press with folder.

Ark., Pine Bluff—Merit Veneer & Box Co., Inc., J. Dent, Dir.—machinery and equipment for the manufacture of wire bound boxes, crates and veneer box products.

Ark., Thornton—The Stout Lumber Co.—machinery and equipment for proposed lumber mill, to replace that which was destroyed by fire.

Calif., Nipinnawasee — S. G. Smartt (woodworker)—power planer.

Calif., San Francisco—G. Lomer, 278 3rd St.—small tools for cabinet work.

Fla., Fort White—Fort White Package Co. (wooden box manufacturer)—machinery and equipment for plant.

Ill., Chicago—Central Storage Co., 1422 St. Louis Ave.—electric crane and derrick.

Ill., Chicago—M. M. Rothschild, 712 Federal St.—two color automatic presses.

Ill., Chicago—Wanner Machine Co., 716 South Dearborn St. (printers' supplies)—26 x 34 Miehle press, power paper cutter and a small power job press (used).

Ill., Chicago—W. E. Williams, 332 South La Salle St.—electric spot welder (used).

Ind., Bedford—The Democrat—12 x 16 in. job press, belting, hangers, pulleys and shafting for motor power.

Kan., Abilene—The Chronicle—linotype, model No. 1 preferred.

Mass., Cambridge — Hingham Knitting Co., Charles River Parkway, (knit goods)—3½ in. cylinders for 200 needle "Banner" knitting machines.

Mass., East Boston (Boston P. O.)—A. Martin, 193 Trenton St.—laundry machinery and equipment, including several four pocket washers and extractors (used).

Mass., North Leverett—D. Glazier (woodworker)—55 ft. of 16 in. 2 ply leather belt, also miscellaneous belting in smaller widths and lengths.

Mass., Somerville — The Progressive Laundry, 203 Pearl St.—extractor, washing machines, dryer, etc. (used).

Mich., Detroit — J. Josseph, 8941 West Jefferson St. (cabinet maker)—power band saw.

Mich., Grand Haven—Daily Tribune—magazine for model No. 5 linotype.

Mich., Highland Park—Ford Motor Co.—miscellaneous equipment for the manufacture of plate glass and converting it into wind shields.

Mich., Highland Park—Ford Motor Co.—gas producers, also coal and ash handling equipment for proposed gas producer plant at Flat Rock.

Mich., Highland Park—Ford Motor Co.—overhead cranes, conveyors, etc., for proposed transfer building.

Mo., Kansas City — Bauer-The-Woodworker, 111 West 18th St., A. Bauer, Purch. Agt.—Universal woodworker.

Mo., Kansas City—Bd. Educ., Purchasing Dept.—floor surfacing machine for Lathrop Manual Training School.

Mo., Kansas City—Kansas City Journal-Post, 8th and McGee Sts.—printing equipment.

Mo., Kansas City—W. Pierce, 2026 Campbell St.—oil well driller.

Mo., Kansas City—Rutherford Flavoring Co., 1619 East 8th St., M. Rutherford, Purch. Agt.—canning retorts.

Mo., St. Louis—E. Stempfle, 4004 Lincoln Ave. (woodworker)—small band saw, 28 or 30 in., motor driven.

Mo., St. Louis — Western Newspaper Union, 3rd and Walnut Sts.—one 10 x 15 in. job press.

Neb., Omaha — Bd. Educ., c/o W. T. Bourke, Secy., 603 City Hall—manual training equipment for proposed $750,000 high school.

N. H., Keene—Keene Silk Fibre Mills—gas or electric singeing machine for silk yarn.

N. H., Nashua—The International Paper Box Machine Co., 815 Main St.—milling machine, planer type, slab miller, 12 to 14 ft. table, 30 in. between housings (used).

N. J., Englishtown — The Englishtown Carpet Co., A. Muldoon, Pres.—twenty looms for proposed factory.

N. Y., Avoca—Avoca Weekly News, G. Peterson, owner—printing machinery and equipment to replace that which was destroyed by fire.

N. Y., Avon—A. J. Stewart—one wood turning lathe.

N. Y., Buffalo—F. Ahrens, 1262 Genesee St.—machinery for the manufacture of candy.

N. Y., Buffalo—E. J. Alberson, 819 Tonawanda St.—equipment for bakery.

N. Y., Buffalo—F. Beck, Abbot Rd. and Kimmel St.—machinery and equipment for proposed factory for mechanically curing and smoking boiled hams.

N. Y., Buffalo—Drouillard Mfg. Co., 460 East Eagle St.—machinery for the manufacture of ice cream cones.

N. Y., Buffalo—J. Grebaum, 1869 Niagara St.—14 x 21 in. Universal or Pearl printing press.

N. Y., Buffalo — The Mary Lee Candy Shoppe, 1123 B'way.—machinery for the manufacture of candy.

N. Y., Buffalo—R. M. Murphy, 153 Wallace Ave.—bakeshop equipment.

N. Y., Buffalo—R. J. Sweet, 1189 Niagara St.—welding and machine repairing machinery.

N. Y., Buffalo—W. T. Teese, 1087 Genesee St.—welding equipment for electric welding shop.

N. Y., Buffalo—G. Urban Milling Co., 200 Urban St.—equipment for blacksmith shop.

N. Y., Canajoharie—Beech Nut Packing Co.—equipment for proposed branch factory at Hamilton, Ont.

N. Y., Dunkirk—Continental Heater Co., Otter St.—machinery for proposed addition to plant for the manufacture of boiler parts and cores.

N. Y., Jamestown—Bd. Educ.—vocational equipment for proposed $350,000 junior high school.

N. Y., Lake View—Acme Shale & Brick Co.—machinery and equipment for proposed tile manufacturing factory on the Pierce Farm.

N. Y., New York—A. G. Schoonmaker, 25 Church St.—air coupressor, 2 cylinder type, 140 to 160 cu.ft.

N. Y., Olean—Kulp, Inc., C. W. Kulp, Pres.—machinery and equipment for the manufacture of art goods and novelties.

N. Y., Palmyra—Palmyra Pump & Accessories Co.—machinery and equipment for proposed plant for manufacturing patented headlight non-glaring device for automobiles.

N. Y., Rochester—M. D. Knowlton Co., 28 Industrial St., manufacturer of paper boxes —machinery and equipment for proposed addition to plant.

N. Y., Rochester—Newman Bros. Grain Co., 304 Troup St.—milling equipment for proposed addition to grain mill.

N. Y., Rochester—W. B. Williams, 295 Monroe Ave.—equipment for proposed addition to paint shop.

N. Y., Rochester—Wood Specialties, Inc., 124 Railroad St.—one variety saw table.

N. Y., Wilson—Niagara County Preserving Co.—small power hydraulic press.

O., Canton—Klingstedt Bros. Co., Cleveland Ave., V. W. Klingstedt, Purch. Agt.—machinery and equipment for proposed $75,000 printing plant.

O., North Canton — Hoover Suction Sweeper Co.—additional machinery and equipment.

O., St. Clairsville—H. G. Nichol, Box 176 —power paper cutter.

O., Warren — The Alloy Electric Steel Casting Co. (manufacturer of electric furnace and open hearth steel castings)—machinery and equipment for new plant.

Okla., Tulsa—W. Huddleson, R. R. No. 4 —$2,000 worth of newspaper equipment, including job press and newspaper press.

Ore., Philomath—The Review—6 or 7 column folio newspaper press.

Pa., Ashland — Bd. Educ. — vocational equipment for new $125,000 high school.

Pa., Bridgeport—Bd. Educ.—vocational equipment for proposed high school.

Pa., Coopersburg—The Coopersburg Improvement Co.—machinery and equipment for new granite polishing plant.

Pa., Corry—Bd. Educ.—vocational equipment for new $125,000 school.

Pa., Erie—A. Baker, 2415 Wayne St.—22 in. paper cutting machine.

Pa., Freeland — Washington Silk Co. — machinery and equipment for silk manufacturing factory.

Pa., Girard — Girard Model Wks., Inc., S. L. Connell, Dir.—machinery for the manufacture of wire shapes, small springs and mechanical toys.

Pa., Lansford—Lehigh Coal & Navigation Co.—machinery and equipment for $45,000 coal washing plant at Tamaqua, to replace that which was destroyed by fire.

Pa., Meadville—The Meadville Iron Co., Inc., Mill St.—machinery and equipment for one story addition to iron works.

Pa., New Castle—The Newcastle News, F. Rentz, Mgr.—motors, shafting, belting and hangers.

Pa., New Holland—Bd. Educ.—vocational equipment for proposed $100,000 school.

Pa., Oil City—Oil City Boiler Wks., 351 Seneca St.—machinery and equipment for large addition to factory.

Pa., Phila.—Electric Storage Battery Co., 19th and Allegheny Sts.—equipment for proposed branch factory in Kansas City, Mo.

Pa., Pringle (Wilkes-Barre P. O.)—Bd. Educ.—vocational equipment for proposed $85,000 school.

Pa., Reading—J. Biehl Wagon & Auto Wks., 31 South 5th St.—machinery and equipment for new two story plant for the manufacture of automobile parts and equipment, at West Reading.

Pa., Rochester—M. R. Regan—carload of thread protectors.

Pa., Throop — Bd. Educ.—vocational equipment for new $175,000 school.

Pa., Towanda—Bradford County Coal & Oil Co., J. Conklin, Dir.—pumping machinery and drilling equipment for new oil well.

Pa., Troy—Bd. Educ.—vocational equipment for proposed $100,000 high school.

Pa., Uniontown—Provant Coal Co.—machinery and equipment for new coal tipple, fan house and mechanical draft department.

Pa., Warren—J. T. Newell, 244 Penn Ave.—additional machinery and equipment for proposed 4 story printing plant on Liberty St.

R. I., Pawtucket — Lumb Knitting Co., Central Ave.—cylinders and dials, 14 cut, for 17, 18, 19, 20, 21 and 22 in. body machines.

R. I., Providence—Eddy Finishing Co., H. A. Clason, 1008 Turks Head Bldg., Purch. Agt.—cotton goods printing and dyeing machinery for plant (being organized).

S. D., White Lake—The White Lake Cooperative Creamery Assn., J. L. Jensem, Secy. and Mgr.—cream vats, paraffiner, tester, rotary and deep well pumps, shafting, hangers, belting, mostly double leather, pulleys, water storage tanks, pipes and fittings, pipe cutting tools, vise, dies, etc.

Tenn., Chattanooga—The Dixie Spinning Mills—complete machinery for spinning mill.

Tex., Fort Worth—Southwest, 844 Monroe St. (newspaper)—power job press and paper cutter.

Tex., Kenedy—The Kenedy Ice & Electric Co.—laundry equipment.

Va., Petersburg—Petersburg Printing & Stationery Co., 17 East Bank St.—cylinder printing press.

Va., Richmond—T. W. McCabe, 20 South 10th St. (manufacturer of cornices, ventilators and roofing)—one steel cornice brake and one burring machine.

Va., Richmond—The Rosenthal Printing Co., 412 East Main St.—one large cylinder press.

Va., Winchester — Winchester Lumber Co., W. B. Cornell, Pres.—machinery and equipment for proposed lumber mill at Gore.

Wis., Auburndale—W. Schmidt (grist mill)—feed grinding machinery, gasoline engine or motor power.

Wis., Cuba—J. Selleck & Co.—zinc mining and crushing machinery.

Wis., Jump River—Crane Lumber Co.—saw mill machinery, belting, shafting and hangers.

Wis., Kaukauna—The Ground Wood Pulp Supply Co.—machinery and equipment, including grinders, for proposed pulp mill.

Wis., Kaukauna—P. A. Mitchell—storage tanks, pumps and equipment for proposed filling station.

Wis., Marshfield — Roddis Lumber & Veneer Co., East 2nd St., H. Roddis, Purch. Agt.—medium size planer.

Wis., Milwaukee — The Natl. Knitting Co., 905 Clinton St.—knitting machines for proposed addition to factory.

Wis., Milwaukee—E. F. Seybold, 342 6th St. (produce)—refrigeration machinery.

Wis., Park Falls—Hines Lumber Co.—power machinery for proposed $75,000 saw mill at Loretta near Draper.

Wis., Racine—Racine Pine Mills Co., 1010 13th St. (dairy products)—steam driven refrigeration machinery.

Wis., Slinger—L. A. Burg—storage tanks and pumps for proposed garage.

Ont., Brantford—Brantford Roofing Co., Ltd. (manufacturer of asphalt roofing products), C. M. Thompson, Mgr.—roofing machinery.

Ont., Hamilton—Standard Underground Cable Co. of Canada, Ltd., T. D. Waring, Mgr.—machinery for stranding and cabling of wire and cables, also electrically driven pumps for operating hydraulic presses.

Ont., Stratford—W. W. Camp (manufacturer of peat)—machinery and equipment for the manufacture of briquettes.

Ont., Windsor—Wilkie Products Co., 312 Pitt St., W.—equipment for proposed factory for the manufacture of piston rings and garage equipment at Tillsonburg.

Que., Montreal — Howard Smith Paper Mills, Ltd., 138 McGee St., C. H. Smith, Pres.—complete equipment for bleached soda pulp plant.

Australia, New South Wales, Sydney—L. P. R. Bean & Co., Ltd., 229 Castlereagh St. (electrical engineers and importers of electrical supplies and machinery), L. P. R. Bean, Purch. Agt.—refrigerating machinery for restaurants, hotels and domestic use, also ice making machines, electrically operated.

Metal Working Shops

Ala., Bessemer—The Nashville Bridge Co., Shelby Ave., Nashville, Tenn., will build a fabricating plant, here. Estimated cost $85,000. A. J. Dyer, Pres.

Calif., Chico—Chico High School District will build a shop building for the high school. Estimated cost $20,000. R. H. Camper, Secy.

Calif., Fresno—The United Engine & Machine Co. plans to build a machine shop, foundry and molding shop, pattern shop and forge building for the manufacture of heavy castings, valves and piston rings as a specialty.

Calif., San Francisco — The city and county of San Francisco, Bd. of Park Comrs., Park Lodge, Golden Gate Park, will soon receive bids for the construction of repair shops and sheds. Estimated cost $24,400.

Conn., Bridgeport — The Belknap Mfg. Co., Union Ave., awarded the contract for the construction of a 2 story, 20 x 60 ft. addition to its plant for the manufacture of water fittings. Estimated cost $12,000.

Ill., Chicago—F. D. Chase, Inc., Archts., 645 North Michigan Ave., receiving bids for the construction of a 1 story, 124 x 173 ft. factory at 5800-5814 Throop St., for the Goldsmith Bros. Smelting & Refining Co., 29 East Madison St. Estimated cost $55,000.

Ill., Chicago — L. G. Hallberg & Co., Archts., 116 South Michigan Ave., receiving bids for the construction of a 1 story, 30 x 112 ft. factory on 103rd St. and Hoyne Ave., for the Chicago Steel & Wire Co., 10257 Torrence Ave. Estimated cost $15,000.

Ill., Chicago—T. G. Hallberg & Co., Archts., 116 South Michigan Ave., will soon receive bids for the construction of a 1 story, 68 x 190 ft. addition to garage for Huguelot Bros., 908 Gary St. Estimated cost $50,000.

Ill., Elgin—The Elgin Stove & Oven Co., 14 Chicago St., awarded the contract for the construction of a 3 story factory on State and Schiller St. Estimated cost $100,000. Noted Feb. 23.

Ky., Ashland — The Amer. Rolling Mill Co. awarded the contract for the construction of an addition to its plant, including a jobbing and sheet mill, also a galvanizing plant.

Mass., Hyde Park (Boston P. O.)—The Tileston & Hollingsworth Co., 49 Federal St., Boston, manufacturer of paper and cardboard, awarded the contract for the construction of a 1 story addition to its machine shop, here. Estimated cost $40,000.

Mass., Somerville — C. R. Bowlby, 16 Thorndike St., West Somerville, will build a 4 story, 60 x 75 ft. garage on Buena Vista Rd., here. Estimated cost $40,000.

Mich., Flat Rock—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Nov. 4 for the construction of a 2 story, 59 x 148 ft. gas producer plant, including coal hopper, here, for the Ford Motor Co., Highland Park.

Minn., St. Paul—The American Radiator Co., 1807 Elmwood Ave., Buffalo, N. Y., is having plans prepared for the construction of a plant for the manufacture of radiators, including foundry, machine shop, warehouses, etc., on a 525 x 120 ft. site, on Prior Ave., here. Estimated cost $1,500,000. J. F. Groebe, c/o owner, Engr.

Mo., Joplin—The Norton Taxicab Co., 6th and Wall Sts., plans to build a 2 story, 100 x 155 ft. garage and machine shop at 520 Wall St. Estimated cost $35,000. V. Norton, Pres. Architect not selected.

Mo., Kansas City—The Electric Storage Battery Co., 19th and Allegheny Sts., Phila., Pa., awarded the contract for the construction of a 1 story, 160 x 220 ft. branch factory on Belmont St., here. Estimated cost $150,000.

N. J., Trenton — The Eberhard Watch Corp., Commonwealth Bldg., plans to build a plant for the manufacture of watches. G. F. Eberhard, Pres.

N. Y., Dunkirk—The Continental Heater Co., Otter St., awarded the contract for the construction of a 1 story, 64 x 220 ft. addition to its plant for the manufacture of boiler parts and cores.

N. Y., New York—The Canter Constr. Co., c/o F. Parker, Engr. and Archt., 44 Court St., Brooklyn, will build a 2 story, 150 x 195 ft. garage on Park Ave. and 164th St., here. Estimated cost $150,000.

N. Y., New York—The 431 West 54th St. Realty Co., c/o F. A. Rooke, Engr. and Archt., 15 East 40th St., will build a 6 story, [illegible] x 90 ft. garage at 431 West 54th St. Estimated cost $125,000. C. Scott, Pres.

N. Y., New York—The Transit Comn., 49 Lafayette St., awarded the contract for the construction of foundation for the third addition to its shops on Lenox Ave. and 148th St. Noted Oct. 19.

O., Cleveland — The Lees-Bradner Co., 6210 Carnegie Ave., manufacturer of machine tools, is having plans prepared for the construction of a 3 story addition to its factory. Estimated cost $100,000. E. G. Lees, Pres. Private plans.

O., Cleveland — The National Screw & Tack Co., c/o F. G. Walker, 2440 East 75th St., is having plans prepared for the construction of a 5 story factory on Platt Ave. near East 76th St. Estimated cost $400,000. F. G. Walker, c/o owner, Archt.

O., Cleveland—The Otis Steel Co., c/o R. Brakeman, Engr. and Archt., 3341 Jennings Rd., is having plans prepared for the construction of a 1 story steel mill, including blooming mill, strip mill and open hearth furnaces on Jennings Rd. Estimated cost $1,[illegible].

O., Cleveland — The Vance Motor Co. (Ford agents) awarded the contract for the construction of a 2 story, 62 x 132 ft. garage on East 9th St. and Central Ave. Estimated cost $100,000.

O., Cleveland Heights (Warrensville P. O.)—The Heights Battery Co., c/o J. Herman, 2777 Mayfield Rd., awarded the contract for the construction of a 2 story, 50 x 100 ft. garage at 2770 Mayfield Rd. Estimated cost $40,000. Noted June 2, 1921.

O., East Cleveland — The Pollock-Davis Co., 11623 Euclid Ave., awarded the contract for the construction of a 2 story, 72 x 74 ft. garage. Estimated cost $40,000.

O., Kent—The Lamson & Sessions Co., 2188 Scranton Rd., Cleveland, manufacturer of nuts, bolts and rivets, have had plans prepared for the construction of a 1 story, 168 x 200 ft. factory, here. Estimated cost $125,000. G. S. Rider & Co., Century Bldg., Engrs. and Archts.

Pa., Ambridge — The National Metal Moulding Co. will build a 1 story, 98 x 100 ft. cafeteria and shop building.

Pa., Coraopolis — The Standard Steel Spring Co. awarded the contract for the construction of a 1 story, 64 x 141 ft. factory building. Noted June 22

Pa., McKees Rocks—The Federal Enameling & Stamping Co., Thompson Ave., will build a 1 story factory for the manufacture of tin and enameled wares.

Pa., Phila. — Neubauer & Supowitz, Archts., 525 Chestnut St., are receiving bids for the construction of a 2 story, 50 x 100 ft. garage and hall on Wyoming Ave. and Marshall St., for P. Randolph, 41 East Poplar St. Estimated cost $100,000

Pa., Pittsburgh—The Fleishman Yeast Co., 701 Washington St., New York City, awarded the contract for the construction of a 2 story, 75 x 192 ft. agency and garage building on Allegheny and Western Sts., here. Estimated cost $50,000. Noted June 22.

Pa., Tamaqua—The Lehigh Coal & Navigation Co., Lansford, plans to rebuild its coal washing plant which was recently destroyed by fire, here. Cost between $45,000 and [illegible].

Tenn., Knoxville — The Cherokee Motor Co., 311 State St., plans to build a 2 story, 100 x 150 ft. addition to its garage and repair shop. Estimated cost $75,000. C. [illegible], Pres.

W. Va., Huntington—The Armstrong Mfg. Co. awarded the contract for the construction of a 1 story, 168 x 201 ft. addition to its plant for the manufacture of hardware and specialties. Noted Oct. 19.

Wis., Chilton—[illegible] & [illegible], c/o A. Hingess, [illegible], plans to build a 2 story, 60 x 100 ft. garage, here. Estimated cost $45,000. Architect not selected.

Wis., Milwaukee — The Milwaukee Air [illegible] Co. [illegible] awarded the contract for the construction of a 1 story, 110 x 240 ft. factory and office building on [illegible] Ave. Estimated cost $[illegible]. Noted Oct. [illegible].

Wis., Slinger—L. A. Berg will build a 1 story, 60 x 80 ft. garage. Estimated cost $[illegible]. Noted Oct. 12.

Wis., West Bend—The Arent Service & Storage Garage, c/o M. A. Johnston, Ashford, R. D., Campbellsport, awarded the contract for the construction of a 1 story, 60 x 80 ft. garage. Estimated cost $40,000. Noted Oct. 19.

Ont., Guelph—B. Tolton & Son, 173 Woolwich St., plan to rebuild their garage and repair shop which was destroyed by fire. Estimated cost $45,000.

Ont., Tillsonburg—The Wilkie Products Co., 312 Pitts St., W., Windsor, Ont., plans to build a 60 x 200 ft. factory for the manufacture of piston rings and garage equipment, here. Estimated cost $100,000.

General Manufacturing

Ala., Birmingham—The city awarded the contract for the construction of a 2 story, 1[illegible]0 x 200 ft. market house, including complete refrigerating plant on 3rd Ave. and 23rd St. Estimated cost $195,000.

Ala., Birmingham—The Lehigh Portland Cement Co., Young Bldg., Allentown, Pa., awarded the contract for the construction of a cement mill, capacity 1,000,000 bbl. per year, here. Noted Oct. 5.

Ark., Thornton—The Stout Lumber Co. plans to rebuild its lumber mill which was destroyed by fire. Estimated cost $200,000.

Calif., Fresno—Black's Package Co., 1025 Van Ness Ave., is having plans prepared for the construction of a 2 story, 200 ft. frontage, stores building and refrigerating plant. Estimated cost $150,000. R. F. Felchlin Co., Bank of Italy Bldg., Engrs. and Archts.

Calif., San Francisco — P. Grassi, 808 Arguello Blvd., awarded the contract for the construction of a 1 story, 120 x 120 ft. marble and terrazzo products factory on San Bruno Ave. Estimated cost $5,000.

Ill., Chicago—E. J. Brach & Sons, 215 West Ohio St., awarded the contract for the construction of a 3 story, 100 x 300 ft. candy factory on Kinzie and Cicero Sts. Estimated cost $1,000,000. Noted Oct. 19.

Ill., Chicago—The Imperial Box Co., Inc., 1506 Carroll St., awarded the contract for the construction of a 1 story, 70 x 110 ft. factory at 1536-40 Carroll Ave. Estimated cost $25,000.

Ia., Sioux City—The Hanford Produce Co., 1st and Court St., awarded the contract for the construction of a 3 story, 100 x 150 ft. cold storage warehouse and ice plant on 1st and Virginia Sts. Estimated cost $100,000.

Me., Lewiston—The Bates Mfg. Co. has had plans prepared for the construction of a 4 story, 170 x 370 ft. addition to its plant for the manufacture of gingham goods. Estimated cost $600,000. Architect not announced.

Mass., Everett—Stone & Forsyth Co., 67 Kingston St., Boston, awarded the contract for the construction of a 2 story, 18 x 46 ft. addition to its paper plant on Spring St., here. Estimated cost $15,000.

Mass., Fall River—The Sagamore Mfg. Co., Benefit St., awarded the contract for the construction of a 2 story, 75 x 96 ft. addition to its plant No. 1. Estimated cost $40,000

Mass., Somerville—The Mitchell Bakery Co., South St., Cambridge, awarded the contract for the construction of a 1 story, 65 x 90 ft. bakery on Vine St., here. Estimated cost $30,000.

Mich., Flat Rock—A. Kahn, 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Nov. 4, for the construction of a 1 story, 242 x 761 ft. plate glass factory, here, for the Ford Motor Co., Highland Park. Estimated cost $1,500,000.

N. J., Englishtown — The Englishtown Carpet Co. awarded the contract for the construction of a 2 story, 50 x 75 ft. carpet factory. Estimated cost $12,000. A. Muldoon, Pres.

N. J., Lambertville—The Jesperson Newsprint Corp. plans to rebuild its paper factory to replace the one which was recently destroyed by fire.

N. Y., Alfred—Reynold Bros. plan to rebuild their 4 story cheese factory and warehouse, which was destroyed by fire. Cost between $50,000 and $60,000. Architect not announced.

N. Y., Buffalo—The Pillsbury Flour Mills Co., 202 Metropolitan Life Bldg., Minneapolis, Minn., awarded the contract for the construction of a 10 story, 100 x 268 ft. flour mill, here. Estimated cost $1,000,000. A. C. Loring, Pres. Noted Oct. 19.

N. Y., Jamestown—The Alliance Furniture Co., Allen St., awarded the contract for the construction of a 4 story addition to its factory, to contain 20,000 sq.ft. floor space. Cost will exceed $35,000. Noted Oct. 12.

N. Y., Jamestown — The Empire Case Goods Co., 142 Foote Ave., awarded the contract for the construction of a 2 story addition to its furniture factory, to contain 7,000 sq.ft. floor space. Noted Oct. 12.

N. Y., Rochester—The Newman Bros. Grain Co., 304 Troup St., plans to build an addition to its grain mill. Estimated cost $25,000. Architect not announced.

Pa., Phila.—The J. B. Stetson Co., 5th St. and Columbia Ave., is having plans prepared for the construction of an 8 story, 62 x 75 ft. hat factory, a 1 story, 114 x 114 ft. garage and workshop, and a 1 story, 75 x 124 ft. machine and repair shop on 4th St. and Columbia Ave. J. O. Potts, 5th St. and Montgomery Ave., Archt.

Tenn., Kingsport—The Mead Fibre Co. awarded the contract for the construction of a 2 story, 75 x 275 ft. paper mill. Estimated cost $350,000. Noted Oct. 5.

Wash., Tacoma—The Northern Furniture Co., South Water St., Sheboygan, Wis., is receiving bids for the construction of a 4 story, 110 x 150 ft. furniture factory on Edison St., here. Estimated cost $60,000. W. C. Weeks, 720 Ontario Ave., Sheboygan, Wis., Archt.

Wis., Delevan—The State Bd. of Control, M. J. Tappins, Secy., Madison, awarded the contract for the construction of a 1 story cold storage plant, here. Estimated cost $40,000.

Wis., Fond du Lac—The Model Laundry Co., 66 Macy St., plans to build a 2 story, 60 x 90 ft. addition to its laundry, etc. Estimated cost $40,000. Architect not selected.

Wis., Green Bay—E. J. Balza Co., 327 Main St., is having plans prepared for the construction of a 2 story, 50 x 95 ft. pickle factory. Estimated cost $40,000. E. J. Balza, Mgr. Private plans.

Wis., Green Bay—Brown County, c/o H. F. Wittig, Clk., Court House, will build a 2 story, 70 x 95 ft. laundry. Estimated cost $40,000. Noted Sept. 14.

Wis., Green Bay—The Fairmont Creamery Co., 200 North Bway., awarded the contract for the construction of a 2 story, 100 x 105 ft. dairy and power boiler house. Estimated cost $60,000. Noted Sept. 21.

Wis., Milwaukee — The Air Reduction Sales Co., 2236 South Lumber St., Chicago, awarded the contract for alterations to its 1 story factory on Buffum St., here. Estimated cost $30,000.

Wis. New Holstein—The New Holstein Canning Co. will build a 1 story, 60 x 160 ft. canning factory. Estimated cost $40,000. A. T. Hipke, Secy.

Wis., Oconto—The Elsnore Veneer Co. will build a 1 story, 90 x 150 ft. veneer factory. Estimated cost $40,000. J. O. Atwater, Mgr. Noted Oct. 5.

Wis., Plymouth—The Phenix Cheese Co. is having plans prepared for the construction of a 5 story, 30 x 60 ft. cheese factory. Estimated cost $60,000. R. A. Harbach, Mgr. Singer-Pentstein Co., 9 South Clinton St., Chicago, Archts. Noted Aug. 29.

Wis., Racine—The Belle City Malleable Iron Co. plans to build a 1 story, 45 x 50 ft. gas plant for annealing and core ovens. Estimated cost $40,000. C. S. Anderson, Mgr. Architect not selected.

Wis., Racine—The Davies Shoe Mfg. Co., Northwestern and Carlisle Sts., plans to build a 2 story, 75 x 150 ft. shoe factory. Estimated cost $100,000. C. Davies, Pres. Architect not selected.

Wis., Racine — The Wisconsin Gas & Electric Co., 305 6th St., awarded the contract for the construction of a 1 story, 50 x 95 ft. gas plant. Estimated cost $40,000. Noted Aug. 17.

Wis., Union Grove — The State Bd. of Control, M. J. Tappins, Secy., 902 Garfield St., Madison, awarded the contract for the construction of a 1 story, 50 x 90 ft. laundry at the Wisconsin Home for Feeble Minded, here. Estimated cost $40,000. Noted Oct. 5.

Wis., West Bend—The West Bend Concrete Products Co. awarded the contract for the construction of a 2 story, 50 x 65 ft. factory for the manufacture of drain tile and concrete products. Estimated cost $40,000.

B. C., Powell River—The Powell River Co., Ltd., is having plans prepared for the construction of a 2 story, 80 x 360 ft. addition to its paper mill. Estimated cost $200,000. R. Bell-Irving, Powell River Archt.

American Machinist

Volume 57 NEW YORK, NOVEMBER 9, 1922 Number 19

Storage and Disbursement of Small Tools

The Different Ways of Keeping Track of Tools—Single and Double Check Systems—The Register System—Check Room of the Future

BY W. J. SANSOM

A MODERN tool storage and disbursement system, in order to be efficient, should be based upon the principle of "a place for everything and everything in its place." When any particular system is selected as being best fitted to the conditions obtaining, there must be consistent and persistent fufillment of all details connected therewith, for it is well known that an intermittent system is worse than no system at all. Care should be taken to install the system that will best suit the condition and that provides for the upkeep of the tools. A plant manufacturing a standard product, year in and year out, can install a different method of disbursement of tools from that desirable where the product is subject to change. Therefore the writer will explain how various systems are applied and to which class of shop each one is suited.

In addition to the problem of disbursement, attention will be given to the storage, ordering, maintenance, inspection and final disposition of tools, together with suggestions for blank forms to be used in connection with the different systems outlined. It is earnestly recommended that a capable man with good mechanical training be placed in charge of the tool service department. He should be a man in whom confidence can be placed to direct intelligently all phases of the work such as the ordering of small tools, repair parts for machinery and the maintenance of small tools for the entire plant, one who is broad-minded enough to settle disputes that are bound to arise with the workmen and adjust these differences to the satisfaction of and with justice to both employer and the employee. Such a man, who in addition to the foregoing qualifications can take care of the details, it is the details that count in this branch of factory management, is a valuable asset to any organization.

Tool Checking Systems

The single check system is the one in common use and, contrary to general belief, is not very efficient as there are greater opportunities for losses than appear upon first consideration. The employee, when he applies for tools, is given a check number which is recorded and serves as an identification. A stated number, usually ten, of stamped metal checks bearing this identification number are then issued and the workman, upon making a request for a tool, will leave one of these checks to be placed in the bin from which the tool is taken. When the tool is returned it is again placed in the bin and the check returned to the workman.

The double check system involves a set of checks with the workman's identification number stamped thereon to be furnished for each employee, an identification tag or card, and metal checks of a different shape than the number checks, stamped with the names and sizes of the tools in stock. The workman is given an identification number stamped on a large metal tag, or perhaps a printed card which is arranged to display the identification number in prominent figures and should also be arranged so that his own signature will appear thereon. This identification tag or card must be shown when tools are called for.

Card Record Check

Inside the tool room, a large board should be located at the most convenient point for the attendant's use and having a double row of hooks, the upper row to receive the ten checks bearing the workman's number, the lower row for the checks that are stamped with the names of the tools that the employee is using. Each tool bin must also have two hooks, one for the number check and the other for the check which is stamped with the name of the tool. In making requisition for a tool, let us take for instance a one-inch machine reamer, the workman will give his identification number which we will assume is number 50. The check room attendant will take one check numbered 50 from the board and hang it on the hook in the bin containing the one-inch machine reamer, remove the check marked one-inch machine reamer from the bin and hang it on the hook below the number check on the board and deliver the tool to the workman. Upon the tool being returned the procedure is reversed.

Under the plan known as the card record and check system, all tools that are likely to be a part of the workman's permanent outfit, such as oilcans, wrenches, files, brushes, etc., are recorded on a card which is filed at the time the tools are issued. Other tools that are to be used only for short periods are checked to him by one of the checking systems. Should the employee be discharged or resign he is expected to return the tools checked and also the tools charged to him on the record. In the event of tools on record being worn out, new ones are given out when the old ones are returned to the checkroom or credit given on the record if the tools are not replaced.

No metal checks are used in the disbursement of tools under the register plan with the exception of an identification tag. A register is used like the McCaskey or American, together with written memorandum slips made in duplicate. To all intents and purposes it is practically the same method as used in many grocery stores for charge purchases. Each check room attendant is furnished with a duplicate pad and as the individual employee receives tools he is given the original

slip with his number and a description of the tool he has received written thereon. The duplicate is filed under the employee's number in the register. When the tool is returned the original slip accompanies it and the original and duplicate are then destroyed, thus closing the transaction. This method has many advantages which are explained later.

Denominational checks may be used to good advantage on certain classes of tools and are useful especially when workmen are engaged on tool or repair work where large numbers of a few kinds of tools are to be used. These checks may be issued, of a different shape from the ordinary check, with the workman's number on the face, the reverse side being stamped 2, 3, 4 or 5 and may be used on such tools as bolts, straps and jackscrews. None of the checking systems are really suitable for pattern or wood shops, as a tool is generally used for only a short period and perhaps by the entire working force at least once during the day. All tools, however, including band saws, routers, saw files, templets and all other tools owned by the employer should be charged directly to the foreman of the department. To maintain an accurate record, breakages or renewals must be promptly recorded thereon. General tool accounts of this nature, to be kept accurate, should be checked four times a year and oftener if found necessary.

System for the Erecting Floor

If the erecting floor is a large department and situated at a distance from the machine shop checkroom, a separate room may be maintained to contain all tools that are used in the department and, while the tool disbursement expense may be increased, there will be greater efficiency in output. The time spent in walking back and forth to the distant check room is avoided as also is the probability that tools intended for erecting floor use may be in service in the machine shop. It requires very little nonproducing time of workman to pay for the services of the extra check room attendant and the congestion will naturally be less at the machine shop check room. This will materially assist the production of that department.

When a tool is broken in use, the employee should not be able to go to the check room and replace it with-

TOOL BREAKAGE Date________

Workman ____________ Check No. ________

Name of Tool

Broken } Line thru one
Worn out }

Reason for breaking:-

__________ __________
Tool Director Foreman

FIG. 1—TOOL BREAKAGE REPORT FORM

out the knowledge of his foreman for the reason that by so doing the foreman would not have the opportunity to discover the cause of breakage and to take the necessary steps to avoid a repetition of the damage. "Tool breakage" reports should be carried by each foreman, should be filled out when the tool is to be replaced and the check room attendant instructed not to replace any broken or worn-out tool except upon receipt of the breakage report signed by the foreman. A simple form is shown in Fig. 1.

A daily or weekly report may then be made out for the superintendent by the tool director giving the tool breakage in condensed form. See Fig. 2. This report would be compiled from the tool breakage reports is-

STATEMENT OF TOOL BREAKAGE

Total ________ For week ending ________ 191

Departments:	Mon	Tue	Wed	Th	Fri	Sat
Machine						
Assembling						
Foundry						
Tool						
Forge						
totals:						

____
Tool Director.

FIG. 2—WEEKLY REPORT ON TOOL BREAKAGE

sued by the shop foreman and would enable the superintendent to keep in close touch with the amount of and reason for the breaking of tools.

When a workman resigns his position or is discharged, his tool account should be carefully scrutinized and steps taken to have all tools returned to the check room. A report should be made to the accounting or time keeping department certifying that the employee's account is clear or, should there be tools lost, notation should be made on the report to that effect. The form in Fig. 3 may be used.

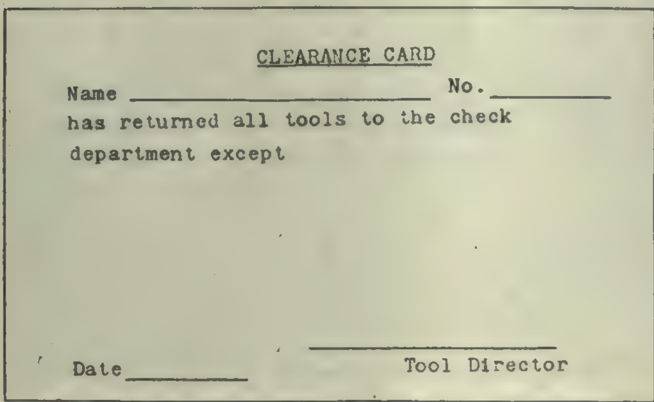
Single Check System

The single check system, while the simplest and least costly in its operation, has many weak features that too often are allowed to pass unnoticed. A few simple instances are given: The check room attendant may place the workman's check on the wrong hook, he may accidentally knock the checks off the hooks and in replacing them be in doubt as to where they belong and he may perhaps replace them on the wrong hooks, the employee may return a certain tool in exchange for another and the attendant neglect to change the check from the first to the second tool. All these errors will occur every day in a check room of any size and especially in shops where the prevailing practice is to employ for tool checking young boys, whose sense of responsibility is usually lacking or only partly developed.

Often a tool checked to a workman is lost in the shop or perhaps it has been loaned by him to another employee and the transaction forgotten. Again it is not an uncommon practice for a workman to use a tool that is charged against another man without asking his permission and when the loss is discovered the workman against whom the tool is charged will quite frequently disclaim all knowledge of the tool to the attendant. After considerable argument, to avoid congestion at the tool room window while the discussion is going on and consequent delay in giving out tools to other workmen, the attendant will be forced to give the workman the benefit of the doubt because he fears that the check might have been misplaced in the check room through one of the errors above explained. In the same way the employee might break a tool and attempt to evade the

responsibility for the act by denying that he had received it.

Those readers who have not actually had charge of this branch of shop management, may doubt that these are common occurrences and will not believe that workmen will distort the facts to such an extent. The vast majority of people are honest and the workman who



CLEARANCE CARD

Name ____________________ No. ________

has returned all tools to the check department except

Date ________ ____________ Tool Director

FIG. 3—WORKMAN'S CLEARANCE CARD

will prevaricate about tools in all probability would not remove one cent's worth of material from the plant for his own use. The course of reasoning usually followed by him is that the tool is in the shop somewhere, he hasn't it anyway, and why should he have it charged up to him or receive a reprimand from his foreman if he can talk his way out of the difficulty. Considerable time may therefore be lost in finding checks when tools are returned to the checkroom and, in most cases, useful machine time is lost in addition to the labor.

When inventory is taken all tools must be accounted for and in a large plant this will necessitate that some tools be returned to the check room quite a considerable time before the employees leave work so that all will be able to turn in their tools by quitting time. As a consequence some workmen will be idle between the time that their equipment is called for and the regular quitting time of the shop. There will be similar loss of time on the day following inventory as it would be impossible to start every workman promptly, each man having to await his turn at the check room window for the necessary tools.

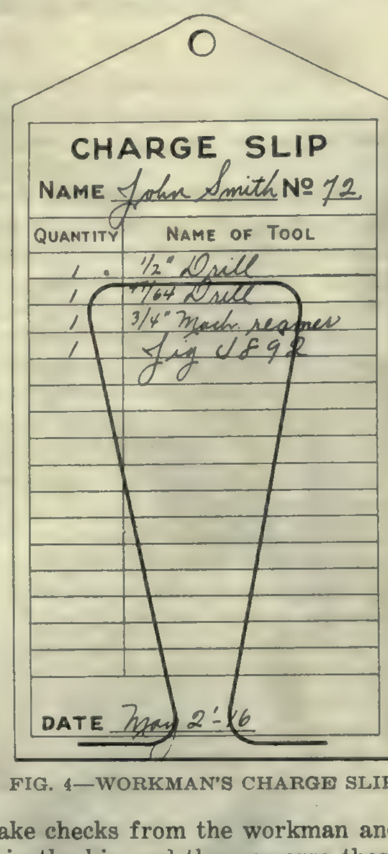
Inventory Difficulties

What has been said regarding the single check system is equally true of the double check system and, in addition, the extra work involved in handling two sets of checks must also be borne in mind. Furthermore, if twenty men were using the same size and kind of tool simultaneously then there would have to be twenty tools each with its check ready for use. An advantage over the single check system lies in the fact that each tool could be stamped or otherwise marked with a number and each name of tool check given a corresponding number so that identification of the tools that any workman might have would be complete. This system, however, would necessarily entail considerable work in its installation if a large number of workmen are to be furnished with tools and would be rather cumbersome in its execution.

The card record and check system combined is a step in advance of the plain check system but is open to the same objections as above except for the few tools that may be kept on the card record. The register system is an improvement over the previous methods as there are no metal checks whatever to be considered and while there is a slightly increased cost of operation in providing pads instead of metal checks the ultimate saving through the absolute knowledge of who is charged with each tool will more than balance the small cost of the pads. This system has none of the drawbacks that the check systems have for the simple reason that all transactions are duplicated in writing, one copy retained by the check room and the other by the workman receiving the tool. If he does not receive the tools listed to him, the workman would report it for correction at the time of receiving the tools and the charge slip.

Responsibility Settled

There cannot be any future argument regarding his responsibility for the tools. The employee is given a clip holder like that in Fig. 4 for filing all the charge slips that may be in his possession and it may either be hung on a nail by his machine or bench or kept in the tool box. He has the advantage of knowing exactly how his account stands at the check room simply by referring to his file, as all tools when returned to the check room are accompanied with the charge slip issued therewith. Upon the tools being returned to the check room, no time is lost in looking up checks as a glance at the charge slip and the tools will usually suffice to prove that the correct tools are returned and the workman is immediately released to return to his work of production. The tools are returned to their proper place at the check room attendant's convenience. Separate boxes may be placed at a convenient point to receive charge slips returned and charge slips issued and these also may be filed, or the duplicates, in the case of charge slips returned, removed from the register at the attendant's leisure. Objection may be made that it will require too much time for the attendant to write out the slips, but, as a matter of fact, it is a quicker operation for the competent attendant to write the charge slips than to take checks from the workman and hang them on a hook in the bin and then reverse these proceedings when the tools are returned. In addition, the shortening of the non-productive time of the employee through avoiding the necessity of waiting for checks is considerable in the aggregate.



CHARGE SLIP

NAME John Smith № 72

QUANTITY	NAME OF TOOL
1	½" Drill
1	11/64 Drill
1	3/4" Mach. reamer
1	Jig J892

DATE May 2-26

FIG. 4—WORKMAN'S CHARGE SLIP

It is customary in some plants to keep the check allotted to the workman on a board within the check room, the attendant taking the checks from the board when the tools are returned. In that event, the workman need not be detained after his tools are returned

to the check room while the attendant is looking up his checks although it might be preferable from the check room attendant's viewpoint were he to do so. It would be possible for the wrong tool to be turned in and the error undiscovered until after the workman had left the check room, thus making it necessary for the attendant to take the matter up for adjustment later.

If the double checking system is used then there would be the name-of-tool checks on the board, as previously explained, to correspond with the tools that the workman has received and the check room attendant in that case would only find it necessary to take these from the board and compare with the tools returned, placing the tools in their respective bins at his convenience.

In preparing for inventory under the register system, it is not necessary that tools be returned to the check system as the register system automatically provides a perpetual inventory of tools in use in the shop so that a clerk may take a copy of the tools listed in the register and count only the tools that are in storage. A saving may thus be made in workman's time at the inventory period and is an important consideration in favor of the register system. This method also provides adequately for the loan of equipment to other employees who may not have identification numbers such as office people or others outside of the works who may borrow tools. In addition, tools used by a department as a whole and not chargeable to individuals, as for instance, band saws in the pattern shop, may be recorded in the same manner.

The check room has not received the attention it has deserved until recent years but since scientific methods have been applied to shop management the importance of this department has been more fully recognized and its operation more systematically developed. The writer, in looking ahead, makes the suggestion that in the future the ideal check room will consist merely of a private storeroom from which tools will be delivered to groups of machines by an overhead carrier system and returned to the check room in the same way. The workman will be charged with the tools by a register system similar in every detail to the cash register used in all stores. There will be no occasion for the workman to leave his machine, neither will it be necessary for the tool attendant to leave the check room. A check room so managed that no workman wastes valuable time waiting for tools is indeed rather hard to imagine, but so were some of the recent developments in management only a few years ago, and while the writer is aware that the ideal check room is hard to develop, it must be admitted that the requisite conditions are not impossible.

Machine Shop Bulls—III

By Joe V. Romig

Tim Doolin had bulled his job again, a shaft this time, and was busily engaged in trying hard to dope out a way of getting out of this mean scrape. He knew well that it meant the "grand bounce" for him if Jennison, his foreman, would find out, and so he schemed how best to hide or dispose of the bulled shaft. Tim was one of those who bulled frequently, through inattention to his work, and was known by all to be on his last chance. To hide, and where, were his thoughts as he threw off the apparently finished shaft and placed another one between the centers.

After the midnight lunch hour, things usually quieted down a bit, and it was during these hours that Jennison, the boss, usually took his wee bit of a nap. Choosing this opportune time, Tim shouldered the bulled shaft and disappeared through the side door of the shop. Crossing over twenty or more tracks of the mill's railroad yard brought him to the river bank, down which he disappeared, shaft and all. Reaching the river's edge he scooped out a shallow ditch with an old tin can and socked the shaft into its grave with a vengeance. Covering it lightly he went back to his work, thinking and smiling about how good a job he had made out of a bad one.

While still smiling to himself, at 3 G.M. a heavy hand was held on his shoulder and there stood Murphy, the [illegible] detective.

"Say bo, who is your foreman?" he inquired of the frightened Tim. "Go get him quick," he continued, "he is wanted out here in the yard, right away."

Not wishing to cause suspicion or get in wrong with the copper, Tim went and hunted up Jennison and brought him to the still waiting Murphy, chief of the detective staff.

Jennison was told that he and his man here, were wanted to attend an inquest over on the river bank, and slipping quietly over to the now frightened Tim, Murphy inquired whether he would go over with or without the cuffs. Tim leaped into the lead of the party, taking them straight over the tracks to his dead and buried bull.

He was told to dig, and out came the shaft, which he was ordered to carry back again into the shop. Murphy then turned to Jennison, and said, "I have now done my duty, you do yours," and walked away, knowing that justice would be meted out accordingly.

After a few moments of reflection, Jennison turned to poor Tim and said, "Tim, firing is too good for a guy like you; I'll keep you on, but from now on and forever, you will be called the 'undertaker' of machine shop No. 8." And the name stuck, for even to this day he is known and called by his nickname, Undertaker.

"Three-Handed Workers"

By A. W. Brown

Some one, let us say Sydney Smith, who gets credit long after his death for most good things that we can not exactly place, has said that some persons have three hands: "two like you and me, and *a little behind hand!*"

Every badly managed plant has some of these. They cause loss not only by doing less work than they are paid for, but by keeping others waiting for supplies, instruction or service; also by their bad example.

A good remedy is to deduct from the pay envelope or the check a sum representing the late minutes or hours, and paying it into an employees' sick fund or amusement "kitty."

It is disagreeable for most employers to drive the lesson of punctuality home through the purse of a worker.

Being prompt is almost entirely a matter of habit and the rut of lateness is very likely to spread beyond a man's time at the shop. Amputated at work, "the little behind hand" will be lost in his daily life.

FIG. 1—A GENERAL SHOP VIEW

A Machine Shop Which Moved Out of the City

Increasing Business Made Expansion Necessary—A New Shop Nine Miles Out of Baltimore—Layout of Shop and Arrangement of Departments

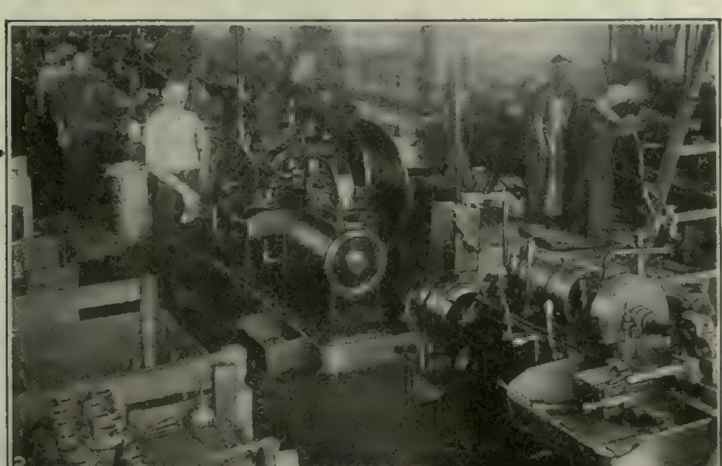
SPECIAL CORRESPONDENCE

THERE has been talk of decentralization in machine building, both on account of the difficulty of securing additional room in cities and the advantages of light, air and freedom from transportation difficulties in some cases. Therefore, when the need for expansion became urgent for them, the Black & Decker Manufacturing Co. found a site at Towson Heights, about 9 miles out of Baltimore, Md. The company there erected a new plant and the story of growth, which made this expansion necessary, is interesting.

Beginning back in September, 1910, Messrs. Black & Decker began business as tool and jig designers, builders of special machinery and also of a few electric tools. According to Mr. Black, in order to raise capital for a start, he sold his automobile for $600 and Mr. Decker raised a like amount from some similar source. Things grew very satisfactorily until 1914 when it was decided that as special machinery depended too much on the personality of the principals, they would specialize on some staple product. They settled on electric drills and air compressors.

The shop shown herewith was built in the fall of 1919 and ready for use early in 1920. Some of its features, both of construction and equipment, are worth consideration by others who are contemplating getting out of the city and away from the crowds. The building is a high, single story one with a monitor in the center. It is 13 ft. in the clear with 5 ft. 5 in. more to the roof. The monitor is something over 5 ft. more. A general idea of the construction, as well as the large window area, can be had from Figs. 1 and 2.

In Fig. 1 is shown a general shop view with the assembly in the foreground. This shows the location of the steam radiators up in the girders and the distribution of light all over the shop. The illustration, Fig. 2, shows mostly Potter & Johnston machines, with their



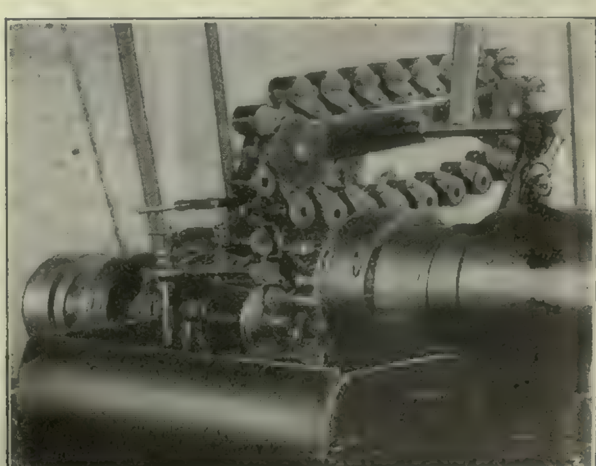


FIG. 2—POTTER & JOHNSTON DEPARTMENT. FIG. 3—MAGAZINE FEED FOR BUSHINGS

curved oil guards, the types of bins and benches used and the kind of step ladder used for overhead work. An interesting detail of manufacture is shown in Fig. 3, where a Cleveland automatic with magazine attachment is used to handle cast bushings. Casting the bushings eliminated the use of solid rod as stock, with the resultant saving in metal.

Part of another assembly department is shown in Fig. 4, while the testing bench for drills and grinders is shown in Fig. 5. Each unit being tested is plugged into a light circuit the same as in practice. The instruments show current consumption at all times. Being away from city restaurants, an eating place became a necessity, hence the cafeteria shown in Fig. 6.

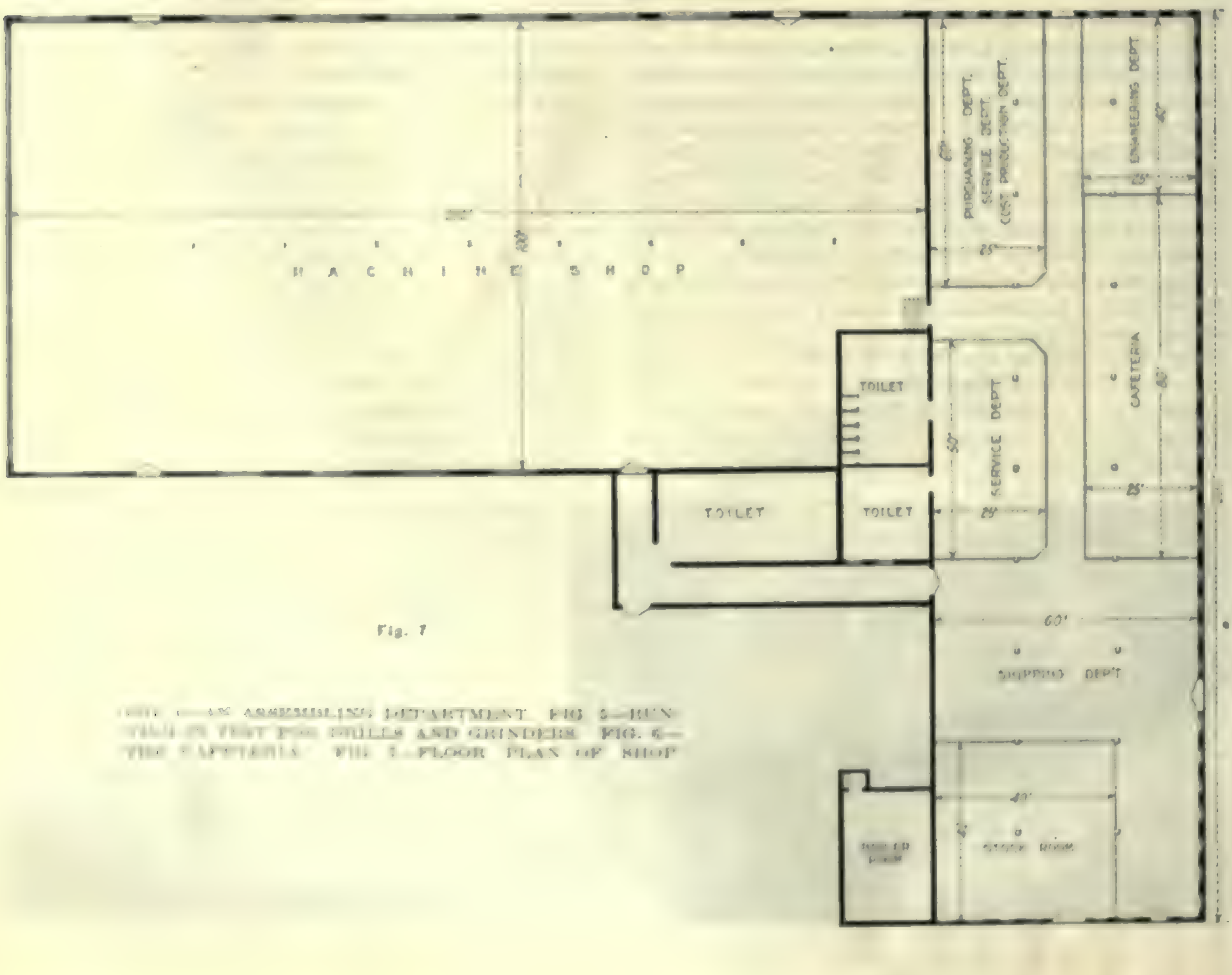


Fig. 7

FIG. 4—AN ASSEMBLING DEPARTMENT. FIG. 5—BEN[illegible] TEST FOR DRILLS AND GRINDERS. FIG. 6—THE CAFETERIA. FIG. 7—FLOOR PLAN OF SHOP

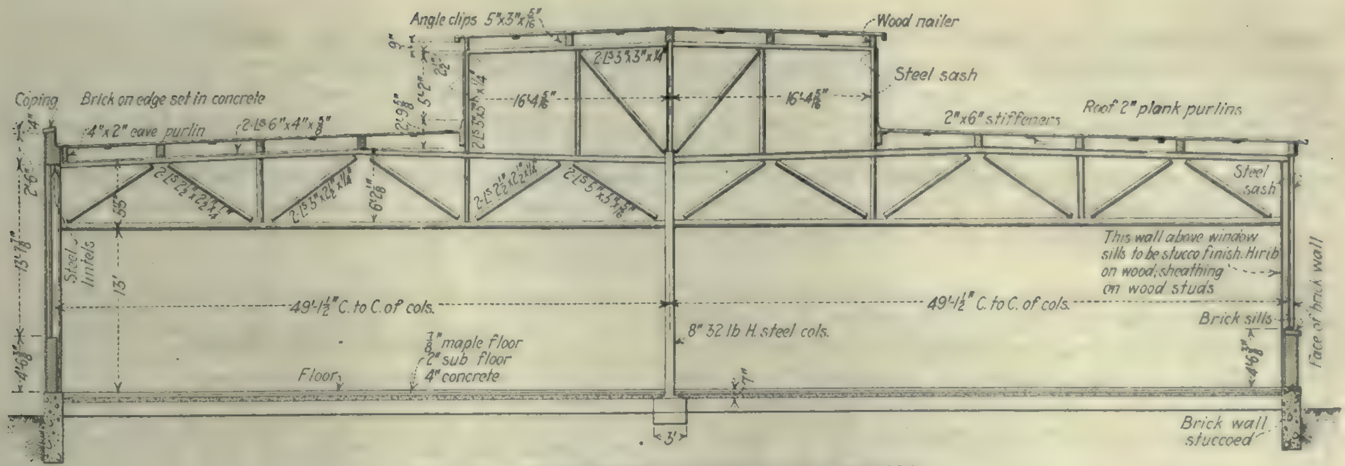


FIG. 8—CROSS-SECTION THROUGH MONITOR

The plan of the shop is shown in Fig. 7, while Fig. 8 is a cross-section giving the principal dimensions to anyone who has need of a similar shop. The exact floor layout can, of course, be altered to suit conditions but the general construction will be found serviceable in many places. This move into the country also involved the building of a number of houses along very attractive lines. Anyone interested can secure information as to these houses as well as further details of the shop buildings and their equipment.

Learning the Trade Forty Years Ago

By W. S. Davenport

(The first of four articles)

Boys of the present day who are mechanically inclined and who live within easy reach of the modern vocational and trade schools, with their able instructors and complement of fine machinery upon which to work, little realize the difficulties that beset the boys of 40 years ago who wished to "learn the machinist's trade." When I was a boy and lived on a farm among the hills of old New England I wanted to run machinery. Though at that time the term "machinist" was unknown to me, I knew the kind of work I wanted to do and the rare opportunities that came to me, perhaps once or twice in a long year, to visit the machine shop in a neighboring town were wonderful treats indeed. Well do I remember saying, one Sunday morning on my way to church, that I wanted to "work in iron," a desire that greatly perturbed my good mother, who had pictured me a farmer like my father and most of her acquaintances.

In the summer I was kept pretty busy during my hours away from school, attending to the many minor duties about the farm. Thus, I had little chance to indulge my craving for machinery, but with the coming of autumn and the harvest time there came also the traveling threshing machine with its crew and I was in my glory. This machine was driven by an old-fashioned horsepower in which a pair of horses were made to walk continually up an interminable hill while the "ground" beneath their feet was as constantly sliding backward.

Sawing Wood and Threshing Grain by Horsepower

Later in the season, when it was time to prepare the winter's stock of firewood, the threshing machine was replaced by the "dragsaw," a wonderful device operated by a system of gears and cranks and driven by the same horsepower. Never, thought I, could anything be more marvelous than the way the wheels turned and the reciprocating saw was pushed rapidly back and forth, never could logs be severed more quickly.

A crank churn, with gears and wheels to make the floats revolve, was of absorbing interest and to me a mowing machine was about the finest piece of mechanism that could possibly be evolved.

My father, like all New England farmers, was "handy with tools" and possessed an assortment of saws, chisels, planes and other implements of the carpenter's trade in which I early became interested. At the age of ten years, I could split a log and prepare the pieces with plane and saw and chisel to make picture frames and other simple objects. For this work I received considerable commendation and was told that I would make a good carpenter, if I would stick to it.

My First Lathe

My grandfather, who lived in a neighboring town, had a wood turning lathe that he had built and rigged up to be driven by a belt from the grindstone, the hired man at the crank of the grindstone supplying the energy. I could not command the services of a hired man but, inspired by the example of my grandfather, I set out to construct a lathe of my own.

The shaft of an old churn furnished the spindle for this lathe, while odds and ends from broken down or worn out farm machines, pieced out with blocks and strips of hard wood, provided the remainder. For a power plant a discarded grindstone was seized upon and to this I fitted a square shaft made by rip-sawing (by hand) a hard maple plank, 2 in. thick, and by whittling the ends of the resulting square strip round with a jackknife.

For "bearings" I bored holes with an augur in the legs of the carpenter's bench and to one end of the shaft I fitted an unique pedal motion, a duplicate of which has never been seen before or since its construction. Notwithstanding the crudeness of the device, it could be made to run and, with a good deal of exertion and perspiration, I was actually able to accomplish some creditable wood turning upon it.

Like many another farmer's boy I had the *Youth's Companion* and in the premium lists of that publication

there would appear from time to time pictures and descriptions of turning lathes which put my poor effort to shame. Long I studied over these pictures and, fired with the ambition to produce something that would at least be better than the one I had, I again tackled the maple plank and sawed out some strips from which to make the front and back ways of my new lathe. I likewise prepared sundry blocks and pieces from which to build up the bed.

The axle of a scrapped mowing machine, together with the large gear already upon it, made a fair spindle and fly-wheel that could be driven from my grindstone power plant and for the rest of the machine I was obliged to resort to my rapidly accumulating stock of parts from discarded farm implements. With this lathe I made some patterns and had them cast in the foundry of the shop in the adjoining town so that I was able to build a jig saw that was the envy of all the boys around.

My First Acquaintance With Twist Drills

I could devote only odd moments of leisure to my shop. I was a long time in reaching this stage and, in the meantime, I had graduated from the *Youth's Companion* to the *Scientific American*. In this periodical, I had seen the advertisements of the Morse Twist Drill & Machine Co., and had painstakingly studied over them until I had acquired a considerable technical knowledge of drill gage sizes, machine screws and threads.

Though pennies were to me more scarce than are dollars to many of the boys of now-a-days I carefully saved up enough money to send for a ¼ in. twist drill, which I received with great joy. It was a most wonderful tool and attracted a great deal of attention as it was probably the only one of its kind in a radius of 20 miles from my home. The only kind of drill that had hitherto been known thereabouts was the flat drill, forged by the country blacksmiths to somewhere near the desired size.

With the product of my jig-saw I traded with neighboring farmers for broken down mowing machines, hay cutters, sewing machines, etc., in fact anything that had gears and wheels in it, until I had collected quite a treasure of what had once been machinery. The cash value of this junk was probably not worth considering but to me it represented vast wealth, as from it I could now build other machines and thus acquire experience and understanding of my chosen trade.

I Build a Steam Engine

Among the advertisements to be found in the *Scientific American* was one by Goodnow & Wightman of Boston, who would, for a consideration, undertake to supply amateur mechanics with a set of castings and other material from which to build a model steam engine. Seized with an intense desire to be the constructor of a steam engine that would really go, but too poor financially to purchase the bill of material, I eagerly studied these advertisements, pored over the pictures, digested all the reading matter that pertained to them, and decided to build an engine from my own junk pile.

With much labor and painstaking care, I proceeded to make the patterns for a slide valve engine of 1⅜ in. bore by 2 in. stroke, including a fly-wheel with straight arms, for I did not like the looks of the crooked ones that were then thought necessary to avoid breakage in shrinkage. The molder, to whom I entrusted this pattern for casting, assured me that it would break but, much to his surprise and my gratification, it did not.

I knew nothing of cores as used in a mold and my cylinder was, therefore, cast solid. How to bore a 1⅜ in. hole through this chunk of cast iron puzzled me not a little, but, by collaboration with the village blacksmith, we evolved a flat drill which he said was made of "sleigh shoe" steel (I guess it was, it wouldn't hold an edge) and with it I prepared to bore out that cylinder in my own lathe.

What Is a Mechanic?

By Charles W. Lee

Many people think of a mechanic as some sort of a low person who does something with his hands, even including digging the tradional post holes, made famous and immortal by good old "Chordal"; and of an engineer as some other sort of a low person who starts and stops a steam engine. From this point of view a mechanical engineer must be two low persons rolled into one, and therefore twice as disreputable as either alone.

This objectionable state of mind is well illustrated by the remark made by a beautiful lady at Old Point Comfort during a meeting there of the American Society of Mechanical Engineers. In answer to her inquiry she was told that the party was "The Mechanical Engineers."

"Mechanical Engineers! But they are quite respectable looking!"

Therefore the following definitions are proposed:

Mechanic: one who understands mechanical art.

Mechanical Engineer: one who solves mechanical problems.

It is true that the popular definition of "mechanic" has dictionary authority, but so have some other words which have more than one meaning, and even exactly opposite meanings, which makes confusion. Yet some other words have outgrown the dictionary, and why should not this one?

There should be a distinction between one who merely manipulates something with his hands, and another who knows what his hands are doing and why they are doing it. Manual dexterity should not be confused with mechanical knowledge any more than mechanical knowledge with scientific knowledge. There is nothing at all in this that is intended to belittle manual dexterity.

Science, which dreams and discovers; mechanical art, which applies science; and manual dexterity which finally makes it possible for the dreams of science to be realized, are all factors, and therefore equally necessary to the perfect whole—and accordingly equally honorable.

Friendly Competition

By A. W. Brown

While in some activities of life, competition is too sharp, a certain amount is good not merely for the community (which may be the shop, the nation, or the world) but for the competitors. Many a man has "found himself" only as the result of friendly competition with the man at his elbow, or in the shop across the street, or on the other side of the ocean. He discovers in himself and in things new sources of power and new methods of utilizing the old ones, and emerges from each contest more able and ready for the next.

Resistance Welding

The First Article—Methods of Welding—When a Flux Is Necessary—Current Required for Electric Welding—Principles of Electric Welding Apparatus

By A. L. De Leeuw
Consulting Editor, *American Machinist*

Modern methods of welding have often been called the long-waited-for "putting-on" tool. This is particularly true of arc welding, autogenous welding and the Goldschmidt thermit process. In all of these processes metal is added to an existing piece, either to fill up a crack, to enlarge the piece at some point where the forging or casting made it too small or to form a bridge of metal joining two pieces. None of them is true welding. Resistance welding, on the other hand, does exactly what is accomplished by the blacksmith when he welds one piece to another. In books, 30 to 40 years old, one may find the statement that one of the qualities of iron is that it is not weldable. Brass or bronze or pure copper were not considered weldable.

What was meant by "weldable" was that certain materials could be brought, by heating, to a state of plasticity which made it possible to join them by pressure in much the same way that we can make two softened pieces of beeswax adhere to each other. No reasonable amount of pressure will join these pieces of wax when they are at the temperature of ice but as we gradually warm them they become softer until finally it is possible to unite them by slight pressure. They have become one in all respects. If we should try to separate them we would merely succeed in pulling the piece of wax apart and the probability would be that the break would not be where the joint was.

Conditions of Welding

Any two materials which can be brought to this plastic state can be welded. The reason why wrought iron was weldable was that it could be brought to this plastic state. As a matter of fact, practically all metals can be brought to such a plastic state and if we wish to understand the possibilities and also the difficulties of resistance welding, we should first look into the question as to why one material can be welded so much more easily than another when both can be brought to the plastic state required for the operation.

In Fig. 1, a diagram is shown in which the temperatures are laid out on the horizontal scale. Going from left to right the temperature increases. Three stages are shown, one representing the solid state of the material, the second its fluid state and the third the point at which it evaporates or boils. Fig. 1 is entirely imaginary. We see that from 0 to 500 the material is in the solid state, at 500 it suddenly changes over to the liquid state, at 800 it suddenly changes to gas. Such sudden changes do not occur in reality.

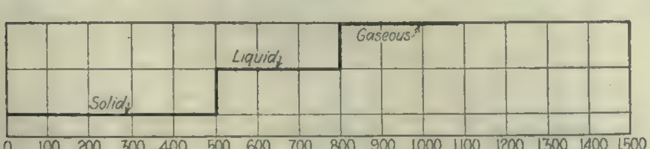


FIG. 1—DIAGRAM ILLUSTRATING RELATIONS OF TEMPERATURE AND CONDITION OF A METAL

Fig. 2 gives the diagram of the changes which take place in reality, though the figures are again imaginary. From 0 to 500 the metal remains in the solid state. From 500 to 1,000 it gradually changes, becomes less and less hard or, if we may say so, less solid until at 1,000 deg. it is completely liquid. It remains liquid from 1,000 to 1,300 when it begins to evaporate.

The range between 500 and 1,000 is the range of temperature with which we are mostly concerned when doing resistance welding. It is the range within which the material is in the plastic state. It is very little plastic at 500, almost liquid near 1,000, and there are various degrees of plasticity between these two points. If we should have a material which is really in the plastic state between such wide limits as our diagram represents, that is between 500 and 1,000 deg., it would be very simple to weld two pieces together because even the crudest way of heating the piece would give us a sufficient time limit between the moments when it is entirely solid and when it is entirely liquid.

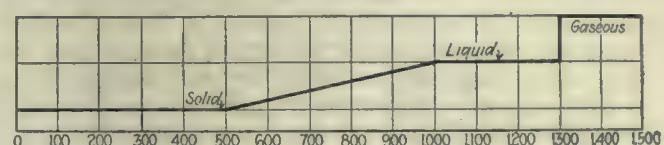


FIG. 2—DIAGRAM ILLUSTRATING THE GRADUAL CHANGING FROM SOLID TO LIQUID WITH RISING TEMPERATURE

If, on the other hand, we should have a material which is entirely solid at 500 deg. and entirely liquid at 510 deg. it would be extremely difficult to weld two pieces together because we would have to catch the exact temperature between very narrow limits and thus work so exceedingly rapidly that the material would have no time to cool before the welding became complete. This is the reason why wrought iron and steel can easily be welded and why it is so difficult to weld copper, brass and various other materials.

The Old Method

When the blacksmith wanted to weld two pieces of wrought iron or steel together he would heat them to a point where the sparks began to fly, which was, to him, an indication that the metal was soft enough and far enough advanced in the plastic state, to permit the two pieces being joined by relatively light pressure, such pressure as could be given by hitting it with a hammer. Before actually applying this pressure he would put a flux on one of the pieces for the purpose of removing any oxide or other foreign material. He knew it was necessary that the pure, clean metallic surfaces should come in contact with each other. The flux was some material which, combining with these impurities, would become a liquid which could easily be squeezed out from between the two pieces to be welded.

The operations in resistance welding are very much the same as those of the blacksmith. In order to stay

as close as possible to the old process of the blacksmith, we will confine ourselves for the present to a form of resistance welding which is called "slow butt welding." In this process two pieces of metal are joined end to end. We will see later that there are also other methods of resistance welding. In the slow butt welding process the two pieces to be joined are heated until the plastic state is reached and then pressure is applied, joining them together. There is no flux used and the question of removing the oxides and other impurities must be solved some other way. The manner in which this is done is to melt off part of the material so that all the impurities will be removed with this molten metal and then to squeeze the two pieces together before the air can reach the new surfaces.

Resistance Welding

There are then, two things which we must accomplish if we wish to weld successfully. One is to bring the material to the proper heat and the other is to apply the pressure. The manner in which we obtain the proper heat for welding is by sending a current of electricity through the pieces. We are all familiar with the fact that a body is heated up by the passage of an electric current. Incandescent lights are based on this principle. The amount of heat developed is in direct proportion to the amount of power we send through the circuit. If for instance, we have a dynamo developing 100 kw., all of which is consumed by a system of wiring and a number of incandescent lamps, we know that there is enough heat developed in this system to absorb all of this 100 kw. Part of this amount may be used in the lamps themselves and another part in heating the wiring. If we have a great length of circuit, we can use only relatively few lamps because much of the power is consumed in the wiring itself. If, on the other hand, the circuit is short, we can have more lamps.

The amount of current which flows through a circuit depends on two items, the voltage supplied by the generator, battery or transformer and the resistance of the circuit. If we have a generator or battery or transformer which supplies current at 110 volts and which is so regulated that it will always deliver this voltage regardless of other conditions, then the amount of current will depend directly on the resistance. If, for instance, we had a 1,000-kw. generator furnishing current at 110 volts and if we had a short line with only two 50-watt lamps in it, the amount of current delivered by this generator would be only 100 watts or $\frac{1}{10}$ kw. notwithstanding the fact that it could deliver 1,000 kw.

Amount of Current

In most applications of electricity, with which we are familiar, voltages and resistances are rather high and the amount of current rather low. In resistance welding the opposite is the case. Here the resistance is very low and so is the voltage, while the amount of current is very high.

Various pieces of work may require various amounts of current but their resistance may be such that they would receive an entirely different amount from what they need if the voltage were always the same. In order then, to be able to furnish as much current as is required and no more nor less it is necessary to have a variable voltage. The simplest way of obtaining such variable voltage is by the use of a transformer with an alternating current circuit. Without going into reasons why a transformer is able to do so, we may say here that this piece of apparatus can give any voltage required when the current which leads into it has one fixed voltage. For instance, we can lead a 440-volt current into a transformer and take from it a current at 220, 110, 55, or even 1 volt. Moreover, we might have gone the other way and taken the current from the machine at 880 or 2,200 volts.

The general construction of such a transformer is two sets of copper windings around one and the same iron core. The current coming from the generator is led in around the iron core and out again back to the generator and is known as the primary current. The secondary current is that current which we take from the apparatus. The winding for the secondary current has more or less turns around the core than that for the primary one, according to whether we wish to step the voltage up or down. If the primary winding has 10 turns around the core and the secondary winding has 100 turns, then the secondary voltage will be ten times as great as the primary. If, on the other hand, the primary winding has more turns than the secondary, we will have a reduced voltage. Suppose we should have 10 windings on the secondary current and suppose that this will give us 10 volts. Then, if we should tap our wiring not at the end of the 10th winding but the end of the 9th we would get only 9 volts and if we should tap it at the end of the 2nd winding we would get only 2 volts. This shows how it is possible to get any voltage from an alternating current circuit.

Making the Contact

The resistance welding machine consists of a transformer with means to tap the secondary circuit at various points and so obtain varying voltages. As the amount of current will be very great the secondary winding must be made of heavy copper wire or bars. As the voltage of this secondary winding is very low all the joints of the wiring must be made perfect so as not to have a loss of voltage by imperfect contact.

The work to be heated is held between two copper electrodes. As these electrodes must be shaped to suit conditions and shape of the work, they are generally called dies. There are then, two pairs of dies, each pair gripping one of the pieces to be welded together.

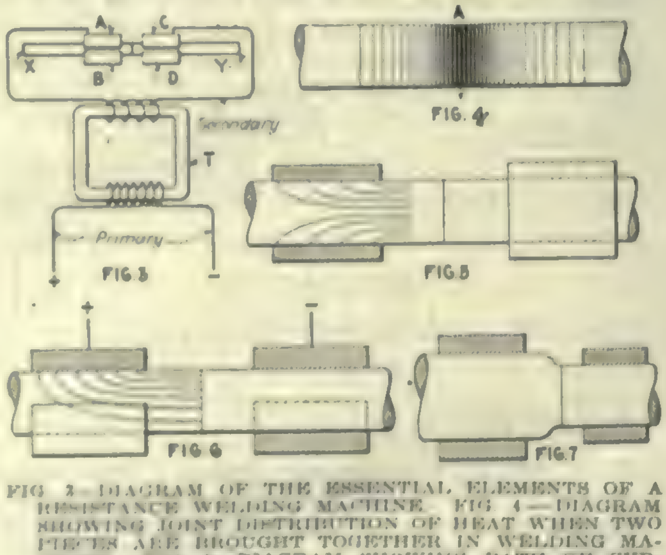


FIG. 3—DIAGRAM OF THE ESSENTIAL ELEMENTS OF A RESISTANCE WELDING MACHINE. FIG. 4—DIAGRAM SHOWING JOINT DISTRIBUTION OF HEAT WHEN TWO PIECES ARE BROUGHT TOGETHER IN WELDING MACHINE. FIG. 5—DIAGRAM SHOWING PATH OF CURRENT WHEN PIECES ARE SURROUNDED BY DIES. FIG. 6—DIAGRAM SHOWING UNEQUAL RESISTANCE WITH ONE FLAT AND ONE CURVED DIE. FIG. 7—TWO PIECES OF UNEQUAL DIAMETERS HELD IN WELDING MACHINE.

One pair of dies is stationary, the other can be moved by means of a lever or some other mechanism. In the case of very heavy welding, hydraulic cylinders are used to supply the required pressure.

When a piece of work is gripped in each of the two pairs of dies and the switch is thrown in so as to permit the current to flow through, nothing will happen until the two pieces of work are brought together because the circuit is not closed. As soon as the two pieces of work touch, this circuit is complete and the current will flow through, heating the pieces. It might be asked whether the entire apparatus is not going to be heated and where the greatest heat will be developed.

Elements of Machine

In Fig. 3 the elements of a resistance welding machine are shown in diagrammatic form. T is the transformer core with its primary and secondary windings; A and B is one set of dies; C and D the other set; the two pieces to be welded are marked X and Y. They are shown here to be in contact with each other so that the current will flow from the transformer through A, through X, then through Y and C and back to the transformer. In reality the windings are not wires as shown in the diagram but heavy cables, or, where this wiring is attached to the movable parts of the machine it may be a set of copper leaves which will permit their movement. In either case the resistance of the wiring is very small. In fact, the total resistance of the circuit is small so that the amount of current which will flow through it is very great, notwithstanding that the voltage used is low.

When the current flows through this system, the two pieces X and Y will be heated at the joint and the question naturally arises why this should be so. To the man who is not daily considering electrical problems it may be confusing to hear one moment that the amount of current is very great because the resistance is low and the next moment that the greatest amount of heat is developed at the joint because that is where the resistance is greatest. The matter is very simple, however, if one gives it a minute's thought. The amount of current flowing through the entire system is great because the resistance of this entire system is small. If the voltage is indicated by V, the resistance by R and the current by C, the relation $C = \frac{V}{R}$ exists. If once the voltage is fixed, the amount of current will depend directly on the amount of resistance so that with the two pieces in place a certain amount of current will flow through the system, depending on the total amount of resistance of the wiring, the dies and the pieces to be welded.

Theory of Heating

If, in any circuit, there is a certain amount of current flowing, then this current will heat up all parts of the system but not, necessarily, equally. We know that the amount of power consumed anywhere in the system equals the product of the voltage and the amount of current. Power $= CV$, and as $V = CR$, we find that the amount of power consumed in any part of the system is C^2R. Now the amount of current, that is C, is fixed by the total resistance of the system and we see that the greatest amount of power is consumed and therefore the greatest amount of heat is developed at that part of the system where R is the greatest. Come to consider it, we really were familiar with this fact. The reason why the filament of the incandescent lamp is heated, whereas the insulated wire leading up to it remains cool, is simply that the resistance of this filament is many times that of the copper wire.

Knowing these elementary facts, we can now readily understand why the heating will start at the joint of the two pieces X and Y. This joint is imperfect. Even though we may press Y against X the contact between the two pieces can never give the same conductivity as that of a solid piece of material. It is at this joint then that the heating of the system starts. The heating continues and spreads backward, somewhat as illustrated in the diagram, Fig. 4, with the joint of two pieces as shown at A and with the amount of heat developed as represented by heavier and lighter lines. It will be noticed that the pieces are gripped in copper dies. These dies have a broad contact with the pieces, have a large exposed area and, as a rule, are water cooled so that the heat of the pieces is rapidly carried off by them.

Figure 4 shows the two pieces bearing squarely against each other so that the resistance is the same at any point of the cross-section. As a consequence, the same amount of heat will be developed at all points of the joint. If the pieces were not square or if their axes were making an angle with each other there would be a pointed contact, or at least, a contact over very limited surfaces. The resistance would be maximum at that point and the heating would start there. Unless we do something to counteract this effect, the metal at that point will melt. Such conditions must be avoided.

Ideal Welding Conditions

With heating, such as shown in Fig. 4, we have ideal conditions for the making of a perfect weld. The metal at the joint will gradually become hot enough to melt. Immediately behind this zone there will be a layer of metal close to the melting point, but still solid. Further back there is metal which is perhaps not plastic enough to be suitable for welding but soft enough to be easily compressed. Still further back the metal may be hot but hard enough so that it cannot be deformed by the pressure brought to bear when we make the weld.

The relative thickness of these layers is affected by quite a variety of things. For instance, if the dies have a broad grip on the piece and are water cooled, the heat will be carried off so rapidly that only a very short piece of the metal is heated. Even at that, the heating depends on the amount of projection of the piece beyond the die. If a long piece should be projecting, the heat would have to traverse this long piece before it would reach the die so that there would be a large amount of metal in the molten or plastic state. This would be still further aggravated if the projecting piece were of small diameter because the resistance would increase and therefore the amount of heat developed and the rapidity with which the heat can be carried off would be reduced because the cross-section along which the heat would have to flow is very small.

The manner is which the piece is gripped by the dies is also a factor determining in what manner the piece will be heated. In Fig. 5, the pieces are shown as held in solid copper bushings which, by the way, is not the way we would do it in practice. There is here a perfect, even grip all around the piece and as a result the current flows in a perfectly even manner from the dies through the cross-section of the piece toward the joint. In Fig. 6, another extreme is shown. In this case there

is a flat top die, making a line contact with the piece, while the bottom die reaches about half way around the piece. Here the current, which enters the top die only, must flow along a path of varying length to reach the various different points of the joint. As the lengths of these various paths are unequal there is an unequal resistance to overcome so that, in this case, we would find that the pieces are heated more at the top than at the bottom, notwithstanding that they bear squarely against each other.

There is still another item to be considered. The resistance of the material changes as it is being heated. It becomes greater. If the pieces are heated at one point, due to some defect in the bearing or distribution of the current, the resistance at that point will be increased. Consequently, the heating effect at that point will be still further increased.

If pieces of uneven diameter should be pressed against each other, see Fig. 7, the following will occur: The heat developed at the joint has, of course, a tendency to warm up both sides of metal but this heat will be carried away on the left side by a much larger section and larger dies, both pieces of steel and die having a larger radiating surface. As a result the metal will all melt away on the right side, whereas that on the left side will remain relatively cool.

Resistance Altered by Heat

Assembling the various points discussed so far, we see that the heat developed depends, in the first place, on the voltage; in the second place, on the resistance of the entire circuit; in the third place, on the nature of the contact between dies and pieces; in the fourth place, on the way in which the dies are cooled; in the fifth place, on the manner in which the two pieces make contact with each other; in the sixth place, on the amount of projection beyond the die, and finally, on the cross-sections.

It would seem as if, with so many variable elements, it would be extremely difficult to get conditions right for the making of a weld but this is not at all the case. Due to the fact that there is such a wide temperature range within which welding can be made, the fact that there are so many elements helps us in many cases for if conditions are unfavorable in one respect there are several elements within our control which we can modify so as to make conditions right in some other respect.

We will now see how the foregoing can be applied to the making of welds. A great many names are given to various combinations of pieces to be welded and to the various processes to effect such welds. The main processes are these:

Slow butt welding (sometimes called "up-set" welding).
Flash butt welding.
Spot welding.
Seam welding.

Feed Pressure of a Twist Drill

By R. Poliakoff

In the Sept. 28 issue of the *American Machinist*, p. 480, A. L. De Leeuw, in his article on "Methods of Machine Tool Design," while speaking about feed pressures says, "In a drill press the feed pressure depends on two items, both of which are rather undetermined at the present time. Using a twist drill, we find two elements requiring feed pressure. One is the penetration of the lip into the material, the other the penetration of the bridge or web between the lips. This latter item is entirely undetermined and may be very great. The first item resembles to a certain extent the pressure required to feed a lathe tool into the work."

Extensive experiments have been made in 1907 by the writer and Mr. Dempster Smith of the Manchester School of Technology in Manchester, England, for the very purpose of determining the feed pressures of a *high speed* twist drill when working on different metals under different conditions and also the two items of same—one due to the lips and the other due to the web. These experiments were made the subject of an extensive paper read before the Institution of Mechanical Engineers in March, 1909 and, while it would be out of place to go into the details of these tests and all the results of the same, those interested may consult the "Proceedings of the Institution of Mechanical Engineers," London, 1909, pp. 315-415.

I may mention here that those tests have shown that the web is accountable for about 20 per cent of the total end or feed thrust. To be more specific, it was found that in case of soft cast iron, the pressure P can be expressed by the equation

$$P = 35{,}500\, d^{0.7}\, t^{0.75}$$

If we eliminate the effect of the web, the pressure would be

$$P = 12{,}600\, d^{0.7}\, t^{0.6}$$

or about 25 per cent less. This difference increases with the feed, (d is the diameter of the drill and t the feed).

In case of medium steel, respective equations are

$$P = 35{,}500\, d^{0.7}\, t^{0.6}$$
$$P = 27{,}000\, d^{0.73}\, t^{0.6}$$

In this case, the thrust due to the web is about 21 per cent of the whole drill.

Unnecessary Interruptions

By Frank V. Faulhaber

"This is what I call a machine shop of half-way jobs," is the way an employee recently explained it, after he had been taken away from one job, uncompleted, to start another. "There are so many things to do here that you don't often have the time to finish a given job from beginning to end."

Where this practice is existent the men in charge do not realize how much valuable time is being wasted in the process. For one thing, there is always the time in between two different jobs, however little, that is lost. And we have noticed in certain machine shops where it is customary to take a man from one job and start him to work completing another, that much unnecessary additional work is involved, since the second man must find out what the first one had been doing, entailing the asking of questions and other details, which would not have been necessary had the first man finished his task.

In this connection, one executive recently gave the advice: "Never take a man away from a job unfinished, if you can possibly avoid it, and do not interrupt him during a job. If you have something to tell him, wait until the job is done, otherwise you are taking his mind away from his work."

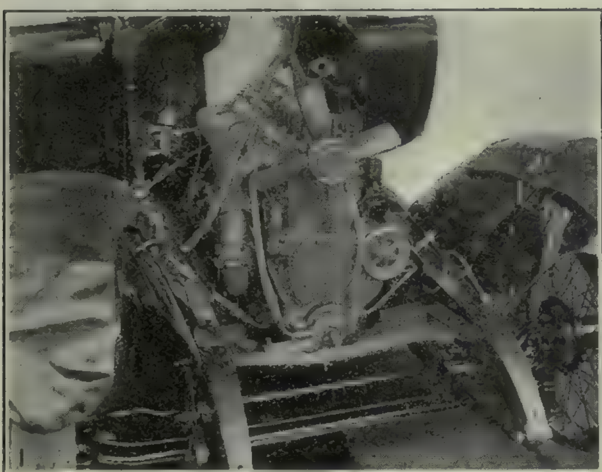
This is true talk. The man who is interested in his job resents interruptions while he is busy, even from the boss himself.

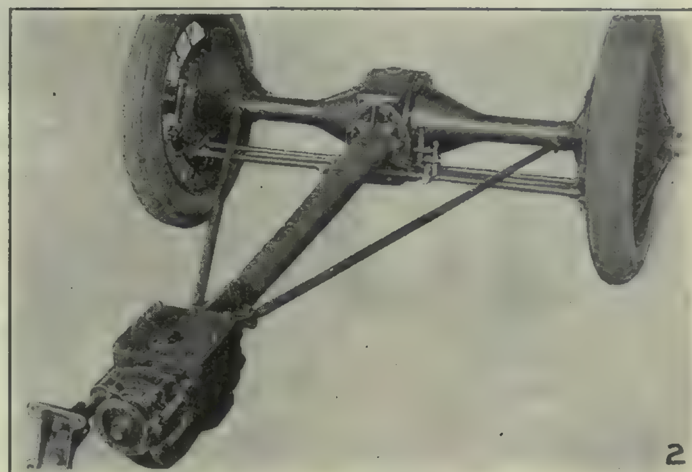
Disassembling the Marmon for Repair Work

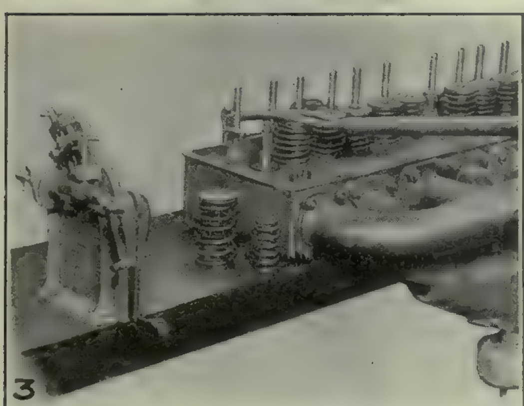
Twelve Steps in Handling Cars in the Service Station—Caring for the Motor, Transmission and Rear End Units

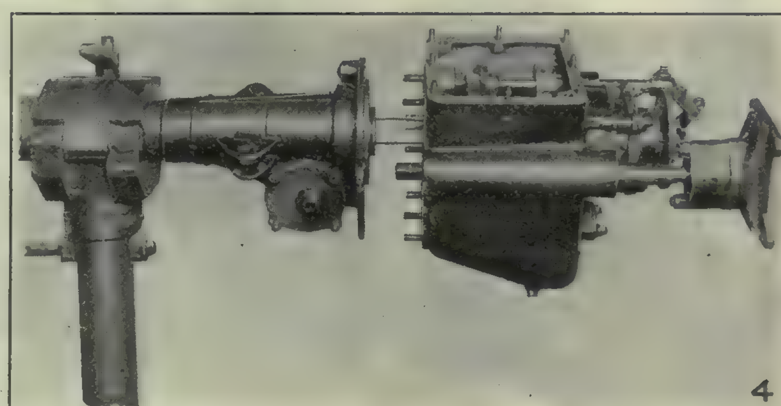
By FRED H. COLVIN
Editor, *American Machinist*

ECONOMICAL repairs are being considered more and more by buyers of automobiles and, as the cost of overhauling depends somewhat on the time required for dis-assembling, the following suggestions may be of service to all service station men, although they apply especially to the Marmon cars. First of all, it would seem natural to protect fenders, as in Fig. 1, but too few take the trouble. The main object of this view, however, is to show how to handle the engine quickly and safely. Valve facing is shown in Fig. 3 while









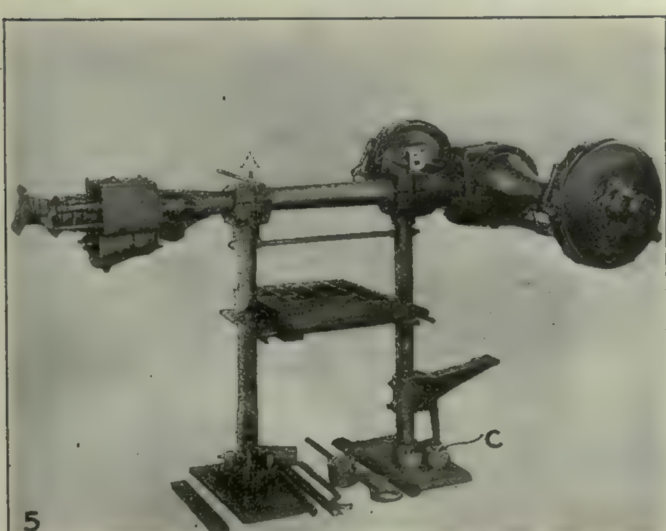
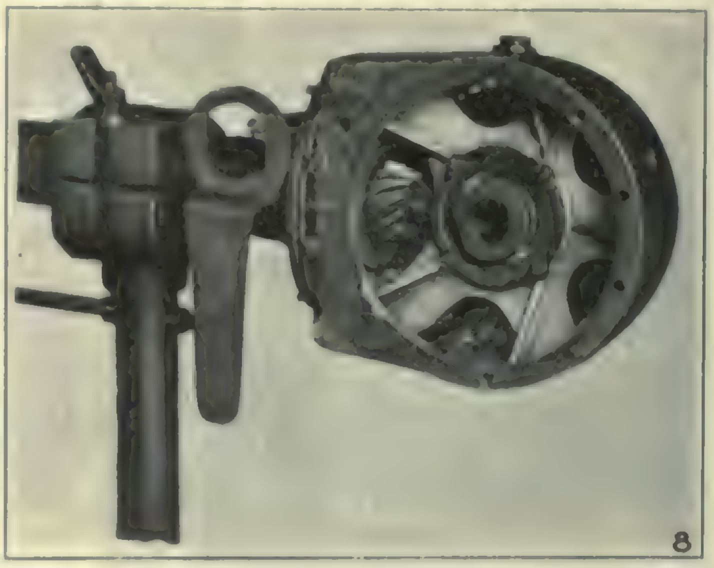


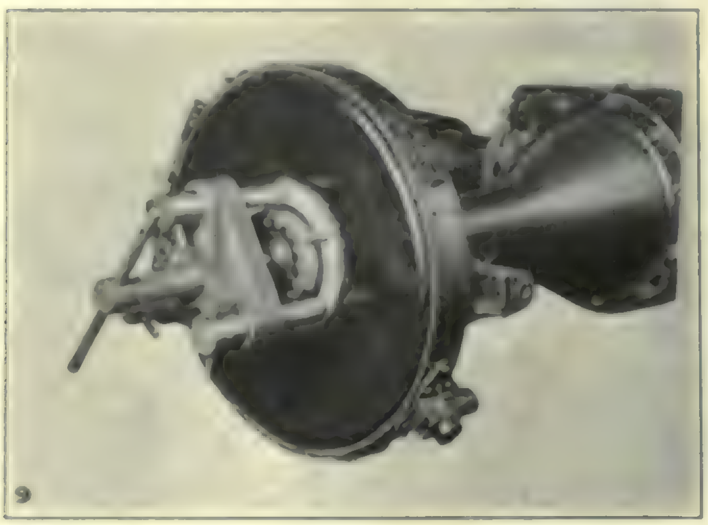
FIG. 1—METHOD OF SLINGING MOTOR FOR HOISTING. FIG. 2—REAR END UNIT REMOVED FROM CAR. FIG. 3—TAKING OUT VALVES AND TRUING THE SEATS. FIG. 4—PULLING OUT THE TRANSMISSION CASE. FIG. 5—WORKSTAND FOR REAR END; CLAMPS AT A, B AND C. FIG. 6—AXLE SWUNG UP ONTO SUPPORT

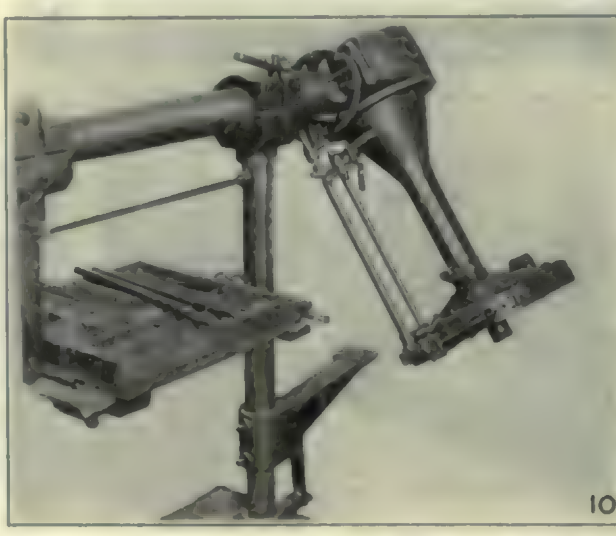
Figs. 2, 4, 5 and 6 show the stand used for handling the rear axle assembly with the work in different positions.

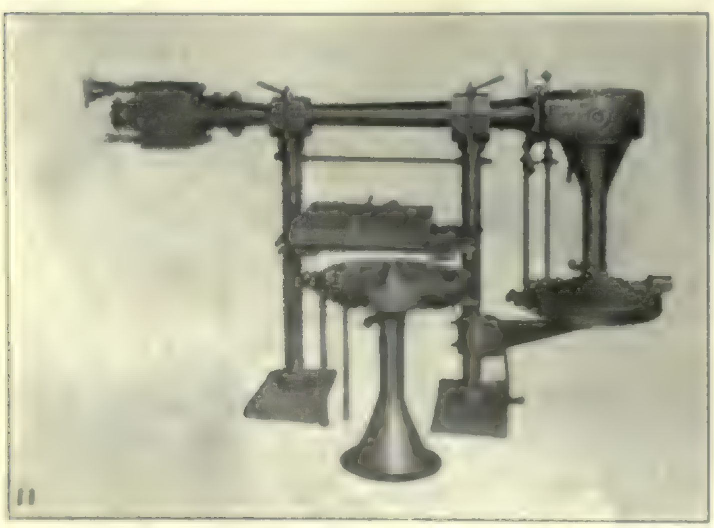
The driving pinion and the puller for removing it are shown in Fig. 7 while Fig. 8 shows the differential case in place. Another puller, having three legs in this case, is shown in Fig. 9. These legs screw on the ends of the studs and act on the ball bearing shown.

Figures 10 and 11 show a convenient form of stand for transmission work, the step acting as a support for the brake drum. Tools and small parts are kept in the tray on the stand within easy reach. More details are shown in Fig. 12, where the housing has been removed, exposing the inner roller bearing. All these and similar devices help reduce the cost of overhauling a car and keeping it in good shape during its life.









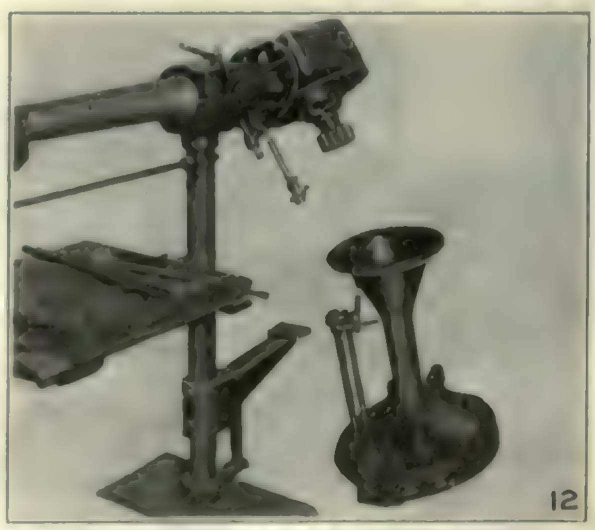


FIG. 7—READY TO PULL THE DRIVING PINION. FIG. 8—DIFFERENTIAL UNIT WITH AXLE HOUSINGS REMOVED. FIG. 9—PULLING THE REAR-AXLE BALL BEARINGS. FIG. 10—REAR AXLE PARTLY DISASSEMBLED. FIG. 11—SHOWING CONVENIENCE OF WORK STAND. FIG. 12—AXLE HOUSING REMOVED SHOWING INNER BEARING

Industrial Cost Accounting for Executives

Introductory Chapter Outlines Whole Problem to Be Treated in Series—Subject Matter Based on Experience in Many Plants—Purpose of Series

By Paul M. Atkins

> THE FIELD of cost accounting has long been an industrial battle ground. The professional cost accountant, with little knowledge of actual production methods, has advanced one point of view, the engineer another, and the factory cost accountant still another.
>
> Between these various fires the bewildered manager has had to conduct the business, pulled this way by one partisan, that way by another. Unfortunately his knowledge of the subject is usually insufficient to enable him to judge accurately the value of the various claims and theories presented to him. Most books on cost accounting are too technical for him and presuppose an acquaintance with accounting methods which he may not have.
>
> With the executive's predicament in mind, this series by an expert on cost accounting is presented with confidence that it will fill a long-felt want.

WHEN a busy factory executive finds himself confronted with a series of articles on a subject like cost-accounting, he is properly desirous of knowing what he may expect from spending his time reading them. It has also been proved frequently that it is much easier to solve a problem when one has had a general view of it than when one begins at once with some detail and endeavors to work out its solution. For these reasons, I feel that it would be most helpful to the reader to give him a brief survey of what is to follow in the succeeding articles of this series. In this way he can see if they seem to hold for him what will be of value to him. If he decides in the affirmative he can get an idea of their organization and be prepared to fit into their proper places the various details as they are developed.

In the first place, these articles have been written with the idea that cost-accounting is essentially a part of the factory records and is a means of representing, in terms of dollars and cents, what goes on in the factory. No one, not familiar with the work of the factory, is properly equipped to install or operate a cost-accounting system. At the same time, no one is properly trained for this task unless he also knows something about general accounting methods. The cost accounts must tie in with the financial accounts, while the controlling cost accounts are usually kept in the general ledger. Hence, if the cost accountant is not trained in the fundamentals of accounting, he finds himself almost hopelessly handicapped for his task.

This explains the reason why so many cost accountants fail. They lack experience in one or the other of the two phases of their work. It also explains why so often we find professional accountants and practical shop men and engineers at logger-heads over the cost records and the way they shall be kept. Both sides are right in feeling that the cost accountant should know something about their approach to the problem and both are wrong in thinking that their side is the only one or the most important one. Cost-accounting is really a bridge between the factory and the general accounts and it needs to be firmly anchored at both ends. The effort is made in these articles to keep both points of view in mind and show their relationship to each other.

With this brief sketch of the approach which these articles make to the subject of cost-accounting, let us now turn to a consideration of their contents. It is planned to have thirty of them altogether and they fall quite naturally into seven groups. After outlining the several groups, we will briefly glance at the topics to be treated in the individual articles.

In the first of these groups some preliminary topics are discussed. Some of them, like the organization of the company, may seem at first glance rather out of place, but later on it will be evident to every careful reader why it was brought in. The second group deals with the question of material, and explains the control of material in all the various effects which it has on the cost records. The next section does the same for labor.

The fourth group takes up the problem of expenses. Often there are difficulties of a practical nature in handling expenses but the troubles of a theoretical sort have usually been magnified. The effort is made in these chapters to present the subject in such a way that the fundamentals of expense records may be easily grasped.

The fifth section leads us to a consideration of burden, as to what it is and how it should be applied to the product. It will be seen that all expenses are not a part of the manufacturing burden and that all of that burden is not always properly chargeable to the product. Several methods of burden application will be explained, in particular one which is especially applicable to metal-working industries.

In the sixth division, the method of finding the cost of the product is taken up. In addition, some pertinent suggestions for the operation of the cost department are offered. In the last group the interlocking of the cost-accounting with both production and the general accounts is explained in the light of what has been said in previous articles. Certain cost records, which do not form an integral part of the cost accounts but which are of great use to the management, are developed.

In all these chapters, sound theory is not sacrificed to expediency and, at the same time, impossible and useless methods are not presented. The articles will be illustrated by methods which I have personally tested out in actual practice, and, while that does not mean that they would be satisfactory for all occasions, it does mean that they have all survived the test of actual application. Sound practice can only be based on sound theory and sound theory can only be developed by the study of actual experience and careful analysis of the results.

The foregoing gives a brief synopsis of the following articles but for those who would like a little more detailed information the remainder of this article will be taken up with a hurried survey of the individual chapters. Such a survey will serve to amplify the outline which has already been given and will make clearer the reason why certain topics have been included.

In the article which follows this one and is entitled, "Executive Uses for Cost Records," an outline is given of the possible uses of cost records, particularly to the executive. It is an article which is prepared on the same lines as this one in that I try to point out some of the ways in which cost records may be utilized to benefit the management and so indicate why it is worth while reading about cost systems at all.

In the good old days, the man was considered a good salesman who could slip something over on his customers and get away with it. He was thought of as a sharp, shrewd trader and a good business man. Now we are coming to realize that sharp practice is not worth while, but that it is better business to give our customers their money's worth. I am trying to follow out this latter idea in what follows and explain to my readers in these first two articles just what they may expect these articles to contain and what they may hope to find in the way of benefits to be obtained from a cost system. Of course, all I can attempt to give here are some samples, or better, a description of my goods, but I hope that from this the reader can decide whether or not he wants more, and, if what I have to offer in these articles is what he wants or needs, I am quite hopeful that he will not be disappointed.

A Survey of Cost Elements, Records and Relationships

In the third article, I shall try to make plain the various elements of manufacturing cost. On the face of it, it may appear simple. Material, labor and burden are commonly accepted as these elements. The difficulty comes when one tries to define these elements in a useable and practical fashion. It is necessary to obtain such definition before undertaking any discussion of industrial cost-accounting. In the fourth article comes a summary of the cost accounts and journals by means of which the cost records are kept. The details of this summary are included in later articles.

The next two articles are likely to seem quite misplaced for they deal with the functions of a business and their organization. Yet fundamentally expenses are nothing more nor less than the costs of carrying on the various departments of the business, and hence it is quite impossible to understand either the recording or distribution of expenses unless the significance of the various departments and their interrelationship to form an organization is realized. The second of these articles takes up the question of an organization manual.

In the following article, a topic is taken up which is seldom touched on by writers on cost-accounting in any adequate fashion. This topic is the service of the production control system to the cost-accounting system. Yet a good system of production control is almost always a prerequisite to satisfactory cost records. By far the larger part of the mass of details which the cost department must handle comes from the planning department, and the aid which a good planning department can give to satisfactory cost-accounting is incalculable.

The next three articles deal with the records for material. Since the cost records for material come from the production system, it is necessary in one of these articles to trace the control of material till it enters the cost system. Another article is devoted to the problem of the accurate pricing of material withdrawn from the store-room. This seems like a very simple little problem and yet it is one of the places where some of the most serious errors in the cost records are made. Three methods are explained for dealing with the problem. The last article takes up the question of maintaining correct inventory balances and explains a simple but practical method for accomplishing it.

Only one article is given to a discussion of the payroll and the details which are needed to make it up. There are two points somewhat out of the ordinary in this article which it may be appropriate to mention. One is the emphasis laid on the cost of wages calculation as a factor in selecting a method of wage payment. The other is the use of a labor journal to meet the needs of a factory where there is an extensive and constant shifting of workers from one task to another.

Expenses

The next article will deal with the question of expense classification and also will take up the scheduling of budgeting of expenses. It serves as an introduction to several articles on expenses. The following one will give an outline of a typical symbolized expense classification. It is the result of much experience and should serve as a guide for anyone who is faced with the problem of preparing a similar classification. The next article is devoted to a discussion of depreciation and other fixed charges, charges which are a vital matter to the manager for they continue to run along whether business is dull or brisk and cannot be stopped by shutting down the factory.

There will then follow two articles dealing with current expenses, one given up to a discussion of manufacturing expenses both direct and auxiliary and the second to administration and selling expenses. After them will come an article in which a satisfactory method for the recording of all these various expenses will be explained. It will be found that a good many expense accounts will be suggested as desirable in order to permit the necessary analyses of expenses and if such accounts are set up in the ordinary fashion, they will be much too cumbersome.

Interest and Cost

The eighteenth article will be devoted to a summary of the pros and cons in regard to the desirability of including interest as an element of cost. I shall try to make clear that this question is not so serious as it is often supposed to be and to indicate a reasonable attitude to take toward the whole problem.

The succeeding article will take up the question of the distribution of expenses so as to obtain the departmental burden. This is a topic which presents serious difficulties and is usually side-stepped by most writers on cost accounting by saying that it should be done on some *appropriate* basis and then they forget, with hardly an exception, to state what the appropriate basis is. Two practical methods will be presented. They are not ideal; they are not entirely satisfactory; but they will work, for they have worked.

We have now reached the articles dealing with bur-

den. The first will be given up to a discussion of what burden is, the difference between earned and unearned burden and how the unearned burden may be disposed of. The next two will take up several different methods of allocating the earned burden to the product. The machine rate method which is of especial interest to metal-working industries will be developed with particular care.

The Operation of the Cost Department

In the article on the recording of costs which now follows, not only will methods for recording the cost of the product be discussed, but also the improvements which the company may make for itself from time to time. All too frequently, this rather significant detail is overlooked and it is of particular importance to those industries which are using and often making large quantities of tools.

The twenty-fourth article will discuss certain aids to efficient and rapid cost recording, including not only machines of several kinds but also standard practice instructions for controlling the work of the department. The following article will contain a sample of standard practice instruction which may serve as a guide to those who wish to prepare similar instructions, the value of which cannot be realized until they are tried.

The Utilization of the Cost Records

The next article will deal with the tie-in between the cost accounts and the general accounts. It will follow the same outline as the earlier chapter on much the same topic but it will be written with the idea in mind that the reader has read the intervening articles, and so will be ready for this more rigorous treatment of the topic.

The following two articles will present some of the cost statistics which do not ordinarily form a part of the regular cost accounts but may be obtained from them, as well as the uses of these statistics and the cost accounts as an aid in production control. The relationship of the cost department and the planning department is not one-sided, but reciprocal.

In next to the last article will be given a brief but comprehensive selected bibliography of books on cost-accounting so that the reader who wishes to study the subject more intensively may be guided in his efforts. At the end of the series will come a concluding article.

This, in brief, is what I plan to cover in this series of articles on cost-accounting. I hope that my readers may obtain therefrom assistance and guidance in solving their problems. Good, well-fitting cost-accounting systems do not come ready-made. They must be tailored to fit. I have no expectation that the methods which I shall outline in these articles could be adopted without any alteration by any company, but to the intelligent man who is not entirely acquainted with this subject, they should bring fruitful suggestions.

Grinding Off Stock

By John Mark May

The article, Grinding Off Stock, by Entropy on page 552 of the *American Machinist* brings to mind another axe factory that, about twenty-five years ago, was doing a profitable business, one as large as their power supply would permit. They used water-power and used all that was furnished by the stream upon whose bank they were located. This company operated less steadily from year to year and with an ever-decreasing number of employees for a period of about ten years. At that time they closed their doors.

There was difficulty experienced in getting the operators to use improved methods but there is some grounds for the belief that the management could not foresee any advantage in adopting improved methods. They allowed matters to drift along until their business had gone to such an extent that very radical changes were needed. Then they found that the men, having worked so long without any changes, seemed to have lost any progressive spirit that may have been present at an earlier period. Had the management in this case and perhaps in the case described by Entropy been believers in evolution, as far as manufacturing processes are concerned, it is possible that the one might still be in business and the other more prosperous than they now are.

I cannot quite agree with Entropy that the solution of the problem, as far as the manufacturing problem applies, lies in the employment of younger men who have no precedents to break down. I would suggest, however, that, instead of changing directly to the wheel that was soft enough to do the work satisfactorily, a very gradual change be made by using wheels that are only the least bit softer for the first change, believing that the vast majority of men would soon adapt themselves to bearing on slightly less. When this has been accomplished, succeeding steps can be taken until the desired results are obtained. The advantages would be derived from the experience of the older men who remained, as Entropy has pointed out.

The Desire to Create

By Elam Whitney

One of the factors in securing the greatest efficiency among employees and one little recognized by welfare managers is the desire to create. This desire is evidenced in the discontent of a tracer who wants a chance at drawing as well as the discontented machine operator who wants to be transferred to the tool making department. It is quite often the cause of so-called government work in the various machine shops and wood making departments, the wasting of employers' time while the employee is making parts for some device of his own. This practice is not so common among employees who are engaged in creative work and are made to feel that they are a part of the factory organization and not merely one of the machines.

This creative desire is not always the cause of the employee working on devices of his own, as is evidenced by the great amount of automobile repairing, nickel-plating, etc., being done on the companies' time. This practice is often caused because of the example set by the foreman in doing these same things himself. There is one large concern which has been very successful and at the same time has almost ignored this desire to create. But they have compensated to a great extent by establishing a minimum wage. Excellent results will follow a careful checking up of employees' ambitions and careful guidance and development along the line of greatest benefit to employer and employee alike.

United States—Exports of Metal Working Machinery

Period—1909 to 1921, Inclusive

Country	1909	1910	1911	1912	1913	Annual Average for 5 Years	1914	1915	1916	1917	Fiscal Year 1918	July 1st to Dec. 31st 1918	1919	1920	1921
Germany	$943,119	$1,804,682	$2,523,735	$2,953,361	$3,175,188	$2,280,017	$2,167,240	$ 121,756	$	$	$	$	$ 8,746	$ 144,192	$ 118,393
England	907,199	1,315,901	2,268,169	2,581,682	3,209,559	2,056,502	2,988,684	11,842,842	19,925,934	15,835,414	17,537,114	9,588,126	14,960,613	10,260,957	2,545,193
France	307,143	691,480	962,890	1,267,831	1,936,908	1,033,251	1,771,525	8,695,826	13,316,702	29,254,179	20,270,530	6,131,391	15,785,280	7,595,733	3,924,561
Canada	214,029	336,172	766,127	1,362,326	2,326,270	1,000,985	1,199,356	1,813,188	6,464,332	7,780,396	3,751,127	3,072,263	4,034,646	5,813,514	1,218,012
Russia in Europe	71,655	234,776	389,330	547,752	1,088,751	466,453	1,333,644	2,125,195	10,280,566	12,587,938	1,918,605	962	87,677	178,270	1,179
Belgium	154,470	162,529	397,157	646,541	786,679	429,475	552,531	35,416	......	......	......	420	3,882,163	1,920,172	662,127
Austria-Hungary	225,198	173,525	237,152	398,804	600,593	327,454	268,010	24,256	......	......	......		4,939	5,702	
Italy	93,655	134,583	351,271	271,344	437,910	258,152	421,603	511,134	4,779,178	8,771,496	5,076,878	1,129,845	1,892,070	1,480,818	239,270
Australia and Tasmania	94,184	138,392	281,979	349,638	406,093	254,057	1,316,952	282,487	800,825	664,264	400,068	255,502	669,591	883,490	490,977
Brazil	23,063	19,657	128,454	331,422	346,187	169,757	115,974	55,106	29,606	55,409	164,587	110,913	616,396	455,184	726,228
Sweden	23,472	98,673	138,748	164,977	241,373	133,849	310,613	621,458	204,840	313,044	96,737	......	842,019	446,787	109,806
Netherlands	23,700	70,855	139,407	143,528	260,893	127,677	186,756	79,403	311,559	436,128	23,580	......	668,046	361,074	153,961
Argentina	72,871	237,123	88,155	117,061	112,747	125,591	109,836	25,700	142,907	154,581	166,041	66,385	442,660	551,407	351,143
Japan	41,555	87,160	236,733	113,546	119,558	123,710	120,166	86,166	437,159	1,092,317	2,525,276	2,254,151	5,383,184	4,250,583	2,636,018
Mexico	175,403	84,892	160,027	46,977	83,259	110,112	74,706	37,530	103,083	97,631	314,534	92,178	319,719	610,572	748,894
Scotland	44,627	45,428	50,836	97,313	201,584	87,958	185,649	449,470	509,000	461,489	858,194	243,804	249,267	238,140	152,928
Cuba	10,295	42,072	66,470	89,900	124,669	66,681	146,596	100,507	151,886	334,512	278,698	171,820	737,238	1,218,849	575,683
Spain	23,202	36,340	53,970	62,536	109,624	57,134	111,686	98,693	776,495	1,686,392	1,252,525	89,471	1,282,704	1,144,844	349,031
Norway	10,769	34,133	44,576	91,332	79,366	52,035	92,729	211,640	233,931	356,514	121,018	248,687	470,843	158,200	29,452
Denmark	15,905	12,486	39,424	59,025	84,753	42,319	48,204	247,244	86,797	338,920	21,652	10,653	439,109	234,491	31,771
New Zealand	11,175	15,114	39,131	46,958	54,732	33,422	36,260	21,679	68,926	67,192	56,731	27,136	123,399	198,261	119,695
Chile	112	29,302	24,649	59,662	43,930	51,531	85,168	28,430	58,447	426,980	792,882	230,181	677,018	443,379	254,768
British India	19,088	45,765	20,162	28,281	43,717	31,403	17,953	23,700	52,225	273,744	1,271,698	561,287	900,429	1,374,068	1,422,184
Panama	41,732	34,919	17,031	9,923	10,886	22,898	35,210	4,736	52,061	92,844	35,453	22,564	53,620	71,800	62,002
British South Africa	7,309	7,340	19,389	41,193	27,671	20,580	28,822	29,917	71,478	143,582	194,322	98,956	484,545	336,182	312,822
Philippine Islands	10,183	8,933	23,387	19,162	5,824	13,498	10,266	13,640	12,568	25,936	78,673	60,568	252,505	251,431	184,656
Peru	......	2,399	6,926	15,073	40,651	13,010	35,294	31,631	30,151	71,477	77,964	44,783	153,905	222,829	190,613
Finland	......	......	8,956	25,644	24,947	11,909	35,934	2,784	64,215	26,058	2,636	......	110,364	63,106	20,620
Switzerland	7,271	7,338	7,416	18,653	17,108	11,557	22,627	57,403	54,052	117,889	178,264	......	230,333	257,935	18,889
Dutch East Indies	9,335	4,365	8,341	26,443	6,366	10,970	20,216	9,229	56,281	245,594	168,684	243,678	614,498	326,086	361,296
Straits Settlements	340	1,044	29,074	7,103	14,638	10,440	18,930	3,514	5,186	22,036	10,357	11,616	29,170	53,420	27,815
China	7,117	6,339	13,287	19,923	3,192	9,972	17,668	25,321	54,456	119,245	109,780	87,710	1,360,433	932,351	371,184
Uruguay	......	11,193	5,515	19,305	13,828	9,968	20,612	1,845	5,382	27,162	29,281	5,770	47,014	53,833	19,898
Portuguese Africa	......	3,954	5,755	9,437	7,418	5,313	4,523	8,072	4,052	13,007	21,761	6,139	17,662	22,292	74,133
Japanese Leased Ter. (China)	2,863	......	17,020	5,877	120	5,176	6,909	6,559	453	15,340	4,316	3,845	31,700	10,621	7,452
Venezuela	11,909	761	4,100	2,941	4,706	4,883	4,950	6,975	7,080	17,365	25,581	4,585	22,808	50,875	50,613
Colombia	3,462	1,240	7,795	1,939	8,967	4,681	16,838	11,572	9,488	20,859	17,087	3,548	27,550	112,043	107,909
Turkey in Europe	......	......	6,750	9,693	3,105	3,910	1,911	210	......	......	......	......	941	32,537	10,395
Ecuador	815	2,006	1,054	13,659	510	3,609	5,077	3,567	2,972	16,700	14,307	2,803	7,716	18,736	25,181
Newfoundland and Labrador	9,339	283	2,358	2,810	1,992	3,357	958	519	6,216	5,977	7,824	1,500	8,341	13,746	7,879
German Africa	......	5,976	2,091	6,930	1,491	3,298	308	860	90	......	......	......	......	1,353	......
Ireland	152	1,634	15	7,782	6,512	3,219	4,297	2,489	2,869	2,931	......	1,293	12,066	136,470	62,197
Portugal	1,892	4,232	3,149	3,070	1,391	2,747	8,903	1,612	14,829	75,987	67,718	11,185	49,343	64,086	14,020
Chosen	4,958	325	5,378	1,179	50	2,378	......	......	5,389	6,398	3,166	580	2,306	12,403	4,447
Costa Rica	1,542	3,481	3,921	1,018	1,432	2,279	2,602	48	3,163	3,715	9,875	1,216	4,120	19,057	7,364
Turkey in Africa and Egypt	6,089	1,242	597	3,096	176	2,240	......	......	......	......	......	......	......	......	......
Santo Domingo	830	1,087	559	4,272	3,837	2,117	2,990	4,315	6,280	33,370	52,196	6,580	24,239	49,103	54,932
Other British East Indies	165	......	357	6,230	3,007	1,952	589	450	250	198	15,356	10	12,754	6,290	1,289
Hongkong	1,905	2,040	1,779	1,061	59	1,369	660	......	905	2,391	15,565	24,043	57,657	197,338	111,451
Br. W. Indies—Barbados, Jamaica, Trinidad, Tobago and Other Br.	197	1,387	4,891	307	23	1,361	2,220	2,218	2,120	12,446	23,312	5,566	29,199	79,259	65,888
Bolivia	61	......	......	5,937	187	1,237	9,896	291	56	1,725	15,679	12,390	22,353	14,831	6,133
Turkey in Asia	......	442	330	375	3,219	873	1,468	4,529	......	......	......	......	1,252	5,457	2,862
Salvador	738	1,120	2,000	......	241	820	2,108	36	2,752	7,066	12,530	445	4,673	3,794	5,508

United States—Exports of Metal Working Machinery—*Continued*

Period—1909 to 1921, Inclusive

Country	1909	1910	1911	1912	1913	Annual Average for 5 Years	1914	1915	1916	1917	Fiscal Year 1918	July 1st to Dec. 31st 1918	1919	1920	1921
Russia in Asia		242	1,416	393	1,600	730	1,381	365,389	2,052,170	2,740.874	111.263	8,425	157,840	7,336	
British Guiana	89	1,316	1,668	242	206	704	61	163	367	3,191	12,602	10,713	8,820	6,462	331
Roumania	56	1,814		1,431	110	682	3,239	1,200					6,344	104,841	244,374
Guatemala	267	750	224	673	997	582	4,312	294	4,883	4,633	2,595	3,087	12,115	9,923	13,947
British West Africa		792	434	1,666		578	557	2,155	3,894	5,843	1,996	16,904	14,208	8,059	1,434
British Honduras			2,855			571	435	273	19	187	321	1,042	382	107	471
Greece		25			2,310	467	548	779	10,345	7.327	630	720	41,588	55,372	50,554
Nicaragua	895	344	521		80	368	1,104	449	233	1,251	905	607	15,778	6,037	5,543
Siam	215		435	294	870	363	1,449	354	225	6,477	15.047	4,793	6,139	2,500	7,190
Haiti	139	397	939	186	100	352	125		826	5,174	30,017	620	7,239	4,481	1,812
French Oceania					1,645	329			3,061	120	94	65	7,408	4,880	1,201
Honduras		647		310	607	313	110	5,418	2,358	2,360	1,429	364	10,636	30,498	27,441
French Guiana	991	72				213							260	9,955	12,573
German Leased Ter. (China)	833					167				543					
Bermuda	282	144		355		156	131	50	289	161	1,091	79	607	2,386	3,092
Dutch Guiana			700			140				916	446	283	675	2,046	19,029
Bulgaria	120	480			13	123	8,173							14,071	1,609
Persia					400	80		13,628		203	3,190				4,425
French Africa				210	175	77		500			314		8,436	9,749	1,591
Other British Oceania	18	118		79	72	57	309	205	21	279	18		212	67	1,869
Canary Islands				144	100	49				10	8,558		91	1,079	328
French Leased Ter. (China)		235				47					77				
German Oceania				4	106	22							140	1,283	940
Danish West Indies	36				7	9		12	39	1,079	5		788	5,010	3.903
French West Indies					11	2		250	8	9.787	5,254	2,138	7,777	3,468	4,879
Dutch West Indies					9	2	31	15	5,034	3,402	13,743	209	1,264	1,297	15,147
Azores and Madeira Island							416	272	104				290	8,681	4,872
Gibraltar							10	200	1,015	2,268			4,044		
Iceland and Faroe Islands										328	218	80	616	1,702	950
Malta, Gozo, etc							965							135	
Paraguay							237				14,036		5,484	10,115	
Aden								125					805		
Belgian Kongo										1,302	53	75	18,267	7,222	1,603
British East Africa							300		346	2,839	8,621	3,603	159	6,925	7,060
Egypt							2,839	69	178	11,153	3,132	2,055	11,685	31,412	14,419
Liberia									10	615					
Madagascar									60	1,425	1,588		975	2,050	17
Morocco									355	5,528			737	5,337	1,066
Spanish Africa										67		10,860			
French East Indies											25		5,785		476
Miquelon, Langley													25	1,105	19
Poland and Dantzig														38,676	108,281
French Indo-China														2,982	
Czecho-Slovakia														2,859	
Hungary														2,324	
Yugo-Slavia, Albania, etc															124
Hedjaz and Arabia															128
Palestine and Syria															401
Annual Totals	$3,640,034	$5,975,503	$9,626,965	$12,151,819	$16,097,315	$9,498,327	$14,011,359	$28,162,968	$61,315,032	$84,935,410	$58,327.668	$25,213,050	$58,507,942	$44,312,233	$19,635,821

Note.—Period from 1909 to 1918 inclusive consists of Fiscal Years ending June 30th, and period from 1919 to 1921 inclusive consists of Calendar years.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Experiment With High Speed Grinding Head

By Ellsworth Sheldon

Almost the final operation performed upon the Jacobs drill chuck is to grind the jaws to insure concentricity of running. As some of the chucks are quite small, the grinding wheels are correspondingly minute and must run at exceedingly high speeds. Some of the little wheels are but $\frac{1}{8}$ in. outside diameter and run at a speed of 50,000 revolutions per minute.

The work of grinding has been done on a grinding machine of standard make with the regular internal grinding head and, owing to the necessity for frequent renewals, the Jacobs Co. has been making the spindles in its own shop.

EXPERIMENT WITH HIGH SPEED GRINDING HEAD

The work of making them is very simple but as a spindle could not be made to run at this excessive speed for more than 8 or 9 hours without developing a looseness in the bearings that would put it out of service, the making of a new spindle every day for each machine not only imposed a monotonous burden upon the tool room force but greatly increased the overhead charges on the work.

To relieve this burden the company has been experimenting with a "Dumore" high speed grinding attachment and the cut shows the device mounted upon the machine, doing away with the back counter and belt drive. At the time the photograph was taken the Dumore had been running more than 400 hours (not consecutive) and had not developed any perceptible looseness in the bearings. The motor is running 15,000, and the grinding spindle 50,000 revolutions per minute, upon Norma ball bearings.

Putting Limits on All Dimensions—Discussion

By Martin H. Ball

The article under the above title by John Thomas, which was published on page 639, Vol. 56, of *American Machinist*, and the discussions which followed have interested the writer very much. While there are times and places where it is best to vary almost any rule, it seems to me that Mr. Thomas is nearly right in asking for limits on all dimensions. I mean by all dimensions, those which apply to finished surfaces and not the dimensions that concern the pattern maker only. Exceptions are made in instances where the requirements for some surface without machine finish are unusually exacting.

This method does not involve as much extra work on the part of the designer and draftsman as it would seem at first thought. There are many cases where notes stating the limits on a drawing can be used, as for example, "The limits on all dimensions on this drawing are $\genfrac{}{}{0pt}{}{-0.002}{+0.002}$ in." The limits may be grouped as follows: "All holes on this drawing have a limit of $\genfrac{}{}{0pt}{}{-0.001}{+0.001}$ in., all diameters $\genfrac{}{}{0pt}{}{-0.0005}{+0.0005}$ in. and all other dimensions $\genfrac{}{}{0pt}{}{-0.003}{+0.002}$ in." Where there are some dimensions that cannot be easily grouped, these can each be limited in the usual way and the others can be taken care of by a note thus, "Where not otherwise shown, all dimensions have a limit of $\genfrac{}{}{0pt}{}{-0.0005}{+0.0015}$ inches."

Placing limits on dimensions, however, does require a more thorough knowledge of the requirements on the part of the designer. Because of this fact and on account of the extra time required in designing and drafting, many who are responsible for results hesitate to insist that dimension limits be specified. But they fail to realize the time lost in the machine shop due to uncertainty and they overlook the fact that a much better product might be obtained if all concerned knew exactly what was desired.

When parts go to different departments to be machined, this uncertainty increases. The man who makes the holes may know how much allowance should be made for the shaft or pin to fit properly, but he does not know how much allowance the man who made the shaft or pin did allow. The designation desired is that which is plainest to the dullest and the least experienced worker. Any plan can be learned and used, but the plainer it is, the less will be the cost in time and material. I feel, therefore, that the plans suggested by Frank C. Hudson on page 794, Vol. 56, and by J. A. Roy, on page 188, Vol. 57, of *American*

Machinist have much merit. The only change that I would suggest is that the desired size may be always shown in large figures first and followed by the allowable tolerances, which may or may not be an equal amount above and below the desired size.

For illustration, a fit of 0.003 in. clearance is desired where a minimum of 0.002 in. and a maximum of 0.006 in. are permissible. The dimension for the hole would be 1.793 $\begin{smallmatrix}-0.0005\\+0.0015\end{smallmatrix}$ in. and the dimension for the shaft would be 1.790 $\begin{smallmatrix}-0.0015\\+0.0005\end{smallmatrix}$ in. The basic dimensions of 1.793 in. and 1.790 in. stand out prominently, will be read first and are likely to be understood as the sizes desired for a first-class job without further explanation from any one.

An Uncommon "Shark's Jaw"

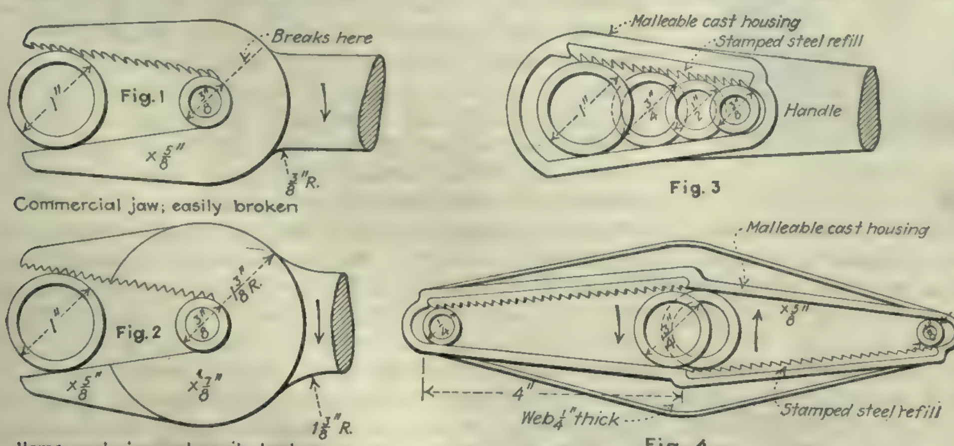
By J. T. Towlson

London, England

The common "shark's jaw," usually known in America as the alligator wrench, than which few tools are of greater all-round service, is shown in Fig. 1 of the accompanying sketches in its commercial form. Its life is long, if properly used, but, as with the Clyburn shifting spanner, the rule governing its proper use is more honored in the breach than in the observance. When it is abused it soon breaks along the line indicated in the sketch. Home made shark's jaws like that shown in Fig. 2 have greater strength here and, though a trifle heavier, they last much longer.

The tool shown in Fig. 3 is still stronger for the reason that the jaws are tied together at the outer end, leaving a triangular opening into one side of which the tool steel toothed section is inserted. The body of this tool, as also the one shown in Fig. 4, is of malleable iron. The common form, Fig. 1, is somewhat paradoxical in design in that the larger the work upon which it is used the greater is the leverage tending to break it across the throat. It is to counteract this defect that the tool shown in Fig. 4 has the triangle reversed. This latter tool is made double ended and will handle from 1/8 to 3/4 in. gas pipe sizes.

[The fact that the wrenches in Figs. 3 and 4 can be used only by passing them over the ends of pipe or rods limits their usefulness.—Editor.]



"SHARK'S JAW," OR ALLIGATOR WRENCHES

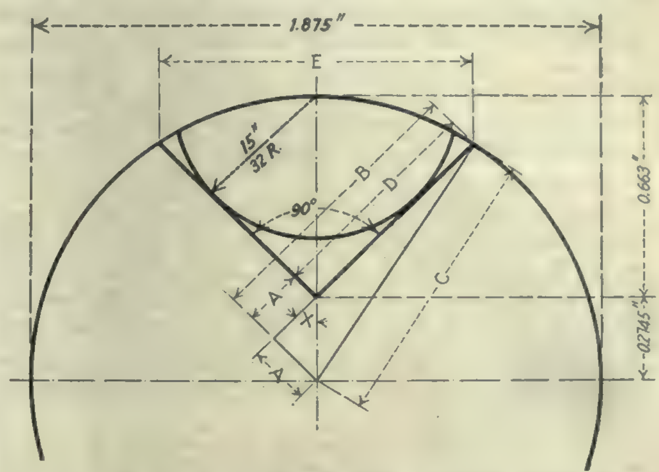
FIG. 1—THE COMMON KIND. FIG. 2—A STRONGER "HOME-MADE" TOOL. FIG. 3—SINGLE-END WRENCH; CLOSED. FIG. 4—DOUBLE-END TOOLS WITH TRIANGLE REVERSED

A Problem in Shop Trigonometry

By Edward J. Rantsch

Every now and then some mathematical problem confronts us in our regular line of work that makes us employ a little trigonometry to reach a solution. In this case it was required to make a piece with a groove of 90 deg. included angle. This groove was to receive another part having a circular form with a 15/32-in. radius on one side and a radius on the other side to conform with the radius of the first piece, which was 1.875 in. in diameter. The center about which the 15/32-in. radius was drawn was to lie on the circumference of the circle of 1.875 diameter, as shown in the accompanying sketch.

The first step was to take the 15/32-in. radius and multiply it by 2, which gives a 0.9375-in. diameter.



A PROBLEM INVOLVING SHOP TRIGONOMETRY

Letting this diameter 0.9375 in. equal the distance across the flats of a square, and multiplying it by 1.4142 gives us 1.326 in. as the distance across the corners of the square; dividing by 2 we get 0.633 in. as one-half the distance across the corners of the square. As the diameter of the large circle is 1.875 in., the radius is 0.9375 in. Subtracting 0.663 in. from 0.9375 in., we get 0.2745 in. as the distance from the corner of the square to the center of the piece, as noted in the illustration.

Now drawing a small triangle at this point in which 0.2745 in. becomes the hypothenuse and angle x equals 45 deg., then sin x, or 0.707 $\times$ 0.2745 in. equals 0.194 in. for lengths A and A, which are two equal legs.

By drawing line C, which is a radius of 0.9375 in., we get another right-angle triangle in which A equals 0.194 in., and C equals 0.9375 in. Dividing A by C, or 0.194 in. $\div$ 0.9375 in., gives 0.20693 as sin x. Then x is 11 deg. 57 min. Multiplying the cosine of 11 deg. 57 min., which is 0.97833, by C or 0.9375 in., we get length B, or 0.917 inches.

Having found length B to be 0.917 in. and length A 0.194 in., subtract A from B and we have 0.723 in. as the length D, which is equal to one side of the groove.

Now assuming that 0.723 in. is the length of one side of a square, or in other words, the distance across the flats of a square, to get the distance across the corners multiply 0.723 in. by 1.4142, and we have distance 1.0225 in. for *E*. This value represents the length of the chord and is the last unknown dimension to be found. Thus we have found all the unknown dimensions by the use of shop trigonometry, reasoning step by step, a method that can usually be employed in solving the problems that arise in everyday practice.

Salvaging Cracked Saws by Welding

By Ellsworth Sheldon

A method of salvaging the circular saws used on certain metal sawing machines when they have developed cracks that would otherwise put them out of business is shown in the accompanying illustration The disk is first cleaned by immersing it in the soda kettle and then, taking it to the electric spot welding machine, a row of spots is welded along the line of the crack, as the photograph shows.

Two or three teeth are then ground out of the periphery immediately behind the crack to relieve the disk as much as possible from shock at this point and the saw is put back into service. If the crack has not extended clear to the center hole, the acetylene torch is brought into play to burn a small hole through the disk at the end of the crack and thus discourage its further extension.

While this method cannot be guaranteed to save a saw, its application requires nothing but the expenditure of a few minutes time in a shop where the electric welding machine is already installed and, if it is successful, will keep in service as a valuable tool a saw that is otherwise but a candidate for the scrap pile. If it fails nothing is lost but the time.

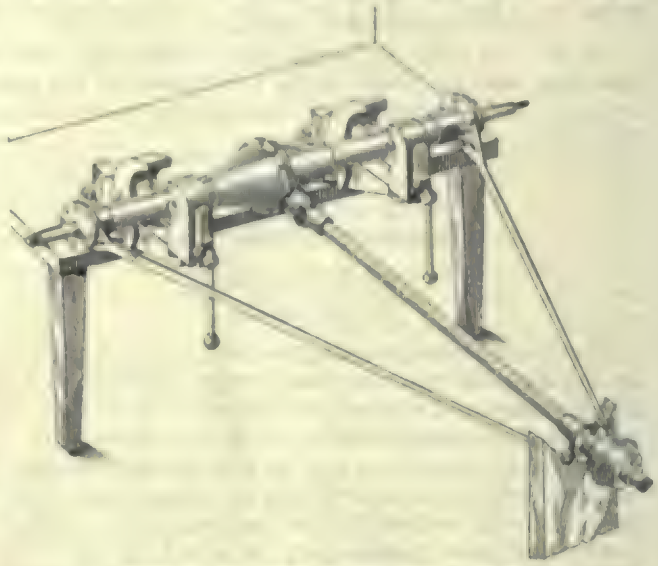

CRACKED SAW, SPOT WELDED

At the Butterfield plant of the Union Twist Drill Co., Derby Line, Vt., the writer saw in operation several of these saws that had thus been reclaimed and that were doing as good service as before they were cracked. Such a repair would not be advisable, however, on the swiftly moving saws used in the wood working shop because the consequences of failure would be too disastrous.

Two Vises to Handle Axle Assemblies

By G. A. Luers

In the absence of a special stand for holding either front axles or rear axle assemblies, which stands are very serviceable for overhaul, the use of two vises placed three feet apart on the edge of a bench, as shown in the sketch, will afford a means of clamping the axles solidly while renewing bushings, putting on spindles, aligning gears or adjusting the many parts. It is possible with an assembly like a Ford rear-end to clamp the housings in the vises, place a block under the drive shaft end and work on the universal, connection, radius rods, put in the retaining bolts, cotters, etc., as well as carry out the work of overhaul from a most favorable and comfortable working position. But a third of the time is required to assemble these parts in this manner, as well as to add to the comfort and convenience of the workman.


TWO VISES FOR HANDLING AXLES

Can These Things Be True?—Discussion

By R. Kraus

In reply to M. Tolliver's article, which appeared under the above title on page 270 of *American Machinist*, it is the writer's opinion that the problem of the heat treatment of steel can be handled in two different ways. One way is to determine a method by research, which requires a thorough knowledge of metallurgy, and the other is to make use of reliable information which can be obtained from the maker of the steel to be treated. The latter means is the one which is best adapted to the average user.

The steel manufacturer is not only glad to supply the necessary information but he will even send his specialist for a demonstration as it is to his interest to have the steel properly treated. The manufacturer is really the best one to judge how the merit of his product may be brought out. Manufacturers now pursue a broad policy in building good will and they frequently go to an expense in demonstrating their product since they anticipate the demand in a locality as well as in a special prospect.

Good information may also be found in the catalogs of allied products, as for instance in a catalog of a

company which manufactures pyrometers. All the knowledge necessary is the analysis of the steel one is using.

This condition is a reminder of what is expected from us in the successful treatment of steel and that is just a little effort to keep rigid order in the stockroom. If we are using the makers' information, we do not have to know the composition of the steel, but we must know with certainty what steel we have. This condition requires a rigid rule to mark the incoming steel immediately, by stenciling it with vivid color every few feet and at both ends. As a chart must be followed, the blueprint of it should be framed and given a coat of transparent shellac.

The suggestions made are not new, but they form one of the principles of production, namely, to avail oneself of the cumulative experience of others, which is a secret of saving time.

Two Ways of Making a Core—Discussion

By M. E. Duggan

On page 461, Vol. 57, of the *American Machinist*, P. W. Blake offers criticism of an article by the writer under the above title on page 233, Vol. 57. In presenting that article I had in mind the apprentice and the young journeyman pattern maker who have been denied the privilege of visiting in the foundry and core room, and who welcome any information they can get through the columns of trade papers. Moreover, I had in mind general pattern, molding, and core making practice and not any one specialty. I merely used the sketch as an example of the method used by the core maker in making cores with projecting members, *dried on end.*

Again I ask, "Is this method practicable and does it answer the requirements of the core maker?" We are told that the pattern maker predetermines the operations of the molder and the core maker. I don't believe this. The apprentice or journeyman pattern maker who has had little or no training in practical molding and core making is mighty poorly equipped to even hint at how the job should be done in either of these departments of the foundry. Mr. Blake says, "Any pattern maker trained in the manufacture of plumber's brass goods knows that the practical method is to use core driers on small sizes, because the driers keep the cores from warping." Why should a special training in plumber's brass goods be necessary to know and understand the "why" and the "wherefore" details that pertain, not to any individual specialty, but to general pattern making practice.

Mr. Blake mentions the word "proper" in connection with the making of these cores and driers. The word "proper" does not apply in the making of patterns, core boxes, molding, or core making. The superintendent of a large foundry doing a general jobbing business has remarked, "Make a pattern and the core boxes for it, send them to the foundry and the molders and core makers will tell you of nineteen better ways by which they can be made."

In conclusion, I think it only fair to suggest that when reading an article illustrating and describing a way to do a certain piece of work with a view to criticizing it, you either read it as it is written or *read between the lines.* If the method has any merit in comparison with your way of doing the particular job, then use it; if it has not, then pass it up.

Removing a Bushing from a Blind Hole —Discussion

By W. H. Storey
Surrey, England

In an article under the above title on page 865, Vol. 56, of the *American Machinist*, Art Weiss, in criticizing the method of removing a bushing from a blind hole as outlined by me, asks why we should not make the bushing as shown in his sketch. I think it is up to me to answer his question. I do not think it can be denied that the following points are against his method:

1. A plain standard bushing from stock cannot be used.
2. Expensive cast steel is used for the tapped portion necessitating slower machining speeds.
3. The tapping of cast steel should always be avoided if possible on account of wear and breakage of taps.
4. Due to the recess, the effective length of the bore is reduced and usually it is desirable to keep the length of the bore of blind hole bushings as long as possible.
5. The bushing may crack in hardening, (a) due to the thread, (b) due to the recess, (c) due to the excess of metal at the bottom.
6. Grinding the blind hole in the bushing is objectionable, demanding as it would a great amount of time. Blind holes are the cause of much grinding-wheel breakage and are never as satisfactory as the straight-through bore.
7. In order to grind the outside diameter a special mandrel will have to be made as a standard mandrel cannot be used.

Mr. Weiss states that my method involves the hunting up of loose washers when the bushing has to be removed. May I point out that this is not accurate, for, as with his method, a setscrew is all that is required to extract the bushing. In fact our methods are virtually the same with the exception that I require a shorter setscrew and have the tapped portion made separately from a piece of soft machine steel, thus enabling a

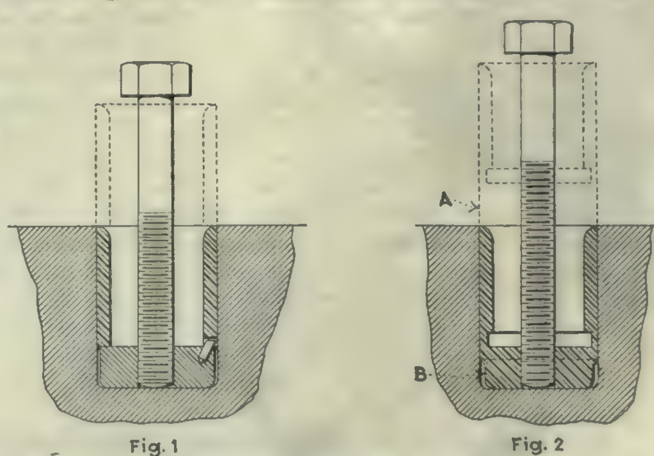


FIG. 1—THE AUTHOR'S METHOD. FIG. 2—ART WEISS' METHOD

standard bushing to be used. By my method the necessity of a recess with its attendant risk of cracking and wheel breakage is eliminated, less of the expensive cast steel is used, much less time in manufacture is required and there is no necessity for making a special mandrel for grinding the outside diameter.

If, after reading this, Mr. Weiss ever again uses the

method he outlined, I would suggest that at least he chamfer the bottom of the bushing or turn it away, as shown at *B* in Fig. 2, so the blind hole in the jig casting need not be accurately bored down to a sharp corner at the bottom, and so that a lead will be provided to assist in forcing the bushing in, and prevent it cutting away and enlarging the sides of the hole. Also, by cutting the bushing away, a shorter setscrew can be used for extracting it.

Mr. Weiss states that my method requires some preparation, apparently assuming that his does not, because it is in one piece. As his method requires a special bushing I would suggest that it actually requires more preparation than mine. Comparison can better be made, however, by considering the relative costs. For the convenience of readers the sketches are reproduced, Fig. 1 shows the method adopted by the writer whilst the dotted portion at *A*, Fig. 2, shows the method of Art Weiss. The reduced portion at *B*, Fig. 1, shows the writer's suggested improvement.

Misapplied Machine Tools

By D. A. Nevin

The writer has observed, during the past year or two, numerous accounts of single-purpose machine tools being adapted for some special use for which they were never intended. A lathe used for milling, a planer converted into a grinder, a punch press adapted for slotting, are a few of the stunts we read of and there are, of course, many more which have never been published. There are many occasions where it is necessary to rush out some work and, no other machine being available, the foreman is justified in adapting or altering some machine intended for an entirely different purpose. Again in job shops, these stunts are very often necessary due to lack of equipment or the necessity of utilizing as much of the equipment as possible and not have machine tools stand idle.

No lathe was ever designed to absorb the vibrations caused by a milling operation and certainly could not retain its accuracy if this class of work were to be continued for any length of time. The writer recalls the adaption of a small planer for surface grinding, also the use of a hand screw machine for a "push" assembling job and in both cases the regular work to be produced on these machines was considerably delayed. In some cases clever mechanics delay the purchase of necessary equipment by indulging in these stunts, because in these days of strict economy (and in some cases false economy), new machines will not be purchased as long as the work can be produced without them. The overhead cost should indicate a saving to be made in conservative investment in labor-saving machines.

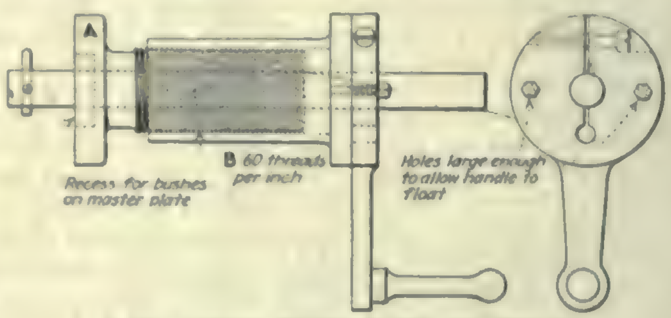
Designers are frequently instructed to design along the lines suitable for manufacture by present equipment and this procedure often proves to be an expensive one when production falls below sales requirements. Automatic screw-machine work is considered very economical because one operator can operate from three to five machines, and yet sometimes, with a little thought, screw-machine parts could be designed for more economical production in the punching machine and generally with an added advantage of saving in the amount of material used.

Bushings Used as Buttons for Locating Holes Accurately—Discussion

By A. Cox

I have read with interest the article under the above title by Harrie M. Pike on page 384, Vol. 57, of the *American Machinist* and, while commending Mr. Pike's method of locating holes on large jigs with bushings, I must take exception to his statement that "The job was then placed on the table of a true running drill press and the holes drilled and reamed through the bushings." In an earlier part of his letter Mr. Pike states that "their location was so important in fact that no tolerance at all was allowed in locating them."

Having spent over thirty years at the tool making game, including three years on large jigs and fixtures for the Sunbeam aeroplane engine for the British Government and in one of the finest equipped toolrooms I have come across in my long experience, I will state that I have yet to find a "true running drill press" that will drill and ream a hole to limits of 0.0002 in. (in location) with slip bushings or anything else. To my view Mr. Pike's method has no advantage over the ordinary button method and certainly is not so accurate as boring with an eccentric chuck.



HAND BORING FIXTURE FOR JIG WORK

I think I am free to admit that the most accurate tool on the market today is the Pratt & Whitney jig boring machine, yet I doubt if the makers will guarantee a drilled and reamed hole to be accurate for location within 0.0002 inch. For the benefit of those engaged on large jig work, I will describe the methods used in the above mentioned shop where the limit of error on production never exceeded $^{+0.0002}_{-0.0001}$ in. The base of the jig and all machined surfaces are accurately scrapped to a surface plate and all holes laid off and drilled, leaving roughly about 0.020 in. for boring.

We found that in moving a heavy jig around the shop and placing it on a machine it required very little jar to move the buttons and it was necessary to check them all over again. In order to avoid this trouble we abandoned boring the jigs on machines and used the hand-boring fixture shown in the accompanying sketch and which, although slower than the machine, was certainly much more reliable. The boring fixture was made of machine steel, pack-hardened, ground and lapped. The body *A* was accurately located over the hole to be faced and fastened in position by straps. The feed nut *B* was then slipped on, the boring bar clamped to the handle and the boring was performed by turning the handle.

Three boring bars were used, the tools being set for gradual decreasing cuts, the last one removing 0.002 in. and being run through twice. The fixture was then

removed, a ground and lapped plug inserted in the hole and the fixture re-located for the next hole with Johansson blocks or micrometers. The result was a splendid job, without moving the jig from the surface plate. In some instances, a master plate was fastened to the jig and with the hand-boring fixtures located on the plate. With bushes ground to fit both the master holes therein and the recess in body *A* of the boring fixture, it was easy to transfer the same locating points in all jigs used for the one particular part to be machined.

Formula for Determining the Safe Load for Gears

By V. Charushin

The accompanying table is based on a gear formula that is commonly used in Germany, and is given by C. Bach in his "Maschinen Elemente," 1920 edition. In comparison with the well-known Lewis formula, this formula gives more conservative values for the safe loads. Consequently, the gears determined according to this table, possess much better wearing qualities.

The basic formula as given by Mr. Bach is as follows:

$$W = Cfp' = C\pi \frac{f}{p} \qquad (1)$$

W = safe load on pitch line in pounds
f = face of gear in inches
p' = circular pitch in inches
p = diametral pitch.

C is a function of r.p.m. and is expressed by the equation:

$$C = 426.69 - 7.11\sqrt{N} \qquad (2)$$
$$N = \text{r.p.m.}$$

This formula is for machined cast-iron gears and takes an allowable stress equal to 6,400 lb. per square inch when the speed is very low. Equation (1) may be written for diametral pitch as follows:

$$W = \pi(426.69 - 7.11\sqrt{N})\frac{f}{p} \qquad (3)$$

The table is easily computed from equation (3). For steel gears all the values in the table must be multiplied by 2½. The table is especially valuable for preliminary layouts. It gives the safe loads at a glance without the necessity of going through the tedious calculations.

What Is the Best Way to Show Sections Through Ribs?—Discussion

By Elam Whitney

Under the above title on page 458, Vol. 57, of the *American Machinist*, Martin H. Ball's illustration, as the writer sees it, does not keep the draftsman's work down to a minimum as would be the case if the section *X-X* were taken through the holes.

This is especially true of drawings where the holes are numerous and the method of taking a cross-section "off center" is one which will be found of value in a great variety of drawings, as for instance assembly of punches and dies, when it is desired to show up projections corresponding to the rib that was shown in the illustration given by Mr. Ball.

If the drawing were made in accordance with the above method, not only would the area to be cross-sectioned be reduced, but the lines would show up much clearer as well and especially would this be the case if a blueprint were made from it.

SAFE LOAD IN POUNDS FOR MACHINED CAST-IRON GEARS

NUMBER OF REVOLUTIONS PER MINUTE																			
50	59	71	83	106	142	177	236	355	591	828	1,183	1,774	2,365	3,548	4,730	5,912	8,278	11,826	17,738
75	57	69	80	103	138	172	229	344	573	803	1,147	1,720	2,294	3,441	4,588	5,735	8,029	11,471	17,205
100	56	67	78	100	134	168	223	335	559	782	1,117	1,676	2,234	3,351	4,468	5,586	7,820	11,171	16,757
125	55	65	76	98	131	164	218	327	545	763	1,091	1,636	2,181	3,272	4,363	5,454	7,635	10,908	16,361
150	53	64	75	96	128	160	213	320	533	747	1,067	1,600	2,134	3,201	4,268	5,335	7,466	10,669	16,004
175	52	63	73	94	125	157	209	313	522	731	1,045	1,567	2,090	3,135	4,180	5,225	7,315	10,450	15,675
200	51	61	72	92	123	154	205	307	512	717	1,025	1,537	2,049	3,074	4,098	5,123	7,172	10,246	15,369
250	49	59	69	89	118	148	197	296	494	691	987	1,481	1,975	2,962	3,949	4,937	6,911	9,873	14,810
300	48	57	67	85	114	143	191	286	477	667	954	1,430	1,907	2,861	3,814	4,768	6,675	9,536	14,304
350	46	55	65	83	111	138	184	277	461	646	923	1,384	1,845	2,768	3,690	4,613	6,458	9,226	13,839
400	45	54	62	80	107	134	179	268	447	626	894	1,341	1,787	2,681	3,575	4,469	6,256	8,937	13,406
450	43	52	61	78	104	130	173	260	433	607	867	1,300	1,733	2,600	3,467	4,333	6,067	8,667	13,000
500	42	50	59	76	101	126	168	252	420	589	841	1,262	1,682	2,523	3,364	4,205	5,887	8,410	12,616
600	40	48	55	71	95	119	159	238	397	555	793	1,190	1,587	2,380	3,173	3,967	5,553	7,933	11,900
700	37	45	52	67	90	112	150	225	375	525	749	1,124	1,499	2,249	2,998	3,748	5,247	7,495	11,243
800	35	42	50	64	85	106	142	213	354	496	708	1,063	1,417	2,126	2,835	3,544	4,961	7,087	10,631
900	34	40	47	60	80	101	134	201	335	469	670	1,006	1,341	2,011	2,681	3,352	4,693	6,704	10,056
1,000	32	38	44	57	76	95	127	190	317	444	634	951	1,268	1,903	2,537	3,171	4,439	6,342	9,512
f/p	0.05	0.06	0.07	0.09	0.12	0.15	0.20	0.30	0.50	0.70	1.0	1.5	2.0	3.0	4.0	5.0	7.0	10.0	15.0

f = FACE, p = DIAMETRAL PITCH

Editorial

THERE ARE still some mechanics, and for that matter some foremen and even superintendents, green enough to be proud when they make blue chips with red tools. The proper color scheme is white. If two men take the same size cut at the same speed and one gets his chips blue and the other white, it is a safe bet that the latter has the tool which will last longer and use less power.

Statistics on Foreign Trade in Metal Working Machinery Begin in this Issue

HOW MUCH do we know of foreign trade in machinery? Much has been written—and read—about how to ship machinery across seas. The requirements for dismantling, slushing and boxing have been specified. There has been a word or two about the kind of salesmen to send abroad. Correspondence and mail matters have been touched upon.

But what of the markets? How have exports and imports grown or diminished during the past 10 years? What future is indicated? Statistics on those conditions should be in every sales manager's office. They are available, thanks to the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, and they have been handed out piecemeal from time to time. Fortunate the man who could collect them and keep them together.

It is now the purpose of the *American Machinist* to distribute the statistics of foreign trade in machine tools for the years 1909-1921 inclusive. They will be presented each week with either a page or two pages per issue. The tables will show the values of metal working machines exported from the principal countries, the names of the countries receiving them, and the values of the machines received by each. A like arrangement will show the details of imports. Invaluable figures they have been termed by some.

No table will back up another, an arrangement that gives perfect freedom in clipping. Table I, Export of Metal Working Machines from the United States, is in this issue.

What's Wrong With the Railroad Shops?

A VERY ENLIGHTENING series of articles might be written telling the history of railroad development with particular reference to the repair shop angle. The series would tell of the strangling effect of railroad regulation as practiced by federal and state bureaus and would point out the valiant struggles made by the men in charge of the mechanical departments against conditions brought about by insufficient appropriations resulting from lack of revenue. It would also tell of the boring-from-within tactics of labor unions whose rules operated to combat every attempt at progressive management. Such a series would be pleasant to write but it would be outside of our province and would lead to no improvement.

We have the utmost sympathy for the railroad managements in so far as they are oppressed by governmental regulations, and they certainly have had more than their fair share of it, but railroad regulation is here to stay and there is nothing to do but make the best of it. If anything we could say would have any effect in lessening the oppression, we should be only too glad to shout it in 24-point type but we are not so egotistical as to harbor any such idea.

In the series we have written, and of which the second article appears next week, we have discussed things as we found them and tried to point out definite improvements which might be made. If what has been written has seemed to savor of destructive criticism, bear in mind that only a quack doctor endeavors to cure the patient before he finds out what is the matter with him. If we had nothing better to offer, the series never would have been started, for constructiveness has been the aim of the *American Machinist* since its beginning nearly fifty years ago. So far, we have contented ourselves with pointing out the faults. In later articles we shall suggest remedies, drawn from the practice and experience of other shops and applicable to railroad repair shops.

The Red Cross Roll Call

IT SEEMS ESPECIALLY appropriate that the coming Annual Roll Call of the American Red Cross should begin this year on Armistice Day. To many, the splendid service which this organization gave to humanity during the World War ended with the coming of peace in 1918. It would be unfortunate, indeed, if the energy and relief which the American Red Cross still dispenses should be unrecognized or unsupported at this time.

The Red Cross campaign to spread the benefits of hygiene, the active interest in the comfort and entertainment of our disabled Service men, and the ever-ready emergency relief—these alone would justify the annual contribution of a single dollar from each of us. Leading even these good interests, however, comes the active fight which the Red Cross now wages on tuberculosis. Support of the organization in this, the greatest of its campaigns of relief, makes membership almost an obligation for those who can give.

Just Suppose

SUPPOSE you had bought a machine which is guaranteed to turn out twenty-four pieces per hour, let us say, for $6,000. And suppose the best you can possibly get out of this machine is twenty pieces, and even the maker's expert can do no better. You would probably feel that you are entitled to a discount.

Now suppose it were the other way; that you get twenty-eight pieces instead of twenty-four, and that without straining the machine or the man or even your imagination. Would you feel that the maker is entitled to a bonus, and feeling that way, would you offer it?

Oh, come now! You know things are not done that way. Yes, but—

Just suppose.

Shop Equipment News

Baird Six-Spindle Chucking Machine

What is virtually an automatic lathe for handling five short pieces of work at one time has recently been placed on the market by the Baird Machine Co., Bridgeport, Conn. The machine, as shown in Fig. 1, is a six-spindle horizontal chucking machine and is suitable for work on small castings, forgings and bar stock requiring a number of operations such as turning, facing, drilling and threading that can be performed on a lathe. The capacity is for work up to 6 x 6 inches. The chief feature of the machine is the fact that there are always five pieces of work in operation at the same time. As many as twenty-one cutting tools can be used simultaneously. The sixth spindle is in the loading position while the others are operating, so that the work may be inserted and removed without interfering with the operation of the other spindles.

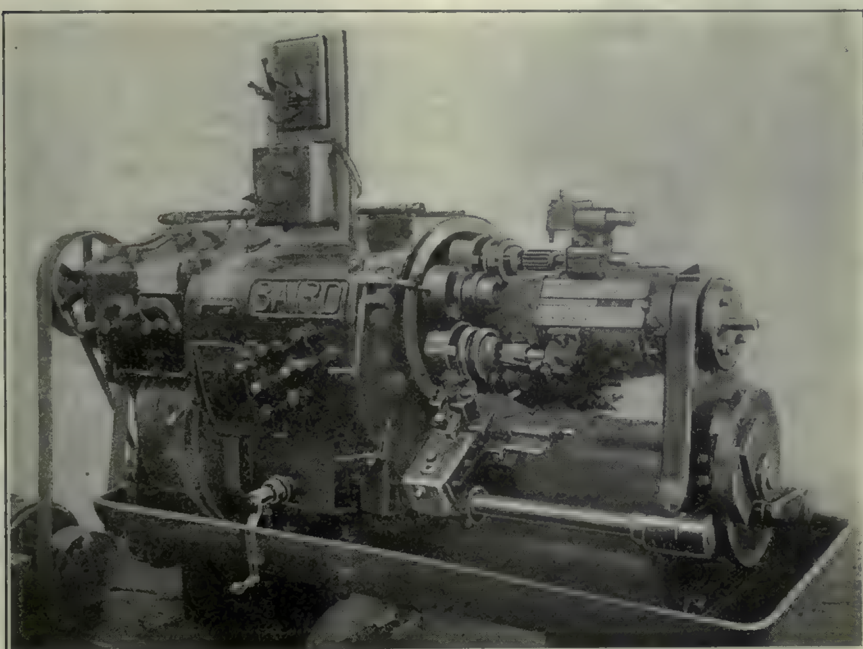


FIG. 1—BAIRD SIX-SPINDLE CHUCKING MACHINE

As the finished piece reaches the unloading position the machine automatically stops, so that a second cycle of operations will not be made on a part due to inattention of the operator. The operator immediately starts the machine again when he is ready to take out the piece, so that the five work spindles need not be stopped during the time required to remove the piece and place a new one in position. The machine can be run without stopping at the completion of each piece.

Separate toolslides are supplied for each working position with a choice of two lengths of feed with any setting. The cross-feed toolslides are mounted on the bed. The toolholders are interchangeable and are designed to receive standard forged or inset tools. The machine can be turned over by hand from either the front or back of the machine for setting the tools.

The machine is ordinarily driven by a single constant-speed pulley at a speed of 800 r.p.m., and it can be arranged for either belt or motor drive, a 5-hp. motor being ordinarily required. The spindle speed varies from 28½ to 440 r.p.m., a total of twenty-four speeds lying between these limits. There are eight possible combinations of gear drives and three quick changes of speed available for each spindle. By changing the gears in the main drive the range of speed of all of the spindles can be raised or lowered; three changes are still allowed for each spindle independent of the other spindles. There are seventeen changes of feed for the cutting tools.

All the changes of speed and feed are effected by heat-treated quick-change sliding gears. The work can be run at the speed and feed best suited to the operation, so that a hole of small diameter can be bored at a high spindle speed while the outside diameter of the work may be turned at a relatively low spindle speed.

Rapid traverse and reverse motions are provided so as to increase the speed of operation. The minimum productive speed with the drive pulley running at 800 r.p.m. is one piece in 9 min., and the maximum is 2⅝ pieces in 1 min. Chucks are ordinarily employed, but special fixtures for holding the work can be substituted. Each spindle has a means of adjustment to take up wear. Back of each spindle is a driving clutch that releases automatically to allow the turret holding the spindles to index. All operating levers are conveniently located in the front.

In Fig. 2 is shown a view of the rear of the machine, in which the cam drum and such features can be observed. A power-operated pump for cutting lubricant is incorporated. The machine requires a floor space of 93 x 46 in. and weighs about 8,500 pounds.

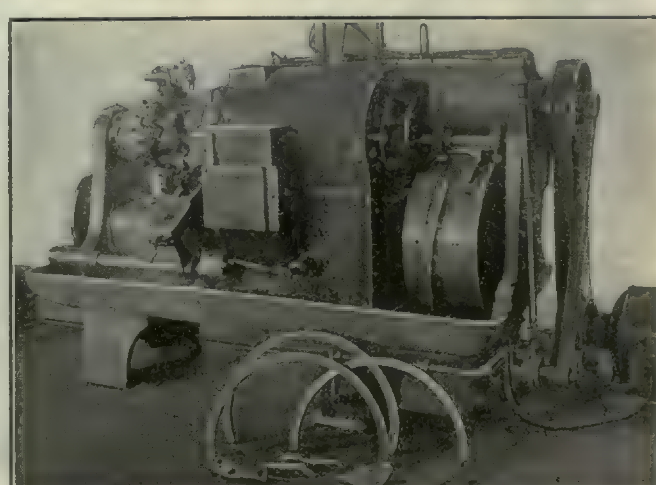


FIG. 2—REAR VIEW OF BAIRD CHUCKING MACHINE

Chambersburg Punching and Shearing Machines

The Chambersburg Engineering Co., Chambersburg, Pa., has recently developed a line of vertical punching and shearing machines on which electrical control is employed. This control mechanism is so constructed that setting and adjustment of the length of stroke can be easily made and the action then performed electrically. The mechanism by which the adjustment is made is mounted on the front of the head and can be seen in Fig. 1, as well as the foot switches by which the operation of the presses can be controlled.

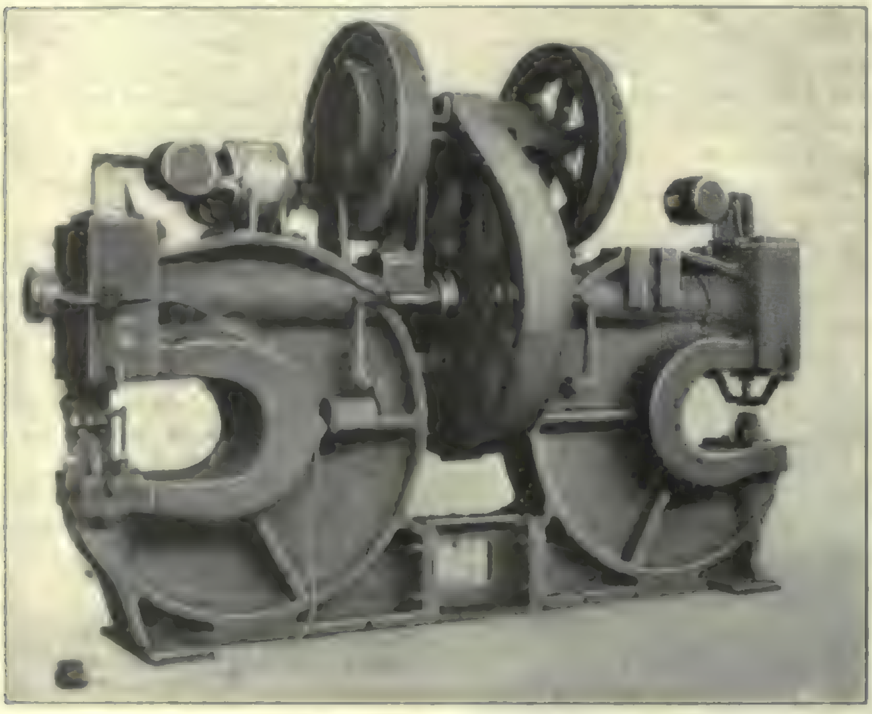


FIG. 1—CHAMBERSBURG DOUBLE-END PUNCHING AND SHEARING MACHINE WITH ELECTRICAL CONTROL

The machine as illustrated is double ended. Two units can be mounted end to end so that the same motive power can be employed for each. Although the electrical control is the chief feature of the new machines, belt-driven machines can be furnished controlled by the mechanism ordinarily employed for this type of work. Such a machine is illustrated in Fig. 2. The electrical control and adjustment feature is recommended, however, when suitable electric current is available.

The frame of the machine is of I-section semi-steel having large fillets as a safeguard against cracking in the corners. Since no cores are necessary in forming the castings, faulty sections can be more readily detected than in a box-section frame. The sliding head is a semi-steel casting and has a broad take-up wedge.

The eccentric shaft is a one-piece steel forging and is employed for the eccentric box. Sight-feed oil cups are provided on the main bearings and the sliding head. The tool blocks are made of cast steel; they can be easily removed by making a quarter turn of a handle. The punch is so constructed as to incorporate the features of both a fixed and a floating punch in one tool.

Machine-molded semi-steel gears are employed, and the pinions are shrouded. Since fractional ratios are used, smooth running conditions are promoted. On the motor-driven machine, a cut steel gear is furnished on the motor shaft. Guards can be supplied for all gears. The driving shaft runs in babbitted bearings.

Eight sizes of the machine are made. On the smallest size a punching capacity of a $\frac{5}{8}$-in. hole through a $\frac{1}{2}$-in. steel plate, or its equivalent, is provided. Plates $\frac{11}{16}$ in. thick can be split. Throat dimensions of 6, 12, 18 and 24 in. are standard. The largest size machine has a capacity for punching a $2\frac{1}{2}$-in. hole through a 1-in. steel plate, and plates up to $1\frac{5}{16}$ in. thick can be split. Throat depths of 15, 24, 36 and 48 in. are furnished. The entire range of machines is especially suitable for motor drives, with the motor mounted on top of the frame so that only a limited floor space is required.

The automobile electric control makes it unnecessary for the operator to leave his position in front of the machine to start or stop the operation. The push-button switch is portable and may be operated by either hand or foot. The clutch is of the solid jaw, renewable-face type. The sliding half is a steel casting and the fixed half is a part of the large gear and is reinforced by a steel ring shrunk into place. This clutch disengages in case the electric current fails, as a safety measure.

When making the adjustment for the length of stroke, the cap shown on the front of the head is turned to the adjusting position so that the electric circuit is opened and the clutch disengaged. The adjustment is then made by positioning around the cap a headless setscrew which is exposed. The point at which the stroke will end can be easily predetermined. Depression of the pushbutton by hand or foot causes the clutch to engage and the head to descend to the predetermined point. The head then rises and stops.

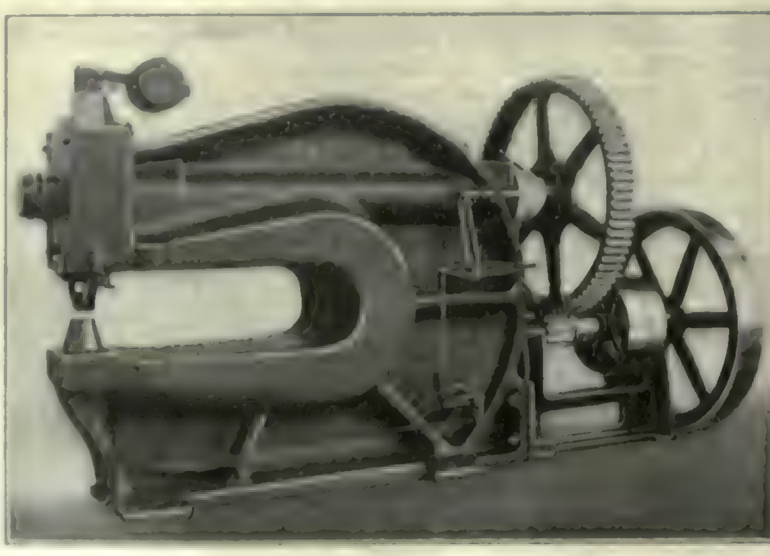


FIG. 2—CHAMBERSBURG MECHANICAL CONTROL PUNCHING MACHINE

Keller Type F Automatic Die-Sinking Machine

The automatic die-sinking machine shown in Fig. 1 is designated as the Type F and has recently been placed on the market by the Keller Mechanical Engraving Co., Brooklyn, N. Y. The machine is intended for work in which impressions up to 36x20 in. and 8 in. deep must be made, and is adapted to the manufacture of forming, stamping and forging dies as well as metal patterns and core boxes.

The machine is intended for smaller and lighter work than the Type BG machine described on page 389, Vol. 55, of *American Machinist.* Since the Type BG machine carries work of very large weight, the work remains stationary and all movements are made in the head carrying the spindle and tracer. The Type F machine is different, because of the moderate size of the work. The horizontal movement is in the work table, which is provided with a range of speeds for cutting as well as a quick-return movement in each direction. The vertical movement and the in-and-out or transverse movement are in the head. Lead screws operate all the movements. There is also a contouring movement, so that a templet, ridge or groove in the pattern can be followed.

The control of all movements is electrical, as regards both the automatic feed and the pushbuttons employed for hand control. The control cabinet contains all of the mechanism necessary for the complete control of the movements. Although the illustration shows the machine equipped with the control board and an angle plate fixture, the control cabinet, which is a separate unit, is not shown.

The machine works from a master, which it reproduces. This master can be of plaster, cement or wood, as only a very slight pressure of the tracer is exerted upon it. However, all the required pressure is applied to the cutting tool, so that large cutting power as well as accuracy in reproducing the patterns can be obtained. The arrangement of the master and the work when cutting a steel die for an automobile front axle is shown in Fig. 2. The work leaves the machine in practically the finished condition, so that only a small amount of handwork is necessary to completely finish it.

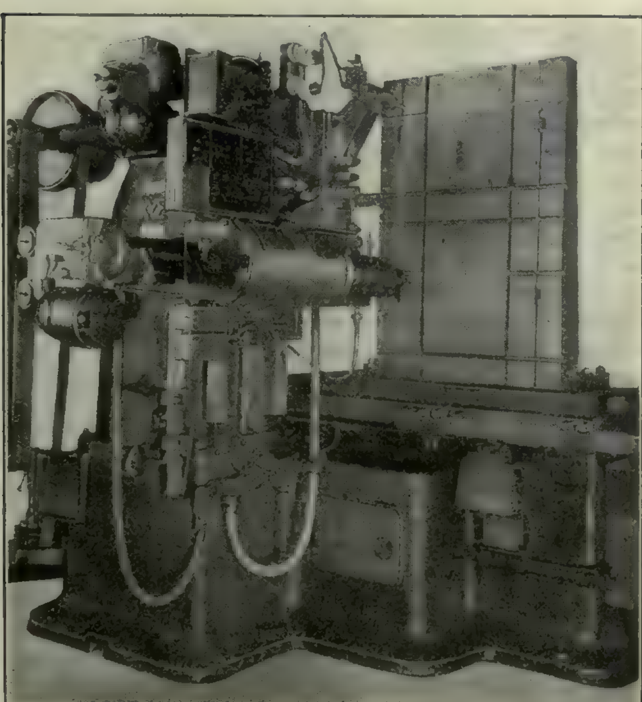


FIG. 1—KELLER TYPE F DIE-SINKING MACHINE

The table has a working surface of 53x22 in. It is provided with T-slots and an oil channel around its edge. Its horizontal travel is 36 in. and speeds from $1\frac{1}{2}$ to 12 in. per minute are obtainable through rheostatic control and change gearing. The slide carrying the spindle has a vertical travel of 20 in. on the head; the rate of speed varies from 0.01 to 0.83 in. per stroke. The slide is counterbalanced. The transverse movement of the head is 8 in. This movement is electrically controlled so that the tracer can follow the impression of the master. All the moving slides have large bearing surfaces and are provided with tapered gibs, so that wear can be taken up.

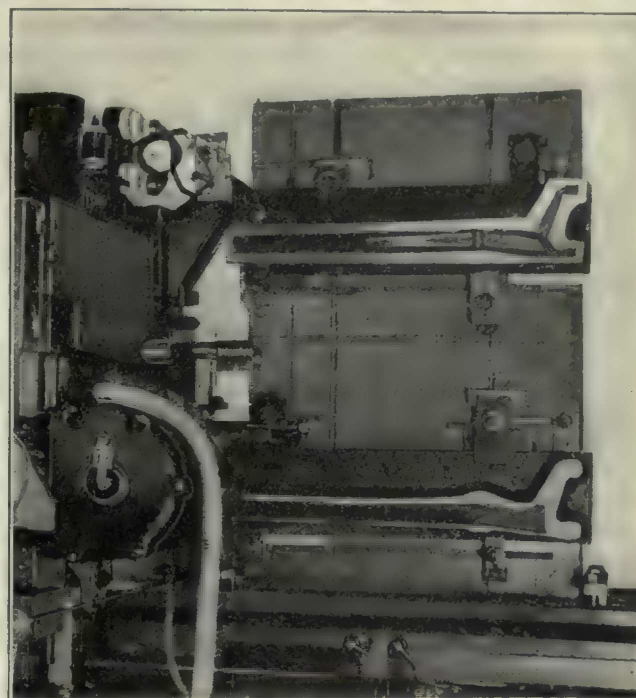


FIG. 2—WORK AND MASTER ON KELLER TYPE F MACHINE

For the purpose of following an outline templet in one plane, there is provided a contouring attachment similar to a profiling attachment. The device is controlled by a pushbutton and follows the outline whether it be inside or outside. The automatic and semi-automatic controls make the machine adaptable to a great variety of operations in which forms must be accurately cut.

Two separate motors are provided, one being a variable-speed motor of $\frac{3}{8}$ hp. for controlling the various movements. A 2 hp. d.c. motor for 110 or 220 volts is directly connected to the lower cone-pulley shaft mounted on the rear of the column. The spindle driving pulley is carried on the upper cone-pulley shaft. Two separate spindle driving pulleys, as well as two spindles, one for slow speed and one for high speed, are provided. The slow-speed spindle has the back gears mounted as a unit on the spindle head. The high-speed spindle is driven by means of a grooved pulley from the pulley shaft of the slow-speed spindle. The slow-speed spindle runs in adjustable bronze bearings and is equipped with a No. 9 B.&S. taper; the high-speed spindle has a No. 7 taper. A range of speeds from 80

to 3,636 r.p.m. is obtainable by the two arrangements.

The spindle and slide are lubricated from a multiple sight-feed cup located on the spindle head. Coolant is supplied to the cutter by a force-feed, gear-driven rotary oil pump. The tank for the coolant is provided in the base, so that the coolant drains into it from the trough in the table.

The machine is complete with the motors, tracer points, milling cutters and other equipment. The control cabinet containing all the electrical apparatus is a separate unit connected to the machine by wiring. The machine is about 6 ft. 8 in. in height, and occupies a floor space of 9 ft. x 8 ft. 1 inch.

Sigourney High-Speed Ball-Bearing Sensitive Drilling Machine

The Sigourney Tool Co., Hartford, Conn., has brought out a line of high-speed sensitive drilling machines of both the column and floor types and having single, two, three and four-spindle heads. The single-spindle floor-type machine is shown in Fig. 1; the same style of head is used upon all the machines.

In these machines the spindles are completely enclosed by telescopic sleeves to prevent oil from being thrown upon the work or operator. The projecting upper end of the spindle is also enclosed in a stationary removable sleeve.

The spindles run upon Norma ball bearings and are capable of being driven at a speed of 4,000 r.p.m. without shock or vibration. At a speed of 900 r.p.m. of the first countershaft, the corresponding spindle speeds are 950, 1,600 and 3,000 r.p.m. The spindle driving pulley runs upon ball bearings that are independent of those of the spindle, and it also is enclosed by a hood that is permanently a part of the head bracket. All bearings are standard commercial ball bearings and are conveniently adjustable so as to keep them tight in service.

FIG. 1—COLUMN TYPE OF HIGH-SPEED SENSITIVE DRILLING MACHINE

FIG. 2—NO. 1 HIGH SPEED BENCH DRILLING MACHINE

The table may be moved vertically on the column for a distance of 30 in. (33 in. in the single-spindle machine) and is balanced by a counterweight inside the column. A planed line upon the column and a witness mark on the table facilitate setting the hole in the latter in exact alignment with the spindle.

The table dimensions are 9½ by 12½, 12 by 25, 12 by 31 and 12 by 37 in., respectively, for the one, two, three and four-spindle machines. The heads are adjustable vertically upon the face of the brackets for a distance of 6 in. The maximum heights under the chucks are 34½, 32, 32 and 31 in. A taper hole in the spindle accommodates a No. 1 Morse taper shank. The rated capacity when using chucks in the spindles is $\frac{5}{16}$ in. drills. If larger sizes are desired, drills with taper shanks should be used directly in the spindles.

The vertical movement of the spindle by rack and pinion is $2\frac{5}{16}$ in. and the moving parts are counterbalanced by a concealed coil spring. A clamp stop with a knurled screw for fine adjustments is provided on each head. All belts are endless and the tension of each may be regulated individually by moving the second countershaft, conveniently located screws being provided for this purpose. Chucks, V-blocks, point and bell centers are furnished as extras.

The net weights are 400, 625, 765 and 960 lb., respectively. Boxed for export the machines weigh 600, 860, 1,090 and 1,360 lb., occupying a space of about 37, 45, 58 and 66 cubic feet.

The same type of head is also applied to the No. 1 bench drilling machine shown in Fig. 2, the specifications in the matter of speeds, adjustments and measurements being the same except that the table of the bench machine is 11 by 14 in., the maximum height under the chuck is 8 in., and the weights, net and boxed, are 215 and 360 lb., respectively. The space occupied by this machine when boxed for export is 19½ cubic feet.

Bausch & Lomb Contour Measuring Projector

A contour measuring projector by means of which gages, threaded work, gears and form cutters may be inspected, has been placed on the market by the Bausch & Lomb Optical Co., Rochester, N. Y. With the instrument, all sorts of small parts can be inspected for contour, and after heat-treating can be checked to detect distortion.

The equipment does not require a dark room for operation, as the image is produced on the horizontal table supported on the front leg of the stand. A curtain drapes the table to exclude the light of the room, as shown in Fig. 1. As the screen is attached to the instrument, any inaccuracy from the vibration of the screen alone is eliminated. Leveling screws are placed in the base so that, when in use, the base may be lifted off the castors.

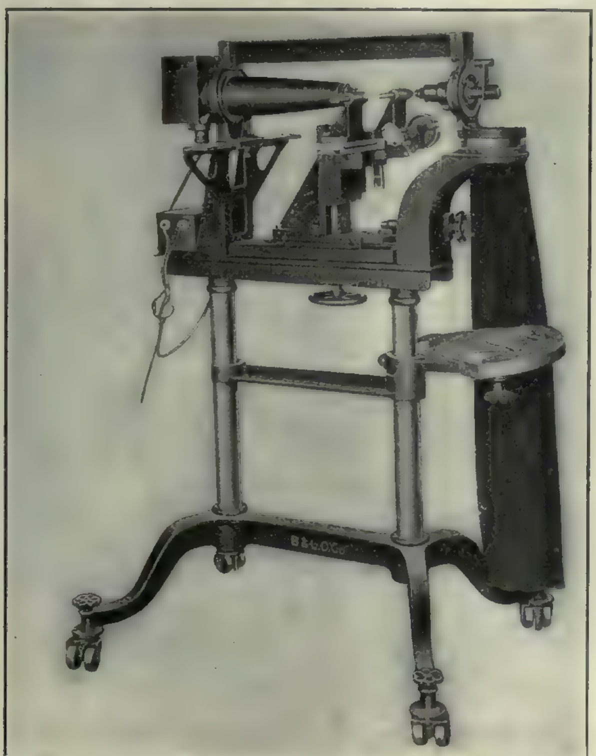


FIG. 1—BAUSCH & LOMB CONTOUR MEASURING PROJECTOR WITH ADJUSTABLE THREAD CHART AND LEAD MEASURING ATTACHMENT

The work carrier is a compound slide which may be given three movements by screws with handwheels. One handwheel controls the vertical and one the lateral movement to bring the work into position, while the third produces a movement toward or away from the objective for focusing the image on the screen. As a pair of V-blocks with adjustable centers is part of the equipment, the work may be held between centers or may be supported by the V-blocks. The adjustable thread chart, lead measuring device, screw holder, gear attachment, two opaque attachments, photographic plate holder, and angle plate are devices that can be furnished for attachment to the instrument.

A special concentrated, single-filament, 6-volt, 108-watt, Mazda lamp, operating in conjunction with a transformer on an alternating current is regularly supplied. For extremely critical work, the "Tungsarc" lamp is recommended for use when projecting gear contours at high magnifications, or inspecting spiral gears by reflected light. The light condensers are mounted in a cone which keeps them always in optical alignment. The iris diaphragm allows the diameter of the beam to be reduced as required. If desired, the prism reflecting the light down on the table and forming an enlarged image, can be swung out of the way on an arm, so that the light is projected straight ahead on a vertical screen. The optical system is fixed, and focusing is brought about by moving the object back and forth.

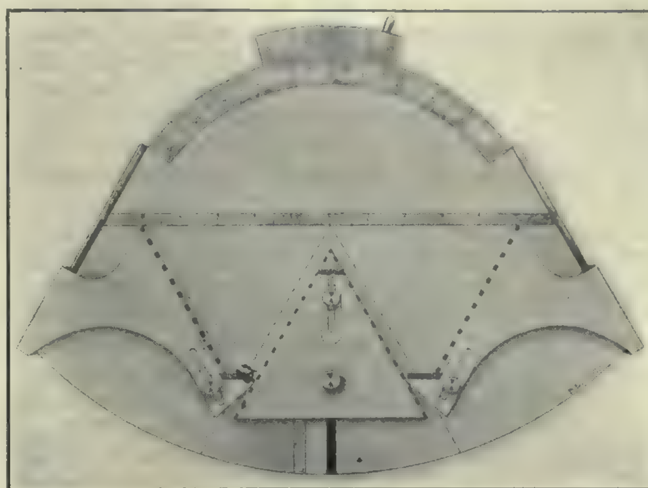


FIG. 2—ADJUSTABLE THREAD CHART

In the regular equipment are two focus objectives, a 24-mm. special objective in a long tapering mount of small diameter to work over the top of large diameter gages or threads, and a 48-mm. objective where less magnification or a larger field is desired. Eye-pieces of 5 X and 12.5 X for projecting threads up to 3 T.P.I. U.S.F., and gears up to 12 diametral pitch are also included in the equipment. By lowering the table and thus increasing the projection distance, greater magnifications can be obtained. These magnifications, however, vary slightly with different objectives and eye-pieces and are not for use in taking direct measurements.

When projecting threads, the entire optical system is at all times lined up along a single central axis. The light source, the condenser, the portion of the screw to be projected and the objective are always part of a single coaxial system, and the screen receiving the image is always perpendicular to the axis of this system. Where the helix angle is large, the flank angle can be determined by calculation.

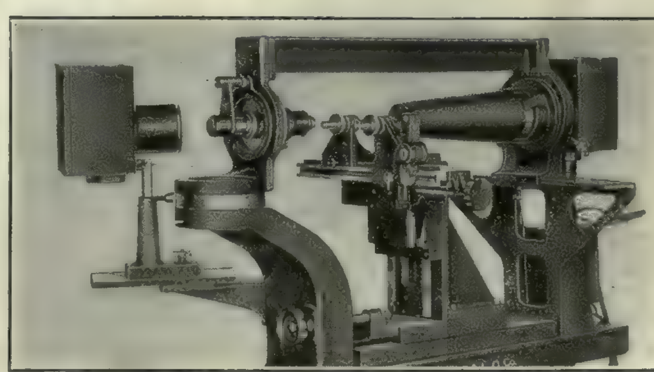


FIG. 3—CONTOUR MEASURING PROJECTOR WITH GEAR AND OPAQUE LOW-MAGNIFICATION ATTACHMENTS IN POSITION

The adjustable thread chart, shown in Fig. 2, is for very accurate measurement of threads. It has a graduated arc and vernier for checking the "lean" of threads and adjustable straight-edges which may be set by means of scales for any pitch and flat on the root of the thread, with a magnification of any desired value. It is set upon the table as shown in Fig. 1 and the contour of the threads is projected upon it.

The lead measuring attachment shown in Fig. 1 attached to the work-holding slide, is for checking the lead of a screw and for measuring gear teeth. A bracket clamps in a "T" slot on the front of the cross-slide and carries a dial gage which acts as a zero point. The reading of the lead or movement of the slide is made by means of a micrometer fitted with a drum graduated to 0.0001 in. and thus errors in lead of 0.0001 in. may be readily detected.

A holder and pitch blades have been made to substitute for the centers, and to accommodate a range of work varying from the smallest diameter and finest pitches of watch screws to diameters of 3 in. and coarse standard pitches. The holder supports the screw entirely from the thread walls or effective diameter. In thus combining the errors of lead and diameter, it may be shown whether or not the screw will assemble.

By means of the gear attachment the contour of the gear tooth and the cutting tool may be checked. Special adjustable brackets with ½-in. diameter studs support the gears while an indexing pivot indicates the errors, tooth by tooth, over a number of teeth. By rotating the gears at an even rate, the rolling and sliding action of the teeth may be observed. In Fig. 3, the brackets and pivot are in position on the work carrier. Measurements of thickness and height of teeth can be taken to close limits with the lead measuring attachment.

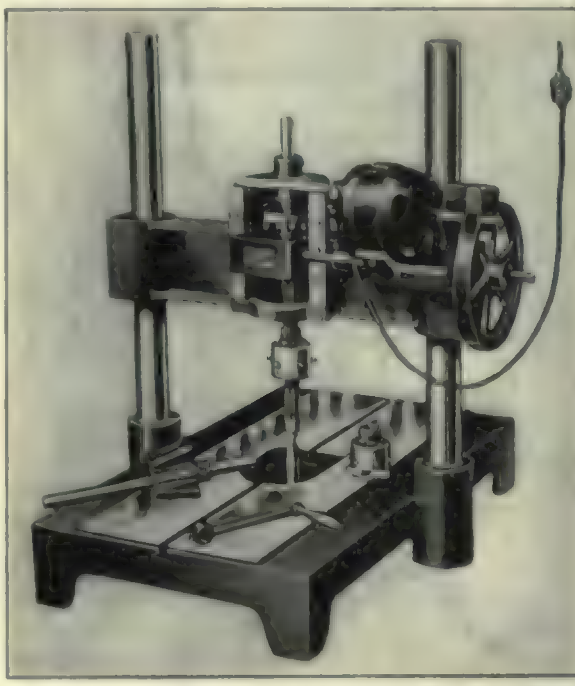
In measuring spur gears, the light may be passed along the tooth; but for spiral gears it is necessary to illuminate the work by oblique or normal illumination directed against the surface of the work being examined. Fig. 3 also shows the arrangement of a device for illuminating by oblique light. It is composed of a lamp house containing a 6-volt, 108-watt Mazda lamp fitted with a condenser, and is mounted on an optical bed. This arrangement can be used only for low-power objectives. The opaque attachment is for examining very small parts requiring high power objectives. The device, which consists of a vertical illuminator attached to the nosepiece of the optical tube, provides illumination normal to the surface under examination. With this attachment a 5-amp. arc lamp is substituted for the 6-volt Mazda lamp.

It is possible to take photographs of the image projected on the table and for use in this connection there is an attachment in which either photographic plates or bromide paper may be placed. Another attachment is the angle plate, which fits the cross-slide and has a clamping block for holding small flat or odd-shaped pieces in place, and a device for taking the casts of large diameter rings. Holes tapped in the face of the angle plate permit the clamp to be shifted for various diameters while the screw on the end of the clamp regulates the height according to the thickness of the ring. A cast composed of sulphur and graphite can be easily poured while the ring gage is fastened to the angle plate. The ring is loosened by tapping lightly, and the cast with its support is then transferred to the projector, where it is positioned properly in the V-block by a key on the support for the cast.

"Superior" Cylinder Reboring Machine

A machine for reboring automotive cylinders and designated as the "Superior" reboring machine, has recently been placed on the market by the Production Machinery Co., Jackson, Mich. The machine, which is shown in the illustration herewith, is of rigid construction and will handle any automobile motor cylinder or other internal combustion engine cylinder of similar design.

The machine consists of a bed-plate, to which the cylinder is clamped, and a cross-rail which carries the working parts. The boring bar is held between two centers, which prevents any deviation of the cutter from true alignment due to hard or soft spots, ports and clearances. It is stated that the construction also prevents the cutting tools from chattering while in operation. Both centers are made of tool steel, tempered and ground.



"SUPERIOR" CYLINDER REBORING MACHINE

The cutterhead is rigidly constructed, which also tends to insure perfect alignment where cylinders are out of round so that more metal must be removed from one side of the cylinder than the other. The cutter contains six blades, which are adjusted simultaneously by operating a hand wheel. All blades are made of high-speed drill rod and carefully tempered. They are ground to form a left-hand helix, which tends to draw away rather than into the metal. The machine is furnished complete with two cutter heads, which makes possible a range of from 2⁴⁄₅ to 4¾ in.; blades larger than this can be furnished if desired.

To locate the cylinder for boring, the bar shown lying on the table of the machine is placed between the centers and the locater is lowered into the top of the cylinder, where it is locked with a thumb-screw. This arrangement holds the cylinder in position until it can be clamped to the table by means of a T-bolt, after which the boring bar is substituted.

One of the features of the machine is the feed mechanism. Four different feeds are available by simply changing the position of the rollers with which the star

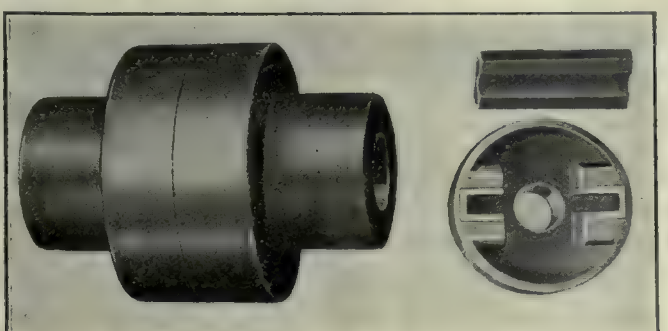
wheel comes in contact. Both the rollers and star wheel are hardened. The boring bar is driven by hardened steel helical gears, producing an even, constant feed.

The machine can be furnished either with an electric motor, as shown, or with pulleys for belt drive. The electric-driven machine is equipped with a ¼-hp. standard G. E. motor, for either 110 or 220-volt alternating or direct current, with cord and plug for connecting to a light socket, and a G. E. thermal switch which protects the motor.

"Tilting-Bar" Flexible Shaft Coupling

The "Tilting-Bar" flexible coupling recently developed and placed on the market by the American Foundry & Manufacturing Co., Frederick, Md., is shown at the left of the accompanying illustration. The coupling consists of only three parts, two flanged hubs with sockets in their faces and a steel bar that fits into the sockets. On the left of the illustration one of the flanges and the bar can be seen. Flexibility is obtained by the tilting and sliding of the bar in its sockets, so that parallel, angular and endwise misalignment of the two shaft ends can be accommodated.

Except for very slow-speed drive, the sockets are bushed with leather to furnish electrical insulation and to give quietness of operation. These bushings are impregnated with paraffin to make them water-proof and to lubricate the surfaces. The driving is done



"TILTING-BAR" FLEXIBLE COUPLING AND PARTS

through solid metal parts which are not subject to appreciable deformation, so that breakdown is not as apt to occur as when a number of springs and rubber pads are employed.

Due to the shallow V-shaped groove in the tilting bar there is a tendency for the two hubs of the coupling to move toward each other. The tilting bar is held centrally in one but is free to move endwise in the other. In this way the bar cannot be thrown out of center so as to cause a loss of balance and consequent vibration of the machine.

The factor of safety of the coupling is stated to be as high as 12, so that the shafts themselves would be twisted before the coupling would be broken. Due to the perfect balance, the coupling is suitable for the connection of shafts running at high speed. Parallel misalignment from 1/16 in. in the smaller sizes to ⅛ in. in the larger sizes can be compensated for. Angular misalignment of 7 deg. can be accommodated. Endwise motion, such as the float of an armature, is allowed also.

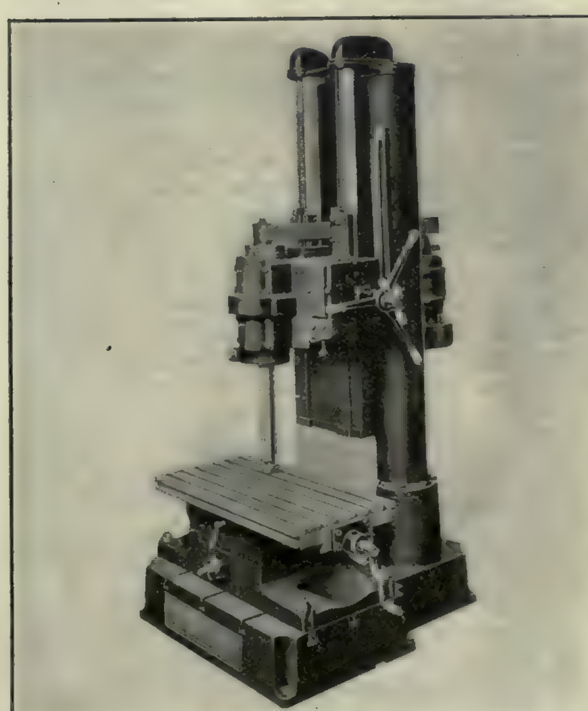
The coupling is ordinarily fastened to the shaft by means of one setscrew on top of the key and another at right angles to it. There are no projections on the outside of the flanges. The standard sizes in which the couplings are made are for shafts ⅞ to 6½ in. in diameter, although couplings for larger shafts can be furnished on order. The weight of the smallest size of coupling is 3 lb., while the weight of the largest is 1,080 pounds.

Williams Vertical Cylinder Grinding Machine

The Hy-Way Service Co., 225 South St. Joseph Street, South Bend, Ind., has recently developed and placed on the market the Williams cylinder grinding machine that is illustrated herewith. The machine is of the vertical-spindle type, so that the work lies on the horizontal table with the cylinders vertical. One advantage of the vertical position of the spindle is the fact that all the driving mechanism is located above the grinding wheel, so that the abrasive dust drops down through the cylinders and does not settle on the bearings and running parts. It should be noted that the vertical ways on which the head slides are protected by a canvas curtain.

The longitudinal slide of the table provides sufficient movement for positioning the work under the spindle to grind three cylinders on either side of the center without uncovering the ways of the slide and exposing them to the abrasive dust. After the work has been clamped on the table in approximately the correct position, it can be located under the spindle by the longitudinal screw and by the transverse screw operated from the front of the machine. The table mechanism with its movements is a separate fixture mounted on the base of the machine. The finished top of the table is 28 in. long and 18 in. wide.

The entire mechanism for driving the wheel is mounted on the wheelhead, which slides on the two widely spaced ways on the vertical double column. A 2-hp. General Electric motor is carried on the back of the head and serves to counter-balance the spindle



WILLIAMS VERTICAL CYLINDER GRINDING MACHINE

mechanism. It performs three functions, namely, driving the grinding spindle at the high speed necessary for cutting with an abrasive wheel, transmitting the planetary rotary motion to the spindle unit, and feeding the head downward to advance the spindle into the cylinder and then returning it to the starting position.

The motor drives at both ends. At the top of it there is a pulley carrying a fabric belt to transmit power directly to the grinding spindle. The speed of rotation is varied to suit the size of the abrasive wheel employed by changing the pulleys on the motor and the spindle, the speed being usually from 5,000 to 7,000 r.p.m. The spindle is mounted in a sleeve located eccentrically in another sleeve, the rotation of which gives a planetary motion to the spindle. A bevel ring gear on the outer sleeve is connected with the driving mechanism, so that power can be applied to rotate the sleeves independently of the rotation of the grinding spindle.

The two sleeves in which the grinding spindle is mounted are so arranged that by making suitable adjustments the eccentricity of the spindle from the center of the spindle unit may be varied from zero to 1¼ in. A graduated dial is provided to indicate the amount of eccentricity for any given setting. The range provided is sufficient for grinding practically all commercial sizes of automotive cylinders when grinding wheels of suitable size are employed, without the necessity of changing the pulleys. Holes as small as 2¼ in. in diameter can be ground to a depth of nearly 17 inches.

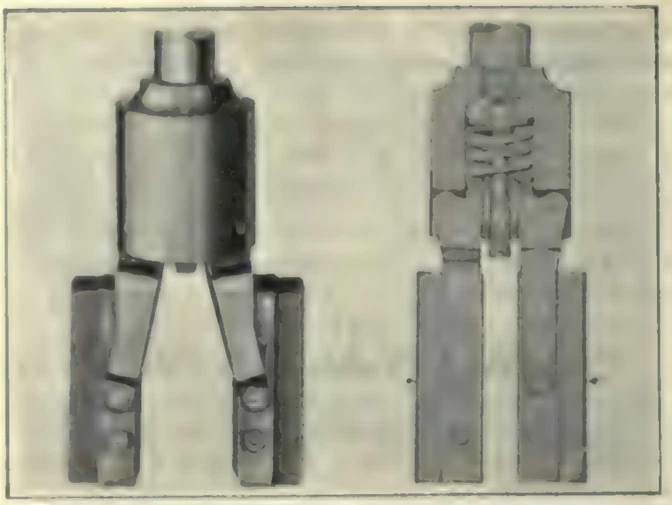
Power for imparting the planetary movement to the spindle is taken from a pinion at the lower end of the electric motor and carried through suitable gearing to the bevel ring gear on the eccentric sleeve. Two speeds of rotation are provided, one of 40 and the other of 60 r.p.m., obtainable through gearing and clutches by manipulating a hand lever on the left side of the machine.

The rate of feed of the wheel vertically into the work is susceptible to wide variation, as twelve rates of feed are available, ranging from 0.007 to 0.375 in. per revolution of the grinding spindle. All the changes are obtained through gearing. Stops are provided to limit automatically the travel of the spindle and to raise the spindle again to the starting position after its downward stroke.

The vertical operation of the head is accomplished by means of pinions meshing with racks on both sides of the column. A capstan wheel is provided on the right side of the machine for raising or lowering the head by hand. The total vertical travel is 28 in. All of the mechanism of the feed box runs in an oil bath, and oilers are provided on all sliding surfaces. The machine has an extreme height of 7 ft. and requires a floor space of 37x42 in. The weight of the complete machine is 4,000 pounds.

Storm Cylinder Finishing Tool

A tool for finishing the bores of automotive cylinders by polishing or burnishing action after the cylinders have been reamed, rebored or reground has recently been placed on the market by the Storm Manufacturing Co., 406 Sixth Ave. South, Minneapolis, Minn. This tool, which is shown both completely assembled and in sectional form in the accompanying illustration, may be driven by an ordinary drilling machine or by a special driving mechanism that can be furnished.



STORM CYLINDER FINISHING TOOL

The tool carries two abrasive stones of fine texture which rub against the bore when the tool is revolved, so that the surface is given a very smooth finish. The stones are held in contact with the cylinder wall by the action of the spring in the center of the body. The tension may be adjusted to suit different diameters of cylinders by turning the arbor in the center.

The spring is usually compressed to about 110 lb. pressure. This pressure is transmitted from the lower disk to the cams on the arms holding the stones. When the tool is perfectly centered in the cylinder, the pressure is evenly distributed to the two cams. When the tool is off center, all the pressure is transferred to one cam, so that only one stone bears against the work. Rotation of the tool naturally draws the driving block into such position that both stones touch the work and both cams are in contact with the disks. This centering action allows the tool to be operated at high speed. No universal joints nor flexible couplings are employed.

Oliver 10, 12 and 14-Inch Engine Lathes

To complete its line of engine lathes, the Oliver Machinery Co., Grand Rapids, Mich., has recently placed on the market 10, 12 and 14-in. sizes, so that machines ranging from 10- to 30-in. swing can be furnished. The lathe is made in both cone-pulley and geared-head, single-pulley types, a 12-in. size of the latter being illustrated. Straight or gap bed, bench or floor legs, oil pan and pump, and countershaft drive or motor drive can be furnished. The tool is for general use where an engine lathe for screw cutting is required.

The headstocks of the 10-, 12- and 14-in. lathes provide swings over the bed of 11, 13 and 15 in., respectively, and over the carriage of 8, 9 and 10½ in. The cone-pulley headstock is of the bowl type and has three steps. It is provided with single back gears, so that six speeds from 25 to 500 r.p.m. are provided.

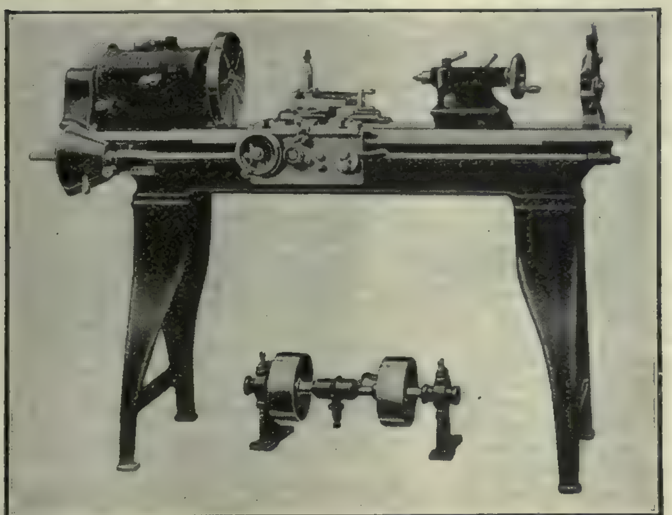
The single-pulley-drive geared headstock is fitted with steel gears that run in an oil bath. Six speeds ranging from 32 to 500 r.p.m. are obtainable by shifting two levers. A friction clutch is fitted in the driving pulley, so that the lathe can be started and stopped without the necessity of starting or stopping the motor or the driving belt.

The spindle runs in phosphor-bronze bearings adjustable for wear. In the two smaller sizes, a No. 2 Morse

taper is employed, and a No. 3 on the 14-in. size. The holes through the spindle are, respectively, 1, $1\frac{1}{16}$ and $1\frac{1}{4}$ in. for the different sizes of machines. The diameter of the spindle nose is $1\frac{5}{8}$ in. with 10 threads per inch on the 10- and 12-in. lathes, and $2\frac{1}{8}$ in. with 8 threads per inch on the 14-in. lathe. The tailstock has a screw-operated set-over for turning tapers. This set-over, as well as the spindle, is graduated in sixteenths of an inch.

The bed is provided with three V-ways and one flat way. The standard lengths are 4 ft. 3 in., 5 ft. 3 in., and 6 ft., the lengths allowed between centers with the tailstock flush being 25, 36 and 36 in., respectively.

The carriage has a cross-slide travel of $6\frac{3}{4}$, $7\frac{1}{4}$ and 8 in., respectively, for the different sizes. The compound rest of the 10-in. machine carries a tool $\frac{1}{2}$ x $\frac{3}{4}$ in. in



OLIVER 12-INCH SCREW-CUTTING ENGINE LATHE

size, while for the 12- and 14-in. machines, the tool-holders can be $\frac{1}{2}$ x $1\frac{1}{8}$ in. The back of the carriage is machined and tapped, so as to receive a taper attachment for turning tapers up to $4\frac{1}{2}$ in. per foot.

The apron gearing is so arranged that the operator may shift from thread cutting to either the longitudinal or the cross feed without the necessity of shifting gears. The two halves of the phosphor-bronze lead-screw nut can be closed on the lead screw only when the feed lever is in the neutral position, so that both the lead screw and one of the power feeds cannot be engaged at the same time. The lead screw is $\frac{15}{16}$ in. in diameter and has five threads per inch. It is splined, so that the power feeds are operated by it.

The change-gear mechanism for the feeds is mounted on the left end of the lathe. The gears are slidably set on the end of the lead screw, so that they can be moved along to bring the proper one in mesh with the driving gear from the headstock. The range of feeds is from 0.0025 to 0.039 in. for all sizes of the machine, and all standard threads from 3 to 40 per inch can be cut. If desired, a small quick-change gear box can be furnished. The direction of feed may be reversed from the headstock without the necessity of stopping the lathe, reversing the direction of the spindle, or engaging or disengaging gears.

A countershaft can be furnished for either the cone-pulley or the single-pulley drive machine. The cone-head machine may be made self-contained by mounting a friction countershaft on a swinging arm at the rear of the headstock and fastening the motor on a bracket bolted to the leg. Means are provided for adjusting the tension of the driving belt. A countershaft may also be mounted for constant-speed-pulley drive, an arrangement that is applicable to the bench type machine. The geared-head machine may have the motor mounted directly on top of the headstock, or the motor may be mounted on the leg and belted to the driving-pulley.

A universal milling attachment can be provided for doing light milling work. A variety of attachments can be furnished, such as a follow rest, turret on either the carriage or the bed, draw-in attachment, chuck and metric lead screw and transposing gears. The regular equipment consists of large and small face plates, steady rest, compound rest, the necessary centers and a double friction countershaft.

The net weights of the three sizes of machine are 575, 875 and 1,300 lb. The boxed weights are 700, 975 and 1,400 lb., and the boxes have contents of 80, 90 and 100 cu.ft.

Test Questions for Hiring Employees —Discussion

By S. N. Bacon

Referring to page 141, *American Machinist*, Mr. Robert Grimshaw makes a suggestion for hiring employees which the writer does not believe would work out to very good advantage. Mr. Grimshaw would have us question the applicant as to whether he could operate a "Broynton" milling machine and if he replied yes, it would prove that he was not a milling machine operator or was at least unreliable. The writer believes the question is just as unfair as the answer and has in mind a period some years ago when he was considered a fairly good screw machine operator, experienced on Brown & Sharpe, Cleveland, Acme, Hartford, and Gridley automatic machines. Had the question been asked can you operate a "Broynton" screw machine he would have answered "yes" not because he would lie due to lack of experience but because his knowledge and experience of all the leading makes gave him enough confidence to tackle a machine he never heard of before. His experience on the Acme and Brown & Sharpe screw machines qualified him to operate a Universal screw machine without any previous experience.

A milling machine is composed of just so many standard operating parts and, if an applicant has had several years experience on Universal, Lincoln type and automatic milling machines, similar to the Pratt & Whitney, he is certainly justified in saying he can operate a Broynton or any other make. Another practice, which has been adopted by employment managers, while not exactly unfair, is at least an attempt at deception in advertising and is contrary to law in some states. This is the practice of inserting two advertisements and using different box numbers when the intention is to employ but one man for a particular job. The advertisements are worded differently so as to trap the applicant into writing two different letters of his experience. Chances are the applicant has really had all the experience claimed but it is not always to advantage to tell it all in an application for a special line of work. In these days of unrest let us use fair methods in securing employees and be that much surer of obtaining the best and lasting results.

News Section

Advancement in Mechanics To Mark National Exposition

The National Exposition of Power and Mechanical Engineering will open at 1:00 p.m. on Thursday, December 7, 1922, at the Grand Central Palace. It will immediately follow the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers and will remain open until December 13th, except on the intervening Sunday.

This Exposition will be the first large scale attempt to display mechanical and power plant apparatus so that the present extraordinary state of development will be apparent not only to the highly trained technical man but to the layman with little knowledge of the severe problems involved in the engineering design and operation of combustion apparatus and power-generating machinery. A very small percentage of the individuals in the world are informed about the tremendous importance of the engineering arts and sciences to our present civilization.

A detailed program of the Exposition as well as the programs of the A.S.M.E., A.S.R.E. and A.S.S.E., meetings will be announced in these columns at an early date.

American Foundrymen's Convention Announced

According to an announcement just received from C. E. Hoyt, secretary, the next annual convention of the American Foundrymen's Association will be held in Cleveland, April 30 to May 3, 1923.

In conjunction with the convention, there will be held an exhibition of foundry and shop equipment which, according to present plans, will take place in Cleveland's new public auditorium where, also, will be held the convention.

Work is already under way on the program which will be announced in full in these columns at a later date.

Tennessee Central Shops Destroyed by Fire

Fire of unknown origin, but believed to have started from oil ignited in the boiler room, destroyed the main shops of the Tennessee Central Railway, located near the corner of Hermitage and Fairfield Aves., South Nashville, Oct. 27, entailing a loss estimated at between [illegible] and [illegible]. Insurance will cover part of the loss.

Originating in the room where the large stationary engines are located for operating machinery in the various shops, the flames spread to every section of the big building, covering approximately one acre of ground. Located in the building were the machine shop, tin shop, tool rooms, planing mills, blacksmith shop and boiler rooms.

Four large locomotives, three freight and one passenger, were destroyed. Thousands of dollars' worth of equipment, machinery, tools and materials of all kinds are a total loss. More than 30 box cars standing on a siding near the shops were partially destroyed.

Late advices reaching *American Machinist* indicate the construction at an early date of a modern fireproof structure to take the place of the buildings destroyed.

Car Shortage Increases 10,000 in 7 Days

Reports received today from the rail carriers of the country by the Car Service Division of the American Railway Association show that the demand for freight cars over and above the available current supply amounted to 166,349 cars on Oct. 23. This was an increase of 10,040 cars over the total on Oct. 15.

The demand on Oct. 23 for box cars in excess of the supply amounted to 81,784, an increase of 4,623 over the total on Oct. 15. The demand for coal cars totaled 46,575, which was an increase of 1,591 cars within the same period. A shortage of 21,004 was reported for stock cars, an increase of 2,085 since October 15, while there was an increase of 1.717 in the shortage of refrigerator cars which brought the total to 9,348.

Reports also showed that at the same time 4,409 surplus cars of all descriptions and in good order were scattered throughout the country, an increase of 134 since October 15. Of that number, 1,776 were surplus coal cars. This was an increase of 188 since that date.

400 American Firms in China

In view of the recently approved China Trade Act, by which Congress has placed American firms operating in China on an equality, for the first time, with British, French and Japanese firms in the matter of taxation, the following tabulation of foreign firms and persons doing business in China is of especial interest. It has been received by the Department of Commerce from supposedly reliable sources in Shanghai:

	1914		1921	
	Firms	Persons	Firms	Persons
American	136	4,365	412	8,230
British	534	8,914	703	9,298
French	113	1,864	222	2,453
German	273	3,013	92	1,255
Japanese	955	84,948	6,141	144,434
Russian	1,237	56,319	1,613	68,250
Non-Treaty Powers	5	95	14	193
All others	68	2,289	306	3,651
Total	3,421	164,807	9,511	240,769

It will be noticed that the number of foreign persons has decreased from 351,000 to 240,769 since 1920. This decrease, however, resulting from the 1920 depression, is probably a healthy sign, for those who have weathered the storm are in the strongest position.

Reports Great National Interest in Technical Service

L. W. Wallace, executive secretary of the Federated American Engineering Societies, has completed a coast-to-coast tour, during which he set in motion plans for Federation expansion. Stressing the great influence exercised by the Federation since its organization about two years ago under the presidency of Herbert Hoover, and evidencing this by the report of its Committee on the Elimination of Waste in Industry, as well as by the report of the Committee on Work Periods in Continuous Industry, as well as by other sustantial achievements, Mr. Wallace was attentively heard by large engineering gatherings in many cities. Everywhere, he reports, engineers are recognizing the enormous potentialities for technical and public service which reside in the Federation as the instrument of expression and action of the engineering profession in America.

25th Anniversary of N. Y. Merchants' Association

Invitations have been sent out by The Merchants' Association to all business houses in the city which have been in business uninterruptedly for one hundred years to send representatives to the mass meeting which will be held at Madison Square Garden on Nov. 17 to celebrate the twenty-fifty anniversary of the Association. If Mrs. Harding's health permits him to leave Washington, President Harding will address the meeting. While many houses have suffered changes of title during a century of existence, it is believed that a considerable number exists in the city.

Car Loadings Establish Record for 1922

A total of 1,003,759 cars were loaded with revenue freight during the week which ended on October 21, according to reports received today from the rail carriers by the car service division of the American Railway Association.

This was the largest number of cars loaded during any one week in two years. This also was within 14.780 cars, or one and five-tenths per cent of the greatest loading in the history of American railroads, which took place during the week of October 15, 1920.

The total for the week has only been exceeded four times in history, all of which took place in the fall of 1920 and are as follows:

September 24	1,008,109
October 8	1,011,666
October 16	1,018,539
October 27	1,008,818

Loading for the week of October 21 this year was an increase of 20,289 cars over the preceding week.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

THE price movement on the New York Stock Exchange is a factor in our economic complex that the American business man cannot ignore. There are 2038 daily newspapers in the United States. Of these a large majority publish the Stock Exchange quotations and whenever the fluctuations are at all unusual or sensational attention is called to them with "scare heads."

The result is that business sentiment from the Atlantic to the Pacific is more or less attuned to the ups and downs of Wall Street, whch are often otherwise unimportant. This is to be regretted, but it is a fact that we cannot disregard. Attention is called to it because the prevailing commercial optimism seemed to be somewhat chilled early last week by the continued decline in the stock market.

This decline, which had been in progress since September, seems to have culminated temporarily at least, on last Monday. On that day 478 different stocks were traded in on the Stock Exchange and some of them sold 20 or 30 points below the high record of the summer. On Tuesday, when business men read their papers they commenced to say "We don't like the weakness of the stock market" and nearly all the commodity markets became reactionary. By Thursday the stock market had made a substantial recovery, the merchants who had become apprehensive were reassured and as the week ends confidence in the future seems to be completely recovered.

But the sympathy between the commercial and financial markets is not entirely logical. Almost without exception the trade reports are optimistic. If the predictions made are realized the banking resources of the country will be fully employed in financing the distribution of goods.

Moreover, gold is commencing to leave us. Since the 1st of October $17,000,000 has gone to Canada, as the Canadian dollar is slightly above par. The reserve ratio of the Federal Reserve System is slightly lower at 76 per cent, as compared with 77.6 a week ago, the gold on hand shows a decrease of $7,000,000 and the total of bills discounted has increased by $121,000,000. This all points to higher interest rates, which do not favor stock speculation. Therefore it is to be doubted whether the expected improvement in mercantile business will be permanently accompanied by a buoyant stock market. Railway securities may and probably will sell higher, but a renewal of liquidation rather than further buying of the highly speculative industrials seems to be indicated.

But of commerce and industry the converse is predicted and the outlook seems to justify the prediction. There is in the first place the theory of a secondary inflation. It is not yet generally excepted. Some influences are at work to prevent its becoming an actuality, but deflation is unpopular at present and the credit expension in progress is not likely to be arrested until the reserve ratios are much lower and the elation caused by high prices has carried the business community off their feet. This is unfortunate, but it is human and we may as well face the facts.

Meantime those who talk about inflation should remember that only three important raw products are as yet much above their prewar value. They are cotton, wool and paper.

The boll weevil has put cotton up and he will probably keep it up until some way to destroy him is found. Whether the advance will check the consumption of cotton goods remains to be seen. Some authorities fear it may, but thus far the domestic demand shows no signs of abatement and the export movement of raw cotton is again increasing. The advance in wool is directly due to the tariff, which is not likely to be changed for some years.

The demand for paper, which is really phenomenal, reflects the increased circulation of the newspapers as well as the growth of our reading and advertising habits. They are national characteristics that are likely to become more marked as each year passes.

As to the other staples—wheat, corn, oats, rice, sugar, tea, coffee, meat, iron, steel, copper, rubber, leather, lumber, building materials and petroleum—they are none of them in the raw state much above their prewar prices.

Roughly speaking, it is probable that in so far as the industrial classes are concerned their purchasing power and the cost of what they have to buy is closely equated, but this is not true either of the farmers or of clerical workers and it is from one or both of these groups that we shall probably hear the first effective protest against the rise in the cost of living now in progress. For it the careful merchant should be on the alert.

The "overall parade" that everyone ridiculed was the prelude to the "buyers strike" that commenced nearly three years ago and it may be that something equally trivial will be the signal for the next recessional of what we call prosperity.

There are other contingencies that should not be lost sight of. Tuesday's election and its effect upon the minds of the people and the policy of the government are to be considered.

The decline in the German mark to 1⅜ cents a hundred, which seems to indicate that all hope of rehabilitating the credit of the German government has been abandoned, is another development that suggests caution.

Still another is the cost of coal to the small consumers in the large cities. It appears to be again rising to extortionate figures despite the vigilance of the various coal commissioners who have little or no legal power over the unscrupulous profiteers.

A high authority has enjoined us to "beware when all men speak well of you" and as an antidote to over-confidence this advice should not be forgotten in times of prosperity and expansion.

All the indicia of business are now favorable. Postal receipts, car loadings, railway traffic, the sales of mail order houses and department stores, bank clearings, the output of automobiles and most other statistics indicate an increased and increasing volume of business.

But these statistics have reference chiefly to the past and it is for the invisible and the unknown that we must make allowance. When we were in the depths of depression it was safe and wise to rely upon a return to normal, but now that we are getting into a higher altitude we should not foreget that there is a level at which the air becomes so rarified that breathing is difficult.

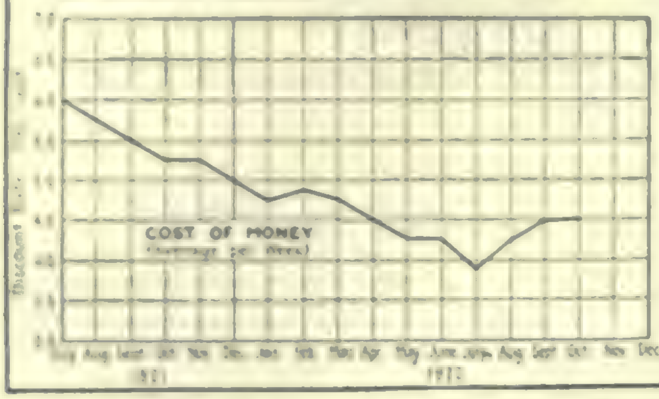
Big Year Ahead for U. S. Manufactures

American manufacturers are evidently preparing for an exceptionally busy season both in their domestic industries and the export trade. In fact, says the *Trade Record* of The National City Bank of New York, they are in many cases doubling their importation of raw material as compared with conditions a year ago, while on the export side manufactures are the one group of articles which shows an increase in exportation while other groups show a decline.

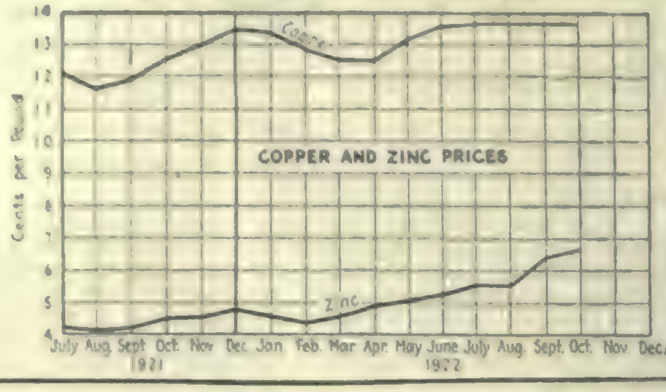
Manufactures exported in the month of August, the latest month for which we have official figures in this detail, showed an increase of 15 per cent in value when compared with the same month of last year, while the other articles exported showed a reduction of over 33 per cent in value in the same period. The few figures thus far received on September exports indicate that the record of that month will also show a heavy fall in exports of nonmanufactured material, and probably an increase in manufactures exported.

The startling factor in the activities of the manufacturers at the present moment is in the tremendous increase in their importation of raw material. Practically every important article for which our manufacturers require foreign material shows a large increase in the quantities imported in August, 1922, when compared with those of August, 1921.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



COST of money as reported from the various points in the Federal Reserve System shows a firmer and higher tendency. City and country banks have been in the market for prime commercial paper and an excellent demand has been in evidence with fairly liberal offerings. The range in rates in October has been between 4½ to 4¾ per cent as compared with an approximate range of 4 to 4½ per cent in the previous month.

Equipment shares fell off during the month from the high point reached in the middle of September, the average price of 10 representative issues dropping to $106.50 as compared with $110.40 in the month previous. The decline has been largely speculative in character with profit taking in evidence. There has been a feeling of caution manifest in various quarters with a disposition to look upon the market, as a whole, as having reached the end of the upward swing which started some months ago and which has been serenely under way since that time. Nothing at the present moment, however, indicates a drastic reaction.

Copper and zinc prices, on the average, show but fractional changes during October. The average price on the New York market for the former was 13.632 cents as against 13.748 cents in September. Zinc averaged 6.840, an increase from 6.110 cents. Buying at the present time is very dull both for domestic and foreign account. January deliveries are being named in copper, this years wants apparently being satisfied. In export an increased demand has developed from France. Zinc producers report an excellent demand with prices stronger and higher. Active European buying has been in evidence recently.

Comparative Prices of Shop Supplies

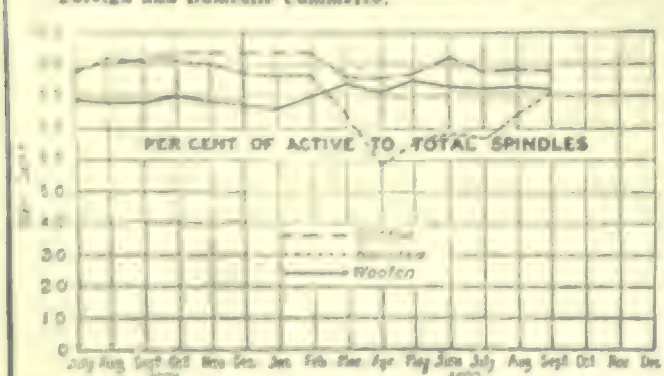
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.......	$0.0295	$0.0285	$0.0273
Cold finished shafting.	per lb.	0.0378	0.0373	0.0379
Brass rods..	per lb...	0.171	0.1700	0.148
Solder (½ and ½)	per lb...	0.23	0.228	0.20
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia	per 100.....	3.11	3.11	....
Lard cutting oil	per gal.....	0.575	0.575	....
Machine oil...	per gal.....	0.36	0.36	....
Belting, leather, medium	off list......	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list......	55% @60%	50%@ 65–10%	50%@ 60–10%

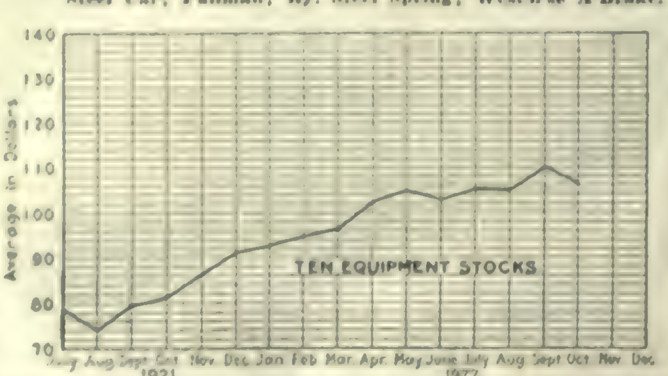
Textile industrial activity in the United States during the month of September compares favorably with the month of August, October figures not yet being available. Cotton spindleage active amounted to 89.8 per cent of the total in place as compared with 87.9 per cent in August. In the woolen industry there was a slight decline from 82.9 per cent to 81.7 per cent. Worsted conditions, on the other hand were better, active machinery amounting to 81.4 per cent of the total in place as compared with 74.8 in August. The demand for woolens and worsteds continues steady. Cotton yarn prices are strong and rising. Exports of cotton cloth continue ahead of last year.

Employment in industries, according to the Department of Labor, shows that in September as compared with August, there was an increase of 10 per cent in foundry and machine shops. Within the same period there was also an increase of 9.5 per cent in the total payroll disbursements and an increase of 0.5 per cent in per capita earnings. In the iron and steel industry per capita earnings increased 9.5 per cent, employment showing a slight decrease of 1.9 per cent. The electrical industry shows a 2.2 per cent increase while employment in farm implement manufacture declined 4.4 per cent.

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.



Business Conditions in Germany

Labor Still a Disturbing Factor—Steel Industry Shows Improvement—Tool Builders Operating on Part Time

By OUR BERLIN CORRESPONDENT

THE gradual decline of business, already noticeable during the first months of the summer, has, after a brief spell of revival, caused by the unprecedented money depreciation, taken sharp dimensions in the middle of September. The depression, signalled by a sharp falling off in incoming orders, has seized simultaneously nearly every line of industry and all stages of manufacture. Buying has nearly come to a standstill, not only with the ultimate consumers, but also with the whole chain of middlemen.

As a sign of the times there may be mentioned the almost complete failure of the last Leipzic fair in August, which started under the most favorable auspices. The numerous buyers it had attracted, have scurried away in haste after hearing prices and left the field practically to the salesmen. As a comprehensive test of market conditions, the Leipzic fair stands supreme. The lesson it teaches is, that prices have reached a level, upon which, at least the domestic market will not follow.

Fall of Mark Demoralizing

A general view of the situation shows, that the carefully preserved position, which Germany occupied in the matter of cost and labor in contrast to surrounding countries and the rest of the world, has been seriously weakened. In a discussion of German labor conditions, published in these columns, the situation has been likened to a vessel, allowing Germany to produce under a lower pressure of cost than in the rest of the world. There can be no doubt, that this vessel has now sprung a serious leak. Prices, which at first kept at a considerable distance from those of the outside world and were only slightly, and never immediately, influenced by exchange fluctuations, are now closely linked with the latter.

The paper mark has lost its capacity as a price unit and surrendered this position to the dollar. The growing tendency to substitute paper marks as a basis of prices by the dollar has, although strongly opposed in actual practice, established itself in virtue. The situation in this respect is one of extreme gravity. Prices are following almost instantaneously every upward move of the dollar exchange, but nothing short of a slump can effect their downslide. Almost the same can be said of wages. The distance, at which the cost of labor has been following the rise of living cost, has gradually diminished.

Apart from the seriousness of the labor question, the position of the industry has become very precarious in other respects. The chief difficulty is pronounced to be the shrinkage of working capital and the extreme tightness of credit. Recent visitors to Germany were greatly non-plused by the inability of the banks to cash checks of even small denominations. This was explained to the public as due to the printers' strike, a rather absurd explanation, remembering that this strike dated months back and lasted only 10 days. The fact is, that wages, salaries and other cost have risen so enormously, that the currency available has become insufficient. In many parts of the country factories could not pay their employees in full.

The situation will be understood, when considering that the whole floating debt of the country of 350,000 million marks is now only worth 900 million goldmarks in comparison to 6,000 million in pre-war times. The depreciation of the money has run far ahead of the inflation, and by compelling the latter to follow, it becomes stabilized in its turn, a very natural consequence.

TABLE I—GERMAN FOREIGN TRADE IN MACHINERY

For First Seven Months of 1922

Month	Imports: Tons	Imports: Value (Millions of Marks)	Imports: Price per Ton (Marks)	Exports: Tons	Exports: Value (Millions of Marks)	Exports: Price per Ton (Marks)
January	1,010	27	26,700	32,695	927	28,400
February	656	19	29,100	39,257	1,255	32,000
March	1,480	19,4	13,100	40,247	1,465	36,000
April	778	24,5	31,000	39,418	1,586	40,000
May	402	10,9	27,000	40,497	1,614	40,000
June	1,519	31,8	21,000	41,527	1,909	46,000
July	776	30,3	39,000	36,381	1,761	48,000

The iron and steel industry showed during August even increased business in comparison with July, caused by the rush upon the market for covering in raw material in view of the quickly rising price level. Shortage and lower quality of fuel have further reduced the capacity of this industry. Scarcity of ore compelled imports of pig iron to an ever increasing extent, which precipitated the rise of prices of machine building material. The last adjustment has decided upon the following maximum prices of iron and steel: cast iron 26,500 marks per ton, mild steel 29,200 marks per ton, ferro manganese 80 per cent 72,700 marks per ton. These prices are not firm, but keyed to the price of coke in such way, that for instance in the case of ferro manganese an increase of 2.70 mark per ton comes automatically in force for every mark the price per ton of coke increases. Of steel products, Siemens Martin bars have now arrived at 63,000 marks per ton, crude sheets from 70,000 to 75,000 marks per ton, gage sheets from 86,000 to 159,000 marks per ton.

Tool Builders Working Part Time

The labor gazette reports that a number of machine building factories had to reduce working time not only on account of shortage of raw material, but because manufacturers were unable to find the money required for buying sufficient stock. According to the labor gazette a general decline of the machinery market outlined itself quite clearly during August.

This is especially true of the machine tool building industry, which as a rule is the barometer of the whole machinery market. Reports from various factories in different parts of the country agree, that a certain slackening of business took place during August. The machine tool trade, which feels the pulsation of the market better and quicker than the works themselves, noticed this change at a considerably earlier date and was viewing the outlook with misgivings at the time when in factories an optimistic tone still prevailed. It is peculiar to note that the first complaints heard of diminishing orders concerned the export and not domestic business. Coinciding with the rapid drop of the mark, this is very significant.

The large amount of orders still in hand is sufficient to keep the machine tool industry employed for a time, varying between two and seven months according to different lines and quality of production. A certain reduction of delivery dates is already noticeable, but for leading makes and a number of lines, like automatics, universal milling machines and heavy tools, quotations are heard for no less than from 5 to 6 months. Standard tools, like lathes of current sizes and plain milling machines, can be frequently had from stock or booked for delivery in 4 to 6 weeks. This is not so much due to the recent slump, which has not had time yet to take strong effect, but to the largely increased output of such tools.

Difficulties in Financing

The complaints heard in other fields of the enormously high cost of production, making the financing of the orders in hand more and more difficult, are not so frequent in the case of the machine tool building industry, but by no means absent, especially amongst the weaker members of the fraternity. In addition to these, complaints are heard of considerable delays in the supply of raw material and even of shortage of labor, especially trained hands. The latter is the result of the labor policy, which has nearly equalized the payment of trained and untrained labor and caused the first to seek employment in better paid lines of work.

Prices of machine tools have continued on their upward move, as is indicated by the directions issued by the German Association of Machine Tool Builders. The increase thus directed over the prices of November, 1921, which were from 15 to 30 times above pre-war level, are the following: December, 37 per cent; January, 42 per cent; February, 61 per cent; March, 87 per cent; April, 143 per cent; May, 190 per cent; June, 225 per cent; July, 294 per cent; August, 460 per cent; September, 980 per cent.

As can be seen, prices are for the time being approximately ten times higher than those of last November or

from 150 to 300 times above pre-war level. For October a further large increase is imminent. Wages are following the rise of prices at a certain distance, but their movement is gathering momentum. The minimum weekly wages for a trained machinist, which in July were 1,400 marks, have in August increased to 1,900 marks, and from the end of August to 3,000 marks or 70 times the pre-war average. This applies to conditions in Berlin. In some parts of Germany wages are somewhat lower and in others higher. It is interesting to note how little the wages for trained and untrained hands differ. The average wages for married trained men in Berlin in August were 1,962 marks per week, while an untrained man earned 1,830 marks or only 6½ per cent less. During September a further increase of wages of 30 per cent took place, and a rise of at least the same extent is already announced for October.

Position of Machinery Exports

In the German foreign business, which up to the end of July has accumulated a large balance on the wrong side, machinery exports form one of the most favorable features. In the case of machinery, the surplus from January to July was somewhat above 10,000 million marks. The figures shown in Table I taken from the official statistics, represent the returns of the foreign business of machinery during this period.

It can be seen that imports remained on the whole stationary, while exports show a steady increase up to June, followed by a considerable drop in July. Of imports, only a few classes run up to a larger amount, as, for instance, locomotives, weaving machines, harvesters and machine tools, which amounted to 1,103 pieces weighing 918 tons or nearly 15 per cent of the total. The imports appear even smaller when considering that a part of them comes from territories, like Danzig, politically detached from Germany, but economically still belonging to her. This applies for instance to the case of locomotives.

It is of interest to observe the prices per ton of machinery exported and imported. The fact that the average ton price is lower in the case of imported machinery is to be explained by the large percentage of imports from former German territories and countries with still weaker exchange, like for instance Austria. The average export price in January was approximately 28 times above pre-war level at a ratio of money depreciation of 1 to 45. By July the price had increased to 48,000 marks per ton, or 48 times the pre-war price. The corresponding ratio of the money exchange was during that month 1 to 110. Export prices have, therefore, not kept step with the drop of the mark. Compared to pre-war standards, exports remained only slightly behind those of 1913. The best return in comparison with that year is shown in the cases of locomotives, the export of which exceeds by far that of pre-war times, harvesting machines, blowers and ventilators, and machines for the leather industry. In a number of other cases it keeps approximately to the pre-war level, like cranes, sewing machines, machine tools, wood working machinery, printing presses, pumps, hoisting machinery. In all other cases, exports are more or less below pre-war level. The drop is especially marked in the case of textile machinery. The decrease in the grand total would be more strongly pronounced if deducting locomotives therefrom, the growing export of which is the balancing fact.

The figures shown in Table II represent the imports and exports of machine tools from January to July, 1922.

The imports show in the average a slight increase, but their total from January to July of 918 tons or 115 tons per month remains far behind that of 1913, when the monthly average was over 600 tons. In view of the difficulty standing in the way of such imports, not only of a financial nature, it is significant that they have already run up to 25 per cent of the pre-war level.

As to countries of origin, Holland sends the largest share, the United States, Switzerland and Austria following. The respective figures (January-July, 1922) are the following: Holland, 383 tons; United States, 139 tons; Switzerland, 115 tons; Austria, 81 tons; all other countries, 200 tons. The machine tools imported from Holland are, of course, not of Dutch make, but probably English or American, obtained through Dutch dealers.

TABLE II—GERMAN FOREIGN TRADE IN MACHINE TOOLS

For First Seven Months of 1922

	Imports			Exports			
	No. of Tools	Tonnage	Value Millions of Marks	No. of Tools	Tonnage	Value Millions of Marks	Prices per Ton
January	—	135.4	5.67		6,897(x)	173.9	25,000
February		62.5	3.6		7,336(x)	178.3	24,300
March		110	2.2		6,852(x)	184.8	27,000
April	124	164	3.9	9,837	4,486	185.5	41,000
May	118	69.7	2.5	8,067	3,496	173.5	49,600
June	361	253	4	9,560	3,918	210	53,000
July	103	124	6	9,376	2,983	181.8	61,000

Tool Prices Below Pre-War

Taking into account the number of tools imported, a tendency towards lighter types is exhibited. The same also applies to exports. In the Table II, the export returns of the first three months, marked (x), contain wood and stone working machinery, which, up to April have been listed with machine tools proper. Even so, it is clearly recognizable, that in the course of the year machine tool exports have dropped in weight if not in numbers. Below the ad valorem figures have been placed the average prices realized per ton, which allow interesting conclusions, when comparing them with the ratio of money depreciation and the sales prices directed by the Association of German Machine Tool Builders, in whose hands the export control rests. From January to March the price per ton hardly changed, although the mark dropped during that time from 200 to 280 to the dollar. An increase becomes noticeable from April to June, although the mark during this period remained almost stable, the further drop in July is not reflected in the ton price of this month.

A similar discrepancy is exhibited by comparison with the increases directed by the Machine Tool Builders' Association. On the average, the export prices realized are from 50 to 60 per cent of pre-war prices. Among the countries purchasing German tools, Belgium stands foremost, Italy, Spain, France, Holland, Austria and Checho-Slovakia following. Small Austria is still buying to nearly half of the extent of the former Austro-Hungarian Empire. Exports to Belgium, Italy and Spain exceed those of pre-war times. A good recovery is exhibited in the case of South American countries.

As a sign that an impending decline of business was anticipated in quarters capable of a general survey of conditions may be taken the increased attention to the problem of reparations in kind. The much discussed Stinnes contract is a first step in this direction, and the eagerness, exhibited in industrial circles, to follow this example or to join in the business, is significant. Similar contracts have been concluded by another large engineering combine and by a group of South German manufacturers of the metal working industry, including several machine building works. According to newspaper reports, a further number are in the course of preparation, amongst which may be mentioned a project initiated also under Stinnes' guidance for a combine between French iron ore producers and German steel works.

A certain danger is seen in the way the problem of reparations in kind is being put into effect, as it tends to further trustification on a large scale. It is expected that the German combines, which have taken the matter in hand, will make every effort to realize the best possible prices, i.e., the French market prices, which would seriously react upon German domestic prices, not to speak of the shortage, which would ensue from large quantities of goods extracted from the German market.

The keen interest given to the reparations problem is also significant for the disappointment felt after the expectations based upon the opening of the Russian market. From reports issued by the Soviet Government it appears that Germany has by no means captured the lion's share of Russian foreign trade and that the latter falls to Great Britain. The by far greater capacity of the latter country of financing such business is held responsible for this fact, and the growing difficulties of Germany in this respect have in the course of time greatly reduced even moderate expectations.

Employment Service for Engineers

The skilled technical man seeking employment as well as the executive in search of high grade help will find the employment bureau opened by the four national Engineering Societies, the offices of which are at No. 29 West 39th St., New York City, of great value. Members of many affiliated societies and organizations are available through this service bureau.

The service is free and parties interested are requested to communicate with W. V. Brown, manager, Employment Service, Engineering Societies' Building, No. 29 West 39th St., New York City.

Washington Notes

By Paul Wooton

In Europe today the greatest problem is that which has as its object the creation of a spirit for peace instead of a spirit for war. There are other problems of magnitude but in no case can their amelioration be purchased, either by the United States for giving the debts owed it by the European countries, or any other way. Their solutions lie in the moral, intellectual and spiritual fields. Incidentally it is the opinion of high officials in Washington that these problems should be solved singly. Effort to solve the problems jointly makes compromise inevitable.

That the United States ultimately will get back the capital sum involved in these loans to Europe, is the opinion held in a most authoritative official quarter. No one of the nations which entered into this obligation could continue to hold up its head and refuse to meet that debt. Its repayment is held to be a moral obligation to the American taxpayers.

Costly Militarism at Fault

No weight is given the argument that the United States should write off these obligations in an effort to compensate for its failure to enter the war in 1914. Those who have made a close study of the situation decline to admit that the United States was at fault for not having entered the war at that time. They hold that this country in taking up arms against Germany was actuated principally by a desire to prevent the collapse of civilization and to save Europe's drowning liberalism. In that connection it should be pointed out that the most reactionary American is more liberal than the most liberal European.

A reduction of the French army by 50 per cent would pay that nation's debt to the United States. In other countries as well it is held that there is nothing to justify military expenditures at the present rate. Were the United States to maintain military forces in the same proportion as is the case today in Europe, its standing army would be 1,000,000 strong. Even our economic system could not stand such a shock.

With Europe in a higher state of productivity than ever before, it would be little short of picking the pockets of the American taxpayers to cancel the debts, particularly in view of the ease with which the payments could be made were unnecessary drains on fiscal finance stopped. Moreover the United States has reached the point where its surplus of gold no longer is large. Month by month the balance of trade against us is diminishing. We may be exporting gold before six more months have rolled around. In 1921 a billion dollars of American money was loaned foreign industry. That rate is not being maintained this year, but even so the disproportion in the holdings of gold by the United States is about to disappear.

Sterling bids fair to be up to gold value in eighteen months. When that point is reached, it means that 85 per cent of the world's commerce will be on a gold basis. That will make for stabilization in some of the other currencies. There can be, of course, no hope for a return to normal in the exchange with countries which continue to publish money.

Mechanical Engineers Wanted

The United States Civil Service Commission in an announcement just issued, states that it will receive applications until December 5 to fill positions of inspector (mechanical) at the Naval Station, Pearl Harbor, T. H. The pay offered is $7.20 a day with an additional allowance of 96 cents a day while employed at the station. Transportation is furnished by the Government.

Competitors will not report for a written examination, but will be rated upon the subjects of technical education and preliminary experience (30 per cent) and special experience and fitness (70 per cent).

A degree in mechanical or electrical engineering from a recognized college or university and at least three years of certain specified experience are required, except that seven years of experience in mechanical engineering will be accepted in lieu of a college course.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the United States civil service board at the post office or custom house in any city.

German Secret Solved in New All-Metal Plane

A secret metal developed for German aircraft during the war has finally been successfully applied to what is said to be the first American-built, all-metal airplane to fly in this country. The metal, known as "duralumin" because it consists mostly of aluminum, has hitherto given trouble in the final processes of manufacturer upon which its strength and life depend.

Duralumin is used throughout in the "Batwing" airplane, the successful flying of which was announced last night by the inventor, Wm. B. Stout of Detroit, at a meeting of the Metropolitan Section, Society of Automotive Engineers.

As its name indicates, the batwing plane has a single wing shaped like that of a bat. But the spruce wood used in practically all aircraft to date has been replaced by structural members of duralumin, instead of cloth wing-coverings, the new machine has a duralumin skin, only a fiftieth part of an inch thick. Even the struts and cables used for bracing are now contained in the so-called thick-wing.

The eventual airplane, according to Mr. Stout, will be practically nothing but wings. Continuing he said:

"In a comparatively few years, wooden airplanes in the air will be scarcer than wooden ships on the sea. All airplanes flying under insurance rulings will be of all-metal construction.

"Metal planes mean greater safety to pilot and cargo; a possibility of considerably lighter weight; less production cost, particularly as the demand increases; and easier repairs.

"Thick-wing airplanes are developing fast, both in monoplane and biplane types. Retractable chassis, wing-type radiators, and other features that the recent Pulitzer races have shown to be practicable, will appear shortly in commercial airplanes and increase their profit-paying possibilities."

Business Items

The Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has made the startling announcement of a reduction of $11 in the price of their Standard quarter-inch electric drill. They make it clear that this is the same machine which has been selling all this year at $39, although this machine is being constantly improved. The latest improvement is the supplanting of the hand chuck by a three-jaw geared-nut chuck. Production of these drills has trebled with the result that they are now able to sell them at $28.

The Herberts Machinery and Supply Co., 3rd and San Pedro Sts., Los Angeles, Cal., has been appointed exclusive representative by the Diamant Tool and Manufacturing Co., Inc., 91-97 Runyon St., Newark, N. J., in connection with the sale of Diamant standard punch and die sets, in the territory covered by the entire states of California, Arizona and Nevada.

The Natlay Chain Corporation, New York, has been incorporated by B. M. Bancroft and W. Hutchinson, with a capital of $100,000 to manufacture a patented steel chain as well as other mechanical equipment.

The Joyce Manufacturing Co., 2970 Jefferson Avenue, Detroit, Frank H. Joyce, president, recently incorporated with a capital of $500,000, has leased a factory building in that city and will manufacture automobile equipment.

The General Tire and Rubber Co., Akron, Ohio, will spend $100,000 on additional tire making machinery in connection with contemplated factory expansion.

The Firth-Sterling Steel Co. announces that it has added to its line of products the Globe polished drill rods drawn by the Globe Wire Co., Sharpsburg, Pa., and will carry stocks in its warehouses in New York, Boston and Philadelphia.

The Western Screw-Products Co., St. Louis, Mo., whose plant was destroyed recently by fire, has secured a new and permanent location at Main and St. George Streets, that city, and are engaged in equipping it with modern machinery. Production is expected to be started Nov. 15.

The Independent Pneumatic Tool Co., Chicago, announces that after Nov. 1, 1922, its Cleveland office will be located at 1204-5 Citizens' Building, Cleveland, Ohio, instead of 1103 Citizens' Building.

The C. F. Davis Machine Co., Rochester, N. Y., has moved its shop to 150 N. Water Street, occupying the second story of a new building, with greatly increased floor space and capacity.

The Coburn Machine Co., San Diego, Cal., has recently moved its plant from Second and G Sts. to 853 First Street, to secure larger quarters to accommodate its growing business.

The Whiting Corporation, Harvey, Ill., manufacturer of foundry equipment, announces that the C. F. Bulotti

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Transformer, Welding and Heating, Electric

U. S. [illegible] Co., 127 [illegible] Bldg., [illegible]

"American Machinist," September 21, 1922

The transformer is for use where hard [illegible] and high power is [illegible]. It is made in a variety of styles and sizes for [illegible] in different types of [illegible] for the primary and secondary [illegible] and for the core are so [illegible] as to prevent [illegible] and [illegible] of any of the parts. The secondary is built up of heavy [illegible] copper bands spaced to [illegible] and well supported [illegible]. The cooling surface provided is large enough to keep the temperature within safe limits during heavy overloads. The internal reactance automatically prevents the current from building up so that the temperature rises more than 50 deg. C above the room temperature.

Planer, Plate

[illegible]-Fund Co., 111 Broadway, New York, N. Y.

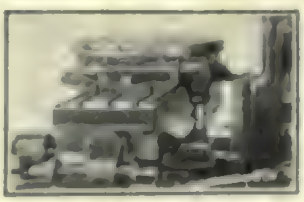
"American Machinist," September 28, 1922

The principal features of the machine are the design of the bed and the method of [illegible] the carriage to the [illegible] are [illegible] from getting on the bearing surfaces of the carriage and screw. The tool carriage is guided by square [illegible] and is secured at both top and bottom by removable [illegible] which have [illegible]. The carriage is reversed automatically. The two [illegible] relieving toolholder slides have simultaneous vertical [illegible] and are mounted on a standard which has horizontal [illegible]. Air is admitted into the tops of the pneumatic jacks for [illegible] the plate, and into the bottoms for unclamping. The [illegible]ted driving motor is controlled by a master switch, so that the machine may be started and stopped by a push button.

Table, Rotary, Milling Machine

[illegible] Milling Machine Co., Toledo, Ohio

"American Machinist," September 28, 1922

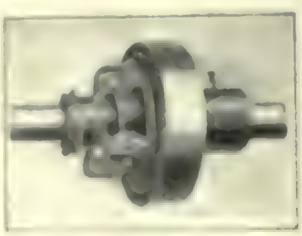


The rotary table is controlled by the regular feed levers of the [illegible], including the traverse. It [illegible] from the feed drive [illegible]. The [illegible] regular feeds of the machine are controlled by the same lever that controls the regular feeds of the table. More than one power feed cannot be engaged at a time. The quick return is also applicable to the rotary table in either direction. The table diameter is 24 in. but work of [illegible] can be accommodated. The table is graduated throughout the entire 360 deg., and [illegible] to minutes can be obtained.

Clutch, Friction, Heavy-Duty, "Universal Giant"

T. B. Wood's Sons Co., Chambersburg, Pa.

"American Machinist," September 28, 1922



The disk clutch has recently been improved to adapt it to severe service encountered in the frequent starting and stopping of large [illegible] gears.

Lathes, Geared-Head, Heavy-Duty, 16- to 30-inch

Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio

"American Machinist," September 21, 1922

The lathes are driven by belt or by motor. The 16-in. lathe will transmit 9.2 hp. with a belt pull of [illegible] lb. per sq. in. The direct-connected motor-driven lathes can be provided with either chain drive or belt drive using an idler pulley. The motor can be mounted on the headstock or in the rear of the cabinet leg. The control may be by means of a rod above the lathe, by a handle at the front of the head or by a lever on the apron. A disk clutch fitted with a brake disconnects the spindle from all gearing when the machine is stopped. Twelve spindle speeds can be obtained with the three handles on the front of the head. On the 16-in. lathe the range of speeds is from 13.5 to 400 r.p.m. in geometric progression.

Grinding Machine, Hob and Form Cutter, Semi-Automatic, No. 10

Harris Engineering Co., Bridgeport, Conn.

"American Machinist," September 28, 1922

The machine is for use in shops where the number of hobs and cutters ground does not warrant the more expensive full-automatic model. The hob or cutter is carried on an arbor fitting into the work-carrying spindle. The work-holding table is operated by the hand lever at the front. Stops limit the stroke to the length of the hob. Hobs having helical flutes are rotated during the table travel by an adjustable sine bar. The spindle is driven by a belt at 2,700 r.p.m. By the truing device, teeth faces may be ground radial or with a top rake. Capacity, 8 in. in diameter and 10 in. long. Number of flutes indexed, 4 to 26. Floor space, 50 x 90 in. Weight, 1,760 pounds.

Drilling and Tapping Machine, Radial, Sensitive, High-Speed

Fosdick Machine Tool Co., Cincinnati, Ohio

"American Machinist," September 28, 1922

This drilling and tapping machine is for work that has too large an area for a high-speed sensitive upright drilling machine, and is also for small holes requiring a greater speed than can be attained on the heavy-duty model. The arm may be swung completely around the column. The sensitive feed and quick return are operated by the lever at the right or the handwheel at the left. For motor drive, a 1-hp. motor of constant or variable speed is required. The machines are built with either 3 or 3½ ft. arms. The dimensions are for the 3-ft. size. Table: vertical movement, 16 in.; working surface, 20 x 33 in.; maximum distance from spindle, 31 in. Spindle: No. 2 Morse taper; vertical traverse, 8 in.; horizontal movement, 28½ in. along the arm. Weight, 2,6[illegible]0 pounds.

Inclinometer, Universal

Stevens-Prentice Manufacturing Co., 377 National Ave., Milwaukee, Wis.

"American Machinist," September 28, 1922

The device is for reading and checking angles, bevels and levels. A vernier pendulum is pivoted in the center of the dial. A small brake stops the oscillation of the pendulum and holds it stationary while the reading is being taken. The device reads to 5 min., but can be furnished to read to minutes. When the line marked 0 on the vernier pendulum coincides with the line marked 0 or 90 on the scale of the dial, the instrument is plumb. The base can be fixed directly to the work that is to be measured and can be furnished with lengths of 7, 18 or 24 inches.

Clip, paste on 3 x 5-in. cards and file as desired

Machinery Co., 67 Main Street, San Francisco, Cal., has been appointed its agent for the State of California, to succeed Eccles & Smith Co., of the same city.

Personals

DR. A. C. HUMPHRIES, Stevens Institute of Technology, Hoboken, N. J., and president of the American Institute of Consulting Engineers, was the principal speaker at the fourth annual meeting of the University of Toronto Engineering Alumni Association held recently in the Canadian capital.

C. E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, has sailed to attend the meeting of the Rating Committee of the International Electro-Technical Commission to be held in Geneva, Switzerland, beginning November 18.

FREDERICK FRANZ, who for the past four years was chief engineer of the Terminal Engineering Co., has established an engineering office at 27 Warren St., New York City, for the purpose of solving special problems of engineering relating to labor saving machinery for industrial plants.

BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric and Manufacturing Co., has been awarded the Joseph Sullivan medal by the Ohio State University in recognition of his notable engineering achievements.

Obituary

WILLIAM BLAKE WOOD, president of Gifford-Wood Co., of Hudson, New York, died October 28 at the Albany City Hospital, after a two weeks' illness. Mr. Wood was born in Arlington, Mass., July 15, 1869. He became a member of the firm of William T. Wood and Co., of Arlington, upon the death of his father in 1896 and continued as a partner with William E. Wood, and later as a member of Gifford-Wood Co. when incorporated in 1905, and succeeded Malcolm Gifford as president upon the latter's death in 1919.

O. B. FULLER, vice-president of the Enterprise Construction Co., died at his home in Los Angeles, Cal., Oct. 19, aged 57 years.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Hydraulic cotton presses for making bales weighing approximately 200 kilos and measuring 90 centimeters on each edge—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Correspondence, Portuguese. Reference No. 4097.

Minting machinery, such as a coining press, a cutting-out machine, an edge-cutting machine, and a rolling mill, comprising in addition a breaking-down and finishing machine—Finland. Purchase desired. Quotations, c.i.f. Finnish port. Reference No. 4100.

Ice-cream-making machinery — Mexico. Purchase desired. Payment, cash. Reference No. 4101.

All machinery necessary for the establishment of a soap factory—Mexico. Purchase desired. Terms, cash against documents. Correspondence, Spanish. Reference No. 4102.

An oil-burning engine and attachments for use in a side-wheel flat-bottom scow ferry boat—Canada. Purchase desired. Quotations, f.o.b. port of shipment. Terms, cash. Reference No. 4103.

All material necessary for tin placer mining—Portugal. Purchase desired. Quotations, c.i.f. Lisbon. Terms, cash against documents. Correspondence, Portuguese or French. Reference No. 4105.

Machinery for sewing hemp soles to cloth shoes (alpargatas)—Argentina. Purchase desired. Quotations, c.i.f. Buenos Aires. Terms, cash against documents. Correspondence, Spanish. Reference No. 4106.

Representation of American firms desired, especially for the sale of goods requiring mechanical knowledge—Denmark. Reference No. 4107.

Aerial tramways for the transportation of lumber and mineral—Spain. Purchase desired. Quotations, f.o.b. New York. Reference No. 4110.

Machinery for the manufacture of pocketbooks, including sewing machines and gluing machines—Canada. Purchase desired. Reference No. 4111.

Milling machinery for small mills—Finland. Purchase desired. Quotations, c.i.f. Finnish port. Terms, cash against documents. Reference No. 4116.

Machine tools, leather belting, kerosene, spraying pumps and spraying materials and machines for orchards, plows, cultivators—Australia. Agency desired. Terms, cash against documents. Reference No. 4077.

Portable sawmill—Mexico. Agency and purchase desired. Quotations, f.o.b. factory or c.i.f. El Paso, Tex. Reference No. 4079.

Warehouse equipment, such as trolleys, hoists, packing machinery, stenciling machinery, and all such material as would be used in warehousing, motor-truck transportation, and the handling of cargo, also furniture covers—China. Purchase desired by firm in the United States having a branch agency in China. Catalogues, prices and full descriptive matter desired. Reference No. 4128.

A complete machine for grinding sugar cane, having 6 cylinders, and of a capacity for grinding 200 tons of sugar cane daily, also a steel or wooden elevator, or feeder, as well as a similar arrangement for carrying off the crushed stalks—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Terms, cash against documents upon arrival of machinery. Correspondence, Portuguese, French or Italian. Reference No. 4140.

Machinery for the manufacture of shoe forms and heels—Italy. Purchase desired. Quotations, c.i.f. Genoa. Terms, cash against documents. Correspondence, French or Italian. Reference No. 4141.

Building hardware, trunk hardware, linoleum, etc.—Argentina. Agent is in the United States for the purpose of securing agency. Reference No. 4142.

Machinery for cannery, such as automatic press, sealing machines and automatic shears—Greece. Purchase desired. Quotations c.i.f. Greek port. Terms, payment against documents or irrevocable credit in New York. Correspondence, French. Reference No. 4143.

Steel pipes, of one-half to 6 inches—Syria. Purchase desired. Quotations, f.o.b. New York. Terms, 25 per cent cassh with order, balance against documents through bank in Tripoli. Reference No. 4144.

Wire-drawing and roller-mill machinery—Sweden. Purchase desired. Quotations c.i.f. Swedish port. Terms cash against documents. Reference No. 4145.

Machine-shop machinery, tools, and general supplies, such as lathes, planing machines, drilling machines and tools, steam hammers, foundry machinery, and cupolas for melting iron and brass—British Guiana. Purchase desired. Catalogues and prices requested. Reference No. 4147.

Machinery for the manufacture of pottery and porcelain, for drying and pulverizing clay, and for pulverizing hard rocks—Straits Settlements. Purchase desired. Quotations, c.i.f. Penang or Singapore. Catalogues are requested. Reference No. 4170.

Trade Catalogs

Logan Air Operated Chucks. The Logansport Machine Co., Logansport, Indiana. This company has just issued a new publication, known as Catalog R-15, which is a series of loose leaf bulletins, in bound form. It contains full descriptions and illustrations of the numerous types of Logan air operated chucks, labor saving devices and equipment for increasing production on automatics, turret lathes, and screw machines. Many drawings are given in the catalog showing the construction details of the different styles chucks, double acting air cylinders and other devices.

Die Heads and High Speed Tapping Devices. The Geometric Tool Co., New Haven, Conn. This company has just issued two new publications. One of them is a special booklet on the subject of its Style DS Geometric Screw cutting Die Heads, specially adapted for Browne & Sharp automatics and other single spindle machines. The publication contains a complete description of the mechanism with illustrations. The other publication is a booklet describing the company's Jarvis high speed tapping devices, tapping machines, quick change chucks and collets and self opening steel setters, with numerous illustrations.

Power Presses and Inclinable Open Back Presses. The Niagara Machine and Tool Works, Buffalo, New York. This company has just issued two new publications, on its line of presses. Bulletin 58, on its Inclinable Open Back presses is of 16 pages and describes in detail the constructive features of this line of equipment, its advantages and specifications with numerous illustrations accompanying the description. Bulletin 59 is a special four-page folder on the Niagara power press, containing a complete description with specifications and illustrations.

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. "What's Under the Hood of Brown Pyrometers" is the title of a new bulletin just issued by this company. The publication has for its object a clearer understanding of the material and mechanism which goes into the company's product, how the product is designed and the method employed in putting it together.

Forthcoming Meetings

American Marine Association, Convention and Exhibition, Grand Central Palace, Nov. 3 to 11.

National Personnel Association, First Annual Convention, November 8, 9 and 10, at Pittsburgh, Pa. Secretary at 20 Vesey St., New York, N. Y.

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923. Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

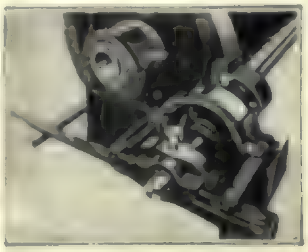
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Glue Pot, Bench, Electric
J. D. Wallace & Co., 1141 W. Jackson Blvd., Chicago, Ill.
"American Machinist," September 14, 1922

The temperature of this electrically heated glue pot is controlled automatically and the current may be taken from an electric lighting circuit. The temperature [illegible] and is maintained between [illegible] and [illegible] deg. F. The glue is always kept at the proper temperature for use, although it is not heated sufficiently to injure its [illegible] properties. The pot may be employed either as a water bath or as a hot air or a dry heat pot. The thermostat contains a sensitive [illegible] substance that contracts and expands with changes in temperature, so as to operate the control switch when the temperature rises to the upper limit or falls to the lower limit. The dial gage indicates the temperature.

Clutch and Brake, Combination, for Tumbling Barrels
Whiting Corporation, Harvey, Ill.
"American Machinist," September 14, 1922



The mechanism is for use in starting and stopping tumbling barrels and mills. It is simple in construction and is controlled by a single hand lever. Shifting the lever toward the mill engages the clutch and starts the barrel rotating. To stop the barrel, the lever is moved in the reverse direction, passing through the neutral position and to the braking position. The [illegible] permits of stopping a loaded mill at exactly the point desired for unloading. The barrel is held in position while the unloading is taking place. Even though the barrel is unevenly loaded, it cannot turn when the brake is set.

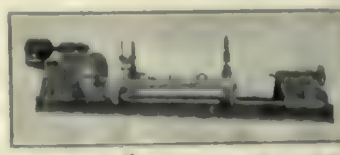
Tiering Machine, Telescoping, Portable, "Economy"
Economy Engineering Co., 2635 West Van Buren St., Chicago, Ill.
"American Machinist," September 21, 1922

In this machine one frame member telescopes into another so that the machine has a lift nearly twice as high as its minimum height. It is made in both hand power and electric driven styles. The heavy-duty types of the latter style are operated from a power circuit, and the "Little [illegible]" types from a lighting circuit. The machine is ordinarily mounted on [illegible] casters and when positioned for lifting the [illegible] is raised so that the legs rest on the floor and prevent the machine from moving. [illegible] are provided for tall machines to support them at the sides.

Pan, Drip, Oil, Lineshaft
The Akron Sheet Metal Co., 103 No. Main St., Akron, Ohio
"American Machinist," September 21, 1922

The drip pan and hanger are for [illegible] oil [illegible] bearings [illegible]. It is [illegible] intended for [illegible] but can be [illegible] bearings [illegible]. The pans and hangers are made in [illegible] being [illegible] shafts from [illegible] in diameter [illegible]. The hangers can be [illegible] on any side of bearing [illegible]. The pan may be readily removed for cleaning without disturbing the hangers. [illegible] in. [illegible] in. deep.

Lathe, Roll, 42-Inch
Reading Iron Co., Scott Foundry Dept., Reading, Pa.
"American Machinist," September 14, 1922



The machine has a capacity for turning a chilled roll 42 in. in diameter by 120 in. long. It is driven by a 20-hp. variable-speed motor, the speeds of which range from 400 to 600 r.p.m. The gear box has two changes of speed, arranged so that the full range of motor speed can be employed with each. The face-plate speed varies from 0.4 to 1.6 r.p.m. The main spindle is 7¾ in. in diameter, and the gears are machine cut. The bearings are large. The heavy construction provides the strength required for heavy service. Weight, 35,000 pounds.

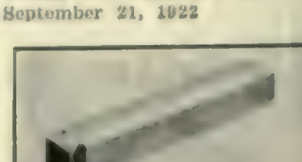
Grinding Machine, Pulley
Diamond Machine Co., Providence, R. I.
"American Machinist," September 21, 1922

The machine is for grinding the faces and edges of pulleys and similar parts. It carries a 14-in. diameter cylinder wheel held in a steel chuck that insures against wheel breakage. The wheel spindle, running on ball bearings, is driven by a 10-hp. motor at about 1,500 r.p.m., the speed being varied to suit the work. The work table has screw-operated movement in three planes, and an auxiliary rapid movement to and from the wheel actuated by a hand lever. Pulleys may be ground with crown, flat, or concave faces. Capacity: pulleys of 2 to 18-in. diameter, up to 6-in. face. Floor space, 3 ft. 6 in. by 4 ft. 6 in. Weight, 2,000 pounds.

Wrench, End, Adjustable, "Instant-Positive"
Gellman Wrench Corp., 131 W. Washington St., Chicago, Ill
"American Machinist," September 21, 1922

The end wrench can be adjusted instantly and stays adjusted until the nut is loosened or tightened. It is strong, but light in weight and thin enough to work in cramped places. No screw is employed in the wrench. The handle member forms the lower jaw and is notched at right angles to the gripping face, while the movable upper jaw is also notched and can be moved up or down when the notches are pulled out of engagement. The wrench can be turned in either direction. The tool is manufactured in sizes of 6-, 9- and 12-in. The 6-in. wrench is suited for light work. The 9- and 12-in. are for heavy duty but fit small nuts as well as large ones. Weight, 4, 10 and 20 ounces.

Key, Machine, Self-Fitting, "Keytite"
Smith & Serrell, Central Ave., at Halsey St., Newark, N. J.
"American Machinist," September 21, 1922



The key is capable of making its own fit in the keyway by shaving the sides of the keyway as it is put in place. It is ground to a size very slightly larger than the nominal width. A cutting edge and chip recess are provided near the front end of the key and a pilot, slightly smaller than the nominal keyway width, fits the keyway and guides the key. In the larger sizes, cutting edges are sometimes provided on both sides. For fitting the top and the bottom as well as the sides, a cutting edge can be provided at the top. Gib keys and other modifications of keys can be furnished with the self-fitting feature. The keys can be furnished in a wide range of sizes, as to both width and length.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Calif., Vallejo—The city, T. D. Kilkenny, City Engr.—$1,000 worth of machinery for proposed garage and repair shop on Virginia St.

Ill., Anna — A. Hargrave (machinist) — short engine lathe, 20 to 28 in. swing.

Ia., Fairfield—Louden Mchy. Co.—One No. 32 Kempsmith milling machine (used).

Kan., Wichita—E. L. Bryan, 622 Pattie Ave., (garage)—drill press, belting, hangers, emery wheel and stand for power equipment (used).

Kan., Wichita — O. G. Smith Machine Shop, 132 North Lawrence Ave.—milling machine and drill press for power equipment (used).

Kan., Wichita—Universal Repairing Co., 122 East 2nd St., (cabinet worker)—A. Travis, Purch. Agt.—wood lathe for power attachment (used).

Kan., Wichita — W. J. Williams, 1103 Lulu Ave., (machinist) — power lathe (used).

Mass., Cambridge—D. E. Forsyth, 14 Parker St.—machinery and equipment for proposed garage at 17 Coventry St.

Mass., Winthrop—Winthrop Motor Sales Co., Somerset Ave.—machinery and equipment for proposed garage.

Mich., Muskegon Heights—The Maxim Motor Co., C. Branston, Purch. Agt.—lathes, drill press, also screw and milling machinery for proposed factory.

Mo., Kansas City—Flexibuilt Belt Mfg. Co., 4404 East 15th St.—pipe threading and cutting machine.

Mo., St. Louis — Mid-Continent Equipment & Mchy. Co., Security Bldg., C. G. Davis, Purch. Agt.—stamping press.

N. Y., Buffalo—J. Waechler, Ross and Ontario Sts.—machinery, tools and equipment for garage and service station.

N. Y., Long Island City—A. Kimoney, 276 Jackson Ave. (builder)—small electric portable riveter.

N. Y., New York—J. E. Kahn, 224 West 20th St. (plumbing)—sheet metal working tools, including brake, etc.

O., Columbus—Brightman Bros. Co., 531 Linwood Ave., (manufacturer of shafting, etc.), G. F. Brightman, Purch. Agt.—screw making machinery, lathes, grinders, presses, etc.

O., Columbus—Fairfield Eng. Co., West 6th St., along tracks of Hocking Valley Ry.—lathes, drill press, grinder, etc.

Ore., Portland—The city, L. D. Kaiser, City Hall, Supt. of Water Works—$1,350 worth of hand tools and one tapping machine.

Pa., Phila.—Pennsylvania R.R., 17th and Filbert St., M. Smith, Purch. Agt.—one 90 in. tire mill, one 6 and one 4 spindle bolt turning machines, 3 turret lathes, ten 4 x 36 in. emery grinders, two 15 in. and three 18 in. slotters, three No. 5 knee type milling machines, 17 engine lathes, six 36 and three 48 in. vertical turret lathes, two 36 in. planers and two 90 in. drive wheel lathes, for shops at Altoona

Pa., Phila — Sobel Machine Co., 880 North 48th St., (machinists), A. Sobel, Purch. Agt.—16 in. shaper (used preferred).

Pa., Sharon—R. Deflin—Complete equipment for proposed welding and machine shop on River Ave.

W. Va., Wheeling—Hazel Atlas Glass Co. —machine shop equipment for branch plant at Washington, Pa.

Wis., Green Bay—J. Strathas, 315 Cass St. (garage)—repair machinery, small tools and air compressor.

Wis., LaCrosse — Bergh Auto Co., 207 South 4th St.—auto repair machinery, including drill press and small tools.

Wis., Madison—West End Auto Repair Co., c/o J. B. Sanborn, 16 North Carroll St.—repair machinery and chain hoist.

Wis., Milwaukee—Wisconsin Sheet Metal & Furnace Wks., 2928 Lisbon Ave., A. Blecker, Purch. Agt.—punch press to punch ½ in. hole, with cutting attachment, also one large size beader.

Wis., Milwaukee — Wisconsin Steel & Dock Co., 253 3rd St., (structural steel and marine repairs), F. W. Stevens, Purch. Agt.—punch presses, power shears, pneumatic tools and air compressor.

Que., Levis—Levis County Ry., E. E. Weyman, Mgr.—32 in. lathe, screw jack car hoist, shaper, vertical drill, double end emery grinder, combination circular saw, planer and band saw and small lathe.

Machinery Wanted

Ark., Conway—Conway Weekly News—linotype and other printing equipment.

Calif., San Diego—Kirk, Roche & Co., 338 7th St.—sheet metal work machinery, also catalogues and prices of machinery for the manufacture of restaurant equipment, furnaces, heating and ventilating equipment, skylights and cornices.

D. C., Wash.—U. S. Chief Engineer—one locomotive crane.

Fla., Daytona Beach—Peninsular Ice & Cold Storage Co., G. G. Bailey, Pres.—cold storage and ice manufacturing machinery and equipment for proposed $100,000 plant here.

Ill., Chicago—Kraft Bros. Cheese Co., 402 Rush St.—special cheese making machinery, belting and shafting, for branch at Antigo, Wis.

Ill., Chicago—W. S. Swift, Brevoort Hotel, 120 West Madison St. (machinist)—emery stand and wheel, sand blast, jig saw for power attachment.

Ind., Hammond—Wanner Malleable Iron Wks.—power hammer.

Ind., Lafayette — The National Refining Co., Kossuth St.—machinery and equipment for proposed oil refinery to replace that which was recently destroyed by fire.

Kan., Wichita—Bd. Educ., C. P. Mueller, Pres., 145 North Main St.—tenon power saw for manual training department of public school.

Kan., Wichita—J. Robertson, 1435 Pattie Ave.—complete set boiler maker's tools and welding outfit for welding boilers.

Ky., Bargourville—Cumberland & Manchester R.R. Co., C. F. Heidrick, Purch. Agt.—equipment for proposed forge shop.

Ky., Montago—Means-Haskins Coal Co.—coal tipple machinery and equipment, including handling and conveying equipment.

La., La Fayette—The La Fayette Sugar Refining Co.—machinery and equipment for proposed refinery, to replace that which was recently destroyed by fire.

Mich., Detroit—J. C. Green, 3656 Seminole Ave.—band saw, wood turning lathe, rip saw, buzz planer and thickness planer.

Minn., Minneapolis — Century Laundry Mchy. Corp., 426 Lincoln St., N. E., J. T. Marrin, Purch. Agt.—machinery and equipment for the manufacture of laundry machinery.

Mo., Carthage—Carthage Casket Co., c/o E. Ulmer Undertaking Co.—wood working machinery.

Mo., St. Louis—C. L. Holland, 909 North 15th St.—power job printing press and power paper cutter.

Mo., St. Louis—Modern Printing Co., 2604 Olive St.—12 x 18 in. Chandler & Price press (used preferred).

N. Y., Buffalo—DuPont Fibre Silk Co., River Rd.—machinery and equipment to double present capacity of plant.

N. Y., Buffalo—C. Grant, 75 Eagle St.—printing machinery for plant at 77 East Eagle St.

N. Y., Buffalo—C. Sudrow, 633 Bway.—machinery for the manufacture of wooden bodies for cars and trucks, for plant at 1099 Genesee St.

N. Y., Buffalo—U. S. Radiator Wks., 1285 Main St., W. H. Smith, Purch. Agt.—equipment for repairing automobile radiators, fenders and bodies, for plant at 16-18 Glenwood Ave.

N. Y., Chili (Lincoln Park P. O.)—J. Harris Seed Co. (seed distributors and sorters)—machinery and equipment for proposed addition to seed plant.

N. Y., Fairport—Douglas Packing Co.—complete machinery and equipment for proposed addition to packing plant.

N. Y., Fredonia — Grape Ola Products Corp., (manufacturer of grape products), H. Card, 123 Cushing St., Dir.—machinery and equipment for proposed addition to plant.

N. Y., Jamestown—Jamestown Panel Co., 34 Steele St.—machinery and equipment for two story addition to panel and furniture factory.

N. Y., New York—Bd. Educ., Park Ave. and 59th St.—P. Jones, Supt. of School Supplies—receiving bids until Nov. 10th for work shop supplies for the day and evening, high and elementary schools.

N. Y., New York—New York Central R.R., Purchasing Dept., 466 Lexington Ave.—one 90,000 lb. power press brake, motor driven.

N. Y., Olean—Olean Garment Mfg. Co., 430 North Union St., E. I. Lovitz, Mgr.—machinery and equipment for garment factory.

N. Y., Rochester — Rochester Packing Co., 900 Maple St.—machinery and equipment for cold storage plant, and for the manufacture of sausage.

N. Y., Tonawanda—The National Roofing Co., Fillmore St.—complete machinery and equipment for proposed branch factory at Athens, Ga.

O., Akron—Enterprise Mfg. Co., 217 Ash St. (manufacturer of small brass, nickel and steel parts)—sand blasting equipment.

O., Cleveland—The Upco Co., 4805 Lexington Ave.—steam jacketed kettles, about 50 gal. capacity.

O., Cleveland—The Wilkshire-Wilk Co., 2162 East 2nd St.—annealing gas furnace with blower (used).

O., Columbus—Dept. of Finance of Ohio, State House, R. V. Johnson, Supt. Division Purchase—one 40 x 94 in. reverse drying tumbler, one No. 38, one No. 51 and two 42 x 84 in. Universal presses, one 48 in. over driven type extractor and other laundry equipment, for the Institution for Feeble Minded.

O., Columbus—Western Newspaper Union —job printing press and paper cutter for power equipment.

O., Lima—Buckeye Casting Co.—equipment for new $75,000 foundry.

O., Ottawa—Putnam Mfg. Co., (manufacturer of wooden articles), G. W. Kahle, Mgr.—complete woodworking equipment for factory.

O., Springfield — Robbins-Meyers Co., Shuey Bldg. (manufacturer of electric motors, fans, etc.)—machinery and equipment for proposed additions to factory.

O., Urbana—Gaumer Publishing Co., (job printers)—No. 5 linotype machine (used).

O., Warren—The Wadsworth Feed Co., J. X. Wadsworth, Pres.—$20,000 worth of machinery for proposed flour mill to replace that which was destroyed by fire.

Pa., Bridgeville—Universal Steel Co.—one 10 ton crane.

Pa., Corry—The Corry-Jamestown Furniture Co.—machinery and equipment for proposed addition to furniture factory.

Pa., Darby—Darby Print Shop, 232 Mall St.—one 10 x 15 in. press, type stands, type, etc.

Pa., Edwardsville (Kingston P. O.) — Wyoming Valley Bakery, R. H. Levy, 388 Chestnut St., Kingston, Dir.—equipment for new bakery.

Pa., Erie — The Dispatch-Herald, 12th and French Sts.—linotype machines and other printing equipment.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Lead quoted in New York warehouses at 7½c. as against 6.95c., a rise of $10 per ton in two days; zinc, now 7¾c. as compared with 7½c. per lb., one week ago. Tin also advanced 1c., making the present warehouse price 38c. per lb. Zinc sheets up ½c. per lb. in casks. Both white and red lead, dry and in oil, advanced ½c. per lb. f.o.b. New York.

Declines—Steel plates quoted at maximum of $2 per 100 lb., f.o.b. Pittsburgh, on sizeable tonnages. Shapes quoted as low as $1.90 on attractive business and at a maximum of $2.10 where orders involve special considerations and speed in shipments, consistent with present embargoes, but average remains at $2 per 100 lb., f.o.b. mill. Market soft on bars with few new inquiries. Some orders booked at $1.90 but average price $2. Sales, however, of carload lots for early delivery quoted at $2.10 per 100 lb.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5
Cleveland	[illegible]

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	[illegible]	4.29	3.80	4.10
No. 16	[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	3.20@3.60	4.70	4.20	4.70
Nos. 22 and 24	3.25@3.65	4.75	4.25	4.70
Nos. 25 and 26	3.30@3.70	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.[illegible]5
Galvanized				
Nos. 10 and 11	3.35@3.85	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.95	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.25	5.30	4.80	....
Nos. 22 and 24	3.90@4.40	5.45	4.95	5.40
No. 26	4.05@4.55	5.60	5.10	5.55
No. 28	4.35@4.85	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.50
Tin, 5-ton lots, New York	38.00
Lead (up to carlots), St. Louis	6.80; New York, 7.37½
Zinc (up to carlots), St. Louis	7.10@7.15; New York, 7.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	2[illegible].75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.00	10.25	.....
Solder (½ and ½), (caselots)	26.50	23.50	20.00
Babbitt metal (83% tin)	35.00	45.00	36.00
Babbitt metal (35% tin)	25.00	17.25	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.75	12.00
Copper, heavy, and wire	11.75	12.25	11.50
Copper, light, and bottoms	9.75	10.25	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.94
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton	$8.00		
Coke, prompt foundry, Connellsville...per net ton	10.50@12.50		

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40¼%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

Pa., Huntingdon—Extension Radiator Wks.—foundry equipment to replace that which was recently destroyed by fire.

Pa., Lebanon—R. Beyer—machinery for the manufacture of special automotive hinges.

Pa., Phila.—Majestic Silk Dyeing Co., 3rd and [illegible] Sts.—winders, dyeing vats, accessories and drying frames.

Pa., Pittsburgh—Guibert Steel Co., 703 Diamond Bk. Bldg.—joiners, woodworking machinery, compressors and band saws.

Pa., Pittsburgh — Pennsylvania R.R., Union Sta., W. C. Phelps, Purch. Agt.—two cranes for Conway shops at Freedom.

Pa., Sheffield—Sheffield Glass Bottle Co.—machinery and equipment for large addition to glass bottle works.

Pa., Tamaqua — Tamaqua Mfg. Wks. (manufacturer of mining machinery)—machinery and equipment for proposed addition to plant.

Pa., Warren—Bd. Educ., c/o J. G. Smith, Member Bldg. Com.—vocational equipment for proposed $[illegible] junior high school.

R. I., Woonsocket—The Manchester Co. (manufacturer of cotton and woolen goods)—[illegible] and other machinery for mill at North Oxford, Mass.

S. D., Edgemont—The Printer, Box 567—complete newspaper equipment, including press, job press, linotype, hangers, pulleys, belting and bearings.

Tenn., Dyersburg — Churchill Compress Co.—complete machinery and equipment for proposed cotton compress plant.

Tenn., Morristown — Taylor Mfg. Co. (woodworking plant), W. H. Taylor, Pres.—band saw, jointer, planer, line shaft, pulleys and several electric motors.

Tex., Athens—Citizens Ice Co., F. N. [illegible]—machinery and equipment for ice manufacturing plant, to replace that which was destroyed by fire.

Wis., Beloit—F. R. Fiebke & Co., 751 [illegible] St. (general contractors)—woodworking machinery for new shop.

Wis., Beloit—Perrigo Fdry. and Machine Co., 8 Emerson St., W. S. Perrigo, Purch. Agt.—foundry equipment.

Wis., Boscobel—National Wood Products Co., c/o J. M. Reppen—woodworking machinery.

Wis., Cedar Grove—Cedar Grove Shoe Mfg. Co., M. J. Le Master, Purch. Agt.—shoe working machinery.

Wis., Fort Atkinson—Better Sox Knitting Co., 211 South Water St., D. Becker, Mgr.—power and special machinery for proposed factory.

Wis., Green Bay—A. F. Coffrin, South State St. (paper manufacturer)—belt driven conveying machinery.

Wis., Madison—W. D. Bird, Pioneer Bldg. (jobber)—complete newspaper plant, including printing press, linotype, belting, hangers, pulleys and motor shafting (used).

Wis., Milton—Burdick Cabinet Co., F. A. Anderson, Purch. Agt.—nickel plating machinery and equipment.

Wis., Milwaukee—C. Daniel, 1741 Teutonia Ave. (carpentry and millwork)—cut-off saw.

Wis., Milwaukee—A. G. Fachnel, 748 New York Ave. (carpentry and mill work) — joiner and rip saw.

Wis., Milwaukee—Kath Monument Co., c/o J. G. [illegible] St. (monuments)—stone cutting machinery.

Wis., Milwaukee—S. Kosecki, 1479 Fratney St. (carpentry and millwork)—one electrically operated floor surfacing machine.

Wis., Milwaukee—R. E. Oberst, Archt., 257 Grand Ave. (owner's name withheld)—gasoline storage tank and pump for proposed [illegible] garage on 16th St. and Fond du Lac Ave.

Wis., Milwaukee—A. Sandrock Co., 1217 [illegible] St. (architectural steel), W. A. Sandrock, Purch. Agt.—power saw.

Wis., South Milwaukee—A. F. Koerner (newspaper and job work)—paper cutter, [illegible] (used).

Wis., South Milwaukee—South Milwaukee [illegible] Co., [illegible] Ave., E. C. Guhr, Purch. Agt.—concrete mixing machine and crusher.

Wis., Walworth—Walworth Condensed Milk Co.—refrigerating machinery for proposed addition to creamery.

B. C., [illegible]—The J. [illegible] Estate—machinery for [illegible] to replace that which was destroyed by fire.

B. C., Vancouver—Standard Shingle Co., Ltd.—machinery and equipment for proposed shingle mill.

N. B., Bathurst — Bathurst Co. — additional equipment for sulphate pulp mill to increase capacity from 15,000 to 19,500 ton.

Metal Working Shops

Calif., Emeryville—The Great Western Motor Co., 5701 South San Pablo Ave., Piedmont, has had plans prepared for the construction of a 1 and 2 story factory, here. Estimated cost $30,000. G. Rushforth, 354 Pine St., San Francisco, Archt.

Calif., Fresno—The Lisenby Mfg. Co., Kern and Angus St., awarded the contract for the construction of a factory for the manufacture of multicolor presses. Estimated cost $10,000.

Calif., Sacramento—The Latourette-Fical Co., 307 Front St., plumbing and heating contractors, will soon award the contract for the construction of a 3 story workshop. Cost between $17,000 and $19,000.

Calif., San Francisco—J. Cassaretto, 347 Berry St., has had plans prepared for the construction of a 1 story, 90 x 125 ft. machine shop on N.W. Folsom and Dore Sts. Estimated cost $25,000. M. Sheldon, 110 Sutter St., Archt.

Calif., San Francisco—E. L. Reese, 332 Pine St., awarded the contract for the construction of a 1 story factory on Bryant St. near Morris St. Estimated cost $6,000. Gorman Metal Co., 141 Clara St., manufacturer of babbitt steel, lessee.

Calif., Vallejo—The city has had plans prepared for the construction of a 50 x 130 ft. garage and repair shop on Virginia St. Estimated cost $4,000. T. D. Kilkenny, City Engr.

Calif., Watsonville—Watsonville Union High School Dist. will soon award the contract for the construction of a 1 story machine shop. T. S. MacQuiddy, Clk. Noted Oct. 12.

Ia., Dubuque—Bosky's Motor Co., 6th and Iowa Sts., is having plans prepared for the construction of a 3 story, 100 x 110 ft. garage. Estimated cost $80,000. Private plans.

Md., Baltimore—The American Can Co., 120 Bway., New York City, plans to build a factory on Boston and Hudson Sts., here. Estimated cost $350,000.

Mass., Chicopee—The Moore Drop Forging Co., 38 Walter St., Springfield, awarded the contract for converting office building into laboratory, and for the construction of a 1 story, 40 x 90 ft. machine shop, on Depot St., here. Estimated cost $25,000. A. L. Converse, Purch. Agt.

Mass., Pittsfield—The General Electric Co., River Rd., Schenectady, awarded the contract for the construction of a 1 story, 100 x 516 ft. factory, here. Estimated cost $150,000.

Mass., Roxbury (Boston P. O.)—The J. J. Walsh Co., 1540 Columbus Ave., awarded the contract for the construction of a 2 story, 50 x 100 ft. factory for the manufacture of automobile bodies. Estimated cost $20,000. Noted Oct. 19.

Mich., Kalamazoo—The Kalamazoo Blow Pipe Co., 408 Church St., is having plans prepared for the construction of a 1 story, 25 x 155 ft. factory. Estimated cost $50,000. E. Batterson, Archt.

Mich., Muskegon Heights—The Maxim Motor Co. awarded the contract for the construction of a 1 story, 62 x 240 ft. factory. Estimated cost $30,000.

N. Y., Brooklyn—B. A. Davies, c/o B. Driesler, Jr., Engr. and Archt., 153 Remsen St., will build a 1 story, 100 x 200 ft. garage on Empire Blvd. Estimated cost $115,000.

N. Y., New York—The Dept. of Water Supply, Gas and Electricity, Municipal Bldg., awarded the contract for the construction of a garage on East 24th St. Estimated cost $23,760. Noted Oct. 5.

N. Y., New York—M. Low, c/o L. Sheinart, Engr. and Archt., 194 Bowery, will soon receive bids for the construction of a 2 story, 100 x 125 ft. garage on Amsterdam Ave. and 57th St.

O., Cleveland—The Brough Co., 3623 St. Clair Ave., manufacturer of beverages, is having plans prepared for the construction of a 1 story, 30 x 80 ft. and 50 x 80 ft. garage and bottling works on East 72nd St. and St. Clair Ave. Estimated cost $40,000. E. Brough, Mgr. J. Brugnone, 3605 Woodlawn Ave., Archt.

O., Cleveland—The Glauber Brass Mfg. Co., 7706 Platt Ave., plans to alter and build a 1 and 2 story addition to its factory. Estimated cost $50,000. M. Glauber, Pres. Private plans.

O., Cleveland—The Hydraulic Press Steel Co., Hydraulic Ave., awarded the contract for the construction of two 1 story, 30 x 30 ft., 33 x 40 ft. factories, and a 20 x 50 ft. crane runway. Estimated cost $50,000.

O., Cleveland — The Mall Motor Co., 4900 Euclid Ave., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage. Estimated cost $40,000. A. Hass, Mgr.

O., Cleveland—J. Sands, East 55th St. and Sweeney Ave., manufacturer of water heaters, awarded the contract for the construction of a 1 story, 60 x 100 ft. machine shop at 10205 Harvard Ave. Estimated cost $40,000.

O., Kent—The Falls Rivet Co. awarded the contract for the construction of a 1 story, 168 x 210 ft. addition to its factory. Estimated cost $50,000.

Pa., Pittsburgh—The Guibert Steel Co., Diamond Bk. Bldg., is having plans prepared for the construction of a 1 story, 55 x 200 ft. steel fabricating plant on West Park St. Estimated cost $100,000. Private plans.

Pa., Sharon—R. Deflin plans to build a 1 to 2 story, 30 x 50 ft. welding and machine shop on River Ave. Estimated cost $6,000.

Tex., Waco—The Texas Fireproof Storage Co. awarded the contract for the construction of a 4 story, 50 x 100 ft. warehouse and garage on 11th and Mary Sts. Estimated cost $100,000.

Wis., Milwaukee—The O. Jaeger Baking Co., 914 Central Ave., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage on 9th St. Estimated cost $40,000. Noted Oct. 26.

Wis., Wausau—The Wausau Wrecking Co. awarded the contract for the construction of a 4 story, 60 x 120 ft. garage. Estimated cost $40,000.

General Manufacturing

Mich., Muskegon—The Central Paper Co. is receiving bids for the construction of a 3 story factory, consisting of six buildings, on Lake St. Estimated cost $200,000. Private plans.

N. Y., Rochester—W. B. Williams, 295 Monroe Ave., plans to build an addition to paint shop. Estimated cost $6,500. Architect not announced.

Pa., Pittsburgh—The McCallum Co., 137 7th St., florists, receiving bids for the construction of a 3 story, 40 x 120 ft. factory at 1803 Beam Ave. Estimated cost $20,000. Private plans.

Tenn., Chattanooga—The Dixie Spinning Mills is building a 1 and 2 story, 67 x 387 ft. mill, and a 40 x 156 ft. boiler, machine shop and pump building. Estimated cost $500,000. Noted July 13.

Tex., Dallas—The Stickle Lumber Corp., Maple Ave. Rd., will build a 1 story, 100 x 200 ft. and 60 x 60 ft. flooring mill and power plant. Estimated cost $75,000.

Vt., Brattleboro—The Twin State Gas & Electric Co., Barber Bldg., is receiving bids for the construction of an addition to gas plant, including scrubbers, holders, etc. Estimated cost $40,000. Private plans.

Va., Gore—The Winchester Lumber Co., Winchester, plans to build a lumber mill, here. Estimated cost $35,000. W. B. Cornwell, Pres. Architect not announced.

Wis., Antigo—The Pacific Ice Cream Co. awarded the contract for the construction of a 2 story, 50 x 64 ft. ice cream factory. Estimated cost $50,000. H. Quackenbush, Mgr. Noted Sept. 21.

Wis., Fort Atkinson — The Better Sox Knitting Co., 211 South Water St., is receiving bids for the construction of a 2 story, 50 x 66 ft. factory. Estimated cost $40,000. D. Becker, Mgr. Private plans.

Wis., Kaukauna—The Ground Wood Pulp Supply Co. will build a 2 story, 60 x 80 ft. pulp mill. Estimated cost $50,000.

Wis., Loretta (Draper P. O.)—The Hines Lumber Co., Park Falls, will build a 1 story, 75 x 100 ft. saw mill, here. Estimated cost $75,000.

Wis., Milwaukee—The Natl. Knitting Co., 905 Clinton St., awarded the contract for the construction of a 1 story, 40 x 100 ft. addition to its factory. Estimated cost $25,000.

American Machinist

Volume 57 NEW YORK, NOVEMBER 16, 1922 Number 20

Automatic Arc Welding

Applications of the Process at the General Electric Company's Schenectady Plant — Manufacturing Solenoid Brake Wheels — Seam Welding — Repairing Armature Shafts

By A. K. West

A LITTLE OVER a year ago the automatic arc welder was brought to a state of practical application. It is now used in the manufacture of a number of products in some of the General Electric Company's plants as well as for various kinds of repair and reclamation work. The manufacturing processes are on the quantity basis and the variety of products is sufficiently large to give an idea of the extent of the field to which the automatic welder may be applied.

This welder is a device for automatically feeding a bare electrode to a welding arc at the rate required to hold a constant arc length. The welding head consists of a steel body carrying feed and straightening rolls which pull the wire from the reel, straighten it, and feed it to the work. The rolls are adjustable for sizes of electrode wire from $\frac{1}{16}$ to $\frac{5}{32}$ inches in diameter. In applying the automatic welder it is necessary to provide some means of moving the arc relative to the work, or vice versa. The majority of arc welding work comes under two general heads, straight line and circular welds, spiral welds being a combination of the two. For such cases, various types of existing machines have been used successfully as a base for the application of the electric welder. Such machines are lathes, for obtaining line welds and spiral welds, and boring mills or turn tables for circular welds. In some cases, however, the welding path is complicated or irregular. It is for these that special machines have been designed in order to obtain the proper travel, either of the work or of the welding head. Also, some of the articles welded are too heavy and bulky to be mounted on ordinary machines and have required the designing of special machines to handle them.

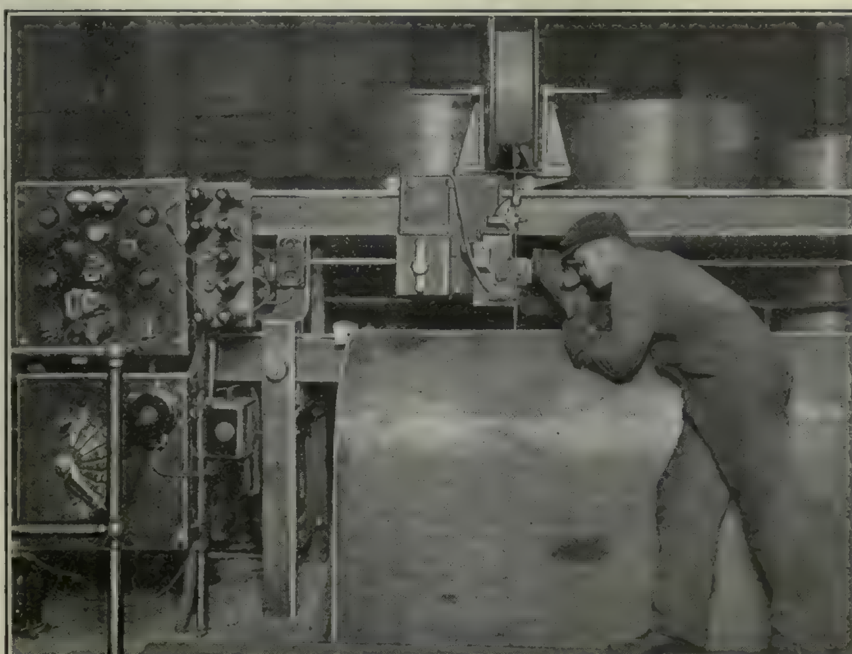


FIG. 1—AUTOMATIC WELDER CLOSING SIDE SEAMS ON LARGE TANKS

One of these built for the welding of side seams in large oil circuit breaker tanks is shown in Fig. 1. The tank is clamped in position on an I-beam with a copper strip on the upper flange, the strip serving as a backing for the weld. The welding head and the wire reel are mounted on a traveling carriage above this beam. The carriage is driven by a long screw shaft between the upper supporting beams, by a motor at one end of the machine.

The welding head is driven through a splined shaft by a motor at the other end. The two driving motors are so interlocked that when the arc is struck the travel motor starts, simultaneously, and if the arc is broken for any reason the travel motor stops. Dynamic braking of the travel motor prevents drifting and insures the starting of the weld at the point where it left off. The rate of welding on this machine, which handles seams up to 108 in. in length, is about $2\frac{1}{2}$ in. per minute, varying, however, with the thickness of the material to be welded. Another type of machine has been designed for welding on the bottoms of smaller tanks. It appears in Fig. 2. The welding path in this case is so much more complicated that a different mechanism is required. The outline of the path is two semi-circular ends, joined by tangential sides. In this case the arc is held stationary and the work moved past the point of contact by a rack which engages with a small pinion driven by the travel motor through the gear train.

An interesting case which has resulted from the application of the automatic welder to production work is the fabrication of brake wheels for solenoid brakes. Formerly these wheels were cast, but so much trouble was experienced from blow holes that showed up when the wheels were machined, rendering them a total loss, that a new welding process was devised to make them. The machine is shown in Fig. 3. The wheels are fabricated from three parts, the hub, cut from a piece

FIG. 2—AUTOMATIC WELDER ATTACHING TANK BOTTOMS

of steel shafting, the web and the rim, which are both cut from boiler plate, the latter being rolled into shape, and the ends joined by welding. (Fig. 2.) The three are then mounted together on a turn table and welded together to form the finished wheel shown in Fig. 4. Not only does this process save the money that was formerly lost in scrapped wheels, but it obviates making a special pattern and mold for every special type of wheel wanted, requiring tapered shafts, offset rims, etc.

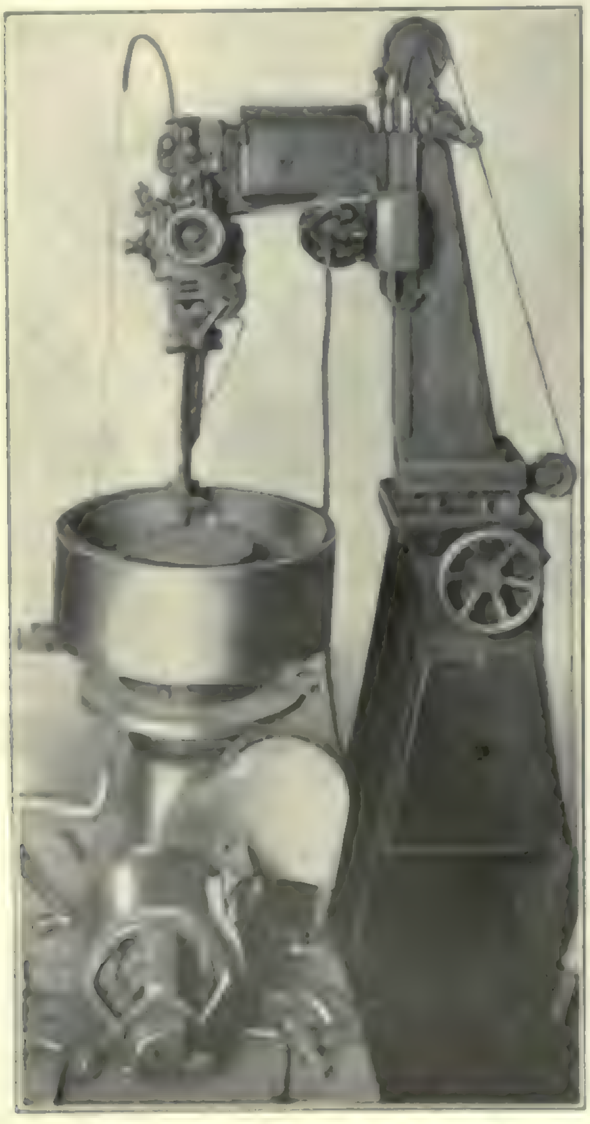


FIG. 3—WELDING TOGETHER SOLENOID BRAKE WHEEL PARTS

These three processes are by no means the only ones that have been improved by the application of automatic welding. The method is now applied to the manufacture of a number of products that were formerly cast or riveted, with the usual expenditures and rejects that attach themselves to those methods. A few of these articles are railway motor gear cases motor frames, motor bearing shells, flow meter nozzles, and condenser cans. Both butt and lap welding are employed and the thickness of the metals welded varies from $\frac{1}{16}$ inch for the condenser cans to $\frac{1}{2}$ inch for the motor frames and some of the other larger articles.

The automatic process has also been very successfully applied to various kinds of reclamation and repair work, with considerable saving of money and material as a result. One such case is that of several large and expensive shaft forgings that were improperly machined, or required increases in diameter after being machined.

FIG. 4—THE COMPLETED SOLENOID BRAKE WHEEL

The shafts, which in some instances would have been a total loss, have been reclaimed in a very few hours and at a nominal expense.

Another case is that of armature shafts that have had their journal, pulley, or gear fits worn so as to render them unfit for further use. Over 400 of them have been reclaimed by welding with the automatic equipment, the metal being deposited on the shaft to any desired thickness and then machined to proper dimensions. In many cases the insertion of a shaft would necessitate the complete disassembling of the armatures, as in many of the smaller sizes the laminations are assembled directly on the shaft.

The result of the application of the welder to both manufacture and repair have been highly satisfactory. The automatic machine deposits metal much faster than is possible with hand welding, and the resultant weld is better both for smoothness and evenness of the deposited metal. The main consideration in designing machines for carrying either the work or the welding head, or in adapting existing machines to these purposes, is to insure a steady and uniform rate of travel of the arc along its path, and proper interlocking between the arc and the travel mechanism, so that simultaneous starting and stopping will be assured.

What's Wrong with the Railroad Shops?—II

The Show Machine and Its Use and Abuse—Desire of the Men to Make a Showing When Possible—General Condition of Equipment

> The condition of railroad shop equipment is a very sore subject. The machinist resents the fact that he has to work with poor tools, the mechanical department official is at his wit's end to get out work with the equipment at hand, the purchasing department is hampered by financial control that restricts the appropriations available for machinery and makes the purchase of cheaper substitutes almost unavoidable. The average board of directors, facing earnings of three per cent, more or less, is hard to convince that a department which is looked upon as an expense, should receive much of the meager income. It seems impossible to prove to regulatory bureaus that their policy is starving the railroads to death.
>
> Our second article shows railroad shop equipment as it is and suggests more efficient use of what is available, as well as the need for replacing the obsolete units with modern ones.

ONE GETS THE impression when talking with the average railroad shop man that the railroad shop is an institution by itself, only remotely related to the machine shop and other industries, somewhat like the relation of the horse and the frog; they are both vertebrates but that is about all. Those responsible for the running of the ordinary machine shop realize the importance of keeping in close touch with all that goes on, not only in their own industry, but in other industries as well. They are constantly on the lookout for new methods, and, whenever they read or hear about some new development in some other line of industry, they weigh the possibility of applying this improvement to their own conditions.

It is true, not all do this and it is also true that a certain amount of inertia and conservatism on the part of the workers, and often, of foremen and superintendents must be overcome, but, stated briefly, it is true that the manager of the machine shop keeps his eyes open for better things and better methods. He must. Competition compels him to. Even without competition there would still be the constant urging of the directors for reduced costs and for increased profits—a good stimulant.

He studies the technical magazines devoted to machine shop methods, new machinery and tools; he visits other plants to get new ideas, and, on the whole imparts as much information as he gets. He sends his superintendents and foremen out on occasional trips and even if these men do not return with revolutionary ideas in regard to shop operations, they come home refreshed and encouraged and full of enthusiasm. Sometimes they return humbled and chastened by what they have seen others do, but in any case they come back better men.

The manager sees the salesmen of the machine and tool manufacturers and the makers of other equipment and considers these men not as so many book agents, nuisances to be gotten rid of as quickly as possible, but as the carriers of valuable information. If he finds that the purchase of new equipment will lead to new economy he tells the purchasing agent what to buy. He has joined various associations and urges his subordinates to join them for the purpose of keeping abreast of the times, of listening to discussions or taking part in them and of obtaining much information which is enthusiastically discussed at such meetings and of which much can be used at home.

He encourages suggestions from his assistants and, though he may not always follow them, he considers them carefully. If his time is too much taken up with other duties and he cannot devote the proper attention to technical matters, or, if his training or ability is not along these lines, he calls in an expert from the outside to assist him and his staff, always with the idea that a sufficient broadness of view, a sufficient amount of knowledge cannot be gathered in one plant. In short, he considers his plant as but a single unit in a great system, deriving support from and giving assistance to other units.

If the average shop profits by information obtained from manufacturers of equipment, it is also active in promoting progress in the design of new machinery and tools. The shop makes certain demands for new features, often to the extent of having special machinery built. Such machinery, when proven successful, may become the standard of the future. This insistence on improved features, designs or materials is the very foundation of progress made in machinery and other machinery. Its influence reaches far indeed.

The railroad shop is largely lacking in this broadening interchange and adoption of ideas. How often does one see the master mechanic of a railroad shop ambling through a plant where automobiles or sewing machines or heavy ordnance pieces are being made? For that matter, how often does he visit other railroad shops? If he does there must be something in the management of railroads which prevents him from using the knowledge thus obtained, for a greater lack of uniformity in methods than one finds in railroad shops is hard to imagine, though such shops are more alike in the nature of their operations than almost any other class of industrial establishments.

It must be said here that, in our opinion, the men themselves are not to blame. A number of them confessed they were somewhat ashamed of their ignorance as to what was going on in the outside industrial world, and defended themselves on the ground that they had no chance for observation. Where lies the exact center of the idea that the railroad shop is "quite apart" is not easy to determine. It has existed so long that it has permeated everything. The dilution of the old force with a number of new men recruited after the strike from other shops, from the farms and other outside occupations may kill the old idea. Let us hope so.

The example of the connecting rod mentioned in a

previous article shows how little uniformity there is between different railroad shops. It also shows how an ineffective machine was used and how even this was reduced to about one-third of its capacity by poor tools. Such examples can be found in large numbers. They were standing out all over every shop we visited. As against this, we were shown the pride of the shop, the driving wheel lathe (this did not happen in just one shop, but in practically all).

Though of various makes these machines were all more or less up to date. The driving wheel lathe was the show machine. Fortunately we have seen heavy chips before and are not easily impressed with them unless they are the symbol of rapid production. This is what we noticed:

One driving wheel lathe was heavily overloaded during the roughing cut. The tool rests bent down under the cut like grain before the wind. A cut was taken ¾ in. deep and ⅜ in. feed, speed about 16 ft. The machine had the requisite power but not the rigidity for such a cut. The gib for the tool slide was merely a flat piece of cast iron held in place by a number of set screws (a very poor construction). These screws had been set up so tight that they had made their impression on the gib. It bulged at the other side and made a cup shaped depression in the slide so that sidewise movement of the slide was no longer possible until the gib was loosened. Now let us see what was the benefit derived from this brutal performance.

Analysis of Tire Turning Operation

The accompanying sketch, Fig. 1, shows the outline of a tire before and after turning. It also shows the scallops or grooves made by the roughing tool. These grooves may seem exaggerated and so they are but, due to the bending of the tool rests, there were many spots in every groove quite as deep as the impressions shown here. After roughing, a forming cut is taken and the illustration shows clearly how the depth of these impressions makes a very deep forming cut necessary.

It should be noticed that the depth of this cut is several times the depth of the impressions. Now this forming cut calls for hand feed and is, therefore, necessarily a slow operation, so that everything possible should be done to reduce the depth of that cut. If less

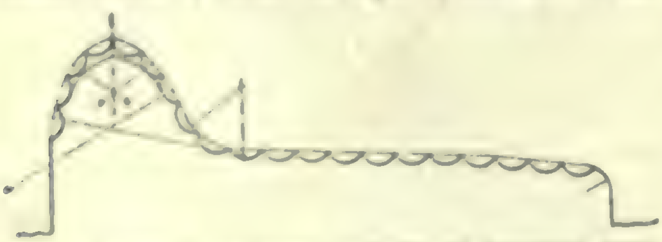


FIG. 1—DIAGRAM SHOWING EFFECT OF FORCING CUTS IN A WHEEL LATHE

feed had been used for the roughing cut with somewhat higher speed, the impressions would have been very much shallower and the depth of the forming cut would have been very much reduced. Possibly five minutes extra might have been spent on the roughing but this would have been saved several times over on the forming.

While talking about this forming, it is a peculiar fact that on the driving wheel lathe a forming tool without rake is used. In a way the railroad shop men are not to blame for this because the lathe does not allow of any other kind of tool. Fig. 2A shows how the tool is now and Fig. 2B how it might be made if the lathe had provision for it. Such a forming tool would cut freer and do faster and better work.

It is perhaps pertinent to state here that such forming tools as shown in Fig. 2B cannot be used on automatic screw machines, for instance, without making provision for vertical adjustment but this is so because on such types of machines the work is of small diameter. The very large diameter of work on a driving wheel lathe would make the loss of height due to sharpening the tool on the face an utterly unappreciable quantity.

We said that the railroad shop men are not entirely to blame, but after all it is up to them to analyze their problems and demand the necessary features in the machine tools they buy to give them the best results.

FIG. 2—TOOLS WITH AND WITHOUT RAKE

On the other hand would their demands be heeded by the purchasing agent or by whoever has the final decision, and if not can we blame them if they recognize the futility of analyzing problems when they are not in a position to profit by the analysis?

At another place the driving wheel lathe was of more rugged design and quite capable of taking the cuts imposed on it but here again too much was left for the slow forming operation. In addition, the handling devices were entirely inadequate so that half an hour or so was lost on this account while every effort was made to save a minute on the roughing cut.

Every effort? Well, in a manner of speaking, but the cut had to be interrupted because the tool gave out. Investigation showed too much clearance, with its result, a weakened tool. Besides, so the workman claimed, the steel was soft. What kind of steel? Nobody within hailing distance knew. Maybe the purchasing agent knew but he was not around. How was this defect going to be corrected? Send it back to the blacksmith shop and a tool dresser would try again.

There was probably somebody in authority in the shop who knew what kind of steel it was and what to do to improve its cutting capacity, but the fact that neither workman, foreman nor assistant superintendent knew these things is significant. It does not make for intelligent co-operation.

Men Anxious to Make a Showing

We could not help but look at the driving wheel lathe performance from different angles. The eagerness to show the heavy cuts proved that the men had the desire to break some records and grasped one of the few opportunities they had to do so. They seemed to realize that the greatest part of their equipment would not allow them to make a showing. There were just the driving and car wheel lathes and the tire boring machines which would give them that chance. With the evident desire to do themselves proud it would seem that the main thing required for an up to date shop, the willingness to make it so, was there. What was lacking was evidently training in modern shop methods, equipment and a certain amount of freedom of action which is so necessary for development.

Another angle which presented itself is this, why was

there an up to date driving wheel lathe when the rest of the equipment was mostly below par? Why was this so in most shops? The answer seems to be that the driving wheel lathe, the car wheel lathe and the tire boring machines are machines specially built for the railroad shops. The makers compete with each other and bid against each other with improvements. A driving wheel lathe must be a driving wheel lathe; it would not be possible to substitute any other kind of a lathe for it and so the buyer is compelled to get the up to date thing if he buys at all. This is true of all equipment built for railroad shops only.

A different condition exists in relation to other equipment. A lathe is a lathe in the eyes of such a disinterested spectator as a purchasing agent may be. Nobody is making any particular effort to make milling or drilling machines especially adapted to the railroad shop because there are not the special requirements to be met as was the case with the driving wheel lathe, the car wheel lathe, the tire boring mill or the double and connecting rod boring machines. Unless, therefore, the men most interested, the men who are supposed to know, specify the kind they want they will get what seems to the purchasing agent the most advantageous purchase. Unfortunately in many cases the shop does not have the privilege of specifying and in others where they do specify, the purchasing agent has the privilege of ignoring the demand of the shop.

Though the modern tire boring machine is also one of the show machines in the better equipped railroad shop it will be found that there is such an astonishing lack of uniformity in the practice of tire boring that it is extremely difficult to find any explanation for it except the one that each shop follows its own ideas without any regard whatsoever for the experience of others. We refer the reader to an article appearing in the *American Machinist* of Aug. 21, 1922, entitled "Angles of Cutting Tools," by J. Herron, in which the author shows that feeds and speeds, angles of tools and everything else in relation to this operation vary within the widest imaginable limits, showing that nobody has profited by the experience of anybody else.

It would seem to us that this utter lack of systematic co-operation, or let us call it intercourse between the various railroad shops, and especially study of practice of shops in other industries, is responsible for much that may be criticised in the railroad shops of today. A thing entirely apart from the men, their ability, their relations with each other or with the outside world is the average condition of the machinery. A railroad shop must be a healthy place for a machine tool judging by the number of old and venerable tools found there. With very few exceptions, there are a number of tools in each railroad shop that had probably reached a comfortable middle age when wood burning locomotives were all the style.

The claim that railroads are poverty stricken does not explain the existence of so many relics for most of them must have been old when the roads were prosperous and mighty. The only reasonable explanation seems to be that the railroad shop is the step child of the company, on which money is spent only when there is no way out of it.

To enumerate the many old and dilipidated machines noticed, would be to give a dreary list containing many names of fossils, known to science only. The condition must be seen to be appreciated. It is our opinion that the railroads could not spend money to a better or more profitable purpose than by cleaning out the old junk and replacing it with the proper kind of modern machinery.

These Figures Show No Standardization of Catalog Sizes

During a period extending over several months, the *American Machinist* recorded the sizes of the catalogs it received. The total of catalogs was 190, the total of sizes 62. Herewith is the tabulation:

Size			Quantity	Size			Quantity
1⅝	by	5¾	1	6	by	9	33
3¼	"	6	1	6¼	"	9¼	2
3¼	"	6¼	1	6½	"	9½	1
3½	"	5¾	1	7	"	10	2
3½	"	6	7	7	"	11	1
3½	"	6¼	3	7¼	"	7½	1
3½	"	6½	1	7¼	"	10	1
3½	"	8¼	1	7½	"	9	1
3¾	"	8	1	7½	"	10½	2
3¾	"	8¼	1	7¾	"	10½	1
4	"	6	1	8	"	9	1
4	"	7	1	8	"	10	3
4	"	7¼	1	8	"	10½	9
4	"	8½	1	8	"	11	3
4	"	9	8	8¼	"	10¼	2
4¼	"	5½	1	8¼	"	10½	1
4¼	"	6¾	1	8½	"	10½	1
4⅜	"	9½	1	8½	"	11	57
4¾	"	7¼	2	8½	"	11½	1
4¾	"	7¾	1	8¾	"	11	1
5	"	7	3	8¾	"	11¼	2
5	"	7½	2	8¾	"	11½	2
5	"	8	3	8¾	"	11¾	1
5¼	"	7¼	1	8¾	"	12	1
5¼	"	7½	1	9	"	10½	1
5¼	"	8	1	9	"	12	4
5¼	"	8¼	2	9¼	"	43	1
5¼	"	9½	1	11	"	14½	1
5½	"	8	1	15½	"	22	1
				17	"	22	1

The majority, it is pleasing to note, were 8½x11 in., a size that is logical on account of its present acceptance as the standard letter sheet. For the catalog that will be used in the office and salesroom and carried in brief cases, that size is probably the best. The pocket size, say 4x6 or 5x7, as a second size, has much in its favor.

As the first step, a standardized size should be determined. After that, refinements, such as punching for a standard binder, should be considered.

Two Hundred Miles per Hour Necessary for Commercial Aviation

Commercial aviation can hardly be accomplished until a speed of 200 miles per hour can be maintained. This opinion has been expressed in connection with the study of results at the Detroit meet. At slower speeds aircraft can rarely be expected to compete with other forms of transportation.

When the distance between Chicago and New York can be covered in two or three hours or San Francisco can be reached in 15 hours of continuous flying from New York, there would be a demand for the service, despite its cost. Only three days of daylight are lost to the passenger who crosses the continent by rail. By the impracticability of night flying no great amount of time is saved to the passenger who undertakes the journey by air under existing conditions. The possibilities of commercial aviation are unlimited and now depend on speed development.

Inclusions in Aluminum-Alloy Sand Castings

By R. J. Anderson

Technical Paper No. 290, of the Bureau of Mines, Department of the Interior, is the result of the suggestion made by a number of foundrymen that the bureau investigate hard spots, put the available information on record and suggest preventative methods. Hard spots, due to foreign matter other than iron, originate in the foundry and can be prevented by not allowing such materials to get into the melting furnace.

When the melting room and foundry floor are being cleaned to gather up small pieces of metal, sloppings and overruns, dirt, gravel, sand, cement, brick and chunks of broken crucibles are swept up. Unless these sweepings are sieved and forked, such materials are likely to be charged into the melting furnace. Whether under fast practice or a moderate rate of production, it will pay to watch the quality of the melting charge. Some of the foreign material may be removed by skimming and fluxing, but if this material is readily wetted by aluminum and is of nearly the same density, it will remain in the liquid metal and will ultimately appear in the castings.

Crucibles should not be used too long or until they become cracked and readily friable. No core sand should be left in defective castings that are remelted, as the hard, fine, silica particles may give rise to small hard spots. Foreign non-metallic hard spots can be largely eliminated, provided sufficient attention is given to the charging practice.

Limiting the Iron Content

In regard to the hard spots caused directly or indirectly by iron, the iron content of No. 12 alloy or of other alloys made from secondary ingots can be kept within reasonable limits by using only such ingots as are reasonably low in iron. Difficulties brought about by the use of secondary ingots or scrap castings purchased from outside sources, can be readily eliminated by chemical analytical control. Actual irony hard spots caused by charging nails, core wire, chills and bits of iron and steel can be prevented by careful attention to the quality of the charge.

Mechanically admixed iron appearing in the foundry scrap or in floor sweepings can be removed by screening and forking, or by electromagnetic apparatus if required. If small loose scrap is charged by fork rather than by shovel, small particles of iron or non-metallic particles should readily fall between the tines of a fork, whereas they would be retained by the shovel and go into the charge. However, if too much scrap is picked up on the fork, the small pieces will not fall through and forking does no good. Unless small forksful of scrap are taken and the scrap shaken up and down on the fork, forking is useless. In certain foundries, forks are used like shovels, but if they are not used correctly they may as well not be used at all.

The practice of charging borings and turnings has practically been abandoned and these materials are usually run down into ingots before charging. In a machine shop, however, iron and steel drillings and turnings may become admixed with aluminum-alloy borings. Unless it is known that aluminum-alloy borings are free from mechanically admixed iron, they should not ordinarily be charged directly. At best it is not good practice to use borings in melting charges because of heavy dross losses.

Hard spots, due to the brittle, complex, ferro-aluminum alloy which forms on the sides of iron pots, may be largely prevented by thoroughly scraping the pots at frequent intervals and by removing the accumulated scale. If eight or nine hour practice obtains, the pots should be scraped at least once a day, say at night, and preferably twice a day, at noon and at night. If two shifts are working, more frequent scrapings will be advisable.

All of the hard alloy should be removed so that the pot is clean and, if necessary, the pot should be dumped. Moreover, during the time the pot is in the melting operation, care should be taken that ladles or stirrers do not hit the sides of the pot. Otherwise, some of the accumulated scale may be knocked off. In the same way, the scale may be dislodged at charging time. By careful attention to the foregoing precautions, the occurrence of hard spots in aluminum-alloy castings that give rise to difficulty in machining and polishing can be largely eliminated.

A complete copy of the paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of ten cents.

Machine Shop Bulls—IV

By Joe V. Romig

Ed was working on a long center shaft, 3$\frac{15}{16}$ in. in diameter and 14 ft. long. This shaft was a red rush job; the mill in which it was used was shut down, men were idle and had to be sent home, and an express car stood waiting to ship it the moment it was finished.

The shop super and foreman had strict orders to rush it through and had given it to their best lathe hand because they could trust him. Every pad had been turned accurately to size and all that still remained was to taper bore the lower end for the thrust bearing spud. Working fast, Ed took a chance without "miking" his bore soon enough, and bulled the job, the roughed hole being $\frac{1}{8}$ in. oversize.

To admit the bull meant the scrapping of the shaft, costly delay to the shut-down plant of the customer and possibly dismissal. A quick conference with his pal decided the course of action. Ed was to bore out the over-size hole to exactly 2 in. in diameter, and Joe, his buddy, immediately turned up a 2-in. plug to fit. This plug exchanged hands quickly and secretly and was socked into the finished bore, a light tapping fit.

The dog was still in position on the plug, and this dog was used when the lathe was started up in low gear to make out the cut-fast fit, the only possible way which they had to tighten the plug without causing suspicion. The plug, fitting neatly, allowed the shaft to make a few revolutions, when it smashed its supporting block into splinters and cut fast like a good fellow.

A few minutes of high-speed turning and drilling made a new hole, dead to size and taper, and the shaft went out of the lathe to the inspector's bench without a soul being the wiser. All had been done so quickly and quietly, that no one knew of the bull but its maker and his buddy. As far as the strength and mechanical fitness of the job was concerned, everything was above board; and by taking this bull by the horns, Ed saved himself an embarrassing situation.

Bulls will creep in once in a while for everyone, and although they are the most unwelcome of creatures in a shop, they must be handled with philosophy and reason.

Multiple Fixtures for Milling Small Parts

A Description of Fixtures Used in Milling Service Machine Parts—Design Applicable to Fixtures for Parts of Other Machines

BY C. E. STEVENS
Chief Engineer, White Sewing Machine Co.

IN DESIGNING multiple fixtures, a considerable amount of thought should be given so as to get the largest amount of production with the least amount of expenditure for tools. The fixtures should be made substantial to withstand the cut and still be simple as possible, both for loading and replacing worn parts.

The accompanying photographs show fixtures used on milling operations for small parts on sewing machines, which increased production from 200 to 400 per cent, with a very small amount of tool cost. These fixtures have been in use for over two years proving very satisfactory and, with slight changes, could be used on other classes of work.

FIG. 1—SET-UP FOR SLOTTING SHUTTLE RACES

In Fig. 1 there is shown a fixture set up in position for use on a Lincoln type milling machine. This fixture holds seven sewing machine parts, known as shuttle races, in each of which a slot $\frac{1}{8}$ in. wide by $\frac{7}{8}$ in deep is milled by feeding the parts into the cutters to a stop. The arbor of the machine is $1\frac{1}{4}$ in. in diameter and holds seven $\frac{1}{8}$ in. by $4\frac{1}{2}$ in. standard saws, separated by spacers of equal length. The center of the arbor is set slightly above the center of the slot which is to be milled. By revolving the cutters downward toward the work, the arbor is forced down upon the fixture and no clamping is necessary.

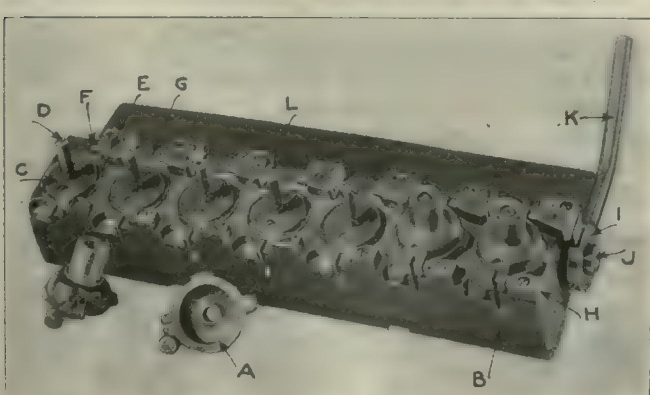


FIG. 2—THE SHUTTLE RACE FIXTURE

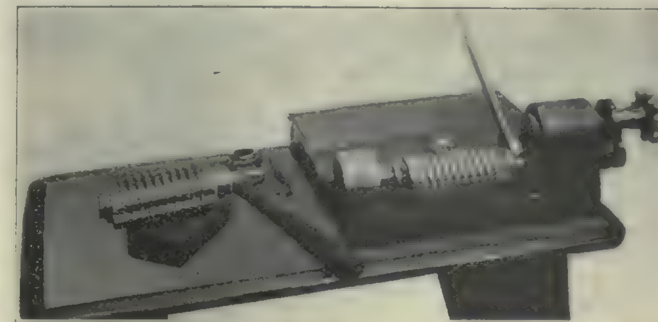


FIG. 3—LOADING THE SHUTTLE RACE COVER ARBOR

The details and method of operation of this fixture are given in Fig. 2. The work is shown at *A*. The body of the fixture, *B*, is made of cast iron and machined to receive the smaller parts. It will be noted that it has been machined at seven regular intervals along one side in the form of semi-circular slots in order to provide clearance for the button of the shuttle race *A*.

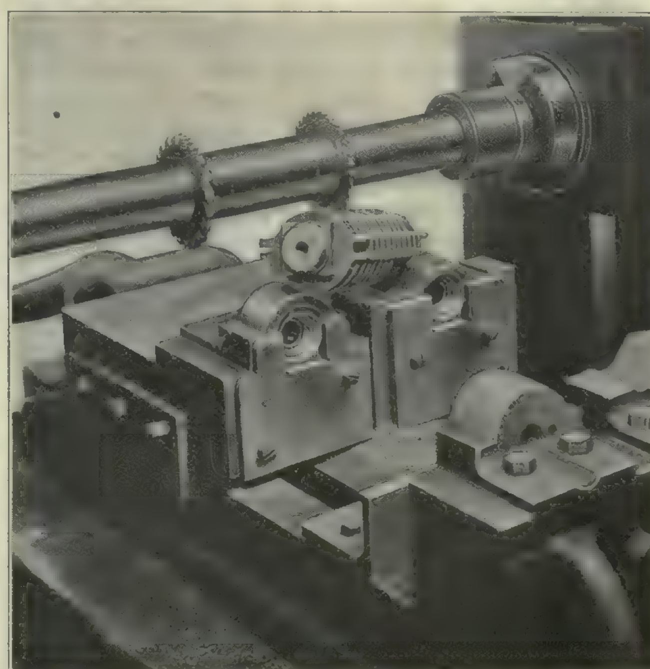
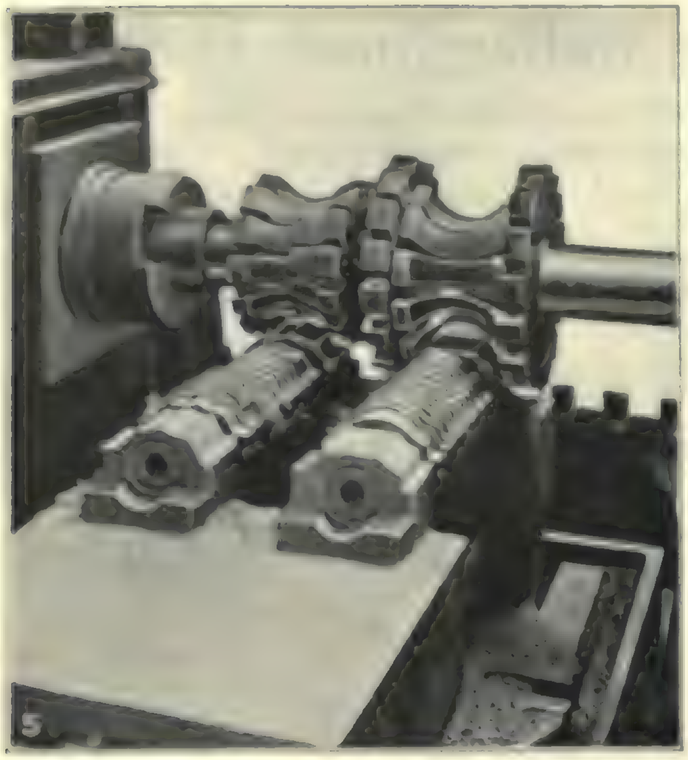
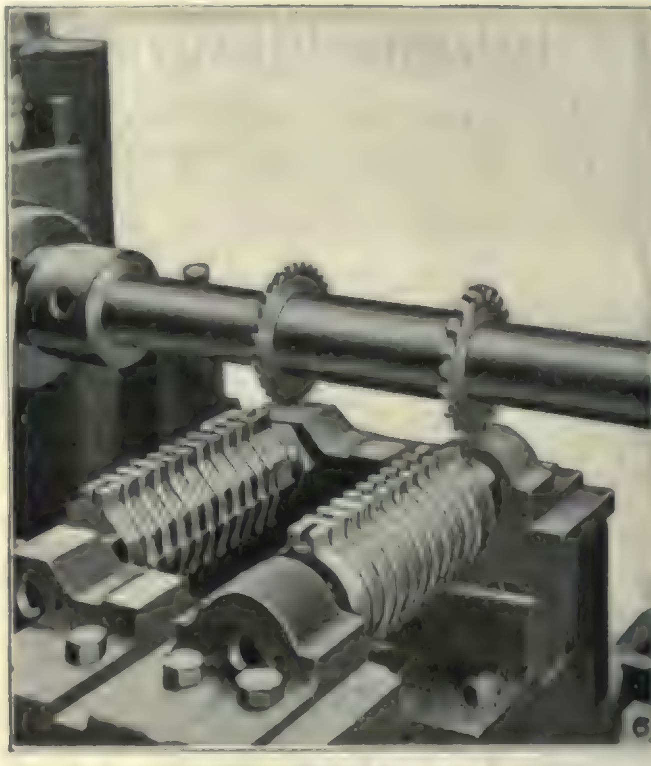


FIG. 4—THE VISES FOR HOLDING THE ARBORS

The plugs, *C*, are made of steel and turned to fit the bore of the shuttle race. At an angle of 15 deg., to suit the race, a hole is reamed in each of these plugs, after which, stems *D*, made of hardened drill rods, are driven into place. The plugs are then doweled into position on the fixture.

On the opposite side of the fixture, seven steel blocks *E* are fastened to the strip *G* by $\frac{1}{4}$-in. filister head screws. The position of this strip and the method of attachment to the body *B* is shown more clearly in Fig. 1. The steel blocks *E* contain shoulder pins, *F*, which are





FIGS. 5 AND 6—FORM MILLING AND SLOTTING OPERATIONS ON SHUTTLE RACE COVERS

backed up by coil springs held in the blocks by means of headless screws *L*.

Attached to the body of the fixture by means of the shoulder screw *J* is a cam *I* which has a rise of ¼ in. In operation, after the fixture is loaded, the handle *K* is raised and brought toward the arbor, as shown at the left of Fig. 1. As the handle *K* is raised, the cam *I* slides the strip *G*. The pins *F* are thus brought against the shuttle races, holding them in position against the gage blocks *H*. The springs in the blocks *E* take up any variations in the shuttle races and keep the cut from chattering.

Before proceeding to the description of the other fixtures, it might be well to mention at this point that each shuttle race is fitted with a race cover which must be milled not only to form to fit the race *A*, but must also be slotted. For these operations the fixtures illustrated in Figs. 3, 4, 5, and 6 have been devised for use in two Lincoln type milling machines.

In Fig. 3, on a stand of convenient height, is shown a loading fixture. It will be noticed that each arbor holds ten race covers and nine spacers. These are held securely on the arbor by a locking washer and a ⅜ in. nut. The locking washer, like the race covers, is milled to form. The arbors are loaded and placed in this fixture between centers. The nut is then tightened, the race covers resting on two parallel strips, one on each side, which locate the race covers on the arbors. The spacers have a small key which fits in a keyway on the arbors. This arrangement brings them always to the same position on the arbor.

In Fig. 4 a loaded arbor will be seen, as well as the vise for holding the two arbors. It will be noted that the arbors have a square on one end. This square is a snug fit in the gage plates on the loose jaw of the vise. Both jaws of the vise have a pair of bell centers which fit the centered end of the arbors. Having loaded the arbors, the first operation on the race covers is that of milling to form and to length as shown in Fig. 5.

Two arbors are placed in the vise and a cut is taken. As the two cutters are different in form, after the first cut is taken, the position of the arbors is reversed and a second cut is made. A newly loaded arbor is then put into the vise, leaving one of the arbors in for a second cut only. It will be seen that at each cut from this point onward, ten covers are completely formed and milled at each cut of the machine.

The next and last operation is illustrated in Fig. 6. Here is shown another view of the vise illustrated in Fig. 5 and also the method of setting up for milling two slots of different widths in these same covers. The procedure is identical with that just described. In the work of milling the race covers a total of five arbors are used. Four are in the two machines while a fifth arbor is unloaded and loaded by the operator while the cut is being taken, the one operator running both machines. Chips are blown from the centers and gage points by air. This fixture not only increased production, but insured the milling of the slots at right angles with the form. To obtain this result had always been one of the difficulties of the old method where the slots were milled one at a time.

Methods of Machine Tool Design

Continuing the Subject of Machine Tool Feed Mechanisms—Design of the Drum Cam Roller—Devices for Eliminating Lost Motion

By A. L. DeLEEUW
Consulting Editor, *American Machinist*

THE roller used with a disk cam should be of cylindrical shape. Being of this shape it will always have a straight-line bearing on the cam and the length of this bearing will be equal to the thickness of the cam if the thickness of the roller is not less than that of the cam, which never should be the case. As to the diameter of the roller, this should be made as large as possible and it should run on a stud as small as possible so that it will be free to turn against the friction between roller and stud. On the other hand, if we make the diameter of the roller large we shall lose considerable time when the roller must pass over the point of the cam or anywhere where the curvature of the cam changes.

Our problem, then, is to select a roller which is large enough to turn freely and yet small enough so that no more time is lost than necessary. Though in one way it is advisable to make the diameter of the stud small, on the other hand, sufficient amount of surface must be retained so that there will not be excessive friction between roller and stud. Thus, the pressure per unit surface will not be so great that the lubricant is entirely squeezed out.

The problem of the cam roller when using a disk cam is not a very serious one as compared to what we meet when we use a drum cam. In Fig. 177 a drum cam and roller are shown in which the roller is made of conical shape. If we should consider that the left side of the cam groove is rubbing against the roller and if we imagine that the groove is at right angles to the axis (which is only the case when there is a dwell in the cam), then the action between roller and cam is the same as that between two friction rollers and their surfaces should be made like the pitch surfaces of a pair of bevel gears, which is the way they are shown in the illustration.

In Fig. 178 a cam drum is shown with a groove running parallel to the axis, which can never be the case where the cam drives the roller, but which may happen when the roller drives the cam. In this case it is obvious that the roller should be of cylindrical shape.

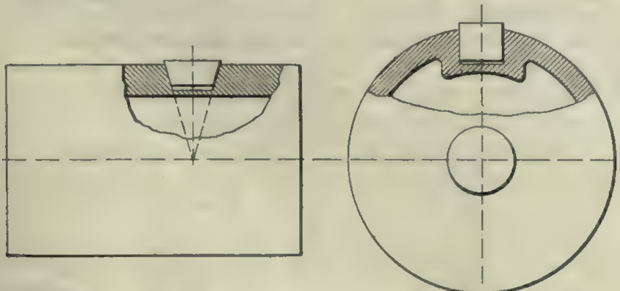


Fig. 177 Fig. 178

FIGS. 177 AND 178—SECTIONS OF DRUM CAMS AND ROLLERS

In ordinary drum cams, parts of the groove may be as in Fig. 177 but the greater part will be at more or less of an angle with the axis. In that case neither the conical nor the cylindrical roller will give entire satisfaction. If in Fig. 177 we had used a cylindrical roller we would have had the following conditions:

Supposing the depth of the groove to be one-fourth of the radius of the drum, then the speed of a point at the top of the groove would have been 4, while the speed of a corresponding point at the bottom would have been 3. As all the points of the surface of a cylindrical roller run at the same speed, there must have been slippage between roller and cam. This slippage would soon wear a flat place on the roller which would prevent it from turning. As soon as this happens the wear would increase and the roller as such cease to function. In order to see what happens when the cam groove is at an angle with the axis, we will take a concrete example. Imagine a cam of which the groove has a depth equal to one-fourth of the radius and with an angle of spiral of 45 deg. When we speak of an angle of spiral in a case like this, we must indicate at which point of the depth of the groove we consider this angle to be, for the angles of spiral of top and bottom of the groove are not the same. In order to find the angle of spiral we would take the circumference of the drum at that point as the base of a triangle, the lead of the spiral as the other right-angle side, and the hypotenuse would show the angle of the spiral.

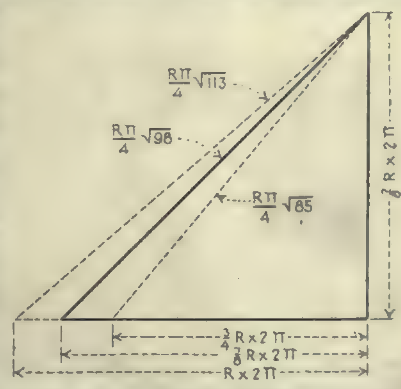


FIG. 179—DIAGRAM TO SHOW VARYING ANGLES OF SPIRAL AT DIFFERENT DEPTHS OF CAM GROOVE

The lead being the same at top, bottom or center of the groove, but the circumference at these points different, we will get different angles of spiral. As a rule, the angle of spiral is given for the center of the depth of the groove or, as it is sometimes called, at the pitch circle. However, there is no reason to give it this name, nor is there a good reason to base our calculations on the angle at that particular point. As a matter of fact, it is safer to consider the angle at the bottom of the groove because at that point the angle is steeper.

Such a triangle as was mentioned before is shown in Fig. 179. The full line triangle is the one we would obtain at the pitch point. As the outside radius is R and the depth of the groove is $\frac{1}{4}R$, the radius at the pitch point will be $\frac{7}{8}R$. The length of the hypotenuse is shown for top, bottom and center of cam groove and we see not only that they are different but also that the length of the hypotenuse at the pitch point is not

the mean between the other two lengths, so that even a conical roller could not engage this cam groove without slippage. This slippage, however, would be considerably less than it would be if we had made the roller cylindrical in form.

Of course it would be possible to construct a roller of such a contour that there is no slippage. In the case illustrated, the top, center and bottom diameter of the roller would have to be in ratio of $\sqrt{113}$; $\sqrt{98}$; $\sqrt{85}$. A number of other points could have been calculated or graphically determined and a roller could have been constructed which would not slip. If such a cam groove should go on without ever changing its direction or lead, such a roller would act without slippage. A cam groove must, however, necessarily return to its starting point, so that there will be a point somewhere where this same spiral is no longer used and therefore where there will be slippage between roller and cam.

If we should have a cam of which the groove goes around one-half the drum without changing its angle of spiral and if then it should at once return to its starting point with the same angle of spiral, we would have an ideal set of conditions so far as the action goes between cam and roller. Such a set of conditions, however, hardly ever occurs in practice. The ordinary cam will have part of its groove at one angle, other parts at another, still other parts running at right angles to the axis, etc., so that the only thing left for us to do is to make some compromise in regard to the shape of the roller. Where we know the exact functioning of a cam we can select that part of the groove where the hardest work is done or perhaps where the groove is of the steepest angle, possibly both, and make the roller conical and with an angle to suit this particular part of the groove. Even then, we should favor the top or larger diameter of the roller so as to have the slippage take place on the smaller part.

FIG. 180—METHOD OF ATTACHING FACE CAM TO GEAR

Where a cam may be used for different jobs and especially where a cam is built up for various jobs by attaching straps to a drum, so that we may be confronted with almost any angle, a practical solution of the problem would be to give the roller, which by the way is never changed no matter what the groove may be, the form of a cone with an angle corresponding to a strap angle of 30 deg. with the axis.

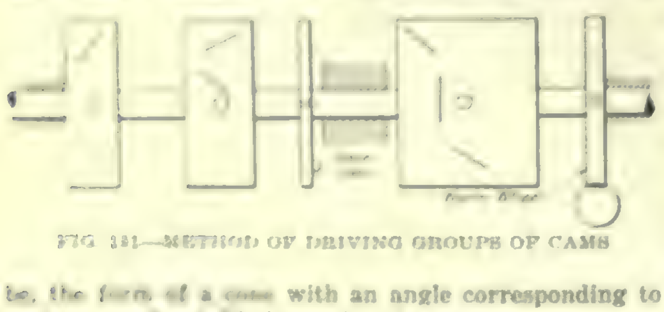


FIG. 181—METHOD OF DRIVING GROUPS OF CAMS

It is sometimes recommended to make the roller slightly barrel shape. This is a good solution where the work is very light but not where the work is of a heavy nature because the barrel-shaped roller provides only a single point of contact between roller and cam.

A single cam may be driven either by a shaft to which it is keyed or fastened in some way, or by a direct drive. Where the cam performs a light duty only, or where its movement does not need to be strictly uniform and without shocks, a shaft drive is acceptable. As a rule, a gear or a screw is loaded fairly uniformly and, if there are fluctuations, they are seldom sudden or periodical. A cam, on the other hand, has a non-uniform load, and, in the nature of things, the load is periodical; that is to say, the changes of load go through a definite cycle and recur in the same order for every revolution of the cam. If a gear is mounted at the end of a long shaft which is driven at the other end, there will be a certain amount of wind in the shaft which is zero at the moment we start to drive and which very soon comes to a maximum. From then on the amount of wind is either constant or changes only slightly and slowly. This is not always so but is true of the great majority of cases. If a cam should be mounted at the end of a long shaft of which the other end receives the driving gear, the amount of wind in the shaft would change with every change in the angularity of the cam and with every change of load. As a result, a cam would have a jerky motion and its action would lack uniformity. For this reason cams should not be mounted far from the source of driving power and, if it is not possible to avoid this, the shaft should be made very heavy so as to minimize the amount of wind.

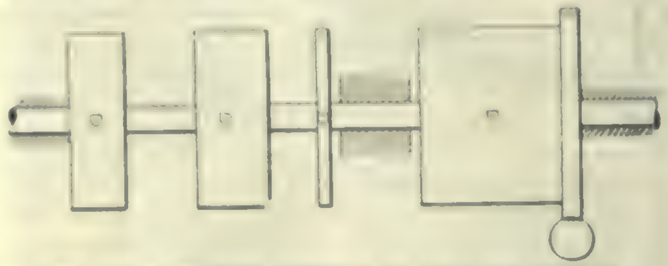


FIG. 182—ANOTHER METHOD OF DRIVING GROUPS OF CAMS

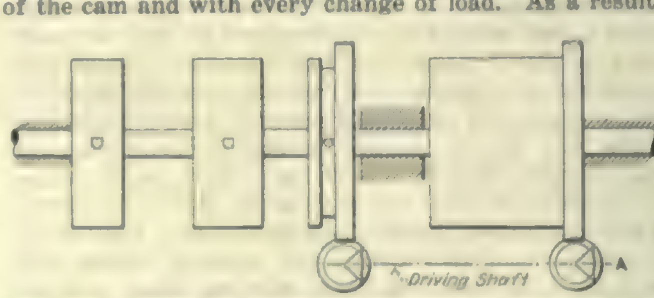


FIG. 183—A THIRD METHOD OF DRIVING GROUPS OF CAMS

The shaft drive is permissible for cams which perform secondary operations and where uniformity of action is not essential, as well as where the sudden jerky movement cannot affect the work. But for cams which are heavily loaded or which are called upon to produce accurate work, such as the main feed cams of automatic machines, a shaft drive is not permissible. In such cases the cams should be driven directly. This may be done by fastening a spur or bevel or internal or worm gear directly to the drum. Where a face cam must be driven and where it is not possible to fasten it directly to a gear because the roller might interfere, an element may be introduced between cam and gear to provide the necessary clearance. Fig. 180 shows the manner in which a face cam might be attached to a gear and provide sufficient clearance for roller or lever or whatever element might interfere. It is hardly necessary

to show how a drum cam can be fastened to a driving gear.

Not only should the cam be directly driven but the designer should see to it that the driving gear is large in diameter, if possible larger than the cam, and if not possible, as near the size of the cam as it can be made. In no case should it be much smaller than the cam.

When there are a number of cams in one machine it is customary to place as many of them as possible on a single shaft and either drive the shaft itself or else drive one of the cams, transmitting this drive through the shaft to the other cams. This is permissible when none of the other cams are called upon to do heavy work. Here again we would have the shaft drive for all of the cams but one. When there is more than one cam in the machine which must have a steady motion, each of these cams should be driven separately by being attached to its own gear. This does not prevent them from being placed on the same shaft if this will lead to simplification of the construction.

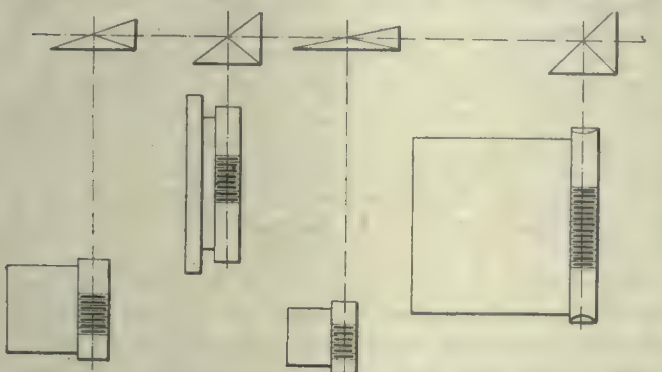


FIG. 184—ARRANGEMENTS OF INDIVIDUAL DRIVE FOR IMPORTANT ELEMENTS

Fig. 181 shows a number of cams all keyed to the same shaft which is driven at one end by means of a worm and worm wheel. Fig. 182 shows a somewhat better construction in which the drum cam is directly attached to this worm wheel, while the other cams are keyed to the shaft. In Fig. 183 is shown the same arrangement again but here it is supposed that the face cam also must have a smooth and uniform motion. It is keyed to the shaft, whereas the large drum cam is running loose on it. All the other cams are also keyed to the main shaft. The two important cams, the large drum cam and the face cam, are each provided with their own worm wheels and the worms are driven by sets of bevel gears which derive their power from shaft *A*. As the number of teeth of bevel gears and worm wheels are the same for both cams, they will run in unison. As a consequence, though the drum cam is not keyed to it, it will not have any movement in relation to the shaft. We might have keyed the drum cam to the shaft, leaving the face cam loose, but with the arrangement of cams as shown in the sketch, this would have brought a larger part of the shaft in torsion than with the proposed arrangement. Generally speaking, that cam should be keyed to the shaft which is nearest to the secondary cam.

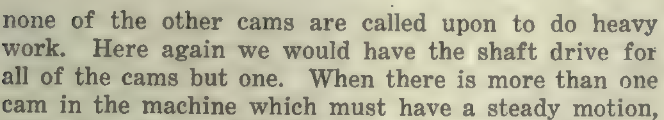


FIG. 185—ANOTHER ARRANGEMENT OF AN INDIVIDUAL DRIVE FOR IMPORTANT ELEMENTS

It might be asked why both cams are not keyed to the shaft. This should not be done because there is no absolute uniformity either between the two worm wheels or worms or the gears driving them. These little errors would cause one of the two cams to take the lead over the other at some point of the cycle, while at another point these conditions may be reversed. This would cause the very twist in the shaft which we aim to avoid.

In many automatic machines, particularly those constructed for some special purpose, one will find a number of slides or other elements carrying tools, all of which must have a smooth and uniform motion. In such a case, all of them should have their own individual drive. Fig. 184 shows such an arrangement. As will be seen, each cam has its own worm wheel but, as not all cams have the same size, it is not necessary to make all worm wheels of the same diameter. It is necessary that all cams should run at the same speed and make the same number of revolutions per minute. This may be accomplished by giving the sets of bevel gears used for the various cams different ratios. This is shown in Fig. 184.

Not only is such an arrangement correct because it gives the proper kind of drive to each of the cams but it is also a very elastic arrangement and can easily be designed in such a manner that any number of cams may be thrown out of action so that small cams may be used where otherwise large ones would be required. As a rule, a large proportion of all the cams used in such a machine is idle, thus requiring a large cam for a small field of action. By modifying the construction, as shown in Fig. 185, we obtain the condition by which small cams can be used, which lends itself to the construction of a program machine, and which permits of many changes of jobs without the necessity of revising the camming of the entire machine. A change of work might require the changing of a single cam with this arrangement, whereas with the ordinary arrangement a change or at least an analysis of all of the cams is necessary.

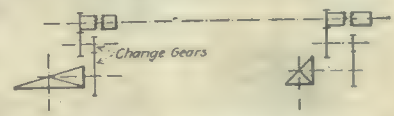


FIG. 186—A THIRD ARRANGEMENT OF AN INDIVIDUAL DRIVE FOR IMPORTANT ELEMENTS

A further improvement, which would make such a machine more universal, is shown in Fig. 186. In the arrangement of Fig. 185 all cams were supposed to run at the same speed. This, however, is not absolutely necessary. It would have been possible to select the bevel gears or worm gears so as to obtain different speeds for the various cams, thus giving each cam a cycle in keeping with the work it has to do. When the machine is once arranged, the relative length of these cycles cannot be changed. It would be possible to speed up or slow down all of the cams but not to change their relative speed. This condition is improved by the arrangement shown in Fig. 186 where each cam may be driven at any speed within a certain range by change gears. It should be noted that such an arrangement permits the running of all cams at the same time, or each cam separately, or any combination. A machine built with such a system of cams may be considered as a group of machines which are only connected by a common source of driving power, by a common feed shaft, and by a common system of control.

Mention was made of the fact that a shaft drive is

not desirable on account of the jerky motion due to wind or twist of the shaft. There is another item which affects the smooth and even motion of the cam and that is the fact that in a drum cam the roller can never completely fit the groove; in other words, that we have lost motion. This lost motion becomes especially visible when the direction of the cam changes, for instance, when it goes over from feed to return, or vice versa. It also becomes visible when the cam changes from slow to fast, or vice versa. This is so well recog-

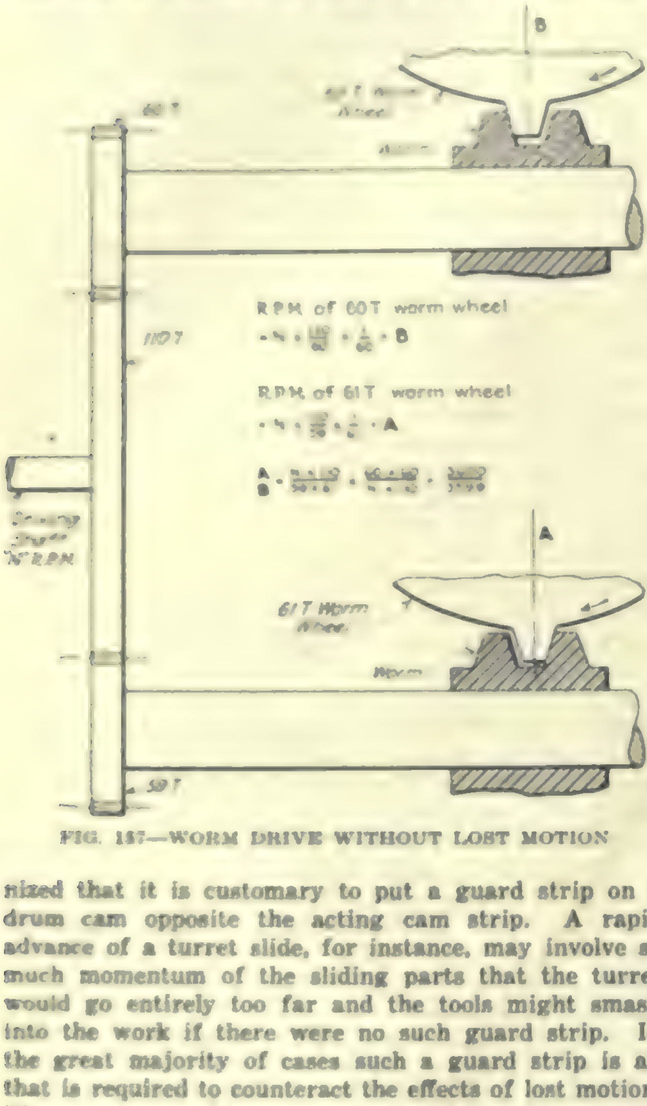


FIG. 187—WORM DRIVE WITHOUT LOST MOTION

nized that it is customary to put a guard strip on a drum cam opposite the acting cam strip. A rapid advance of a turret slide, for instance, may involve so much momentum of the sliding parts that the turret would go entirely too far and the tools might smash into the work if there were no such guard strip. In the great majority of cases such a guard strip is all that is required to counteract the effects of lost motion. There are cases, however, where much greater smoothness of action is required than can be obtained by this means. In such cases springs or weights may be used to hold the roller against the active side of the cam whether this be a drum cam or a face cam.

When all this is done, there still remains another source of lost motion which, as a rule, does not need to be considered seriously, but which, in a few instances, should be taken care of. We refer to the lost motion between worm and worm wheel or between pinion and gear driving the cam. In cases where a particularly smooth motion is required, nothing but a worm and worm wheel would be considered fit for the drive, so that we need to look at this kind of gearing only when we consider how to overcome whatever lost motion there may be left.

There are, of course, a number of ways in which the lost motion between a worm and worm wheel is supposed to be taken up. The worm may be brought deeper into mesh or the worm wheel may be made in two halves bolted together and so arranged that one half can be shifted a slight amount in relation to the other half, or the worm may be made on a taper so that it can be brought deeper into mesh by being moved in an axial direction. None of these methods overcomes entirely the lost motion because they all take for granted that the wear in worm and worm wheel has been even. This is never entirely the case and certainly not with a cam drive, because the pressure required at various points of the cam is not alike and the wear on the worm wheel cannot be expected to be even all the way around. In such cases, where extraordinary smoothness of action is required, some device should be used which will take care of uneven wear and do it automatically. Fig. 187 shows such a device in diagram. Before describing it it may be well to analyze it along the line of thought one should follow when confronted with such a problem. The analysis will show how the realization of the requirements of a problem necessarily and automatically leads to a solution.

The situation is this: We must not have any lost motion between worm and worm wheel, notwithstanding that both may have uneven spacing of the active sides of the teeth, due to wear or to initial inaccuracy. The natural solution is to prevent the worm wheel from moving backward, meanwhile permitting it to go forward. This might be done by wrapping a rope around the hub of the wheel and attaching thereto a weight heavy enough to prevent the wheel from rebounding whatever may be its tendency to do so. This solution is not practical if the machine must run all the time because the length of the rope is necessarily limited. Such a device *might* be useful if the machine were to make only one or two turns. In that case we would wrap the rope around a drum which can be fastened to the worm wheel. When the machine has made its specified number of turns we would unclamp the drum from the wheel, re-wind the rope on the drum, and fasten this once more to the wheel and then resume operations. For the continuous operation of the machine some other device must be designed.

Another means to prevent backward movement and which suggests itself at once, is friction. If sufficient friction is brought to bear against the wheel there will be no possibility of such backward movement and at the same time it will not prevent the wheel from going forward provided there is sufficient driving power. The objection to this scheme is that much power is lost and that this lost power causes wear of the parts, besides making it necessary to proportion all driving parts on a much larger scale. We would have to double the pressure against the worm wheel and lose at least 50 per cent of the power. This seems to condemn the scheme until we remember that the friction member does not need to be stationary but may revolve as well as the worm wheel. The only requirement we must meet is that this friction member

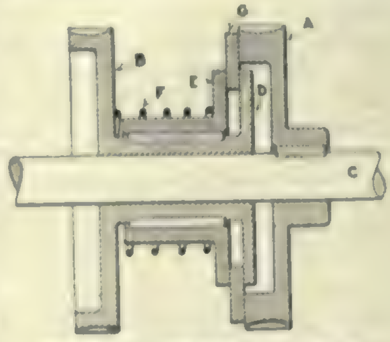


FIG. 188—SKETCH TO SHOW PRINCIPLE OF FRICTION RETARDED WORM

should run somewhat slower than the worm wheel. The difference in speed may be very small because the unevennesses in worm and worm wheel which cause the lost motion are never more than a few thousandths of an inch. This suggests the use of two worm wheels, one fastened to the spindle (or whatever device must be driven), and the other containing the friction device, which will prevent the backward motion.

Fig. 187 shows how such a device would work. A is the acting, and B the retarding worm wheel. A tooth of A will bear against the left side of a tooth of its worm, if the drive is in the direction of the arrow. A will take B along by friction and will make a tooth of B bear against the right-hand side of a tooth of its worm, if this worm stands still or, speaking in a more general way, so long as this worm turns slower than it should to give B the same speed as A.

This leads to the construction shown in Fig. 188. A is the acting worm wheel which is shown here as being keyed to a shaft. It might as well be fastened to a spindle or a cam drum or to any other member. B is the retarding worm wheel which is fastened to a sleeve provided with a friction plate D. Keyed to this sleeve in such a way that it can slide thereon is the friction plate E. The spring F clamps the plate G between D and E. This plate G is fastened to worm wheel A, so that this latter wheel will have a tendency to take B along but is prevented from doing so by the fact that the worm which drives B does not permit it to run as fast as A. Instead of a single spring a number of springs might be employed and, instead of a single plate G, the contrivance which is, in effect, nothing more than a friction clutch, might be made of the multiple-disk type. One thing should be kept in mind, and that is that the unit pressure between plates must be kept low to avoid abrasion. Attention is called to the fact that Fig. 188 does not show a practical construction but merely the principle of this device.

To avoid undue loss of power by friction and the resulting wear and other undesirable features, we should keep the difference in speed between A and B to a very small amount. Both wheels being worm wheels we would accomplish this by giving B one tooth more than A; but even this difference in speed is much more than what is required to make up for the slight errors there may be in the worms and worm wheels. We should arrange the drive so that when B makes a large number of revolutions, A makes one revolution more. For instance, we might have B running 1,000 and A 1,001 revolutions in the same time. We see at once that this cannot be accomplished merely by the difference in teeth of the two worm wheels and we will have to employ some other gears. If we introduce one additional gear ratio both systems A and B will have a speed depending on the product of two gear ratios. The simplest arrangement would be to place a spur gear on each of the two worms and drive them each by means of another gear. If worm wheel B has P teeth and the number of teeth of A is Q, and if we place on the worms spur gears with R and S teeth respectively and drive them both by means of a common gear with T teeth, we will find that when the last-mentioned gears runs N revolutions B runs $\frac{T}{R} \times \frac{N}{P}$ revolutions; and A runs $\frac{T}{S} \times \frac{N}{Q}$ revolutions so that the speeds of B and A bear the proportion $\frac{T}{R} \times \frac{N}{P}$ to $\frac{T}{S} \times \frac{N}{Q}$ or as QS to PR.

We must find, then, two products both large and differing very little. As all the factors of these products are integer numbers (because they represent the number of teeth of gears), the smallest difference we can have is 1. We might construct all kinds of products which differ 1, such, for instance, as 1,000 and 1,001. the first one being the product of, say, 25 and 40; and the latter of, say, 13 and 77. We wish to have the numbers of teeth of the worm wheels close together and we happen to remember that a square as well as a square minus one can always be factored. For instance, we might choose 2,500 and 2,499, the first one being the product of 50 and 50, and the latter of 51 and 49. Fig. 187 shows B with 60 teeth, A with 61, while the worms are driven by gears of 60 and 59 teeth respectively. Thus the speed ratio of the two wheels is as 60×60 to 59×61. In other words, B will make 3,599 revolutions while A makes 3,600, and the work lost by friction is due to one revolution in 3,600. Any other combination might be made and might even be more desirable according to circumstances. It should be noted that the common driving spur gear is shown here to have 110 teeth. This number, however, is entirely immaterial and has no effect on the final ratio.

Attention was called to some arrangements of cams by which some of the secondary operations were performed by a cam which made one-half or one revolution by the application of a single-revolution clutch. This is in principle nothing else but an application of small cams individually driven. In our discussion of such cams we imagined them to perform rather lengthy operation and doing this while the other cams were standing still. There may be many operations in automatic machines which require a very small amount of time, so that their cams can be directly attached to a rather fast-running shaft. The total time occupied by the operation of such cams may be but a very small percentage of the time required for the complete cycle, so that it is hardly worth while to interrupt all the other operations while this particular operation takes place. An instance of this kind is the Brown & Sharpe automatic screw machine where such operations as the shifting of belts, opening and closing of chuck, and stock feed are performed by the single-revolution clutch while the main cam keeps moving.

The action of the cam should be transmitted to the member which is to be moved by the most direct method possible; that is to say, either the cam or the roller should be attached directly to that member. As a rule, it is the roller which is thus attached, but it may just as well be the cam. An instance of this latter construction may be found in the Cleveland automatic screw machine where the cam moves together with the turret. In most other screw machines the cam is held in a fixed position and the roller is attached to the moving part. However, there is no reason why one construction should be selected above the other, except for some advantage to be gained apart from the merits of the transmission itself.

In many machines in which cams are used, in fact it may be said in most machines, there is some intermediary member between cam and the part to be moved, a lever, or slide, or possibly a combination of both. In a great many machines such a construction is not objectionable but in machine tools where it is essential to avoid as much as possible all sources of weakness, all sources of deflection or spring, and where it is desirable to have the tool slides or work-holding members move

with the greatest possible uniformity and smoothness of action, all intermediary members of this nature should be avoided. This rule does not apply when the member to be moved does not perform primary duties, such as guiding a tool or controlling work. Where it is used for trips, the placing in position of stops (but not the accurate location of stops), for closing chucks, feeding stock, etc., we really have the same conditions as we find in automatic machines outside of the machine-tool class and intermediary members are permissible.

Where the conditions of the machine seem to make it unavoidable to use such intermediary members, they should be made exceedingly heavy. The lever should be made with heavy arms and very large bearing for fulcrum, with heavy connections, in fact, everything calculated to minimize deflection, twist, and lost motion; and wherever possible a take-up for wear should be provided. We say "When it *seems* impossible" to avoid such a construction; because it is very seldom indeed that the designer cannot entirely avoid it if he has made up his mind to do so and if he is not afraid to bring a portion of his gray matter into action.

Apprenticeship, Old-Fashioned and Modern

By John S. Watts

Observation of the results of the modern type of apprentice training departments leads me to the conclusion that some of the methods used in training apprentices, while highly efficient in turning out young mechanics who can execute good work of a character with which their teachers have made them familiar, are not as successful as the older ways were in making mechanics who could think out for themselves the solution of some new problem.

The apprentice in an apprentice training department today is taught by doing a job under the direct supervision of his superior who teaches him by showing him in detail just how to proceed step by step, until by practice he is able to execute the job. Sometimes alternative methods of doing the same job may be spoken of, and reasons given for using the method taught; but even if this is done the apprentice in his effort to execute the work in the particular way shown him is not likely to remember much of anything that has been said that did not bear directly on the operation as he was being taught to perform it. In effect this method of tuition is really more a matter of drilling, using the word in its military sense, than it is of educating, and in this to my mind lies its weak point. Because it forms in the mind of the apprentice a habit of depending upon someone to show him how to handle any new jobs, whereas real education means the training of the ability to solve one's own problems by a process of reasoning based upon data observed or previously learned.

There can be no doubt that a long continued course of tuition under the method of teaching by detailed demonstration, will sap the students powers of independent reasoning because of the lack of exercise of this power, until in the end he becomes unable to attack a job with which he is not familiar without someone to show him the correct procedure. Time and again have I known this class of men to ask for information from pure habit, while at the same time they had in themselves all the knowledge that was required. They lacked the ability to apply this knowledge to a different problem, or it might in some cases be more correct to say that they had not cultivated a confidence in their ability to reason from known facts.

In those ancient days when I served my apprenticeship, there was no such animal as an apprentice instructor, and it seems to me now that the general idea was that if a boy worked for four or five years in a machine shop, he would become a machinist if he was fitted for it, by the mere working with mechanics and breathing the atmosphere of a machine shop. Certainly there was no manner of method used to train or educate him, and if he failed to become a skilled mechanic in that period of time the fault was deemed to be in himself, in that he was not capable of becoming one.

For the benefit of the younger men, I may say that the general routine of an apprenticeship in those days, that is, up to about twenty-five years ago, was that during the first six months practically the whole time of the apprentice was spent in running errands, carrying tools, and cleaning up the machines. Whenever it happened that a new apprentice was taken on, the older one was "promoted" to assisting the journeymen on the heavier machines, with an occasional very simple job to do on his own. Even when the apprentice was given a job to do, he was merely told what was wanted and expected to go ahead and do it entirely on his own initiative.

As he struggled along he gradually became aware that everyone in the shop was keeping an amused eye upon him, and an attack of stage fright was added to his other troubles. If the youngster showed the mettle that was in him and really tried his best, exhibiting a reasonable amount of intelligence in tackling the job, allowing for his inexperience, some one or other of the men would give him a hint in passing to put him on the right road. But if the boy had been stuck up, a snob, or otherwise displayed obnoxious tendencies in the shop, or did not handle himself as well as his previous opportunities of observing other men's work should have enabled him to, woe betide him, as he would be allowed to go his own way even to the destruction of the machine.

Granted that this way was a cruel, hard and slow one, still the youngster when he finally got the job done had found out himself how to do it, and had also learned by actual experience what troubles to look out for and what should be done to avoid them. Moreover having discovered this information by the sweat of his brow, he was little likely to forget it. We all know that knowledge gained by personal effort becomes a part of ourselves, unlike that imparted to us by others, which is apt to be forgotten, and in any case is not so thoroughly well understood. Incidentally the repetition of this struggle with each new job, forms an excellent training for the character, leading as it does to an increase in the eminently useful virtues of self-reliance without conceit, of reasoning and foresight.

My purpose in writing this is not to advocate a return to the old system, but to suggest that the new apprentice training schools, while undoubtedly efficient in turning out trained mechanics in a short period of tuition, are not as efficient as the old way in making all-around workmen who could turn their hand to any job within their trade. My point is that it would be better to take a little longer to educate the boys, instead of training them to a parrot-like ability to repeat what they have seen done.

The New Tariff Act

Significance of Elastic Sections — Their Effect on Exports and Imports— Changed Status of Tariff Commission

By R. B. ROSS
Associate Editor, *American Machinist*

THE tariff controversy—will it ever end? Small wonder is it that the American business man has asked this question so many times within the past eighteen months or more. The daily press, the weekly and monthly periodicals, the trade journals—all have staggered under a heavy burden of widely divergent views and comment.

Even today with the bill passed and spread upon the statute books, the average citizen, emerging from the bewildering maze of partisan or sectional argument pro and con, wonders what good, if any, has been accomplished. It is with difficulty, if at all, that he has been able to discover what improvements have been made, how far reaching they are, and what their effect will be if carried out in a broad spirit of equity and justice.

Divesting the bill as passed of any partisan aspect; disregarding whatever charge may be set up that special interests have been favored; and leaving out of the discussion the question of the soundness for the basis of the rates and their effect on living costs, it is, perhaps, worth while to examine the document as a whole. What new features does it contain? Do they, or do they not, mark progress? What new powers have been prescribed, in whom are they vested and what new organization and method of procedure has been provided for?

Gives President Broad Powers

Briefly, in the new tariff act there are three outstanding provisions which are new and which mark a distinct advance in tariff legislation. These three provisions are contained in Sections 315, 316 and 317 of Title III of the act, which covers special provisions. It was these sections that President Harding had in mind when, at the time of his signing the bill he said, "If we succeed as I hope we shall succeed, in making effective the elastic provisions of this bill, this will prove the greatest contribution toward progress in tariff making in a century."

The first of these new provisions, Section 315, has come to be known as the flexible or elastic tariff section. Under it the President has been vested with powers which are almost plenary in character. He is vested with power to change the classification of any article or commodity set forth in the act. He is vested with power to substitute American for foreign valuation in the case of articles which are made subject to *ad valorem* duties. He is vested with power to raise or lower the duty on any article or commodity in an amount not to exceed 50 per cent of the rates specified elsewhere in the act. All this, however, is dependent upon recommendations made to the President by the Tariff Commission. At this point it is interesting to note the enlarged scope of the work of that body.

Under Section 315, and, for that matter, under Sections 316 and 317 also, an application or petition for action or relief may be made by any person, partnership, corporation or association. If the application be made and found in order, and if it disclose to the satisfaction of the Commission that there are good and sufficient reasons for requesting action or relief from existing duties, the Commission may then order an investigation. In this investigation, it is not compelled to confine itself to the issues presented but may broaden, limit or modify the issue as it sees fit. What it will seek chiefly to determine, however, regarding the article or commodity in question, is, to use the words of the act, "the difference in cost of production in the United States and the principal competing country."

If, upon the completion of such investigation it shall be found that an increase or a decrease in the duty fixed under Title I of the act is necessary to equalize the difference in cost of production, the Commission makes its recommendation to the President who is vested, as before stated, with power to take the necessary action.

May Substitute Foreign Valuation

In the case of articles subject to *ad valorem* duties it may be shown upon investigation by the Commission that an increase or a decrease of 50 per cent in the rate will not be sufficient to equalize the difference in production costs. It is then that the President may exercise his power and substitute American for foreign valuation.

The second of the new provisions, Section 316, has to do in the main with goods imported into the United States. It is framed chiefly to provide American industry with a weapon against unfair acts and methods employed by a competing country. In the words of the section, "unfair methods of competition and unfair acts in the importation of articles into the United States or in their sale by the owner, importer, consignee or agent of either, the tendency of which is to destroy or substantially injure an industry . . . shall be declared unlawful."

Protection for Export Trade

Here, again, the Tariff Commission functions to assist the President in making any decisions under this section, in that it is authorized to investigate any alleged violations. If it shall be found by that body that unfair methods are being employed, the President is vested with power to impose additional duty in an amount sufficient to offset such unfair practices. In no case, however, shall such additional duty exceed 50 per cent nor be less than 10 per cent.

The third and last of the new provisions, Section 317, is designed as a measure of protection for American export trade. It may be regarded as the logical outgrowth of the expansion which has taken place in the foreign commerce of the United States in the last decade. Within that period, as is well known, the volume of American exports has increased greatly. Not only has the volume increased but the classes and varieties have broadened. Within this period also, numerous American industries have become dependent to a greater or less degree on other lands for their raw materials vital to the existence of these industries.

It is natural, therefore, that with this great economic change there should come not merely a need but a demand for a more definite, a more stable and a more scientific tariff policy. In formulating Section 317 there has been a reversion to the Tariff Act of 1909 with its maximum and minimum features, and a discarding of the reciprocity policies and penalty duties which marked the McKinley and Dingley bills of the past. The section, however, has been broadened and given increased flexibility.

May Declare Additional Duties

As it now stands, the President is vested with power, "when he finds that the public interest shall be served thereby," to "declare new and additional duties upon articles wholly or in part the growth or product of any foreign country," whenever it shall be found, upon investigation, that such country has granted special favors to the products of a third country, thereby placing American products at a disadvantage in that market. Under this section the President may go even farther. Where it has been found that discrimination has been made against American goods or where, in fact, American goods are not fully accorded equal rights with those of another country, the President may prohibit entirely importations into the United States from the country resorting to such practices.

In one other particular is Section 317 of importance. It provides against preferential export taxes. It vests the President with power to penalize imports into the United States from a foreign country when and where it has been found, upon investigation, that that foreign country has been granted preferential export taxes by a third country.

As a result of these three provisions, Sections 315, 316 and 317, of the new act, a radical change has been made necessary in the organization of the United States Tariff Commission. More particularly under Section 315 is provision made for new and enlarged powers for the commission. Not only does the act provide at this point for issuance by the President of any and all proclamations changing rates or classifications, but it specifically states that investigations to assist the President in ascertaining the points at issue shall be made by the United States Tariff Commission. It also states that "no proclamation shall be issued under this section until such investigation shall have been made."

As far as the Tariff Commission itself is concerned, Section 315 provides for public hearings by that body at which it shall give reasonable opportunity to parties interested to be heard. As a final step in carrying out the details of the procedure, the act authorizes the commission to adopt such reasonable procedure, rules and regulations as it may deem necessary.

Tariff Commission Procedure

Under the executive order issued by the President, Oct. 7, the commission has taken the steps necessary to comply with the act and has issued its rules of procedure governing all applications for investigation and the routine to be followed: It has also organized itself into four main divisions as follows: 1, office of the chief investigator; 2, office of the chief economist; 3, legal division; and 4, secretary of the commission. The chief matter of interest in the organization of the commission is found in the joint offices of the chief investigator and the chief economist. Under the direction of these two chiefs will be eleven subdivisions, each with a chief and several experts in the respective lines as follows: Chemicals, pottery and glass, metals, wood and paper, sugar, agriculture, textiles, leather, sundries, preferential tariffs and commercial treaties, and accounting. It has also provided for the establishment of an office at the port of New York and various arrangements will be made for conducting investigations on the ground in the countries abroad.

On the whole, the new provisions of the Tariff Act of 1922 have created a situation which is certain to be watched with keen interest. The commission has before it a task the size of which it is idle to minimize. Not only will the nation be interested from now on in the manner and method in which it conducts its investigations, but it is certain to scrutinize minutely its every action with respect to the duties levied against the articles and commodities in the fifteen schedules of Title I, now being subjected to much adverse criticism from every quarter.

Are Metal Workers Hidebound? —Discussion

By Alfred Herbert, Ltd.
Coventry, England

The editorial under the above heading which appeared on page 154, Vol. 57 of the *American Machinist* strikes a note which we think is particularly opportune. There is no doubt that the important subject of metal cutting has not received the attention to which it is entitled through its importance as a power user. We ourselves have gone some little way by experiments in connection with tool grinding machines of our manufacture but the subject is such a vast one that we find it impossible to carry out the necessary research and experimental work that it demands.

We do not think that anyone will dispute the statement that for any one metal cutting operation there is one tool which will give the most efficient results, i.e., remove metal at the fastest possible rate with a minimum expenditure of power, but what that tool is there are as many opinions as there are people engaged in metal cutting. It is possible that Professor Coker in his research work, some account of which was given for the Institute of Mechanical Engineers a short time ago, is working on lines which may lead to good results in this direction some time or other, but we would like to suggest that some influential body, such as the Institution of Mechanical Engineers or the National Physical Laboratory, should undertake research work in connection with metal cutting tools in the most thorough way possible.

As an instance of what is possible in this direction, Messrs. Clark & Chapman of Gateshead a few years ago changed over the majority of their lathe tools from the ordinary type to a curved top face type. While they cannot give any definite data on power consumption, they state quite definitely that the amount of power absorbed in their machine shop was reduced by the change. If it is assumed that any one machine at any one operation absorbs say 1 hp., which by change of tool could be reduced to 0.9 hp., such reduction multiplied by the number of machines in this country would very soon show such an enormous saving in power that any research work in this direction would be amply justified.

An Interesting Rack and Gear Movement

The Gear Runs into and out of Mesh with Rack Twice in Each Cycle—While out of Mesh It Acts as a Crank

BY MILTON WRIGHT

AN INTERESTING and somewhat complicated gear and rack movement is that used to reciprocate the "bed" or platen of the Premier printing press made by the Premier & Potter Printing Press Manufacturing Co., Derby, Conn.

The Premier is what is technically known as a "flat-bed" press. The forms of type are locked in position

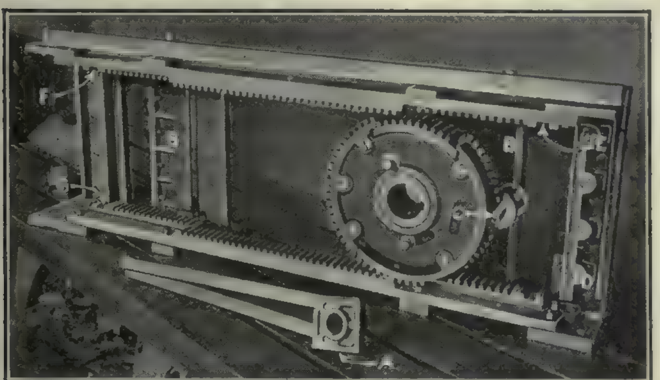


FIG. 1. GEAR AND RACK OF THE PREMIER PRINTING PRESS

on a flat table and caused to pass to and fro under a rotating cylinder that carries the paper upon which the impression is to be made. The cylinder is of such diameter that its circumference matches the length of the bed movement; its peripheral speed, therefore, being exactly the same as the speed at which the type is moving. Any deviation from a true relation in this respect would result in what the printers call "slurring" or smudging the impression.

The cylinder makes two revoltuions for each cycle of movement of the bed; being lifted by cams out of contact with the type as the bed passes back under it to the starting point. The cylinder and bed are not geared directly together and there is no hesitation in the rotative movement of the cylinder, so that it becomes a rather nice mechanical problem to deliver the bed to the swiftly moving cylinder at exactly the right time, place and speed at the beginning of each cycle, and to hold the bed and cylinder together during the entire forward movement as rigidly as if both were stationary.

Not only does this duty devolve upon the parts shown in Fig. 1, but the gear must also shoulder the responsibility of the practically instantaneous reversal of movement of half a ton of metal, and do it without undue shock or jar, twice in each cycle. When it is considered that there are nearly one hundred such reversals each minute an idea may be gained of the nicety with which these parts must function.

The rectangular frame in Fig. 1 is bolted to the under side of the bed and becomes a part of it. For convenience in photographing, the frame is shown upside down in the picture, but as it is entirely symmetrical, with the exception of the pads for the attaching bolts, that condition will make no difference whatever in the relative position of the parts shown, and it may be assumed that its position in the press is the same as in the picture.

The shaft upon the end of which the gear is keyed has no movement other than a rotative one, but, strange as it may seem, it turns *three* times for each cycle or passage of the bed back and forth.

The rack teeth at both top and bottom of the frame are rigid with respect to the latter; being in fact cut from the solid metal of which the frame is built up. The vertical distance between the pitch lines of the two racks is exactly the same as the pitch diameter of the gear, so that were it not for the peculiarities of the latter and the fact that each rack is composed of three sections lying in two different planes widthwise, the gear would be engaged with both racks at once and locked against movement.

Let us first study the gear, both sides of which are shown in Figs. 2 and 3, and the parts disassembled in Fig. 4. From these pictures it will be seen that the gear is twice as wide as the rack; being equal in fact to the combined width of the offset sections. We will note further that for one third of the circumference the teeth extend only half-way across from what we will call the front, (Fig. 2), on another third the teeth extend halfway across from the back, (Fig. 3); while for the remaining third, composed of the two ends of the sliding segment, the teeth extend the full width of the gear.

The sliding segment can be seen to advantage in Fig.

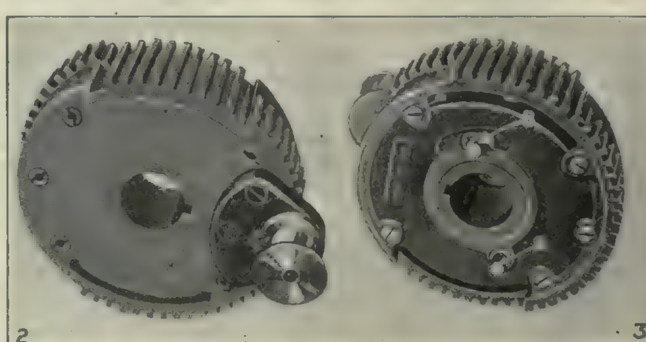


FIG. 2. CRANK SIDE OF GEAR. FIG. 3. COVER SIDE OF GEAR

4, where the cover and the actuating cam are removed. Each end of the segment is a true arc and the teeth cut thereon conform in every respect to those cut from the solid metal of the gear, but the segment itself is shorter than the diameter of the gear by an amount equal to the full depth of a tooth.

The gear as a matter of fact is cut, after assembly, upon an automatic gear cutter in the same manner that an ordinary gear would be cut; the only difference being that at some time after one end of the segment has been cut and before the machine has spaced around far enough to begin on the other end, the operator must happen around and shift the cam that moves the segment from one position to the other. He must also

cause the machine to skip a tooth at a predetermined point, as will be discerned later.

At *AA* (Fig. 4) upon the segment are hardened steel rollers upon which bear the risers *BB* of the actuating cam. The cam itself fits over the hub of the gear with the risers in contact with the rollers. It will be noted that the risers are opposed to each other so that a slight rotative movement of the cam in, let us say, the clock-wise direction will push the segment to the lower position as viewed in Figs. 2 and 4. The lower roller will then be resting on the dwell at the high spot of the cam while the upper roller is at the bottom of the corresponding rise. It is evident that a reverse movement of the cam would send the segment to the opposite position.

The forward and back movement of the cam must be

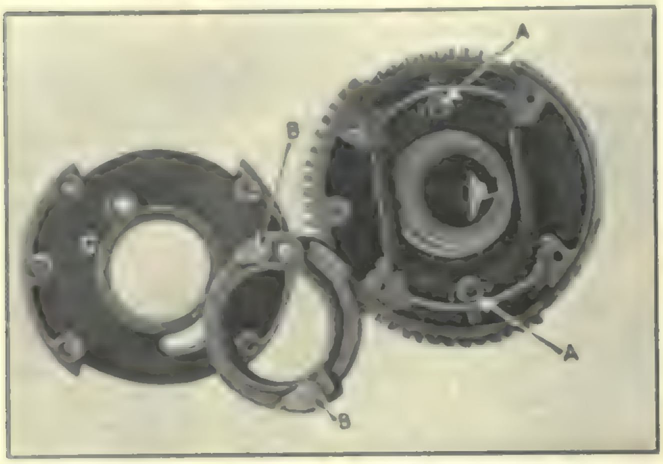


FIG. 4. THE GEAR PARTLY DISASSEMBLED

made twice in each three revolutions of the gear, and to produce such a movement within the constantly rotating gear is not altogether easy of accomplishment. The lever shown in Fig. 5 does the trick.

At *C* in Fig. 4 is shown separately the cover plate that holds the parts of the composite gear together. It is bolted to the body of the gear and becomes a part of it, confining the cam and segment against sidewise movement while allowing the one freely to rotate and the other to slide. A projecting stud, seen to better advantage at *A* in Fig. 3, is driven solidly into the cover plate. A similar stud *B*, driven into the cam, protrudes through the curved slot in the cover.

The lever in Fig. 5 surrounds, but does not bear upon, the shaft that carries the gear, the studs *A* and *B*, Fig. 3, enter the bronze sliding-blocks *A* and *B*, Fig. 5, which are free to move radially in their yokes. The yokes are a part of the ring *C*, which is fitted to turn freely in the shell of the lever. It will be seen, then, that at certain positions in the revolution of the gear, a movement applied at the end of the lever will produce a corresponding but much reduced movement of one or other of the two sliding blocks, while at other positions no movement would result.

The lever is, therefore, alternately of the first and the second class, power always being applied at the end of the lever, the fixed stud being always the fulcrum, and the stud in the cam always the weight to be moved. The fulcrum and the weight to be moved are, however, constantly exchanging positions as the gear and the ring *C* revolve together.

The lever does not at any time move the cam backwards. At certain points in the rotation the cam is moved forward faster than the gear would carry it; at other points it is merely retarded, allowing the gear to run away from it.

The gear is not at all times a gear. One revolution out of every three it is a crank and at these points (one-half revolution at each end of the traverse movement of the bed) it is entirely out of mesh with the rack and has the bed under control of a rigid crank connection by means of which it is enabled to slow down and stop the rapidly moving bed and accelerate it in reverse direction without the slam that otherwise would wreck the machinery at the first reversal. This brings us to the consideration of the complete movement as shown in Fig. 1.

When the press is fully assembled the bronze bearing block *A*, Fig. 1, is permanently located on the crankpin, which may be seen projecting from behind the gear and is held thereon by the removable flange on the end of the pin. The two rods shown attached to the block are attached at their other ends to a free slide and have no other function than to keep the block always in alignment and prevent it from being presented cornerwise to the yokes at either end of the rack frame.

The outer side of each of the above mentioned yokes is formed by the vertical member of the frame at either end; the inner sides are formed by the pieces *BB*, called shutters. Starting with the parts in the position shown in Fig. 1, we will follow through the movements of a complete cycle:

The gear may be considered to be rotating in a clockwise direction and the rack in full movement to the left. As the crankpin reaches its lowest position the right end of the rack frame has caught up with it and the bearing block *A* settles quietly into the lower right-hand corner, at the same time that the big tooth *C* of the gear comes into mesh with the corresponding big space *D* in the lower rack. The shutter *B* at that end, actuated by a stationary cam, closes behind the bearing block *A*, confining it within a fixed yoke, and the gear rolls clear of the rack.

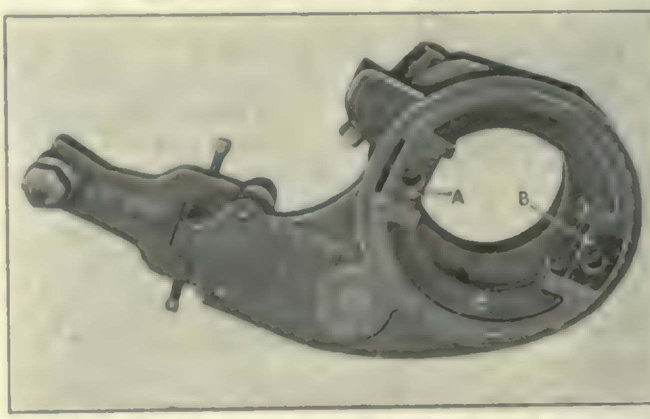


FIG. 5. THE LEVER THAT MOVES THE SLIDING SEGMENT

The gear has now become a crank—without shock to the parts, for all parts are moving in unison. During the next quarter turn of the gear (we will still call it a gear though it is not acting like one) the movement of the bed is quickly slowed until, at just one-half turn of the gear from the position shown in the cut, the bed has come to rest.

From this point the bed accelerates in movement to the right until at the completion of the third quarter turn (from the position shown in the cut) the crank has reached its top position, the big tooth of the gear

(there is but one) is in mesh with the big space *E* of the upper rack. The shutter *B*, released by its cam, now flies open and sets the block *A* free, leaving the rack frame again under control of the gear, which has resumed its normal function.

Now in mesh with the upper rack, the gear sends the frame to the right until, upon reaching the other end of its movement, the block *A* settles into the upper left-hand corner of the frame, the shutter closes and the cycle of movement is repeated, the big tooth of the gear passing out of the upper rack through the space *F* and, upon completion of the half revolution, re-entering the lower rack by the space *G*.

The function of the sliding segment should now be apparent. In the position shown in Fig. 1 the teeth on the upper part of the gear are moving to the right while the rack frame is moving to the left. The teeth of the upper rack have just passed over the blank space of the gear, as well as over the teeth of the withdrawn segment and the first solid tooth of the gear is barely going to clear the first tooth of the middle section of rack, passing at high speed in reverse direction.

When the gear has made exactly one revolution from the position shown in the cut all parts will occupy exactly the same position except that the segment will be in mesh with the upper rack and the frame moving to the right. As the direction of movement of the frame has been reversed, while that of the gear remains the same it is obvious that there should be teeth in the upper part of the gear, but none in the lower part when the swiftly moving rack reaches it.

The shutters *BB* really have little to do, and may be regarded as accident preventers. The press would run as well without them, for the pressure upon the bearing block is always imposed by the outer rigid side of the yoke, first in stopping the momentum of the bed in slowing it to rest, and then in overcoming its inertia during the accelerative period. It would not be safe, however, to run without them, for if by any chance the bed should jump forward out of its true position by the distance of half a tooth or more, the wreckage would be complete.

Learning the Trade Forty Years Ago

By W. S. Davenport

(The second of four articles)

Well do I remember the hot Fourth of July day, so many years ago, when with the aid of the crude lathe I had constructed and the flat drill of "sleigh shoe steel" made for me by the village blacksmith, I succeeded in boring out the cylinder of my first steam engine.

Fourth of July was one of the few holidays that were observed upon the farm and, after the necessary "chores" were done, the whole family except myself piled into the "carryall" to attend the picnic and holiday exercises, leaving me in my little shop with its home-made lathe and grindstone foot power to devote the day to a matter far more important to me than any mere celebration of a national holiday.

Trouble with My Lathe

I could not drive my lathe by means of the pedal and belt to drill such an extremely large hole (it was 1⅜ in.) because it would go too fast and, besides, the belt would slip, so I rigged up a crank on the live spindle and attached a long wooden lever to the tailstock to feed the drill. After a whole day's exertion, during which I lost a great deal of perspiration in my frantic endeavors to be in two places at once, turning the crank with one hand and pulling the lever with the other, I succeeded in getting a hole through the whole 2-in. length of that stubborn casting.

Much to my disgust it was not a very good hole. It was not any too round and, instead of the nice smooth surface suitable for the inner wall of an engine cylinder, it seemed to have a number of rough spiral ridges extending through it. For weeks I tried to study out a way to smooth it up, but in the end I was obliged to take it to the machine shop, seven miles away, where with the aid of a rose reamer in a real lathe it was made true and smooth in a short time.

I managed to face the ends of the cylinder in my own lathe; putting it on a wooden arbor and using a "beechnut" hand-tool that I made out of an old three-cornered file. The heads I machined by holding them in a recessed wooden chuck to which they were fastened by machine screws passing through the chuck from the back. As I look back upon those days I can see that every move was the merest makeshift and that my workmanship was probably very indifferent, but then every piece finished was a triumph that constituted in itself a rich reward.

It was probably a year before that engine was completed, for the only opportunity I had to work upon it was on rainy days and a few minutes stolen each day from the dinner hour; but completed it finally was and I was a proud boy indeed when, after tramping with it to the adjoining town and inducing the engineer of the steam sawmill to connect it to his boiler, I had the satisfaction of seeing it run so rapidly and smoothly.

All good machinists, as I well knew, had tool chests in which to keep their tools, so that winter I set about making one for myself out of a board of butternut wood that I took from a board fence, replacing it, of course, with a less valuable piece of lumber. In making the dovetailed corners of this chest there was a great deal of trying work and many failures, impressing upon me the necessity for accurate workmanship. From that time forward I made it a point to see not how quickly but how well I could do each job.

Having a nice new tool chest it seemed proper to have some tools to put in it, so with much painstaking effort I made several pairs of calipers and a try-square; my materials being broken saw blades and worn-out knives from the mowing machine. Very crude and rudimentary were these early tools, but with each one finished there came the joy and pride of achievement and ownership that has never attended the purchase of much finer tools in a later day.

During the previous summer I had written a letter to the Brown & Sharpe Manufacturing Co. of Providence, inquiring about an opportunity to "learn the trade" with them, and in reply had received a letter (written with a pen and now much prized) from the hand of Mr. Lucian Sharpe himself, in which letter there was enclosed a copy of their terms of apprenticeship. I could not, however, raise the one hundred dollars that was a condition to the indenture, nor did I possess even the means to pay my fare to Providence, to say nothing of living expenses in that city, for at that time they paid but 40 cents a day to boys in the first year.

Table II

United States—Imports of Machine Tools*

Country	1915	1916	1917	Fiscal Year Ending June 30th, 1918	July 1st to Dec. 31st 1918 Number **	July 1st to Dec 31st 1918 Value	Number 1919	Value 1919	Number 1920	Value 1920	Number 1921	Value 1921
Austria-Hungary***	$ 1,829	$	$	$		$		$	522	$ 80	36	$ 8,086
Belgium	31,633											
France	2,902	1,526	494				294	1,428	212	6,241	93	6,205
Germany	84,211						25	91	7,864	74,681	1,234	91,650
Greece	17											
Italy		252										
Netherlands	422								5	24,238	2	4,298
Norway			12,060						1	191		
Sweden			13,159		34	26,149					9	366
Switzerland	2,380	4,457		20			32	73,352	379	222,621	1,041	48,785
England	21,250	30,816	12,541	15,058	15	5,952	1,861	51,013	352	88,963	2,219	26,083
Scotland	1,790	68	1,456				25	1,152	8	435	1	17
Denmark					10	86,832			1	150		
Spain											4	1,834
Canada	13,470	73,235	82,547	259,104	89	79,391	1,199	12,192	152	25,050	174	27,309
Honduras	25											
Panama				95								
Mexico	45											
Cuba	89											
Argentina		1,620										
British West Indies									6	3,098		
China				9,274							3	2,991
British India				180								
Japan	100	423										
Australia	262						1	200				
Union of South Africa	61											
Total	$160,486	$112,397	$122,257	$283,746	148	$198,324	3,438	$139,619	9,501	$446,557	4,816	$217,616

*Included in "All Other Machinery" prior to 1915.
**Number not shown prior to 1918.
***Austria—only after 1918.

Industrial Cost Accounting for Executives—II

Setting Selling Prices—Controlling Methods of Manufacture and Expense Determining Profitable Lines

By PAUL M. ATKINS

IT WAS pointed out in the first article that it was quite appropriate to give the reader some idea of the benefits to be gained from a well-planned, properly installed cost system before taking him into a discussion of its details. The uses, especially from the executive point of view, have rarely been fully recognized and, when they are, the value of a good cost system to a company will be much more appreciated.

Probably the most commonly accepted idea of the use to be made of cost accounts is as a basis for selling prices. There are unquestionably many cases where this is true, and more frequently, perhaps, in the machine-building industry than in most others. It will occur from time to time that machines are built on a cost plus basis and hence the cost must be ascertained before the selling price can be determined. The cost plus system which received such an impetus during the war proved not to be successful, except within a rather limited range of circumstances, and has now been pretty generally dropped.

There are numerous other circumstances in which the cost records are employed for the establishment of selling prices where the connection is not quite so direct. Wherever bids are made and estimates prepared for the setting of selling prices, the cost records should be employed.

Using Cost Records of Other Jobs

It is true that the cost of the actual product, which is being made to fill the order taken, does not enter into the calculations, for the cost cannot be found until after the work has been done. The costs of other jobs of a similar sort, however, are the ones which are used in preparing the estimates or are employed to check the estimates once made.

This use of the cost records will be clearer if we study the matter a little. Material, for example, is usually specified by the engineering department and the quantity per unit or for the entire order indicated. If the material is purchased outside, bids will be obtained or the market price used in estimating the cost. If the material is produced inside the plant, then it is necessary to turn to the cost records to get information about its probable cost.

Whether the material is purchased outside or produced inside the factory, its consumption must be checked by means of the cost records. It is not enough to provide sufficient material for the order if all goes well, but it is necessary to make sure that all probable scrap and wastage is provided for also. This additional material is properly a cost of the order and when an estimate is prepared as a basis for a selling price, its value must be included.

Not only must material be considered but also labor and burden. Without cost records of previous orders, the estimate of these items is likely to be nothing more than a wild guess and wild guesses at any time, and particularly at a period like the present when business is being carried on on close margins, are likely to prove disastrous. An analysis of the business failures in recent months will prove this conclusively. In any business, therefore, where the selling prices are based on estimates and are controlled wholly or in a considerable measure by the executives of the company producing the goods, costs of production are one of the chief sources of information on which the executives may base their judgments.

Industries Where Costs Do Not Affect Selling

While all this is true in regard to many cases, there are more where the costs of production have relatively little or no effect on the selling price obtained by the concern. There is, of course, no hard and fast line separating one class of cases from another. They merge one into another, and often the use of cost records for this purpose will vary in importance among companies and with the condition of the business world. For a very large number of goods which are staples like working shoes, cotton sheeting and certain basic steel products, the selling price is largely determined, if not wholly set, by world-wide market conditions, and not by the act or influence of any one manufacturer.

Cotton sheeting offers a pretty good example of this kind of thing. It is made in this country, in England, France, Germany, India, to mention only a few of the principal producing countries. The price, like that of wheat, is based on the English market. No single manufacturer can raise the price of his product more than a very small amount above the current market price without giving some corresponding advantage, such as better quality, without sooner or later losing his business. For the individual producer, it is a case of getting his cost of production to the point where he can either make a profit or quit the business.

All this does not mean that a good cost system is not of value to the executive in this kind of business. If anything, an accurate knowledge of costs is of even more importance. Unless he knows what his goods are costing him and how those costs are accumulated, he is in no position to study the causes of the several items of cost and in this way learn in what direction he should bend his efforts to reduce them. The closer the margin between the cost price and the selling price, the more necessary for control purposes are detailed costs of production.

The Monopoly Type of Business

There is still another type of business which has not yet been mentioned and which lies at the opposite end of the scale from the one just discussed, the business which is a monopoly or a semi-monopoly. Here the cost of production plays only an indirect part in the setting of selling prices. In such an industry the selling price is usually set at a figure which will give the largest volume of sales measured in terms of money. This often means, of course, that the selling price per unit will be relatively low in order to increase the volume and thus to increase the returns. Some idea of the

cost of production must be had before the selling price can be set but an approximation is usually all that is needed. As in the case before, this does not mean that cost records are valueless. They still have an important part to play in guiding the executive in his efforts to keep costs down.

The reader will probably have noted that the emphasis has been laid so far in connection with use of cost figures for setting prices on the control which the executive may exercise through the knowledge gained from them. That is really the heart of the value of cost statistics to the executive. They are or should be an instrument of control in his hands to aid him in directing his business in such a way as to bring the greatest possible returns to those who take part in it. It should not be inferred that "control" is used as a synonym for oppression of the workers.

The wise manager knows that such practices will simply kick back at him in the long run and that the more generous he can be to his employees within reason, the better off his business will be in the long run. It is poor kindness as well as poor judgment to pay wages so high that the business will be ruined and all employees thrown permanently out of employment when a slight or temporary reduction in the wage scale will permit the business to continue. Control implies the exercise of wise judgment to meet the needs of the particular situation.

Importance of Controlling Inventory

One of the hardest elements in almost any manufacturing concern to control is the inventory. From the viewpoint of the control in production, we have our material records or balance cards as they are often called. The same cards have a part to play in the cost records of material as will be explained in a later article. But it is not sufficient to have records of quantities of material only, it is also necessary to have a record of their value. To ascertain the real value of the materials actually on hand in the storeroom has always been a bugbear of every manager. Usually this has been accomplished in the past by taking a physical inventory from time to time but, as every one who has had experience with physical inventories knows, the best results are far from satisfactory and the poorest are worse than useless. An adequate cost system will provide a means for recording the receipt and issue of material so that the balance remaining in the storeroom may be found at any time.

It should not be forgotten that if the problem is complex and difficult for material purchased outside the company it is doubly so for material made inside the factory unless there is a good cost system. The only way to find the cost price of material so made and stored until it is needed for the final product is by means of the cost records.

The assistance which a good cost system can render a business in connection with its inventories does not stop here, however. It must be remembered that the materials in the storeroom awaiting use or in the stockroom awaiting shipment are only a part of the entire inventory. There are all the goods in process out in the factory to be thought of also. To take a physical inventory of all such goods is even more of a task and less satisfactory than the same kind of inventory for materials in the storeroom. A good cost system will provide the figures wanted at the end of each month or whenever they are needed on very short notice. The method will be fully explained in the later articles.

With the inventories before him during the first week or ten days of each month, the executive is in a position to make decisions with definite knowledge. What is more, he can have a balance sheet ready to present to his bankers and so be in a position to establish the standing of his concern with them in a way which is quite impossible without such aid. It is of vital importance for the factory executive to appreciate the importance of dollars and cents records of material. Accustomed as he is to thinking primarily in terms of quantities, he sometimes forgets that quantities represent money which the company must provide in some manner if it wishes to continue in business.

There are certain incidental advantages to be gained from this knowledge of the inventories. Accumulations of obsolete and useless material may be detected before it is too late to deal properly with them. The detection of losses and thefts of material is also greatly facilitated if adequate cost records are kept. When the material inventories are large, the item of insurance premiums is often a considerable one and the amount of "effective" insurance can be regulated only if inventories are accurately and promptly maintained. Practical experience with particular instances will show other ways in which inventory information is of value in the business.

A good cost system provides a means for measuring the worth to the company of its equipment. The question may arise as to whether or not it is desirable to change one machine for another, to modify a process in some way or to install additional equipment. It not infrequently happens that the answer to such a question is in the affirmative from the engineering point of view. Production quite possibly may be increased and even improved in quality. If, however, normal production is not sufficient to keep that equipment busy all or most of the time, the burden charge for its use may so increase the cost of turning out the product as to render it undesirable to make the change. A satisfactory cost system will give the cost of the present operation and will provide a basis for calculation of the cost of the proposed method and make possible a comparison on a commensurable basis.

Cost Records Point Out Unprofitable Lines

Another aid which the cost records may furnish is information about unprofitable lines. It not infrequently happens that a few principal lines of goods provide all the profits for the company and serve to make up the losses on other lines. With the knowledge of the relative value to the business of the different lines, the manager is in a position to decide what to do. Often this means simply cutting out certain lines altogether. Sometimes it results in combining the best qualities of several lines or sizes and replacing several by a new line. On other occasons it may prove necessary to carry a full line in order to meet competition, and hence be impossible to cut out any. In such a case, the information is just as valuable, for it enables the manager to guide his sales in such a way as to reduce the unprofitable business to a minimum or to insist that all unprofitable orders shall be accompanied by a certain amount of the profit making variety. Such control is absolutely impossible if it is not possible to obtain detailed and accurate costs of production on short notice.

Perhaps the most important way in which a cost

system can serve the executive has been left to the last. The problem of expenses is always one which bothers the manager unless he has adequate means for recording expenditures. If he develops a system he is then in a position to control them. In a continuous process industry, turning out a single line of product the costs of production are not likely to fluctuate violently. Test runs, if properly administered, will frequently give all the needed information in regard to the cost of the product. But even so, the manager cannot afford to be without continuous and definite knowledge of what the various departments are costing him to operate; in other words, his expenses.

One of the best instruments for the control of an entire business is a budget or schedule of prospective expenses. The budget enables them to plan for the future in a way which is quite impossible without it. The budget schedule is only one-half of this means of control, the other half being the record of what the expenses actually are as they take place. They are like two halves of a pair of scissors, neither side will cut well without the other. With such records in hand, the executive is in a position to measure the efficiency of his various departments, to take steps to check unwarranted increases in expenses, and to anticipate difficulties before they come in such a way as either to prevent them or to be ready for them.

Conclusion

The brief space available has permitted the outlining of only a few of the possible uses of cost accounts and records. Perhaps enough has been said, however, to give some idea of their variety and as the reader thinks over the conditions in his own factory he will undoubtedly recall many other possibilities.

The next task which lies before us is to consider what are the elements which go to make up manufacturing costs and this will be done in the following article.

Standards for Portable Electric Drills

What are believed to be the first standards for portable electric drills have been adopted by the Electric Power Club. These rules are the nucleus of a complete group of electric tool standards, and include the test requirements of motors, the performance specifications for drilling, standard sizes of drills and the information that should be given on electric drill name plates.

As electric drills are now widely employed as tools of production, as well as for maintenance work, the users of these tools have felt for some time that they should be standardized. To meet this need, the electric tool section of the Electric Power Club, which comprises the representative portable electric drill manufacturers of the country, has undertaken the standardization work.

The following is the report of the Electric Tool Section as it was adopted by the club:

(1) Definition: A portable electric drill is defined as a compact, semi-enclosed electric motor in combination with mechanical features so designed and constructed as to be applicable for drilling or reaming in wood or metal, more or less intermittently. Adopted Standard.

(2) Voltage ratings:

(a) Standard voltages for d.c. electric tool motors shall be 115, 230 and 550 volts. Adopted Standard.

(b) Standard voltages for universal electric tool motors shall be 115 and 230 volts. Recommended Practice.

(c) Standard voltages for polyphase a.c. tool motors shall be 110, 220 and 440 volts. Adopted Standard.

(3) Frequencies:

(a) Standard frequencies for polyphase a.c. tool motors shall be 60 cycles. Adopted Standard.

(b) Electric tools equipped with a universal motor shall not be guaranteed for operation on frequencies in excess of 60 cycles. Adopted Standard.

(4) Allowable variation from rated voltage: All motors shall operate successfully at normal rated load at any voltage of not more than 5 per cent above or below the name plate rating, but not necessarily in accordance with the standards of performance established for operation at normal rating. Adopted Standard.

(5) Performance specifications: The minimum drilling requirements of portable electric drills shall be based on the drilling of holes in 20-30 carbon steel with carbon steel twist drills of the full rated capacity of the electric drill, at a cutting speed of approximately 50 ft. per minute and at the following minimum rate of feed per minute for the various sizes of drills:

Twist Drill Diameter Inches	Drilling Depth Per Minute Inches	Twist Drill Diameter Inches	Drilling Depth Per Minute Inches
$\frac{3}{16}$	$1\frac{5}{8}$	$\frac{7}{8}$	$\frac{7}{8}$
$\frac{1}{4}$	$1\frac{1}{2}$	$\frac{29}{32}$	$\frac{7}{8}$
$\frac{5}{16}$	$1\frac{3}{8}$	1	$\frac{13}{16}$
$\frac{3}{8}$	$1\frac{5}{16}$	$1\frac{1}{4}$	$\frac{11}{16}$
$\frac{1}{2}$	$1\frac{1}{8}$	$1\frac{1}{2}$	$\frac{5}{8}$
$\frac{9}{16}$	$1\frac{1}{16}$	$1\frac{3}{4}$	$\frac{9}{16}$
$\frac{5}{8}$	$1\frac{1}{16}$	2	$\frac{1}{2}$
$\frac{3}{4}$	$\frac{15}{16}$		

Recommended Practice.

(6) Temperature rise:

Temperature rise in degrees centigrade when operating under normal conditions as specified on the name plate.

Class of insulation	*A*
Load, per cent of rated capacity	100
Time rating	Intermittent
1. Core and windings	
Fully enclosed motors.	55 deg.
All other types.	50 deg.
2. Commutators	
a. If Class A insulation is employed in the commutator, or is adjacent thereto and its life would be affected by the heat from the commutator.	65 deg
b. In all other cases.	85 deg.
3. Bare copper windings	60 deg.
3A. Bare copper windings, enclosed motors Provided the thermometer is applied directly to the surface of the bare copper winding.	65 deg.
4. Mechanical parts †Temperature rise of all mechanical parts not in contact with insulation may be such as will not be injurious in any respect.	†

Adopted Standard.
Maximum Limits.

For descriptive specification covering classes of insulation, see Reference Number 5001.

All temperature measurements by thermometer method. See Reference No. 5301.

All temperature rises are based on an ambient temperature of 40° C. See Reference Number 5002. General guarantees do not apply, and deterioration of insulation may be expected, if this ambient temperature is exceeded in regular operation.

For descriptive specifications covering temperature ratings see Reference Number 5303.

(7) Name-plate marking: The following minimum amount of information shall be given on all name plates:

(a) Manufacture, design of type and frame size.
(b) Horsepower output.
(c) R.p.m. at rated load.
(d) Frequency if a.c.
(e) Number of phases if a.c.
(f) Voltage.
(g) Rated load amperes.
(h) Time rating.
(i) Serial number.
(j) Drilling capacity or reaming capacity for a drill.
(k) Blank space for customer's shop number.

Recommended Practice.

(8) Standard sizes: The standard ratings for portable electric drills shall be as follows:

Universal Drills—Single Speed

Chuck Division Inches	Morse Taper Socket Division Inches
3/16	9/16
1/4	7/8
5/16	1 1/4
3/8	
1/2	

Universal Drills—Two Speed

Chuck Division Inches	Morse Taper Socket Division Inches
1/2	9/16
	7/8

Direct Current Drills—Single Speed

Chuck Division Inches	Morse Taper Socket Division Inches
3/8	9/16
1/2	7/8
	1 1/4
	1 1/2

Direct Current Drills—Two Speed

Chuck Division Inches	Morse Taper Socket Division Inches
1/2	9/16
	7/8

Polyphase—60 Cycle—Single Speed Drills

Chuck Division Inches	Morse Taper Socket Division Inches
3/8	9/16
1/2	7/8
	1 1/4
	1 1/2

Polyphase—60 Cycle—Two Speed Drills

Chuck Division Inches.	Morse Taper Socket Division Inches.
1/2	9/16
	7/8

Direct Current Reamers

Morse Taper Socket Division, Inches

11/16 (with No. 2 socket)	15/16 (with No. 4 socket)
13/16 (with No. 3 socket)	1 1/16 (with No. 4 socket)

Polyphase Reamers—60 Cycles

With Morse Taper Sockets, Inches

11/16 (with No. 2 socket)	15/16 (with No. 4 socket)
13/16 (with No. 3 socket)	1 1/16 (with No. 4 socket)

Adopted Standard.

(9) Hydro-Electric Power Commission, Toronto, Ontario. In December, 1921, eight member companies submitted samples to the above for test and approval. About a month and a half or two months ago, the Secretary of the Power Club inquired concerning the outcome of this test and what treatment was accorded the various companies who had submitted machines. All tests have not been concluded, consequently no definite information is available at any time for the benefit of other sections interested in the outcome of this test.

Consumption of Metal Products in Russia Before the War

BY R. POLIAKOFF

The following table, which may be of interest to American readers, has been compiled from official Russian sources and gives an idea of the potential volume of the Russian market in metal products. The figures are for the year 1912. All data of the first three columns are in millions of dollars.

POTENTIAL RUSSIAN MARKET FOR METAL PRODUCTS

Name of Article	Produced in Russia	Imported	Capacity of Market	Loss Per Cent
	Millions of Dollars			
1. Agricultural machinery	26	31.5	57.5	12
2. Railroad cars	20.5	0.5	21	26
3. Locomotives	10	0.5	10.5	..
4. Merchant vessels	8.6	1.6	10.2	5
5. Electric machines and apparatus	8.4	4.5	12.9	51
6. Sewing machines	7.5	4.0	11.5	..
7. Gas and oil engines	5.6	6.0	11.6	27
8. Steam boilers	4.8	1.3	6.1	65
9. Pumps	2.6	3.6	6.2	19
10. Textile machinery	2.25	0.75	3.0	31
11. Metal working machines	1.4			60
(Machine Tools)		6.5	8.5	
Woodworking machines	0.6			79
12. Bicycles	0.85	1.45	2.3	66
12. Automobiles and motorcycles	0.6	7.3	7.9	58
14. Aeroplanes	0.15	0.15	0.30	40
15. Steam engines	0.65	2.25	2.90	49
16. Printing machines	....	0.85	0.85	..
17. Typewriters	....	0.60	0.60	..

The figures of the fourth column show the loss in per cent of the yearly Russian output due to the decrease of territory on account of the separation of Poland, Lituania, Finland and the Baltic Provinces. With regard to the figures of this column, one has, however, to take also into account that the actual loss of output, as shown by them, would, under normal economic conditions, be less, as a considerable part of the equipment of the enterprises in the lost provinces was evacuated during the war into the interior of Russia and could be used for Russian domestic production, normal conditions.

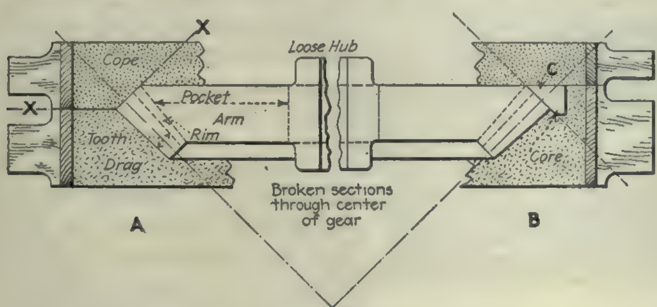
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Better Way to Mold Gear Wheel Patterns

By M. E. Duggan

In the broken section shown at *A* in the accompanying illustration appears the conventional method for molding a gear wheel in green sand, with the parting along the lines *XX*. This method is often the cause of a great deal of lost time in the fitting shop by reason of the necessity for correcting defects in the casting that result from "shifting" or mismatching of the cope flask. The space between the arms is molded in green sand and this sand is lifted with the cope. The cope hub is loosely fitted to the pattern. A foundry that is fully



TWO WAYS OF MOLDING A GEAR PATTERN

equipped with the necessary rigging to handle this class of work can do it very nicely, although few general jobbing foundries are so equipped.

A few of the details that make trouble for the molder in the average foundry are: The shifting of the cope flask; the rising, or rocking, of a poorly fitting cope; or a "crush" in the setting thereof. Again, it sometimes happens that the pattern maker is not quite sure how the gear is going to be molded and in order to play safe he will make the sides of the arms parallel, thus making the lifting of the green sand between them a very difficult task for the molder. When a "rise" or "crush" or "shift" has occurred, the resulting casting will have a fin along the cope edge of the teeth that makes a lot of extra work in the cleaning room.

When the molder finds that the sides of the arms are too straight to insure an easy and clean lift he will convert that part of the pattern into a corebox and make a dry sand core in each of the pockets between the arms, marking each core and space into which it fits so that he may be sure to return each core to its respective place and avoid the trouble that would otherwise surely follow by reason of the pockets not being all of exactly the same size and shape. At *B* in the illustration is shown the pattern made and molded in another and better way, as none of the above-mentioned troubles will affect the production of a clean true casting with but a minimum of chipping required along the edges of the teeth. The pattern is made with a ring coreprint, as at *C*, and the parting is in a straight line along the edges of the arms. The whole pattern is molded in the drag with a "flat-back" cope except for the loose hub.

This method of molding the arms should be made with plenty of draft, thus simplifying the making of the cores within the pockets. These cores are suspended from the cope and lifted with it. The corebox for the ring core is made ½ of the circumference of the pattern. The pattern is laid on the molding floor with the parting face down and molded in the usual way. It is then "rolled over," the cope flask put in position, the core suspension wires securely fastened to cross-bars on top of the cope flask, the molding of the cope finished and the cope lifted off. The pattern is then drawn, the ring cores set and the cope returned to place ready for pouring.

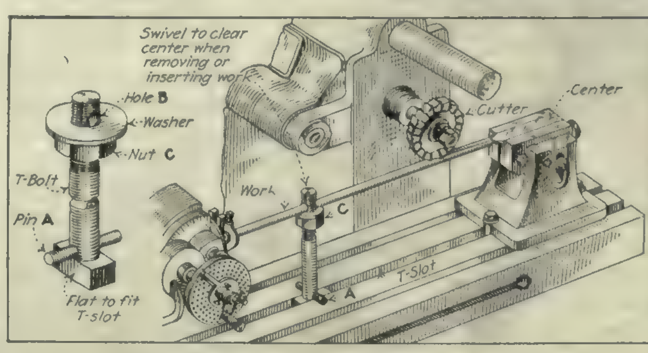
Work Support for the Milling Machine

By Harry Moore

Some time ago we had an ordinary job of milling, that of milling two opposite flats on the ends of some ¼-in. rods, that gave us a lot of trouble because of the necessity for continually adjusting the supporting jack to stop the chatter. Our results were very unsatisfactory.

The operator finally made the device here shown, which consists of an ordinary T-head bolt with the head ground away to fit the narrow part of the slot in the table and a cross pin to rest upon the table surface. A hole was drilled at right angles through the upper end of the bolt to fit the rods and a nut and washer placed upon the threads to screw up against the rods from the under side.

As the hole at the top is carefully located at the correct distance from the supporting pin there is no need for further adjustment and the nut can be screwed



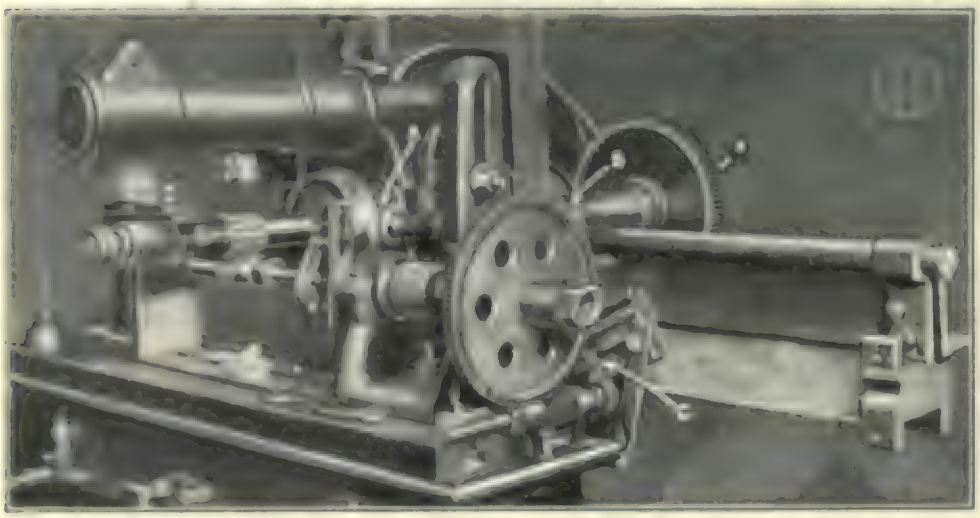
SPECIAL SUPPORT FOR SLENDER WORK

up to hold the rod tightly. At the same time as the head of the bolt fits the narrow part of the T-slot only, the whole thing may be tilted to replace the work. It required but a few minutes' time to make the device and the results secured justified this expenditure by the saving effected on even a very few of the rods.

An Improvised Gear Hobbing Machine That Paid For Itself

By Robert Brainard

The machine described in this article has paid for itself many times over and is still in use in the shops of the Joslyn Mfg. Co., Chicago, Ill. Having a few gears to cut occasionally and an old milling machine that had seen its best days, the foreman decided to kill two birds with one stone. He cut off the lower part of the arm bracket, which carries the bearing for the outer end of the arbor, and attached a flat plate to it by means of a couple of screws. To a similar plate was attached a screw center. The two plates were then bolted together with two cap screws. Next a shank was turned to fit the taper in the machine spindle and the large end of the shank was formed to act as a socket for a ball and socket joint.



AN IMPROVISED GEAR HOBBING MACHINE

After this had been put into the spindle, an internal ring gear was cut and attached to a round plate with a hub that was threaded to fit the thread on the spindle nose. The plate had a bevel gear cut on the back of it to mesh with the bevel pinion *A*. A cutter arbor was attached to a gear that fitted into the internal gear, as shown, the end of the arbor projecting through the gear with a ball turned on the end to fit into the socket in the spindle. Then the cutter was put on and the outer end of the arbor supported by the screw center. The two gears were of the same pitch and the same number of teeth, but a little extra clearance was allowed when the gears were cut, which allowed the arbor to be swung around at an angle to correspond with the angle of the teeth of the hob while at the same time forming a positive drive. A curved slot was cut in the upper plate for the cap screw and graduations were scratched on the top of the plate to indicate degrees. The work was held as shown.

Bevel pinion *A* drives a long shaft carrying a bevel gear *B* that meshes with another gear on a short shaft and thus drives a train of gearing that controls the work-arbor. Gear *C* is an intermediate gear that can be moved on the block on which it is located so as to accommodate the various change gears that have to be used to secure the correct ratio between the hob and the work. As there is no backlash between the worm and wormwheel, it is a comparatively simple matter to turn out first-class work with this outfit.

Cams for Brown & Sharpe Automatic Screw Machines—Discussion

By S. N. Bacon

Under the above title on page 460, Vol. 57 of the *American Machinist*, Stephen McEvoy makes a very good comparison of single and double layout methods. There is another method of double layouts which has caused much misunderstanding, namely; the forming, drilling and cutting off of two parts, instead of one. Many engineers and superintendents, having only a general knowledge of screw machine practice, are of the opinion that this method will result in increased production, but designers of cams, who have analyzed the required feeds and speeds generally agree that the double system is not more productive than the single and is less efficient. It is true that a double cut off tool may be used and the second piece partly cut off while the first is being separated from the bar and that in the drilling, reaming, etc., of both parts, time is saved in indexing the turret. In the majority of cases, when machining one piece at a time, the turret operations (including indexing) are performed during a forming operation. Another point to bear in mind in forming two parts at the same time is the double width of the form tool. Such a tool should be advanced but one-half the amount per revolution of the spindle than would be the case were the single tool used, therefore there would be no saving in time and a more expensive tool would be required.

Double jobs also give trouble in keeping the parts to length, as the length of the first part cut off the bar is gaged between the cutoff tool and the stop in the turret, while the length of the second piece is gaged between the two cutoff tools. As there are exceptions to every rule so will there be a few cases where the double cross-slide tooling or the double cams and turret tools can be used advantageously.

Lubricants for the Shop—Discussion

By Leslie Tourtellotte

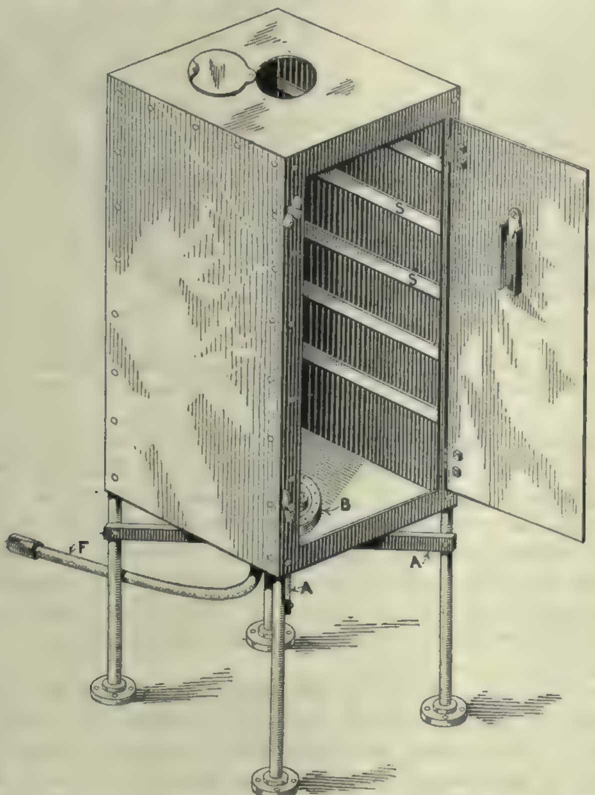
Referring to an article under the above title by H. R. Smith on page 462, Vol. 57 of the *American Machinist*, may say that I have used lard oil and turpentine for a long time, but one time I was cutting a thread and it would tear in spite of anything I could do until the old mechanic said to me "Why don't you put some white lead in your oil?" So I used lard oil, turpentine and white lead. It worked fine; so now we use it nearly all the time. The white lead will settle to the bottom of the can but with a little stirring once in a while it will be all right. It is applied with a brush and should be just thick enough so it will stick on the work without running off too readily.

For a lathe center lubricant we use machine oil and white lead with very good results. It is mixed just about as thick as paste and a little will go a long way.

A Simple Enameling Bake Oven

By Donald A. Hampson

The drawing shows a small oven that may be constructed in any shop at a cost of a few dollars, mostly spent for labor. It will answer its purpose as well as a much more expensive outfit and, moreover, it is portable and may be taken from department to department, if the work so requires. It may also be carried outside of the shop for storage purposes when not being used. As an instance of the desirability of a portable outfit, one shop's experience shows that such an oven was used for two hours on July 10 for baking twenty-five auto horn cases, four hours on July 30 in one of the



OVEN FOR BAKING ENAMELED WORK

private experimental rooms on some radio models, then not again until Sept. 5 when it was used on the floor of the main machine shop for baking the finish on a copying press that had been repaired for a nearby office.

The oven is constructed of half-inch pipe and 24-gage galvanized sheets together with a few pieces of hardware. The four "sides" are alike and are screwed to the pipe standards. The top has two edges turned down and stove-bolted to the sides proper; the opening of the vent may be adjusted by means of a swing cover. The hinged door on the front laps a half inch over the opening cut in the front sheet and is held in a closed position by two metal buttons.

Two cross pieces, *A* and *A*, are screwed to the legs some distance below the sheets to form a support for the burner *B* which is merely the burner from a discarded gas stove. An eight-inch burner serves very nicely for an oven 24 x 24 x 42 in. If the ovens were set up permanently, it would be connected with the gas supply by iron pipe, but in a majority of cases the familiar soft connection *F* is all that is needed and is perfectly satisfactory. To avoid soot and smoke from city gas, it will undoubtedly be necessary to introduce more air into the burner to get a clean bunsen flame and, once adjusted, it will not have to be touched again and the only attention in lighting up will be to regulate the cock for the size of flame desired.

A thermometer will be observed hanging on the inside of the oven door. This location is not ideal but it is convenient and as good as any, for no one location in such an oven reads true for all others. For baking the class of work intended, an exact temperature is not necessary, so that a thermometer reading of say 275 deg. may be assumed as giving a fair baking temperature for a given class of work in all parts. Readings can be taken and the flame adjusted accordingly, by opening the door for a moment. Various ways of supporting the work pieces will suggest themselves in each shop. In this oven, strips *S*, *S* are stove-bolted to the side sheets and upon the strips the rods for hanging the work are laid.

Knurling Bushings in an Automatic Screw Machine

By S. N. Bacon

An interesting problem in automatic screw machine work is shown in Fig. 1. The collar is made from $\frac{7}{8}$-in. brass rod and is counterbored in one end and countersunk and knurled in the other. It would be a simple matter to countersink and knurl from the turret, then counterbore the opposite end in a hand screw machine but as this would add considerably to the production cost of the piece the machine was tooled up, as shown in Fig. 2, and completed in one setting in a No. 2 Brown & Sharpe automatic screw machine.

After the work has been drilled, reamed and counterbored it is countersunk at *A* by use of the turret swing

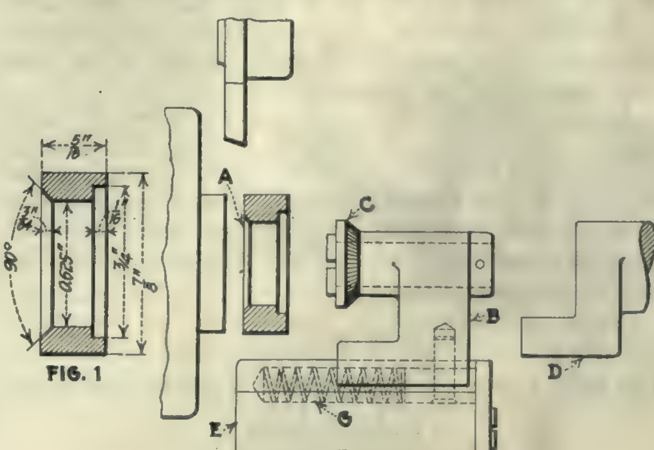


FIG. 1—THE BUSHING TO BE KNURLED. FIG. 2—ARRANGEMENT OF KNURLING TOOL AND HOLDER

or recessing tool. The knurl holder *B* carrying knurl *C* is operated longitudinally by the pusher *D* mounted in the turret. The knurl holder *B* is slidably mounted on the special tool post *E* and is returned, when the turret has withdrawn, by the compression spring. The base of knurl holder *B* is fitted to toolpost *E* with a dovetail slide of sufficient width to prevent chatter.

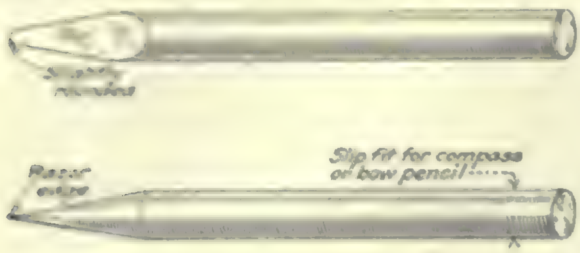
In operation, the front cross-slide can advance the knurling tool transversely and causes it to dwell, while the lead cam advances it longitudinally, into the hole and, in turn, causes it to dwell while the cross-slide cam advances it for a second time, feeding it into the work.

Making Paper Models in the Drafting Room

BY HUGO F. PUSEP

Frequently the tool designer needs a paper model of the piece for which he is to design blanking and drawing dies or other tools. Such a model is of great help in calculating the correct proportions for the design.

The model is laid out on thick drawing paper to the dimension taken from the part print and, when cut out along the pencil lines, becomes an accurate duplicate of the part to be made. Straight lines are easily cut by laying a scale or straightedge on the paper and following it with a sharp penknife, but the radii present



POINTS FOR CUTTING PAPER MODELS

greater difficulties. Some draftsmen use scissors for cutting around the curves, but this is an inaccurate and unsatisfactory procedure.

To make a tool suitable for this purpose, take a piece of drill rod of the same diameter as the compass lead and file or grind it to a round chisel point, as shown in the sketch. Harden this point to glass hardness and then hone it to a real razor edge.

The piece or drill rod may now be secured in the bow-pencil or compasses and, with the needle point on the center of the radius, it needs only a few passes of the sharp point over the curve to cut clear through the paper. The radii of the model should be cut first and joined with the straight lines.

Another valuable kink is to place a piece of thick blotting paper under the model to be cut. The blotting paper has the peculiar quality of resisting sharp pointed instruments, yet allowing them to retain their keenness of edge, thus protecting the drawing board and any other drawing that may be under the model while the cutting operation is carried on.

Getting Long Service from Round Broaches in Cast Iron

BY GEORGE E. HODGES

The writer always gains a few hundred pieces from round broaches on cast iron work by having the new broach oversize and using a lubricant. This would seem odd to those who have set opinions about lubricating tools cutting cast iron but the writer has found that it pays. The cast iron hole closes in about 0.0015 in. on a one inch hole when lubricant is used.

After the broach is used until it cuts small, the lubricant is discontinued, and the broach is good for as many pieces as though it was made to size in the first place. The only disadvantage of this plan is the difference of finish, the one obtained with lubricant being far superior. Soluble oil, diluted as for broaching steel is the lubricant used.

Drafting Room Kinks

BY G. A. LUERS

A double pen, consisting of two pen points placed in one holder with the points overlapping, as shown in Fig. 1, is a time and effort saving device for work with

FIG. 1

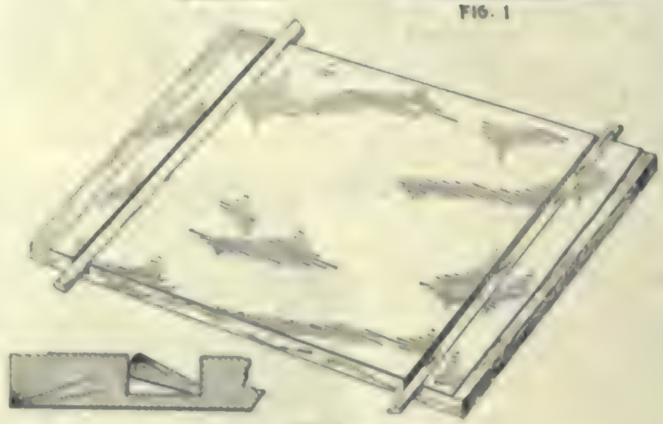


FIG. 2

FIG. 1—A PEN THAT HOLDS CONSIDERABLE INK
FIG. 2—HOLDING PAPER ON THE DRAWING BOARD

India ink. The filling of a pen point with a quill dipped in ink is an annoying loss of time. A fountain pen would be ideal but it cannot be used with India ink. The double pen requires only an occasional filling, serving somewhat as a fountain pen. In lettering work when the body and arms are in position, the constant replenishing of ink is a waste of time. The double pen method is more economical and has been found to be of considerable advantage.

A feature in drawing and sketching, which is undesirable is that of thumb tacking the paper to a sketch board. The paper is continuously shrinking and expanding and necessitates shifting the tacks to have the paper taut. To avoid this, a sketch board made with a groove and a wedging slat at each end, as shown in Fig. 2, has proved of much advantage in placing the paper. With this arrangement no tacks or tack pullers are required and the corners of the paper are not mutilated or corners of the board so perforated that they fail to hold tacks after a period of use.

The paper is made taut by pushing one of the slats into the groove while the other is in place. For thin sketch boards, where the depth of groove is limited, brass strips can be advantageously used in place of wood slats. In either case the fastenings will be below the surface of the board and the T-square will slide freely over them.

Soliloquies of Old Mac

To get a firm grip on a piece of thin tubing without flattening it or leaving the marks of the vise jaws on it, fold a strip of fine abrasive cloth so the abrasive is on the outside. Make a loop of the cloth about the tube and grip the ends in the vise as close to the tube as possible.

It is surprising how tightly the tube may be held in this manner.

Bolt Head and Nut Standards

The National Screw Thread Commission is at work on the problem of standardizing bolts and nuts so as to reduce the number of wrenches now necessary. Recent meetings at Washington, D. C., and Springfield, Vt., brought out much interesting discussion. While it is desirable to have both bolt heads and nuts of the same dimension, the question of securing punched nuts of as small a diameter as is perfectly safe for the head was brought up by bolt makers. This is particularly true when it comes to considering the proposition to adopt the S.A.E. sizes for all work. The following recommendations were submitted:

1. Bolt Heads and Nuts.

(a) Bolt heads, nuts, and capscrews shall conform in short diameter and thickness to the U. S. Standard for coarse threads and to the S.A.E. Standard for fine threads, modified as shown in columns 3 and 4, Table I, N.S.T.C. No. 39.

(b) The maximum width across the flats, short diameter, shall be basic size and this maximum width shall apply to finished, semi-finished, and rough hexagonal and square bolt heads and nuts.

(c) Tolerances on all bolt heads, nuts and capscrews shall be *minus* and in amount as follows:

Bolt Size	Tolerance
1/4 in. to 1/2 in.	0.005 in.
9/16 in. to 1 in.	0.008 in.
1–1/8 in. to 2 in.	0.010 in.
2–1/4 in. to 3 in.	0.012 in.

The allowances and tolerances on openings of wrenches shall be *plus* and in amount as follows:

Bolt Size	Allowance	Tolerance
1/4 in. to 1 in.	0.002 in.	0.005 in.
1–1/8 in. to 2 in.	0.004 in.	0.008 in.
2–1/4 in. to 3 in.	0.006 in.	0.010 in.

2. Machine Screw Heads.

(a) Standard designs of machine screw heads shall be limited to the following:

1. Round head
2. Flat head countersunk (82 deg.)
3. Oval countersunk (82 deg.)
4. Flat fillister head
5. Round fillister head

(b) The length of the screw shall be defined as the distance from the largest diameter of the bearing surface to the extreme end.

(c) The form and size of head shall conform to forms and dimensions derived from formulas of A.S.M.E except for size of slot which shall be as follows:

Size of Screw	Width of Slot	Depth of Slot
0 to 2	0.024 in.	0.020 in.
3 to 6	0.030 in.	0.040 in.
8	0.042 in.	0.050 in.
10 to 12	0.051 in.	0.060 in.

With reference to square and hex. screw stock it was suggested that the effort of the Commission should be to assist in establishing the practice of having all screw stock run from basic to below basic, instead of basic plus or minus.

It is to be understood that the tolerances and allowances proposed for wrenches are to apply to open end wrenches only, socket wrenches are to be considered separately. The second suggestion would eliminate wrench sizes but requires different stock for bolts and nuts to be finished. George S. Case, of the Lamson & Sessions Co., does not feel that the A.S.M.E. sizes will cover all cases and proposed three series of nut dimensions. The first makes the nut the size of the bolt head—the second the size of the next larger bolt head and the third, the size of a bolt head two sizes larger. Mr. Case suggested the following dimensions to 1 in. Above that he suggests that the width across the flats be 1½ times the bolt diameter for both bolt heads and nuts. His proposed sizes are:

	Width Across Flats	
Size	Bolt Heads	Nuts
1/4	3/8	7/16
5/16	7/16	9/16
3/8	9/16	5/8
7/16	5/8	3/4
1/2	3/4	13/16
9/16	13/16	7/8
5/8	7/8	1
3/4	1–1/8	1–1/8
7/8	1–1/4	1–1/4
1	1–1/2	1–1/2

Diameter	Across Flats	Thickness
1/4	3/8	3/16
5/16	7/16	7/32
3/8	9/16	9/32
7/16	5/8	5/16
1/2	3/4	3/8
9/16	13/16	13/32
5/8	7/8	7/16
3/4	1 or 1–1/8	9/16
7/8	1–1/8 or 1–1/4	5/8
1	1–1/4 or 1–1/2	3/4

The makers of wood screws have eliminated many sizes and have adopted the same sizes of wire used in making machine screws.

Attitude of Secretary Hoover on the Metric System

While believing that the metric system can be applied to good purposes in the scientific field, there is reason to believe that Secretary of Commerce Hoover has in no way altered the opinion he has expressed on several occasions since assuming his portfolio. It is his opinion, that there is nothing to justify its general application at this stage of the country's development.

The period when productivity is important would be no time "to warp the brains of the country's mechanics" in their efforts to acquire the metric system, Mr. Hoover thinks. He thinks much of the propaganda for the metric system comes from a single indefatigable enthusiast.

America's Ability in Competition

The United States cannot hope to compete with the low-cost countries in the manufacture of the simpler forms of machinery which are not made on a large scale. There is increasing evidence, however, that this country can compete in any market with machinery which is made in large quantities and with such articles as machine tools, typewriters and locomotives. These are developments of American ingenuity and the actual control of their market will probably remain with this country.

The two great elements which will favor American industries are the use of labor saving machinery and the duplication of parts. Until foreign manufactures are equipped to use of these principles, we should enjoy an agreeable advantage.

Editorial

THE AVERAGE purchasing agent gets little sympathy and sometimes deserves less than he gets. But he is not to be envied when, with a falling or rising market, he is confronted with the problem: To buy or not to buy. If he makes a mistake, his company may be confronted with the problem: "To be or not to be."

What's Wrong with the Railroad Shops?

ONE OF THE MOST important of the several things that seem to us to be at the bottom of railroad shop inefficiency is the matter of equipment. In the second article of our series, which appears on another page, we have gone into the equipment situation with care.

To the average citizen the condition of railroad rolling stock is the indicator of the financial stringency that government regulation of an unintelligent character has brought about. Delays give striking evidence of motive power troubles.

To the engineer and others familiar with the shop, however, a much clearer picture of the lack of funds is presented by the antiquated and obsolete tools that are found in the railroad repair shop. With any semblance of a modern depreciation reserve policy these tools would have been written off the books years ago. As it is they represent a liability rather than an asset.

The statements regarding equipment must of course be taken as general statements. They apply to the majority of shops we have visited but not to all. A few are much better, others much worse.

Another point that is brought out in the article is the place of the "show machine" in the railroad shop. There are not very many machine tools that are built with railroad service first in mind. Axle and wheel lathes, wheel boring machines, slotters and draw-cut shapers are essentially railroad shop tools and are shown off to the visitor with pride. Unfortunately they are not always used efficiently as is indicated in the article. The inefficiency is due partly, of course, to the fact that mass production is unknown in railroad practice. With the wide variety of locomotives in the service of each road, standardization of parts and stocking of spares is out of the question. Here would be a most fertile field for Mr. Hoover's Division of Simplified Practice.

It is a great pity that the men in the railroad shops have had to contend with such adverse conditions. Even the most ambitious and aggressive man cannot but be affected by lack of money, lack of co-operation, lack of proper tools for his job. It is not our intention to try to blame anyone for the present situation, the causes are too complex. But it is our belief that a fair statement of the case will help to speed the coming of changes that must be made if our transportation system is to meet the requirements of the boom period of business prosperity which is just getting started.

Even the One-Man Shop Has a Large Engineering Department

QUEER AS IT may seem, the owner of even the smallest shop has at his command highly skilled engineering forces. All that he has to do to command their services is to ask their immediate employer for a price on the machine he builds and for a guaranty as to its production. Then he buys the machine and the tools necessary for the job and the engineering comes along. Sometimes he gets more—his machine set up and demonstrated, and a stack of parts machined.

Does he pay for the extras? Yes, and for more too. He pays a part of what it cost the machine builder to figure on a job for his neighbor who didn't buy. More than that, he pays a part of what it cost the same builder to figure on a half dozen other jobs that he didn't get. The builder has to get paid, so he distributes such charges over all the machines he sells.

If each customer asked for the services of the engineering force of one builder and then either bought or did not buy, the charges for such services might be distributed equitably. But if each customer asks for the services of six builders and buys from only one, five must go unpaid or collect from those to whom they do sell.

There isn't a good reason why the engineering knowledge of a manufacturer of milling machines, for example, shouldn't be used for the benefit of all performing milling operations. It is expert knowledge and, by its use, the most economical solution of milling problems can be secured in the shortest time. But the man who invokes the engineering services should pay for them whether he buys equipment or not. If he paid that way, it would cost him less in the long run and he would think twice before making indiscriminate use of an article so costly as engineering.

The Future of Radio

WIRELESS TELEGRAPHY has been with us for a great number of years, as we count time in days, when new inventions sprout, grow up, blossom and bear fruit in a fraction of a life time. Though admired and respected, it was never intimate or even on friendly terms with the mass of the population.

Wireless telephony, on the other hand, has taken the popular fancy by storm. Hundreds of thousands, perhaps millions, of radio sets have been made and sold. Radio has given rise to a new industry. It would seem, therefore, that it is about time to take stock of the situation and look into the future as well as we can.

Is radio a fad or a fixture? This same question has been asked about many other industries which have sprung up within the memory of the present generation. There were the bicycle and the automobile, the telephone and the typewriter, the phonograph and the moving pictures. About some of them we are not quite sure even now, but all of them were at one time at a stage where we doubted whether the rapid progress of the new in-

dustry was evanescent or lasting. Radio presents some phases which the other industries did not have and which make a prediction even more difficult.

That wireless telegraphy and telephony, as well as other uses of radio transmission of energy, have come to stay does not admit of any doubt. What is not so certain, however, is the extent to which they will keep a hold on the masses.

The pillars which are now supporting the structure of the industry furnishing the radio sets are the broadcasting stations. Such stations are under great expense to give the entertainment they are furnishing now. They are repaid by the expansion of the industry. As soon as this expansion is checked, it will be doubtful if broadcasting will continue as at the present, and if not, it is more than doubtful whether the same number of enthusiasts can be found which we find at present.

Besides, the radio is merely a novelty to many people, a new sensation, a kind of experiment with mysterious forces. When the novelty wears off there will be many who will no longer have use for the radio sets.

At best the music which is now delivered by the radio set is an inferior kind of phonograph noise. It is doubtful whether it will ever be possible to perfect the radio apparatus to such an extent that the music transmitted by it can be compared to what we hear in the concert hall or even at home. Between the mouth of the singer and the ear of the listener there are so many joints and connections, so many forces at work, so many possibilities for disturbance, that it is not reasonable to look for the perfection of transmission which comes when the voice is brought to us merely through the vibrations of the surrounding atmosphere.

The music which comes to New York from Pittsburgh is wonderful because of the way it got there, not on account of the quality. So also are we willing to listen to lectures given at a distant point, which if delivered in our home town would put us to sleep.

For all these reasons, it seems that we may expect a considerable slacking up of the popular interest. Maybe not now, maybe not in five years, but ultimately, unless some other use is found for radio, a use which is not only interesting but instructive and educational as well. It would seem that by proper co-operation among the great companies, perhaps jointly with state or federal government, much can be done along these lines and, if it were done, the popular interest would be maintained.

Shortly, if radio is to continue to live among the masses, it must be interesting on account of what it gives, not merely on account of its mystery.

High Cost of Distribution

FORTUNATELY, the problem of distribution is receiving more attention than formerly. Even the engineers who have hitherto devoted all their energies to reducing production costs another fraction of a cent per piece are beginning to study the question seriously. In the past they have been struggling only with the smallest item of the total cost of most manufactured articles, direct labor.

A glaring example of the high charge (whether it be all "cost" must be judged by each for himself) of automobile parts happened recently in a large eastern city. The owner of a well known car of distinction, if not exclusiveness, lost a small sheet metal cover which allowed the adjustment of the brake and served to keep dirt out in regular running. At the service station of the company building his car, he was charged two dollars for a new one, plus the labor of putting it on.

It so happened that this particular car owner was also a manufacturer of sheet metal goods and himself made these particular covers for the party who supplied the axles for the car. A dollar an ounce or thereabout seemed rather high for a plain sheet metal stamping and he had his secretary look up the price at which he supplied them to the axle makers for the car.

The books showed that his price on the piece, including material, labor, overhead, and the profit which enabled him to buy this car of distinction, was just eight cents. In going to the axle maker, from there to the car maker, and back to the service station in his own city, it had increased in cost from eight cents to two dollars, or twenty-five times. And yet they say that a rolling stone gathers no moss. It would seem as though the efficiency experts might well give the harassed production man a little time for even peaceful inefficiency and turn their energies to fields which offer so much greater opportunities.

Why Make Machinery the Goat?

AN EDITORIAL in the daily press calls our attention to the fact that a college professor has proved (to his own satisfaction) that many of our modern troubles are due to machinery. Hence, the argument runs, we should cast the machinery from us as an unclean thing and get along virtuously without it. The writer of the editorial is a little less drastic in that he can see a difference between good machinery and evil machinery and would have us keep the good but throw out the bad.

Here we have what seems to be almost the last step in passing the buck. From capital to labor, from labor to capital, to the manager, to the engineer, to the government bureau it has gone, and each has found a way to pass it along. But now it has been passed to an inanimate machine and how can the machine get rid of it?

Just why men who call themselves thinkers will persist in blaming machinery for the mistakes of management is beyond our comprehension. And yet they keep right on doing it. Granted that conditions in steel plants and manufacturing centers are not ideal, is it the fault of the machinery that men have built to do the heavy work for them? We can't see that it is and we are prepared to go a step farther and say that in many cases the bad conditions are at least partly due to the lack of machinery.

Just Suppose

JUST suppose you could hitch a taximeter on your salesman that would start working merrily when the P.A. sends out word he is busy. And suppose you could send a bill to the P.A. for all the money you lost while your salesman wasted his time because the P.A. was discussing the ball game or telling of his latest motor trip. Best of all, suppose you could collect the bill.

Be great wouldn't it? Ought to be done, of course.

But, just suppose you had to pay what the other fellow's salesman's taximeter said you owed him? Perhaps we'd all be more prompt and courteous—if it cost real money not to be? Can't be done? Possibly not, but—

Just suppose.

Shop Equipment News

American Broach & Machine Co. Bench Broach Press on Pedestal

A power-operated bench broach press mounted on a floor pedestal has recently been placed on the market by the American Broach & Machine Co., Ann Arbor, Mich. The machine, which is shown in the accompanying illustration, is similar to the vertical bench broach press described on page 695, Vol. 55, of *American Machinist*. It is intended especially for broaching small holes and keyways. The machine is rapid in its action, so that high production is obtainable.

The machine is operated by belt on a constant-speed pulley, and the power is transmitted through a steel worm and a bronze worm gear to the ram, which is operated by rack and pinion. The machine is fitted with an automatic stop, and the movement of the ram is controlled by a positive jaw clutch of hardened steel. The machine can also be operated by hand power, the handwheel having hollow spokes to receive a bar. A counterweight serves to raise the ram after the power has been disengaged. Approximately, 2 tons pressure can be obtained. The maximum stroke is 14 in., and work up to 6 in. in diameter can be handled. The table has a 2½-in. hole. The driving pulley is 10 in. in diameter and has a 3-in. width of face.

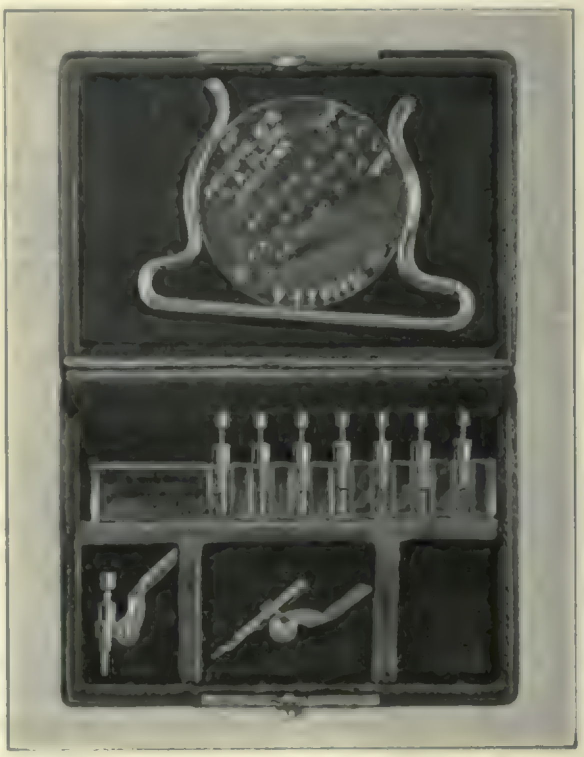
The pedestal shown has an oil receptacle which can be connected to an oil pump when required. The height to the top of the work table from the floor is 36 in. The machine complete with the pedestal as shown in the illustration weighs about 315 lb. Only a small floor space is required.

"AMERICAN" BENCH BROACH PRESS ON PEDESTAL

Bourquin "Leroy & Ames" Set for Draftsmen

Some pens and a lettering instrument for the use of draftsmen, engineers and those doing lettering and drawing work have recently been placed on the market by Edgar Bourquin, 1353 Main St., Waltham, Mass. The accompanying illustration shows set No. 100, although smaller sets including only that part of the apparatus required can be furnished.

The flap of the case that is shown raised in the illustration forms a pocket for holding the Ames lettering instrument that can be seen lying inside the cover of the case. This instrument consists of a nickel-plated steel frame holding a celluloid disk that may be rotated in it. In the disk are three parallel rows of tapered holes for drawing guide lines for lettering. The instrument is used by holding the base in contact with a T-square or straight-edge, and then pulling it alternately from right to left by a pencil placed in a hole in the disk, the position of the pencil being shifted from hole to hole after each movement across the paper.



"LEROY & AMES" NO. 100 SET FOR DRAFTSMEN

The holes in the center row are evenly spaced, while the holes in one side row are spaced so that the bodies of the letters will be two-thirds of the height, and in the other row three-fifths of the height. The numbers on the edge of the disk indicate fractions whose understood denominator is 32, so that the total height of the letter is shown by the number opposite the mark on the base.

In the case are compartments for holding the pens,

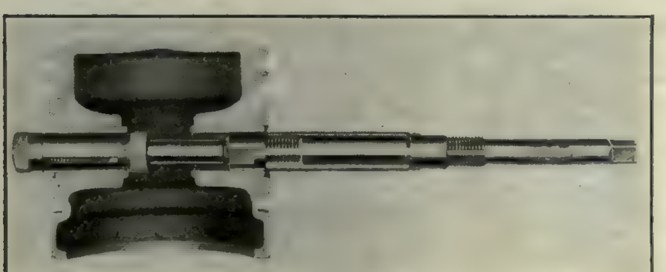
and a special celluloid holder for the Leroy tubular pens. These pens are adapted to both ruling and lettering. They are of the fountain type and are filled by means of a dropper such as ordinarily employed for ruling pens. In each tube is a cleaner that can be easily removed. The slight projection of the cleaner beyond the nose of the tube serves to constantly prime the pen. Movement imparted to the cleaner by the contact of its lower end on the paper, or by turning with the fingers from above, serves to keep the ink agitated so that it will flow, and to remove hardened particles that tend to clog up the point. The ink is retained even when the cup is full, so that it does not drop from the point when the pen is lifted. The width of the line made depends upon the width of the point, so that a range of sizes of pens is furnished. The width of line is easily controlled, as it is always the same for any one point.

The tube points are interchangeable in a swiveling socket, in which they can be locked in such a position as to make the position of the holder most convenient for the user. The same socket can also be employed for holding Gillott's crow quill pens, one of them being shown clamped in position and lying in a tray in the box. The case for the No. 100 set is 4½ x 3 x 1 in. in size, leather covered and lined with plush.

"Nu-Angle" Expansion Line Reamer

The Vedoe-Peterson Co., Norfolk Downs, Mass., has just placed on the market the "Nu-Angle" expansion line reamer for reaming piston-pin bushings. The tool is similar in construction as far as the arrangement of the blades is concerned to that described on page 162 of *American Machinist*. It has six blades placed at angles to the axis so as to minimize chatter and gouging. Regardless of the size of the reamer, it can be adjusted through a range of 0.030 in. Thus accurate control of the size of the finished hole is possible, and either standard or oversize pins can be fitted.

The tool is equipped with a pilot and an expanding sleeve, so that the two holes in the bushing will be exactly aligned. Throughout the whole reaming operation, the tool is guided and supported by the solid pilot and the expanding sleeve in one bearing while reaming the opposite bearing.

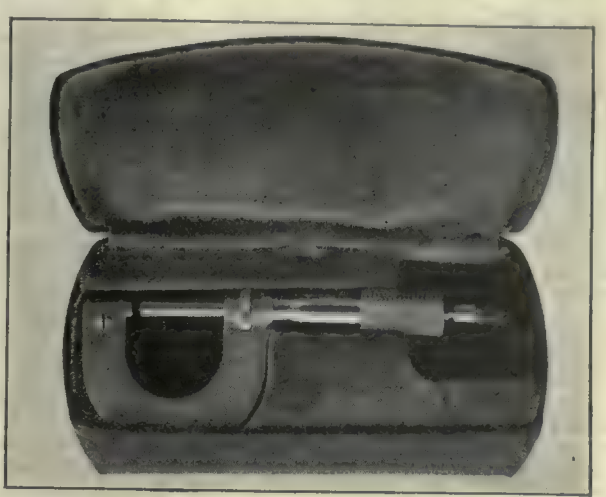


"NU-ANGLE" EXPANSION LINE REAMER

The reamer is made in nine sizes capable of reaming piston-pin bushings in practically every make of automobile. The diameter available ranges from 0.66 to 1.14 in., and the length over all from 9¼ to 12¼ in. Three reamers can be furnished to ream the piston-pin bushings employed in the great majority of automobile motors. The tools are packed in wooden boxes equipped with compartments to hold them in place.

Brown & Sharpe Pocket Micrometer Case

The accompanying illustration shows a case that fits the pocket, and that has recently been placed on the market by the Brown & Sharpe Manufacturing Co., Providence, R. I., for holding 1-in. micrometer calipers. The principal feature of the case is its shape, as it is designed to fit the pocket without taking up much room or causing a large bulge, as might occur with the ordinary case. Its use protects the micrometer from dirt and injury due to carrying in the pocket.



BROWN & SHARPE POCKET MICROMETER CASE

The case is made of metal, covered with leather and lined with plush. It is furnished in two styles, the No. 202 for the standard micrometer made by the concern, and the No. 203 for the "Rex" micrometer. The inside of the case is so shaped as to hold the micrometer securely in position and prevent it from moving in the case.

Moving Machinery as per Schedule

As is generally known, parts of the Ford works are being moved from Highland Park to the River Rouge plant and thereby hangs a tale which may well be noted, and copied. The moving isn't done in a haphazard manner but as per schedule. The time came to move a certain group of machines of the cylinder block group. The machines ran at Highland Park until the moving men backed a truck up to receive the machines, then the men put on their hats and coats, checked out and took a street car, or cars, for the River Rouge plant.

It is a long way from one plant to the other, especially by street car, and it's several miles even as the truck flies, to paraphrase an old saying. But they finally arrived and when they reported to the foreman, their machines were already in place, wires were connected and all they had to do was to put in a piece of work and throw on the current. Needless to say the men were surprised, as is everyone who hears it. But though it might seem like a miracle to most shops, it is not only possible but it actually happened. And all because the moving was planned and carried out systematically.

Incidentally it was made easier to have the machines ready to run by the time the men arrived, due to the independent motor drives with which the machines were supplied.

Some moving!

News Section

A.S.M.E. Annual Meeting Opens December 4

The annual meeting of the American Society of Mechanical Engineers, the biggest of the national engineering gatherings of 1922, will be held in the Engineering Societies Building, New York City, December 4 to 7. At that time John L. Harrington of Kansas City will succeed Dean Dexter S. Kimball of Cornell as president of the society.

A feature of the meeting, which will attract engineers, manufacturers, economists, educators and industrialists from all over the country, will be joint sessions with the American Economic Association, the American Society of Safety Engineers, the American Society of Refrigerating Engineers, and the American Engineering Standards Committee.

H. F. Loree, president of the Delaware and Hudson Railroad Co., and E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., will be among the speakers at the economic forum, at which addresses also will be delivered by Dr. W. C. Mitchell of the National Bureau of Economic Research, and professor of economics at Columbia University; Prof. H. H. Seager of Columbia, president of the American Economic Association, and Dean Kimball. Mr. Herr's topic will be "The Human Problem in Industry." Prof. Mitchell will discuss "Making Money and Making Good."

Taylor Society Will Hold Three-Day Session

The Taylor Society will open its 1922 Annual Meeting in the Engineering Societies Building, 29 West 39th St., New York City, on Wednesday evening, November 22, with its annual dinner at 6 o'clock. This will be followed by the annual business meeting.

The sessions of Thursday, November 23, will be given over to a discussion of the following papers by the authors named

The Organization and Management of a Medium-sized Plant: emphasis on manufacturing organization and management, by Percy S. Brown, Works Manager, Corona Typewriter Co., Groton, N. Y.; Statistical Compilation—some of its uses as a function of scientific management, description of a statistical department, its organization, equipment and product, and the use of the latter in managerial control, by Harry B. Horwitz, Planning Department; Harry A. Wembridge, Statistical Division; and Herman J. Hutkin, Methods Division; The Joseph & Feiss Co., Cleveland; Shaping Your Management to Meet Developing Industrial Conditions, by H. S. Person, managing director, Taylor Society, New York.

The program for November 24 is as follows: Master Budgets of Sales and Production; Case 1—The Hood Rubber Co., by W. W. Duncan, Hood Rubber Co., Watertown, Mass.; Case 2—The Dennison Manufacturing Co., by Ernest E. Brooks, The Dennison Manufacturing Co., Framingham, Mass.; Reduction of Waste through Research Studies in the Operating Departments of Retail Stores—a summary of results of recent studies made by the Retail Research Association. By Philip J. Reilly, associate director, Retail Research Association, New York.

The evening session will be a Symposium on The Supervision of Personnel, the trend following the shock of the depression.

Machinery Exports Show Slight Increase

Exports of metal-working machinery during September were slightly greater than in August and materially greater than the value of the exports in September, 1921. September exports were valued at $1,093,891, as compared with $1,032,483 in August of this year and $1,074,371 in July. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS METAL-WORKING MACHINERY

	August, 1922	September, 1922
Lathes	$52,963	$54,874
Boring and drilling machines	31,370	40,628
Planers, sharpeners and slotters	11,980	15,758
Bending and power presses	16,061	11,085
Gear cutters	15,290	14,667
Milling machines	27,631	29,662
Sawing machines	3,145	5,041
Thread cutting and screw machines	13,530	22,924
Punching and shearing machines	6,735	7,171
Power hammers	10,534	20,886
Rolling machines	734	3,897
Wire-drawing machines	1,665	81
Polishing and burnishing machines	396	1,265
Sharpening and grinding machines	79,356	56,468
Chucks, centering; lathe, drill and other	23,564	18,676
Reamers, cutters, drills and other parts for machine tools	100,295	114,475
Pneumatic portable tools	44,772	35,389
Foundry and Molding machinery	70,228	44,436
Other metal-working machinery and parts of	522,232	596,508
Total metal-working machinery	$1,032,483	$1,093,381
IMPORTS		
Machine tools	$18,926	$20,950

A.S.T.M. 1923 Annual Meeting

The Executive Committee of the American Society for Testing Materials has voted to hold the 1923 Annual Meeting of the Society at Atlantic City in the latter half of June provided satisfactory arrangements can be made. Two dates are tentatively under consideration, viz.; (1) during the last week in June, *i.e.*, June 25 to 29 and (2) immediately following the meeting in Atlantic City of the American Railway Association, *i.e.*, about the middle of June. Announcement of the exact date will be made in these columns as soon as a definite decision is reached.

A.S.M.E. Elects Division Committees

The American Society of Mechanical Engineers, during the past week, announced the elections of the executive committees of the professional divisions. Among the committees selected are the following:

Machine Shop Division: F. O. Hoagland, Worcester, Mass.; Henry J. Eberhardt, Newark, N. J.; Forrest E. Cardullo, Cincinnati, Ohio; George E. Greenleaf, Plainfield, N. J.; and Charles R. Gabriel, Brooklyn, N. Y.

Management Division: R. A. Wentworth, chairman, W. Herman Greul, Alonzo Flack, L. P. Alford and Robert T. Kent, New York City.

Materials Handling Division: H. V. Coes, Philadelphia, Pa., chairman; Fred M. Feiker and R. M. Gates, New York City; Kern Dodge and H. E. Birch, Philadelphia, Pa.

Ordnance Division: Waldo H. Marshall, New York City, chairman; Lieut. Col. G. L. Wall, Aberdeen Proving Grounds, Aberdeen, Md.; Major Wilford J. Hawkins, Bloomfield, N. J.; Col. C. L'H. Ruggles, Ordnance Department, Washington, D. C.; and Major Fred J. Miller, New York City.

Power Division: John H. Lawrence, New York City, chairman; Ervin G. Bailey, Cleveland, Ohio; A. G. Christie, professor of mechanical engineering at Johns Hopkins University, Baltimore, Md.; C. F. Hirshfeld, Detroit, Mich.; and Nevin E. Funk, Philadelphia, Pa.

Railroad Division: James Partington, New York City, chairman; William Elmer, Altoona, Pa.; E. B. Katte, New York City; W. H. Winterrowd, Montreal, Canada; and Burton P. Flory, Middletown, N. Y.

Aëronautic Division: Major Thurman H. Bane, U. S. Air Service, McCook Field, Dayton, Ohio, chairman; Joseph A. Steinmetz, Philadelphia, Pa.; Elmer A. Sperry, Brooklyn, N. Y.; Lieut. R. S. Barnaby, U. S. Navy, Philadelphia, Pa; and Sanford A. Moss, Lynn, Mass.

6th Annual Industrial Conference of New York State

"Elimination of Waste in Industry" will be the central theme of the Sixth Annual Industrial Conference of the State of New York which will be held in Buffalo, Nov. 21, 22 and 23, at the Hotel Lafayette.

Among the speakers on the program who will address the conference are the following: Hon. Henry D. Sayre, Industrial Commissioner; Governor Nathan L. Miller; W. D. Baldwin, Chairman of the Board, Otis Elevator Co.; L. W. Wallace, Vice Chairman, Federated Engineering Societies; M. F. Simmons, General Electric Co.; H. C. Blagbrough, H. H. Franklin Co.; Dean Dexter F. Kimball, Cornell University, and W. R. Bassett, Miller, Franklin & Bassett Co.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

THE economic effect of the election is quite as important as the political realignment that it will bring about. Some maintain that the reduction in the Republican vote was due simply to popular petulance at the failure of Congress to reduce taxes and expenditures. Others assert that it reflects a widespread demand for a policy that will equalize the inequalities of life and correct the alleged unfairness with which the rewards of human effort and enterprise are distributed in this wonderful country of ours.

In our consideration of the subject we shall probably be led astray if it is assumed that the masses are much concerned about taxation or government expenditure. The only direct Federal tax is that levied upon incomes. In 1920 there were but 226,120 persons who reported taxable incomes of as much as $10,000 or more. This is a politically negligible portion of the population and while the rest of the people resent the fact that so much of the country's wealth is concentrated in the hands of the few they take a certain satisfaction in the belief that these few pay most of the taxes and in this belief the many are not acutely conscious of the burden of indirect taxation that is passed on to them.

Corroborative evidence of this statement is furnished by the election in the State of New York, where the candidate whose chief recommendation was his economy went down to defeat.

Nor will the careful student of the political map be inclined to agree with those who assert that the tariff was a major influence in the election. The democratic papers succeeded in making something of a bogey of it, but it has not been long enough in force to increase seriously the cost of living and while it has its iniquitous aspects the average American voter is not much moved by economic abstractions. His grievances must become concrete before he is willing to abandon his party affiliations to protest against them and it can hardly be said that the higher prices which must ultimately be the result of the higher duties have as yet become painful realities.

We may therefore conclude that the changed majorities were not so much a protest against taxation or extravagance or the tariff as against the inequalities of economic opportunity and rewards of which the social reformers talk so much.

The outstanding fact of the election is the triumph of the Progressives. Its explanation is to be found in the promises they made. In nearly every case they pledged themselves to improve the economic condition of the large majority of the people who feel themselves oppressed. In the agricultural states the elected candidates were those who promised higher prices for the products of the soil. In the industrial regions the nominees who were supposed to be in sympathy with the wage earners got the largest vote and in the State of New York the enormous majority given to "Al" Smith is generally interpreted as a protest against the power of wealth that Governor Miller is rightly or wrongly supposed to represent.

The net result of the election is that the balance of power in both houses

The outstanding fact of the election is the triumph of the Progressives. Its explanation is to be found in the promises they made. In nearly every case they pledged themselves to improve the economic condition of the large majority of the people who feel themselves oppressed.

of Congress as well as in several state legislatures will be held by a few men who are known to be anti-capitalistic in their views.

A Coalition of the newly elected Representatives and Senators who call themselves Progressives with the Agricultural "Bloc" will bring into existence a minority unit than can hold up all legislation of which it does not approve. Some of the members of this unit are already on record as interpreting the vote cast last Tuesday into a demand that farm and industrial labor shall be awarded a larger and more equitable share of the wealth that it produces. This means that capital will get less. The justice of this demand need not be here discussed, nor is it possible to say whether it can be successfully resisted by those who may oppose it. The indications are that an attempt to meet it by legislation will probably be made, and if this attempt is made it is likely to prove a disturbing if not a depressing factor in so far as security values are concerned.

Conversely, it is likely that the Progressives will regard themselves as commissioned to find a way to raise wages as well as the prices of farm products. If this is attempted a further advance in both raw materials and manufactured articles may be expected until the law of supply and demand, which is superior to man made statutes, reasserts itself.

But it is not to be expected that these prophetic generalizations will immediately become realities. The newly elected Congress will not meet until the fourth of March and while the special session of the old Congress that has been called by the President will convene November 20th, it is unlikely that it will venture to increase its unpopularity by enacting the Ship Subsidy bill or any other legislation that will involve further demands upon the treasury or the tax-payer.

A winter of comparative quietude politically and financially is therefore indicated. The impetus which the business improvement now in progress has acquired ought not to be exhausted before the spring.

The developments of the past week have not been specially important except in the cotton market, where the feeling of alarm at the prospective scarcity in the world's supply of the raw material has led to a further advance of over two cents. No one knows at what price the advance will be checked.

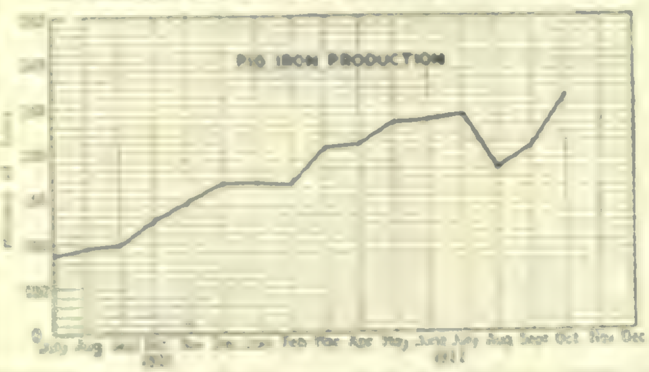
The other two important textiles, silk and wool, are likewise firm, but in no other department of our domestic trade is the upward tendency of prices as pronounced as it was two or three weeks ago. The market for building material is distinctly easier because the railway congestion has led many builders to suspend operations for the winter or until they can get prompter delivery of the supplies they need.

The market for bonds and stocks has changed but little since Wednesday, when it opened at a slight decline upon the news of the elections and promptly recovered the ground lost because the outside public did not seem disposed to follow the lead of the professionals in selling. The money market has been quiet. It is firm but not appreciably higher. The weekly statement of the Federal Reserve System shows a gain of $2,700,000 in the gold held and an advance of $\frac{1}{10}$ of one per cent in the reserve ratio, which now stands at 76.4.

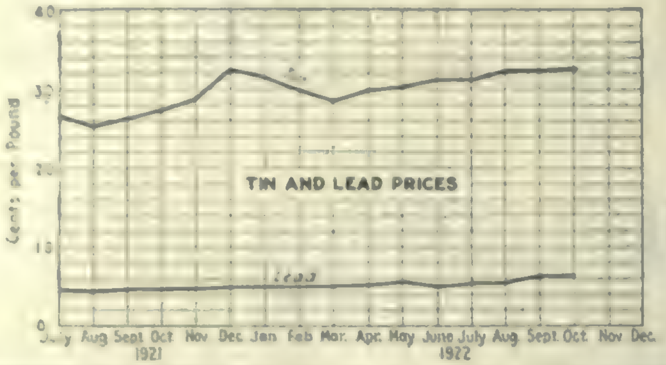
The continued decline in French and Belgian francs has been a feature of the foreign exchange market. It is attributed to the gradual abandonment by France of the hope that she will collect any substantial portion of the reparations claimed from Germany whose paper marks are practically worthless at 1¼ cents a hundred.

There are but few other European developments that call for comment. The Turks are again becoming turbulent but England seems undisturbed. Despite the financial plight of the various continental governments private business in Europe appears to be on the mend and Russia in particular seems to be commencing to emerge from its economic disorder now that the Soviet government has countenanced the resumption of trade and consented to a partial recognition of the rights of capital.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



PIG IRON production advanced sharply during October the output for the month totaling 2,633,-850 tons as compared with 2,003,722 tons in the month previous. The October production represents the largest tonnage reached in any single month since December, 1920, at which time 2,703,855 tons were manufactured. The increase of 30 per cent over September is the largest gain recorded in any single month since March, 1918. During the month there was an increase of 29 stacks in operation, a total of 218 being in blast on November 1st, the first time during the year the figure has exceeded 200.

Tin and lead prices were strong and higher during the month as compared with the average for September. The average for the former was 33.935 cents as against 32.134 cents while lead averaged 6.530 as compared with 6.110 cents in September. Toward the end of the month both metals were affected by increased activity with higher prices resulting, but the activity has been of a speculative character. There is no scarcity of either metal, reputable consumers being able to secure their requirements.

Automobile share markets worked higher during October, ten representative issues moving up to an average of $46.52 per share as compared with $45.65 in September. The high point in the movement which began in August was reached about the middle of October with an average of $47.60 per share. Since that time there has been a gradual decline, the average price on October 30 reaching $45.00. Seasonal falling off in demand has been the chief weakening factor.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

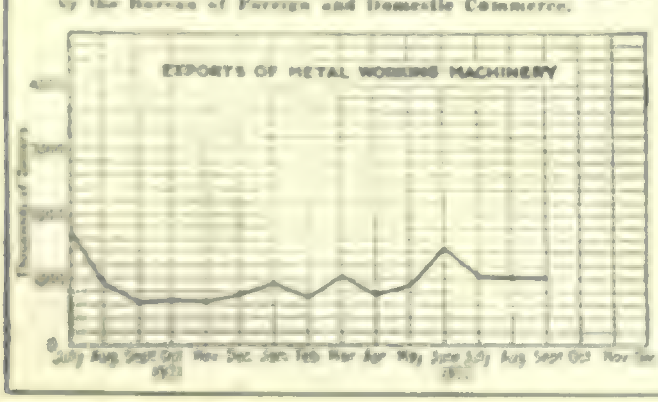
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb......	$0.0295	$0.0295	$0.0273
Cold finished shafting	per lb......	0.0378	0.0378	0.0373
Brass rods	per lb......	0.171	0.1700	0.15
Solder (½ and ½)	per lb......	0.24	0.23	0.20
Cotton waste	per lb......	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia	per 100...	3.11	3.11	......
Lard cutting oil	per gal......	0.59	0.575	......
Machine oil	per gal......	0.36	0.36	......
Belting, leather, medium	off list......	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list......	55% @60%	50% @ 65–10%	50% @ 60–10%

Metal working machinery exports continue to hold up well, September shipments being valued at $1,098,891, a slight increase over the August total of $1,032,483. This is the highest total recorded during the current year and compares with shipments in March valued at $1,057,106 and July, valued at $1,074,371. As compared with the month of September, 1921, the figures show an increase of $467,705. Imports of tools continue in small volume and were valued at $20,950 as against $18,926 in August. Machinery exports to South America are increasing but industrial, and financial conditions in Europe must improve considerably before any great impetus can be expected in metal working machinery exports on the whole.

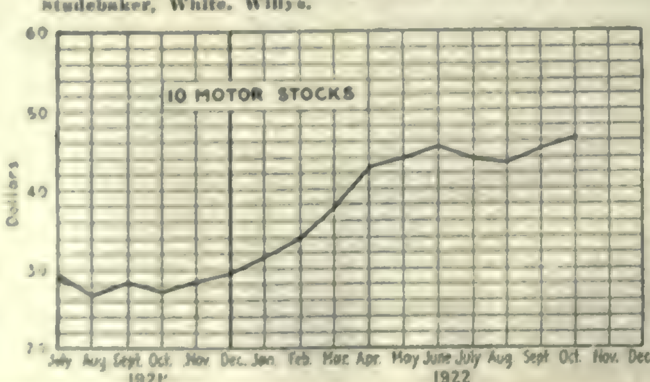
American foreign trade for September shows exports valued at $307,457,198 and imports of $228,794,689, as against August exports of $301,804,618 and imports of $281,412,910. As compared with September, 1921, imports show an increase of nearly $50 millions while exports declined about $10 millions.

Railway earnings on American roads increased slightly during September, Class One railroads reporting a net operating income of $58,-428,000 as against $52,579,799 in the month previous.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



Alabama to Be Center of Pipe Industry

According to a recent bulletin by the Southern Metal Trades Association establishment of several new pipe plants in the Birmingham district the past several months has resulted in making that district the largest manufacturer of cast-iron pipe in the world, with Birmingham and Anniston, Ala., the two larger centers. In the latter city there are about fifteen large plants manufacturing pipe, while Birmingham has the largest individual pipe plant in the world. This plant produces approximately 13 per cent of all cast iron pipe made in the United States. More than 50 per cent of all pressure and soil pipe made in this country is produced in the district.

Plan Exhibit of Inventions and Patents

Announcement has just been made by A. B. Cole, vice-president of the Universal Patent Exposition Corporation, with executive offices at 110 West 40th St., New York City, of an exposition of inventions and patents to be held in Grand Central Palace, in that city, February 17 to 22, 1923.

The object of the exposition is to give all inventors an opportunity to show the public, the manufacturer, the merchant, and the financier the possibilities for utility, business, trade and commerce that are to be found in the products of their genius.

The opening day of the exposition, Saturday, February 17, has been named International Day, each of the five days following being named in honor of Marconi, Steinmetz, Edison, Bell and Westinghouse.

Freight Loadings Make High Record

Loading of revenue freight during the week which ended on Oct. 28 amounted to 1,014,480 cars, according to reports received today from the railroads of the country by the Car Service Division of the American Railway Association.

This was the largest number of cars loaded with revenue freight during any one week in the history of the railroads, except for the week of Oct. 15, 1920, which exceeded this total by only 4,059 cars, or two-fifths of one per cent. This also was the second consecutive week that freight loadings have exceeded the million mark.

Loading for the week of Oct. 28 this year was an increase of 10,721 cars over the week before, and an increase of 63,096 cars over the corresponding week last year. It also was an increase of 33,238 cars, or 3.4 per cent above the corresponding week in 1920 when the total was 1,008,818 cars.

While the total loading for the week was slightly below that for the week of Oct. 15, 1920, which was the largest on record, an analysis shows that there is a more widespread stimulation in business now than two years ago. The seasonal decline in loading usually begins around Oct. 15, but comparisons show an increase in the loading of agricultural products and all other commodities as well.

Bad Order Locomotives Show Decrease

Reports received last week from the railroads of the country by the Car Service Division of the American Railway Association show a steady improvement in the condition of motive power belonging to all carriers.

On Oct. 15 last, 19,231 locomotives, or 29.8 per cent of the total on line, were in need of repairs, according to these reports.

This was a reduction of 496 locomotives during the first half of October, there having been 19,727, or 30.6 per cent, in need of repairs on Oct. 1.

Of the total number on Oct. 15 last, 15,935 were in need of repairs requiring more than 24 hours. This was a decrease since Oct. 1 of 378 locomotives in the number requiring heavy repairs. Reports also showed 3,296 locomotives in need of light repairs which was a decrease of 118 within the same period.

At the same time the railroads of the United States had on Oct. 15, 45,187 serviceable locomotives compared with 44,703 on Oct. 1, an increase of 484.

From Oct. 1 to Oct. 15, 11,404 locomotives were turned out of the shops. This was an increase of 191 over the last half of September.

French Steel Industry Improving Rapidly

Commercial Attache Jones, in a cable to the Department of Commerce, reports marked and continued improvement in the French iron and steel industry.

During the first eight months of 1922, France produced 3,136,000 metric tons of pig iron and 2,809,000 metric tons of ingot steel. There were 98 blast furnaces active on the first of September, 61 furnaces ready to operate, and 62 furnaces being constructed or repaired. The general condition of the iron and steel industry is continuing to improve, due especially to a lack of German competition. Depreciation of the franc favors exports, but domestic demand is slightly calmer. Prices are firm or rising. Producers have orders several weeks ahead, and stocks are low, particularly those of pig iron and semi-finished products.

Strong Tendency Marks Southern Iron Market

According to the Southern Metal Trades Association the iron market in the Birmingham district still is at comparatively high prices though there is a very noticeable tendency for the prices to ease off. Many of the makers that were asking $30 a week or ten days back have reduced to $28 in the competitive fields, while the market can be said to stand at $27.50 to $28 per ton. Further slight reductions are looked for and in another week average prices probably will be around $27. Excellent sales still are reported, with the outlook better than it has been in many months. Many manufacturers in the district look for 1923 to usher in another period of inflation, but expect conditions to hold stable enough that the disastrous after effects will not prevail such as followed the last period immediately after the war.

Steel Production in South Africa Growing

Steel production in South Africa is making considerable progress, according to a report to the Department of Commerce from Trade Commissioner Stevenson, though not as much as had been anticipated.

The Union Steel Corporation (of South Africa) Limited, Mr. Stevenson says, is by far the most important factor in the industry, its 1921 production being 14,434 tons of a value of £361,468. The greater part of the output, or 11,573 tons, consisted of open-hearth steel made from scrap materials, while 2,861 tons were made in a 3½-ton Heroult electric furnace. A new 22-inch mill is being installed to roll heavier sections of angles, channels, girders, and similar products from 20 to 30 pounds per foot, and rails up to 60 pounds per yard. A new 25-ton Siemens open-hearth furnace has been erected and when in full working order the capacity of the works will be 30,000 tons a year. The Union Steel Corporation has already supplied a large part of the reinforcing steel contract for the government grain elevators, and has rolled a few rails which have been purchased by the South African Railways for trial purposes.

The Dunswart Iron and Steel Works, Limited, turned out 5,355 tons of iron, valued at £123,165 in 1921. A new 3-roll high 18-inch cogging mill is in the course of erection. It is intended later to manufacture steel castings up to 7 tons in weight.

The Witwatersrand Co-operative Smelting Works, Limited, has erected a new plant at Driehoek, to which the old equipment is being transferred. The capacity of the new plant will be 4,500 tons per annum. The 1921 output was 1,296 tons of shoes and dies, worth £25,900, as against 1,201 tons in 1920, valued at £24,020.

The South African Iron and Steel Corporation, Limited, at Pretoria, was able to operate only during the first four months of 1921, the output being 1,148 tons of pig iron, valued at £11,480, which was slightly below the 1920 figures.

It would appear, Mr. Stevenson concludes, that the local industry has not as a whole made the progress that was anticipated, even allowing for the depression period. Whether the new Iron and Steel Industry Encouragement Act will prove sufficiently attractive to interest capital is open to some question.

Jones & Laughlin Assisting Carnegie Tech Students

To assist students working their way through Carnegie Institute of Technology, the Jones & Laughlin Steel Co., of Pittsburgh, has arranged to employ students in the steel mills on Friday and Saturady nights or all day Saturday. The shifts are of ten hours length.

Jones & Laughlin Co. is the first large concern in Pittsburgh to come to the aid of students in need of finances. The arrangement is pleasing to the administration at Carnegie Tech because of the opportunity it gives to the students in the College of Engineering to acquire practical as well as theoretical knowledge.

Westinghouse Makes Personnel Changes

A number of changes in the personnel of the district offices of the Westinghouse Electric and Manufacturing Co. have been announced by W. S. Rugg, general sales manager of the company.

In the Pittsburgh office, the power division has been changed to the central station division with Barton Stevenson as manager. Mr. Stevenson will also be in charge of the sale of supply apparatus throughout the entire Pittsburgh district. The railway division has been changed to the transportation division, with F. G. Hickling as manager. A merchandising division has also been organised of which F. C. Albrecht has been appointed manager.

A transportation division has been organised in the Philadelphia office and Thomas Cooper has been appointed manager. A central station division has also been organised with H. L. Moody as manager. Mr. Moody will also be in charge of the sale of supply apparatus in the Philadelphia district, assisted by H. F. Brinckerhoff, who has been appointed assistant manager of the central station division. W. P. Cochran will temporarily have charge of the merchandising division, which has been newly formed.

Similar changes have also been made in the Detroit office. A central station division has been established with L. Whiting as manager. Mr. Whiting will also have charge of the sale of supply apparatus. F. D. Koelbel has been made acting manager of a newly created merchandising division. A transportation division has been established with R. L. Hermann as manager.

Changes in address have been made by the St. Louis and Los Angeles offices. The former office is now located at 717 South Twelfth St., St. Louis, and the latter at 420 South San Pedro St., Los Angeles.

Business Items

The Simplex Wire and Cable Co., of Boston, announces the establishment of a branch office in New York City at 130 West 32d St., with Joseph G. Brobeck as manager. Mr. Brobeck has sold Simplex wires and cables in the New York territory since March, 1920, previous to which he was connected with the Simplex sales organization at Boston for nineteen years.

The Reed-Prentice Co., Worcester, Mass., is to sell the Whitcomb-Blaisdell Machine Tool Co. factory on Gold St., Worcester, and will distribute the work to the other plants of the company in Worcester. The Becker Milling Machine Co. plant at Hyde Park, Mass., will be removed to Worcester, and the Hyde Park property sold. The Becker plant has been controlled by the Reed-Prentice interests for a number of years.

The Parker Metal Goods Co., of Worcester, Mass., has recently been incorporated under the laws of Massachusetts, with a capital stock of $[illegible], to manufacture and deal in metal products, specialties, etc. Arthur H. Parker, 3 Roseland Road, Worcester, has been elected president and treasurer of the company.

The Manufacturers Machine Tool and Supply Co., Inc., of Bridgeport, Conn., has recently been incorporated under the laws of Connecticut, to engage in the handling of machine tools, machinery, and mill supplies, etc. The capital stock is $50,000, and the incorporators are: T. Leo Lalley, 647 Water St.; Ambrose A. Johnson, and Albert E. Wright, all of Bridgeport.

Alvord Reamer and Tool Co., Millersburg, Pa., announces the appointment of Paul A. Cuenot as mechanical representative to furnish special tool service to customers. Mr. Cuenot was formerly connected with the American Locomotive Co. and the Pennsylvania Steel Co.

The Black & Decker Manufacturing Co.'s Philadelphia branch office and service station, formerly located at 318 North Broad St., has re-located, the new address being 824 North Broad St. The new quarters are much more commodious and up-to-date than the old ones.

The Mack Trucks, Inc., for the quarter ended Sept. 30, 1922, reports net earnings of $1,205,733, after deducting charges for maintenance, depreciation, repairs, etc., compared with $12,633 earned during the same period last year.

The Hudson Motor Car Co. for the quarter ended August 31, 1922, reports a net income of $3,656,218, after Federal taxes, or more than $3 a share on the outstanding capital stock. The income account for the quarter showed profits of $4,183,327; reserve for Federal taxes, etc., $527,109; net income, $3,656,218; dividends, $600,247, and a surplus of $3,055,971.

The United States Hoffman Machinery Corporation for the quarter ended Sept. 30, 1922, reports gross sales of $1,528,241, against $1,381,200 in the previous quarter. Net income, after all expenses, but before taxes, totaled $255,435, against $214,984 in the previous three months.

The Seneca Falls Manufacturing Co. of Seneca Falls, N. Y., makers of machine tools and specializing in lathes has been placed in the hands of a receiver by Federal Judge Cooper. Kenneth Bartlett, assistant treasurer of the corporation and William McGreevy of Geneva have been appointed receivers. The petitions filed in Federal court show assets of $673,000 and liabilities of $238,000. The liabilities largely consist of bonds involving $210,000 held by banks and protected by real property said to be worth considerably in excess of the total debts. The capital of the company comprises $500,000 in preferred stock and 15,000 shares of common stock of no par value. The report shows that the business of the company during 1921 and 1922 has been about ten per cent of normal.

The Harrisburg Bar Mill plant, owned by J. K. White, has been purchased by the Harrisburg Pipe and Bending Co., and will be operated by the new firm. E. C. Frey is general manager and treasurer of the Harrisburg Pipe and Bending Co., Harrisburg, Pa. No immediate changes are contemplated.

The Reliance Gauge Column Co., Cleveland, Ohio, announces that its Cleveland Clutch business has been sold to The Western Engineering and Manufacturing Co., 360 E. Grand Ave., Chicago, Ill., which has been incorporated as a subsidiary of the Western Valve Bag Co. for the purpose of taking over the manufacture and marketing of this clutch.

The M. and H. Piston Ring Co., capitalized at $100,000, has filed articles of incorporation with the county clerk in Oakland, Cal. The directors are: John and Charles I. Chartz, Chas. A. McCharles and R. C. Savage, all of Carson City, Nevada.

The Cleveland Twist Drill Co. announces the retirement on November 1, of E. G. Buckwell, secretary and sales manager of the company.

The Scovill Manufacturing Co., manufacturer of brass goods, etc., Waterbury, Conn., is planning the increasing of its capital stock from $5,000,000 to $15,000,000, the amount of increase to be divided into 100,000 shares of $100 par value each. The authorization of the increase was granted the company at the last session of the State Legislature.

The Wm. H. Field Co., machinery dealer, 39 Washington St., North Boston, Mass., is erecting a large one-story 60 x 250 brick and frame machinery warehouse for its own use on Dorchester Ave., South Boston.

The Bee Machine Co., of Lynn, Mass., has recently been incorporated under the laws of Massachusetts, to conduct a general machinist business. The capital stock is $15,000, and the officers chosen are: Frank S. Belliveau, president; Melvin P. Rhodes, vice-president; and Vincent W. Burke, of 32 Baker St., Lynn, treasurer.

The Dunbrack Tool and Die Co., of Waltham, Mass., has recently been incorporated under the laws of Massachusetts, with a capital stock of $20,000. Warren H. Dunbrack has been elected president; and Norman K. Dunbrack, Prospect Hill Ave., Waltham, has been elected treasurer.

Charles J. Britt, of Wilmington, S. C., and P. T. Jones, Jr., of Corinth, Miss., are engaged in the formation of a company that is to establish a plant, probably at Wilmington, for the manufacture of a new traction engine and tractor recently invented and patented by Mr. Britt.

The Norwalk Iron Works Co., pioneer builder of compressors, manufacturing air and gas compressors for all purposes and also refrigerating machinery, with general offices and works, South Norwalk, Conn., has just opened a Chicago office. It is located at 627 W. Washington Boulevard and is in charge of L. R. Bremser who, for thirteen years, was associated with The Gardner Governor Co.

The Cleveland Twist Drill Co., announces the appointment of W. E. Caldwell, formerly assistant sales manager, to the position of sales manager to succeed E. G. Buckwell, recently retired.

The Inopco Corporation has been organized and incorporated in Atlanta with $200,000 capital, to establish a plant in that city for the manufacture of machinery used in the extraction of

Condensed-Clipping Index of Equipment

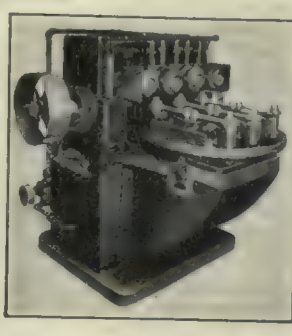
Patented Aug. 20, 1918

Milling Machine, Four-Spindle, Knee-Type, Model C-76

Consolidated Machine Tool Corporation of America, New York, N. Y.,

Newton Machine Tool Plant, Philadelphia, Pa.

"American Machinist," September 28, 1922

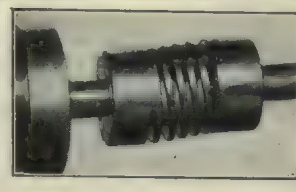


The machine is intended for facing and slotting connecting rods in one operation and at high speed. The drive is by belt transmitted directly to the spindles by worms and wormwheels. The four spindles have tapered ends and individual adjustment for varying the distance between the spindle centers. The vertical feed of the table gives a quick upward movement to the knee, and changes to a slow feed for the cut and then to a quick downward movement after which it automatically stops, allowing the table to be indexed. Each fixture has an individual adjustment for varying the distance between the rods. Floor space, 60 in. square.

Coupling, Shaft, Flexible, Cut-Spring

Steel-Flex Coupling Corp., 1712 First National Bank Bldg., Detroit, Mich.

"American Machinist," September 28, 1922



The coupling is all-steel, has a machine cut spring and is made for shafts up to 1 in. in diameter. Its body is formed from a cylindrical tube and hollow-head safety screws secure it to the shafts. The device is intended for direct connecting light-duty motors to small drilling machines or other tools where shafts are slightly out of line and where it is desired that the coupling should reduce the friction in shaft bearings and act as a shock absorber on sudden starts. By bending in the spring, the coupling allows for both angular and parallel misalignments. A standard line of coil-spring flexible couplings for shafts from 1 to 12 in. in diameter is also furnished.

Marking Machine, Bench-Type, No. 13

Noble & Westbrook Manufacturing Co., Hartford, Conn.

"American Machinist," September 28, 1922

The machine is small, inexpensive and capable of marking four lines of $\frac{1}{16}$ in. lettering on flat or cylindrical articles up to 2 in. in diameter. The marking is done by means of cylindrical steel marking dies. On flat articles the die rolls over the work, and on cylindrical articles both the die and the work roll together. Pressure is applied from the top and not upward through the table as in the larger models. The table can be raised by a handwheel in steps of thousandths of an inch and locked in the proper position. It is furnished with one die holder of suitable design for either flat or cylindrical parts. Bench space, 10 x 12 in. Weight, 60 pounds.

Dresser, Wheel, for Vertical Surface Grinding Machine

Pratt & Whitney Co., 111 Broadway, New York, N. Y.

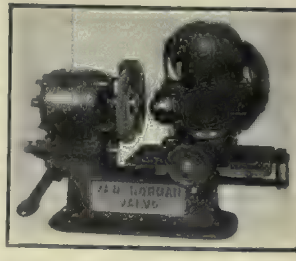
"American Machinist," September 28, 1922

The device is for dressing wheels of vertical surface grinding machines without the danger of injury to the operator. It consists of a bracket bolted or riveted to the wheel guard and supporting the stem on which the dresser proper is pivoted. The dressing wheels are held in one end of a bent bar so that they come to position on the face of the wheel. The other end of the bar forms a handle so that the wheels can be easily moved into position. The dressing wheels can be moved on the face of the grinding wheel in the same manner as the hand dresser is employed. No change in the set-up of the work or wheel is necessary when the dressing is done.

Grinding Machine, Poppet Valve, Self-Contained, Small, "Valvo"

Van Norman Machine Tool Co., Springfield, Mass.

"American Machinist," September 28, 1922

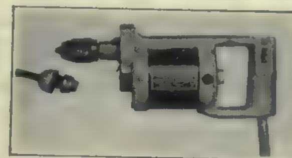


The machine is for grinding the poppet valves of automotive engines. The grinding wheel is mounted directly on the shaft of a $\frac{1}{4}$-hp. motor, while the work head spindle is driven by gearing from a 1/20 hp. motor. The swiveled work head is carried on a movable slide operated by a handle at the left. The valve stem is held in a split draw-in collet which has a capacity up to $\frac{11}{16}$ in. in diameter. The valve is passed across the face of the wheel, while the work is fed to the abrasive wheel by the hand feed wheel at the right. The reamer for the valve seat can be ground at the same setting. Length, 20 in. Width, 15 in. Height, 16 in. Wheel size, 6 x $\frac{3}{8}$ in. Weight, 110 pounds.

Drill, Electric, Portable

Titan Manufacturing Co., 140 So. Dearborn St., Chicago, Ill.

"American Machinist," September 28, 1922

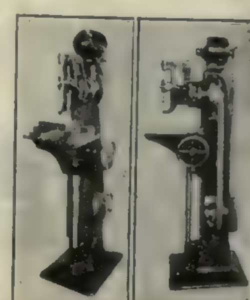


The drill is of the universal type and will operate on either a.c. or d.c. It runs at high speed on light loads and slows down on the heavier loads, providing the proper change in speed for different sizes of drills. The windings are coated with a special compound and baked 90 hours, resulting in a solid coil from which the wires cannot work loose. A vent is located in both the upper and lower branches of the handle, the air being discharged in front of the housing. A spring stop holds the armature from turning when opening or closing the chuck. The quick-break switch located in the handle of the drill can be operated by the thumb.

Drilling Machine, Laying Out, K-N

E. L. Krag & Co., 50 W. Randolph St., Chicago, Ill.

"American Machinist," September 28, 1922



The machine is intended for use in conjunction with the Johansson compound slide and blocks for locating holes. A rigid arm extends below the point of the drill so that a bushing of the correct size for the drill can be located just above the surface of the work. The table of the machine is adjustable for height. The spindle housing and the bracket holding the guide bushings are cast in one piece. Six speed changes are provided of from 400 to 4,300 r.p.m. As a routing or milling machine, the tool can be operated with a single-lip cutter. The head of the machine swings 360 deg. It may be removed from the column and mounted on a milling machine.

Sifter and Strainer, Portable, Electric-Driven

J. D. Wallace & Co., 1401 W. Jackson Blvd., Chicago, Ill.

"American Machinist," September 28, 1922

The device is for rapidly sifting and straining and can be hung from any convenient support. The extreme motion of the riddle is only $\frac{1}{16}$ in. from its central position. The motor is connected directly to the riddle. The armature and the shaft of the motor remain stationary and the field and housing revolve at high speed, giving an eccentric or circular vibrating motion to the riddle. A valve trap at the air intake keeps out the dust and dirt. An 18-in. riddle having a No. 2 screen is ordinarily supplied. The straining attachment at the right has considerable capacity both above and below the screen. The device requires very little head room.

Clip, paste on 3 x 5-in. cards and file as desired

vegetable and other oils. James W. Loeway and Edward P. Thompson, of Atlanta, and Herman Bohmann, of Hamburg, Germany, are the incorporators.

The Abrasive Co., Philadelphia, Pa., manufacturer of grinding wheels and abrasive materials, is now operating at 90 per cent capacity, according to reports issued by the company.

The Warren & Irrgang Co., of 238 Dwight St., Springfield, Mass., has bought the factory building in Chicopee, formerly used by the S. Blaisdell, Jr., Co., at a price of $18,000, for the expansion of their production of factory trucks and tractor trailers, and will remove their operations there as soon as necessary alterations have been made in the building.

The Southern Metal Trades Association, headquarters of which are in Atlanta, has started publication of an official monthly organ under the name of The S. M. T. A. It is devoted to a discussion of southern industrial conditions largely, and is edited by William E. Dunn, Jr., secretary of the organization.

The Rabe Pipe and Foundry Co., of Chattanooga, Tenn., according to a recent announcement by R. R. Rabe, president of the company, is planning the immediate construction of a large addition to its present foundry that will increase the daily capacity to about 100 tons. The plant is at North St. Elmo, jus outside Chattanooga.

The Facto Motor Trucks, Inc., Springfield, Mass., has taken out a building permit for a brick, steel and concrete building to cost $35,000, to meet the requirements of the company's new 2½-ton truck about to be put into production. The building is to be located at 296 Pecousic Boulevard, where the company already has a small building in which the experimental work has been done. Adolf A. Geisel is manager, and H. G. Farr, formerly chief engineer for the Knox Motors Co., is in charge of plant production.

The Independent Pneumatic Tool Co., Chicago, announces that Harry J. Keefe, formerly manager of the order department of the company, has just been appointed to the position of purchasing agent, in place of Thomas J. Keegan, resigned.

Personals

D. K. HITCHCRAFT has been made district manager of the new branch of the Chicago Pneumatic Tool Co., at Tulsa, Okla.

E. G. BUCKWELL, secretary and sales manager of the Cleveland Twist Drill Co., and associated with that organization for the past twenty-three years, has retired from active work. He will, however, remain as a director of the company and retain his interests in it.

L. P. CARLTON, for eighteen years connected with the Consolidated Press Co., but during the past two years devoting his time to the field of farm and landscape equipment, has again become active in the press line. He has recently been appointed western sales manager of the V. & O. Press Co., of Brooklyn, N. Y.

R. H. WOOD, formerly Chicago manager of Modern Tool Co., has been appointed manager of the small tool department of the Consolidated Machine Tool Corporation, Detroit, Mich. The interests of that organization having been taken over recently by the Consolidated Machine Tool Corporation.

OTTO H. OLSON has been promoted to the position of general foreman of the Barber-Coleman Co., Rockford, Ill. Mr. Olson entered the employ of the company in 1905 as an apprentice and completed his course in 1908. Since that time he has held foremanship positions in many departments of the plant.

OGDEN R. ADAMS of Rochester, N. Y., who for the past eighteen months has been associated with the Seneca Falls Manufacturing Co., Inc., in the capacity of president and general manager, has severed his connection with that corporation, his resignation becoming effective as of Nov. 1, 1922. Mr. Adams will hereafter devote his entire time to his business interests in Rochester, Buffalo, and Syracuse.

A. H. HUNTER, president of the Atlas Steel Corporation, formed by the merger of the Atlas Crucible Steel Co., and the Electric Alloy Steel Co., has resigned.

W. NOCHUMSON, western representative of Clark Equipment Co. and Clark Tructractor Co., has moved his headquarters from 86 East Randolph to 30 North Clinton Street, Chicago, Ill.

Obituary

JOHN S. LESTER, 1185 Peachtree St., Atlanta, for the past twenty years southern representative of the Remington Arms and Ammunition Co., of New York, died recently in New York City, after an illness of about two weeks. Mr. Lester was 54 years of age.

GENERAL LUCIUS ALBERT BARBOUR, of Hartford, Conn., prominent in industrial circles of Connecticut, died at his home in Hartford, Monday, November 6, after a long illness. He was 76 years of age and at the time of his death was a director of Landers, Frary, and Clark Co., New Britain, Conn., and several other industrial organizations, and financial institutions.

HERBERT T. GRANTHAM, vice-president of the Belmont Iron Works, Philadelphia, died suddenly in that city, Nov. 5.

W. D. NORTON, for many years a prominent figure in Cincinnati business circles, died last week at Magnetic Springs, Ohio. For several years Mr. Norton and his brother, Clair H. Norton, conducted the business known as the Norton-Broadway Machinery Co., at 238 Broadway, New York City.

GEORGE T. MONTGOMERY, head of Montgomery and Co., Inc., dealers in tools and hardware supplies, 105 Fulton St., New York City, and a director in the Thompson Meter Co., Brooklyn, died at his home in New York City, November 7, at the age of 50. He was prominent in civic and club affairs. He leaves a wife, two daughters, a brother and three sisters.

Book Reviews

Export Merchandising. By Walter F. Wyman, Sales and Export Manager, the Carters' Ink Co. Four hundred and five pages, 6 x 9; 15 special inserts. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $4.

Here is a really good business book on a subject of first importance. It comes at a time when America is adjusting her glass for a broader and more minute inspection of international commerce; when the real significance of overseas trade is beginning to dawn in American industry; at a period when the county is upon the threshold of an era which will be marked by keen conquest for markets abroad and in which only the fittest and best prepared will survive.

Here and there in America are found a few products which have become international household words. A cursory examination to discover the reason for this condition develops at the outset the fact that there has been within each organization a very broard, definite and thorough foreign trade policy. Of such is Carters' Ink and to the author of Export Merchandising, Mr. Walter F. Wyman, belongs to a very great extent the credit for its success. He speaks with authority and wide experience.

The book opens with a chapter on Common Sense in Exporting Trade. It is all that the title signifies. To those who have long been in the habit of looking upon export trade as a "great business venture," who have been hypnotized by the appearance of a foreign postage stamp in their morning mail, this chapter alone is well worth the price of the book. It is a refreshing, every-day view point and shows that, fundamentally, there is but little difference between foreign and domestic business.

In the second and third chapters the desirability of entering foreign markets is stressed as a measure of insurance against dull periods at home. The necessity for establishing, at the outset, a sound export policy is made clear with common sense reasons as to why and wherefore.

With these foundations laid, the author plunges into the important matter of organizing for overseas trade, discussing at length in his characteristic practical manner the export department, its functioning, where it should be located, its manager and his qualifications, and the method of securing and training export salesmen.

Chapters XI to XVI are given over to subjects which are of prime importance to every manufacturer who now is engaged in or who may be considering the question of placing his wares on shelves in other lands. The author prepares the field for the salesman and he prepares the salesman for the field. He shows how he cooperates with him and gives his method of developing the trade by correspondence as well as his advertising campaigns.

The last half of the book, Chapter, XVIII to XXXVI are discussions of the great questions of commission houses, exclusive agents and agency contracts, sales campaigns, credits and credit risks and methods of foreign collections.

The book, on the whole, represents the thought and study of a man who has been long identified with foreign trade and whose record is one of eminent success. Its pages are filled with numerous interesting and instructive facts and the entire subject of export mechandising is presented in a manner which does not make reading a burden.

Factory Accounts in Principle and Practice. By Garke and Fells. Two hundred and ninety, 6 x 9-in. pages. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price $5.

The book is a handbook for accountants and manufacturers and contains, in addition to the ten-chapter discussion of systems of factory accounting, appendices, on the nomenclature of machine details and the rating of factories, a table for the amortization of leases, a glossary of terms and a large number of specimen rulings.

The foreword has been written by Mr. Fells and describes scientific methods in business administration and management. The introductory chapter relates the history of the development of the modern factory system and emphasizes the effect of

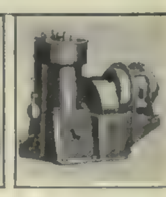
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Hacksaw Frame, "Easy Grip"
Consolidated Tool Works, Inc., 296 Broadway, New York, N. Y.
"American Machinist," September 28, 1922

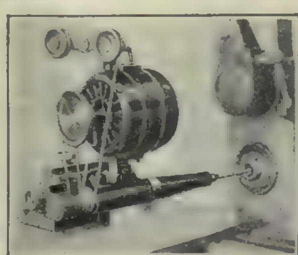
The handle of the frame is so positioned that it affords a comfortable grip for the operator, does not cramp his hand and enables him to obtain a powerful stroke. The frame is made entirely of nickel-plated steel with the exception of the wooden handle. The wing nut for tightening the blade is located at the rear or handle end of the tool, where it is out of the way. The blade may be turned to face in any of four directions.

Compressors, Air, Vertical, Small, Type 15
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.
"American Machinist," October 5, 1922



The machine is built in four sizes in either the plain belt-driven type shown at the left, or the self-contained electric-motor-driven outfit at the right. With the motor drive, the compressor may be driven by means of a pinion and internal gears, or by a short belt. It has a constant-level lubrication system, automatic constant-speed unloader in the belt-driven machine, and centrifugal unloader for controlling the starting and stopping. The smallest size may have either a ribbed, air-cooled cylinder for intermittent service or a water-jacketed cylinder of the reservoir type for constant service. All other sizes are built with the water jacket.

Spindle and Housing Extension for Thread Grinder, "Precision"
Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa.
"American Machinist," October 5, 1922

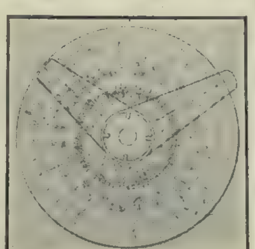


The attachment consists of an extension housing and an extension spindle and is applicable to deep internal grinding. The device has a number of uses and can be mounted on different types of machines. The extension housing is screwed directly on the threads at the front of the spindle cap of the grinder. The extension spindle couples on the end of the regular spindle by means of a tapered joint and is supported by double radial and end-thrust ball bearings at the extreme outer end of the housing. Capacity, 12-in. depth on holes 2 in. or larger in diameter; 6-in. depth on holes ½ in. in diameter.

Lubricator, Bearing, Hand-Operated, High-Pressure, "Dot"
Carr Fastener Co., Boston 39, Mass.
"American Machinist," October 5, 1922

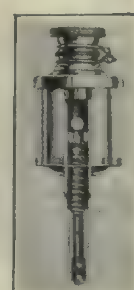
The device is for forcing oil or grease into bearings. Nipples with a spring-loaded ball in the top which automatically closes the opening, are applied to the bearing boxes and can be furnished to face at any angle. The lubricator is fitted with a plunger for ejecting the oil. The nozzle is an integral part of the device and has a special triangular shape to fit the nipples. A slight turn of the handle to the right locks the nozzle to the nipple. With further turning the valve opens and the lubricant is forced under high pressure into the nipple. A quarter turn to the left releases the nozzle and the valve automatically shuts off the lubricant.

Slide Rule, Circular, "Midget"
Gilson Slide Rule Co., Niles, Mich.
"American Machinist," October 5, 1922



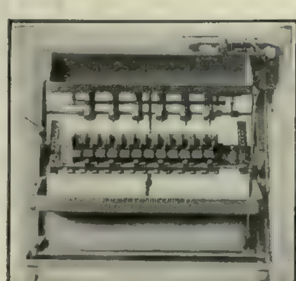
The longer indicator of the rule gives the answer to the problem that is being solved. On the back, scales give the sines, tangents, cosines and cotangents of all angles from 0 to 360 deg., and the decimal equivalents of fractions to six places. The binary scale is divided into 64ths, 32nds and 16ths, and is concentric with another for adding and subtracting decimals and fractions. Concentric with these two scales are the thread and drill size scales. Drills from 60 to 1 and from A to Z are given in thousandths or in 64th of an inch. The drill size to use with any tap of V or U. S. S. thread from 3 to 50 per in. is given. Other scales give logs to the base *e* and the base 10, as well as the square roots and corresponding powers.

Lubricator, Bearing, Ball-Feed, "Auto-Vac"
Kelly Lubricator Corporation, 107 N. Franklin St., Syracuse, N. Y.
"American Machinist," October 5, 1922



In this device a small ball fitted at the bottom of the sliding tube rests on the shaft to be lubricated. This ball is free to rotate in its tube, in which are small oil channels, and which is held in place against the shaft by means of a small spring. The oil adheres to the surface of the rotating ball and is carried to the bearing surfaces by the revolving shaft. Oil is fed only when the machine is in motion. The lubricator is made in four sizes having capacities of ¼, ½, 1 and 2 ounces.

Threading Machine, Tilted, No. 3
Holmes Engineering Co., Oshkosh, Wis.
"American Machinist," October 12, 1922



When equipped for tapping, the machine has both forward and reverse movements for the spindles. The six spindles are placed at an angle of 30 deg. from the vertical. Six of the twelve jigs employed are brought up simultaneously to the taps by a treadle while the six idle jigs are being loaded. A work shelf to accommodate two tote boxes full of parts is located just above the spindles. Capacity: internal threading, taps up to ⅜-in. U. S. S. threads, 1-in. S. A. E. threads; external threading, up to 1 in. U. S. S. or 1½ in. S. A. E. threads. Floor space, 66 x 41 in. Height, 65 inches.

Belt-Lacer, Vise-Operated
Detroit Belt Lacer Co., Detroit, Mich.
"American Machinist," October 12, 1922

The device is for applying wire belt lacing to belting without the use of the regular bench-type closing machine. It is held open by means of a spring so that it retains its position on the vise jaws. When the vise is closed, the jaws come to the proper position to shape the lacing. The device is made of steel, while the magazine is bronze. The standard staggered-type wire belt lacing is employed. The hooks mounted on cards are placed in the closing device and the belt held in position by hand. Pressure from the vise sinks the hooks into the belt and flattens the lacing. Rawhide pins connect the lacing on the two ends of the belt.

accurate accounting on employees. Chapter II deals with labor and under this heading takes up time recorders, wages, wages book, [illegible] traveling and other expenses, factory rules, and rent, and is followed by a diagram of the assimilation of wages and commercial books.

Chapter III discusses stores, covering the purchase of material for plant maintenance, purchasing records, stores accounts, [illegible] to provide expenditures, consumption of material, material returned to vendor, stores rejected book, cost of processes and [illegible] byproducts. The chapter ends with a diagram of the assimilation of stores and commercial books.

Prime cost and the cost ledger are the subjects of Chapter IV. The distinction between stock and stores is brought out, and standard parts, the cost ledger, [illegible] expenditure, work in progress, actual and estimated costs discussed. This discussion is continued in Chapter V under the heading of indirect or incidental expenses and their allocation, followed by diagrams of the assimilation of cost and commercial books.

Fixed capital and depreciation in relation to capital, to current expenditure, to railway and water companies, to reserve funds, to obsolescence, to the life of the object and to the cost of maintenance, as well as the loss on capital, the loss on revenue accounts and the income tax acts, comprise Chapter VI.

Machinery use is the subject of Chapter VII and in this connection the expenditure on the plant, the ratio between the life and the cost of a machine, the idle hour rate, the productive hour rate, the normal machine rate, the cost of fuel, the valuation of patents and goodwill, wasting assets are covered. Chapter VIII deals with stock, its distribution and sales records followed by a diagram of the assimilation of stock and commercial books. Chapter IX gives the value of surveys, stocktaking, the valuation of old material, reduction in the valuation of stocks. The discussion of factory systems is concluded in Chapter X with a description of the subsidiary books essential to accurate factory accounting. The appendices and glossary previously mentioned complete the book.

American Malleable Cast Iron. By H. A. Schwartz. Three hundred eighty-four 6 x 9 in. pages, 196 illustrations. Cloth boards. Published by The Penton Publishing Co., Cleveland, Ohio.

A welcome addition to the literature of malleable cast iron, which, to quote the author, "is limited to a single book first issued about ten years ago and now out of print, and to a series of articles of great diversity of character and quality in the technical publications of this country and Europe."

Mr. Schwartz set himself the task of writing a book for both specialist and layman and has very well accomplished his aim. He suggests that his book may serve a useful purpose as summarizing and recording the contemporary state of the art in the metallurgy of American malleable cast iron in theory and practice. There is much that is elementary, for which the average reader will be thankful. The specialist will find there is ample content aside from that which is elementary.

A selected bibliography forms an appendix. It is classified under four general headings: General Information, Production, Metallurgy and Metallography, Properties and Uses. Two other valuable features are a complete index and a list of illustrations. It is gratifying that the first two chapters tell of the early history of ironmaking and the development of the malleable industry in the United States.

The third to fourteenth (last) chapters treat of the metallurgy and malleable iron; [illegible] thermal and electrical properties.

Belt Conveyors and Belt Elevators. By Frederic V. Hetzel. Three hundred twenty 6 x 9 in. pages, 291 illustrations, [illegible] Cloth boards. Published by John Wiley & Sons, Inc., 432 Fourth Ave., New York, N. Y. Price [illegible].

Knowledge acquired during [illegible] years' experience at drafting board, in the shop, and in the field is given by the author in this thorough treatise on belt conveyors and elevators. The book was written for men who have material to handle—consulting engineers, designers and students. The information is given an analytical presentation most acceptable to these groups, all of which must know the how and why of the methods and equipment they deal with.

The section devoted to belt conveyors begins with a general description of their component parts, follows with a brief history of the development of belt conveyors and then takes up the subjects of belts and their manufacture, how the belts are supported, guided, driven, locked, protected and cleansed, tension devices, discharging methods, conveyors.

Belt conveyors are the subject of the second part. Divisional subjects are centrifugal discharge elevators, elevator buckets, continuous bucket elevators, belts for elevators, fastening buckets to belts, driving belt elevators, elevator boots, inclined elevators, elevator casings.

Why Manufacturers Lose Money. By Robert Grimshaw. 176 pages, 5 x 7½ inches. Published by D. Van Nostrand Co., New York. Price $2.

As stated in the preface, this book is the outcome of a series of lectures on cost reduction delivered by the author in Germany and Austria in 1913 and 1914 and later lectures in this country.

The book is divided into sections dealing with the different causes of losses, such as financial, commercial, organization, technical, personal and miscellaneous. Each cause is taken up in considerable detail and many interesting incidents are given to bear out the points made. Machine equipment, supplies and their purchase, the personnel of workers and many other factors are shown in an interesting manner. There are few who cannot get valuable suggestions from the volume.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Internal combustion engines, machinery and articles suitable for dairymen and farmers—Australia. Purchase or agency desired. Quotations, c.i.f. southeastern Australia. Reference No. 4172.

Complete installation for a large sawmill and for the manufacture of boxes and shooks—Portugal. Purchase desired. Quotations, c.i.f. Portuguese port. Correspondence, French or Portuguese. Reference No. 4186.

Machine for making sisal twine of about 12 strands, and a machine for weaving sacks of sisal twine of various sizes up to 28 by 44 inches. Machine should have a capacity of 1,000 to 2,000 sacks per day of 8 hours—Mexico. Purchase desired. Quotations, f.o.b. New York or New Orleans. Reference No. 4196.

Small locomotives for narrow-gage railway, steam rollers, crushers and all necessary equipment and material for the construction of a harbor and dock—France. Purchase desired. Correspondence, French. Reference No. 4228.

All machinery connected with printing and stereotypography—Switzerland. Purchase desired. Quotations, f.o.b. New York. Reference No. 4230.

Pamphlets Received

Labor and Industrial Conditions in China. Trade Information Bulletin No. 75, by Julean Arnold and William H. Gale of the Department of Commerce. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Algeria. Trade and Economic Review for 1921, No. 19, on the state of trade in Algeria. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Haiti. Trade and Economic Review for 1921, No. 13, on the state of trade in Haiti. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Venezuela. Trade and Economic Review for 1921, No. 14, on the state of trade in Venezuela. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Employers Liability Laws. A compilation of laws relating to mediation, conciliation, and arbitration between employers and employees; laws, disputes between carriers and employees and subordinate officials under the Labor Board, eight-hour laws, etc. Compiled and issued by The House Document Room, House of Representatives, Carl G. Mamberg, Superintendent, Washington, D. C.

Trade Catalogs

Flexible Shaft Driven Tools. The S. S. White Dental Manufacturing Co., Philadelphia, Pa. This company has just published a new catalog of 36 pages, illustrating and describing the numerous styles of flexible shaft driven tools of its manufacture and pointing out their many uses in industrial fields, such as drilling, grinding, polishing, engraving, die sinking, reaming, chasing, sharpening, tool room work, etc.

Midwest Steel Sections. The Midwest Steel and Supply Co., 28 West 44th St., New York City. This company has just published a fifty-four page Architect's and Engineer's Data Book covering Midwest steel sections for overhead shafting layouts and anchorage of piping, cables, machinery, monorails, car tracks and other equipment. The publication has been prepared with care and is replete with illustrations and line drawings of characteristic installations.

Bullard Mult-Au-Matic Operator's Handbook. The Bullard Machine Tool Co., Bridgeport, Conn. This company has just issued a 93-page handbook for operators of the Bullard Mult-Au-Matic machines which is of exceptional value not only to present users of this type of equipment, but to all companies seeking quantity production at low cost. The handbook discusses in detail the construction features of the machine, its operation and care, methods of setting up, speed and feed data, standard tool equipment, and contains a great many diagrams, line drawings, charts and other valuable data related thereto. Every effort has been made to make the instructions complete and cover every function of the machine. The diction and diagrams are marked by simplicity and clearness.

Forthcoming Meetings

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association. Fall meeting, Hotel Astor, New York City, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon. Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16, Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21, Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Society for Testing Materials. Annual meeting at Atlantic City, June 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

New and Enlarged Shops

Machine Tools Wanted

Ala., Anniston—Kilby Pipe Co., (manufacturer of cast iron pipe, fittings, etc.), E. M. Kilby, Pres.—foundry and machine shop equipment.

Fla., Odessa — Dowling Bros. — power house, machine shop and lumber mill equipment.

Ga., Rome—Battey Mchy. Co., West 2nd Ave., J. Cunningham, Secy. and Treas.—gear cutter, similar to No. 13, Brown & Sharpe.

Mass., Ashland — Lombard Governor Co. (manufacturer of governors, etc.)—boring mill and tool room lathe (used).

Mass., Jamaica Plain (Boston P. O.)—W. F. Somes, 38 Green St. (machine shop)—one 15 ft. x 8 ft. to 0 in. screw cutting lathe, also small bench grinder (used).

Mo., Valley Park—Barbour Boat Co.—reversible shaper.

N. Y., Buffalo—F. L. Bumpus, Jr., 1431 Seneca St.—machinery, tools and equipment for gasoline and automobile service station at 1437 Seneca St.

N. Y., Buffalo—C. B. Druar, 233 Dearborn St.—auto repair tools for garage at 282 Franklin St.

N. Y., Buffalo—S. Jacobson, 1168 Abbott Rd.—equipment for automobile repair shop and service station on Abbott Rd. and Bailey Ave.

N. Y., Buffalo—McKaig & Hatch, Ontario and Skillen Sts.—20 or 24 in. production drill press, either 1 or 2 spindles.

N. Y., Buffalo—P. C. Schasre, 128 Arkansas St.—equipment for mechanical automobile repair shop.

N. Y., Naples—E. D. Cornish & Son—machinery, tools and equipment for garage and service station on Main St.

N. Y., Newburgh—J. F. Pittishnock, 66 Bridge St. (jewelry repairing) — power lathe, counter shaft and chucks.

N. Y., New York—A. Loewy, 200 5th Ave.—4 die presses.

N. Y., New York—Logan Constr. Co., 15 Park Row—portable Toledo pipe threading machine.

O., Columbus—Stitt Ignition Co., 16 East First Ave., (manufacturer of spark plugs) B. F. Stitt, Vice. Pres.—automatic screw machine to increase capacity.

Okla., Enid—Kingham Machine Shop, A. Kingham, Purch. Agt.—engine lathe with 14 to 16 ft. bed, also milling machine, belting, shafting, pulleys and hangers.

Pa., Nanticoke — The Nanticoke Garage Co.—machinery and equipment for proposed $65,000 garage on Spring St.

Pa., Pittsburgh — Atlantic Refining Co., Chamber of Commerce Bldg.—mechanical machinery and equipment for large gasoline and service station on Franklin and Main Sts., Titusville.

Pa., Pittsburgh—Atlantic Refining Co., Chamber of Commerce Bldg.—machinery, tools and equipment for proposed large gasoline and service station on Pennsylvania Ave. and Water St., Warren.

Pa., Pittsburgh—Neely Nut & Bolt Co., 26 South 22nd St.—lathe, shaper, grinder, miller, hacksaw, drill press and arbor press.

Pa., Pittsburgh—The Pennsylvania R.R., Pennsylvania Sta., W. G. Phelps, Purch. Agt.—list of machine tools for Columbus, O., shops.

Wis., Baraboo—Allan-Diffenbaugh Wrench & Tool Co., L. A. Maisel, Mgr.—machinery and equipment for the manufacture of wrenches, tools, etc., also power machinery.

Wis., Kiel — A. B. Bessler — drill press, lathe, emery wheel and air compressor for garage.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., (manufacturer of patented mechanical articles), C. A. H. Bahde, Purch. Agt.—speed drills and emery wheels.

Wis., Milwaukee—Sun Light Aluminum Co., 280 East Water St.—29 in. power paper cutting machine and bench shears.

Wis., Racine—Heeter & Heeter, Inc., 1309 Rapids Drive, R. Heeter, Purch. Agt.—repair machinery for garage, including drill press and air tank.

Ont., Toronto—The Toronto Motor Car Ltd., 52 James St.—equipment for proposed $100,000 garage on Jarvis St.

Machinery Wanted

Calif., San Francisco—The Banner Refining Co., Kohl Bldg.—machinery for proposed refinery on Islais Creek.

Calif., San Francisco — The city and county of San Francisco, M. M. O'Shaughnessy, Engr., City Hall—receiving bids until Dec. 6 for one 4 motor electric traveling crane, 8 wheel type with maximum working load of main hoist 270,000 lbs., and auxiliary hoist 30,000 lbs. Approximate maximum speeds of operation with full working loads shall be as follows: main hoist 4 to 5 ft. per minute, auxiliary hoist 25 to 28 ft. per minute and trolley and bridge travel 60 to 80 ft. per minute.

Conn., Seymour—Seymour Mfg. Co. (copper and silver goods)—10 iron body mill trucks, length 10 to 12 ft.

Conn., Waterbury — Hamilton Bottling Wks., Burton St.—equipment for proposed bottling plant.

Fla., Apalachicola—W. L. Papham—electric refrigeration machinery.

Idaho, Nampa — Job Printer, 202 Colonial St.—complete newspaper equipment, including press, linotype, paper cutter, belting and hangers.

Ill., Chicago—Bunge Bros. Coal Co., 1648 West Lake St.—one coal crusher.

Ill., Chicago—Jointless Fire Brick Co., 1130 Clay St. — machinery for proposed brick manufacturing plant at Trenton, N. J.

Ill., Chicago—Print Shop, 1212 Addison St.—22 x 25 in. pony press.

Ill., Chicago—The Western Feed Manufacturers, 345 North Elizabeth St.—portable mechanical conveyors and pilers; automatic scales; feeders, motor power for feed mill at Rice Lake, Wis.

Ill., Morrison — Shawyer Printing Co. — galley proof press and type cabinets.

Ill., National Stock Yards—Natl. Publishing Co.—saw trimmer for power equipment.

Ind., Kokomo—E. Hersenberger, Box 602—printing press, power equipment, also hand wire stapler.

Ia., Iowa City—State University of Iowa, A. V. O'Brien Supt. of Shops—small size electric furnace, resistance type; recording pyrometer; 1,000 lb. steam hammer; Arc welding equipment; one 18 to 20 in. pattern makers' lathe, with slide rest; one 16 to 18 in. disc sander; one Universal wood workers' vise; also two 14 in. x 5 ft. engine lathes.

Kan., Wichita—H. S. Hoefflen, 1516 North Waco Ave. (woodworker)—110 volt, 2 hp. motor, belting, rip saw, shafting, hangers and pulleys.

Ky., Lexington—Lexington Battery Mfg. Co., 416 West Short St.—machinery and equipment for proposed $75,000 plant, to replace that which was destroyed by fire.

La., New Orleans—R. C. Ostendorf, 1539 Canal St. (automobile repairing and paint shop)—welding outfit, paint removing machine and a small size electric drill (new or used).

La., Sterlington (Ouachita P. O.)—Imperial Oil & Gasoline Products Co.—machinery and equipment.

La., Sterlington (Ouachita P. O.)—Thermatomic Carbon Co., (manufacturer of carbon black and by products)—machinery and equipment for proposed addition to plant.

La., Windsor (Doss P. O.)—Texas-Louisiana Producing & Carbon Co.—machinery and equipment for plant for the manufacture of carbon black and similar products.

Me., South Sanford (Sanford P. O.)—Jagger Bros.—equipment for addition to spinning mill.

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg. (machinery)—crane, 75 ft. beam, electrically operated, capable of handling 2 yd. clamshell on 60 ft. radius; shovel, electrically operated, 3 yd. dipper, caterpillar or traction tread.

Md., Baltimore—Holtite Mfg. Co., Warner and Ostend Sts., (manufacturer of rubber heels, etc.), A. A. Esterson, Secy. and Treas.—40 in. mills.

Mass., Boston—Handschumacher & Co., 25 John St., (meat packers and wholesalers)—packing and cold storage machinery and equipment for proposed plant at 16 North St.

Mass., Boston—Knox & Morse Co., Inc., 140 Oliver St. (manufacturer of chemicals)—chemical manufacturing machinery of various kinds.

Mass., Boston—J. C. Santis, 149 Cummings St.—one automatic weighing machine and several 1 to 3 lb. packaging machines (used).

Mass., Millbury—S. E. Hull Co. (woolen mill, shoddy, etc.)—machinery for shoddy mill.

Mass., North Chelmsford—Lowell Textile Co., J. Reed, owner—woolen mill machinery.

Mass., Pittsfield — Clarknit Mills, Inc., (knitting mill), J. A. Clark, Treas.—machinery for mill.

Mich., Detroit—Chevrolet Motor Co., General Motors Bldg.—miscellaneous machine equipment for general automobile finishing, for proposed factory at Norwood, O.

Mo., Kansas City—The Lion Oil & Refining Co., 622 Finance Bldg., V. H. Smith, Secy.—10 or 12 complete Burton type oil stills, also a considerable amount of tankage.

N. H., Tilton—A. S. Brown Mfg. Co.—hosiery dyeing machine.

N. H., Tilton—E. W. Charland—textile machinery for small cotton and woolen goods manufacturing plant, including power cutting, sewing and stitching machines, etc.

N. J., Trenton—Castanea Dairy Co., 234 North Broad St.—machinery for proposed plant.

N. J., Trenton—F. A. Straus & Co., Johnson Ave. (manufacturer of worsted and silk yarns), W. Foster, 369 West State St., Gen. Mgr.—$150,000 worth of machinery for plant recently purchased.

N. Y., Alfred—C. D. Reynolds Co.—refrigeration and cold storage machinery and equipment to replace that which was recently destroyed by fire.

N. Y., Batavia—Gray Machine & Parts Corp. (manufacturer of wrenches)—machinery and equipment for large addition.

N. Y., Brockport—E. H. Norton and others—machinery for addition to plant for the manufacture of power spraying equipment.

N. Y., Buffalo—The Standard Milling Co., c/o A. E. Baxter, Engr., Ellicott Sq.—machinery and equipment for proposed flour mill, 30,000 bbl. daily capacity, on Outer Harbor.

N. Y., Buffalo — J. A. Walter Milling Co., Chamber of Commerce Bldg.—machinery and equipment for flour mill on Ohio St. and Erie Basin.

N. Y., Franklinville—Ontario Knife Co.—equipment for proposed addition to knife factory.

N. Y., Geneva—A. E. Meyers, 150 Castle St.—one crane and clamshell outfit, and one portable sand digger and loader.

N. Y., New York—McGowan & Connolly Co., 739 East 151st St., (marble)—lathe for turning stone column, 10 ft. long and 2 ft. diameter.

N. Y., New York—Natl. Biscuit Co., 85 9th Ave.—repair equipment for new shop on West 16th St.

N. Y., Rochester — Rapps Dry Cleaning Co., 398 South Ave.—complete mechanical equipment for $4,000 cleaning plant.

N. Y., Tonawanda—American Kardex Co., Main St. (manufacturer of Kardex filing system and equipment for offices)—machinery and equipment for proposed 2 story addition to factory on Main and Wheeler Sts.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Lead quoted in New York at 7½c. as against [illegible]; zinc, 7¾c. as compared with 7⅝c. per lb., last week. Prices higher in St. Louis. Improvement shown in copper inquiries. Advance of ½c. in zinc sheets in New York and in brass rods in Cleveland; solder up 1c. per lb. in both cities. Cleveland warehouses also advanced babbitt metal 2c. and scrap lead ½c. per lb., during week. Linseed oil market trifle softer; but Chicago advances price 1c. per gal. Buying better in lubricants; prices firm. Demand steadier for lard oil; New York quotes 60c. as against 55c. per gal. Discounts reduced about 10 points on leather belting.

Declines—Maximum on blue annealed steel sheets down 10c.; black and galvanized, 25c. per 100 lb., f.o.b. Pittsburgh. Mill price of shapes, plates and bars firm at $2 per 100 lb. on ordinary tonnages; shading of $1@$2 per ton on large inquiries. Some of the more attractive tonnages on shapes, have been taken at $1.90, but special or undesirable plate business, quoted as high as $2.10@$2.15 per 100 lb. Electrolytic and scrap copper both down ½c. per lb. in New York warehouses. Connellsville coke reduced 50c. per ton; improvement in car supply.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]@2.75	4.[illegible]	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21	[illegible]	4.70	4.20	4.70
Nos. 22 and 24	[illegible]	4.75	4.25	4.70
Nos. 25 and 26	[illegible]	4.80	4.30	4.75
No. 28	[illegible]	4.90	4.40	4.85
Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.35@3.60	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.70	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.00	5.30	4.80	....
Nos. 22 and 24	3.90@4.15	5.45	4.95	5.40
No. 26	4.05@4.30	5.60	5.10	5.55
No. 28	4.35@4.60	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	38.00
Lead (up to carlots), St. Louis 6.80@6.85; New York	7.50
Zinc (up to carlots), St. Louis 7.20; New York	7.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	4.75
Lead, tea	4.25	4.50	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		$8.00	
Coke, prompt foundry, Connellsville...per net ton		10.00@12.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40–10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55–5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.60	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30–10%	40½%	50%
Heavy grade	20–5–2½%	30–5%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40–10%
Second grade	65–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. C., Concord—Locke Cotton Mills Co. [illegible]—several [illegible] & Knowles [illegible] looms, 30 in. 2-box style.

N. C., Stanley—Lola Gingham Mills, Inc. —machinery and equipment for proposed $250,000 mill for the manufacture of ginghams and cloth.

O., Akron—General Tire & Rubber Co.—additional machinery and equipment for proposed 2 unit plant.

O., Alliance—Amer. Steel Fdry. Co.—4,000 lb. steam forging hammer.

O., Canfield — Dispatch, (newspaper) — model No. 1 linotype (new or used).

O., Cleveland—Denby Wire & Iron Co., 1119 Euclid Ave. (manufacturer of wire railings, bank fixtures, etc.)—additional machinery and equipment for new 1 story plant at [illegible] East 56th St.

O., Cleveland—H. M. Warner, Engr., Public Auditorium, Lakeside and East 6th Sts. —one floor sanding machine.

O., Cleveland—H. P. Whitworth, Archt., 124 Hixon Bldg.—one chain belt conveying machine.

O., Columbus—Arrow Sand Co., Hartman Bldg., S. Stephanian, Purch. Agt.—conveying machine for overhead storage on Grandview Rd.

O., Columbus — Col-O-Hi Battery Co., Dublin Ave., J. D. Saley, Purch. Agt.—wood and metal working machinery.

O., Columbus—Columbus Varnish Co., 264 Conserve St., W. S. Hanna, Pres.— varnish making machinery (new), canning and labeling machinery for proposed addition to factory.

O., Columbus—Rainbow Tire & Rubber Co., 402 Southern Hotel, C. E. Ross, Pres.— [illegible] presses, curing machines for plant at Delaware.

O., Delaware—The Sunray Stove Co.— machinery and equipment for proposed addition to factory.

O., Fremont—Stull-Boylston Co. (manufacturer of pens and pencils)—machinery and equipment for proposed plant at Lima.

O., Leetonia—Fabricated Steel Products Co.—[illegible] fan, 30 or 36 in., belt driven (used preferred).

O., Middletown—The Journal—Mergenthaler linotype and other printing equipment.

O., Newark—Tucker Boiler Works Co.— machinery for the manufacture of steel tanks, also welding equipment.

O., Somerset—Belden Brick Co., G. Brand, Supt.—machinery and equipment for addition to brick manufacturing plant.

Okla., Oklahoma City—The New State Ice Co., 2 West 3rd St.—ice making machinery for new addition.

Okla., Stamps—Blackfoot Lumber Co.— machinery and equipment for proposed [illegible] mill to replace that which was destroyed by fire.

Ore., Portland—F. L. Evans, 412 Consolidated Security Bldg. (Industrial Engineer)—one to six 10 ton units for converting sawdust and wood waste into cattle feed, also to save the by products.

Ore., Portland—F. E. VanHank, 3212 68th St., S. E.—one universal woodworker with either band or scroll saw, lathe, shaper and planer, electrically driven.

Pa., Apollo—Apollo Steel Co., A. McCarthy, Purch. Agt.—two 15 ton cranes.

Pa., Catasauqua — Braden Horse Shoe Co. (manufacturer of horse shoe calks)— machinery and equipment for new plant.

Pa., Coatesville—Lukens Steel Co.—machinery and equipment for 4 unit plant and warehouse at New Orleans, La.

Pa., Corry—The Corry Radiator Corp. —machinery and equipment for proposed foundry.

Pa., Irvine—National Forge & Tool Co.— forge and tool shop equipment.

Pa., Monessen—The Monessen Fdry. & [illegible]—equipment for foundry to replace that which was destroyed by fire.

Pa., Phila.—Arata Dye Wks., Front and [illegible] Sts., J. P. Arata, Purch. Agt.— [illegible] dryers and other machinery for new drying plant.

Pa., Phila.—[illegible] Ice Cream Co., 9th and [illegible] Sts.—ice manufacturing machines, [illegible], wrapping and packing machines, conveyors, etc., for new plant.

Pa., Phila.—[illegible] Mills Co., 43 South Front St.—3 or 4 cylinder Garnett machines, 30 x 60 in.

Pa., Phila.—General Paper Products, 2420 Lancaster Ave. (manufacturer of paper and tin containers), G. L. Hornley, Purch. Agt.—creasing machines, dies and general metal and paper working machines.

Pa., Phila.—R. T. Moorehouse Paper Co., Bridge and Thompson Sts.—one power rotary coal and gravel screening plant.

Pa., Phila.—Mountain Valley Bottling Co., 1626 Water St. (manufacturer of beverages), R. R. Hogan, Purch. Agt.—automatic bottle washing and filling machinery.

Pa., Phila. — Winer Bakery, 60th and Osage Ave., J. Winer, Purch. Agt.—dough mixers, trays and furnaces for bakery.

Pa., Pittsburgh—Gulbert Steel Co., Diamond Natl. Bank Bldg.—crane for new plant.

Pa., Pittsburgh—Mackintosh, Hemphill & Co., Engrs., foot of 12th St., A. Garrison, Fdry. Dept., Purch. Agt.—crane.

Pa., Wilkes-Barre — Diamond Drug Co., 116 East Northampton St., B. Miller, Dir. and Mgr.—machinery and equipment for the manufacture of a complete line of drugs, etc.

Pa., Williamsport—D. Updegraff & Co., Canal and Market Sts. — machinery and equipment for addition to monument works.

Pa., Windgap—A. F. Teel (slate mill)— grinding, cutting and finishing machinery.

Tex., Dallas—Print Shop, 2326 Live Oak St.—Chandler & Price power job printing press (used).

Tex., Fort Worth—The Printer, Box 845, —12 x 17 in. job press, paper cutter, wire stitcher, shafting, motor belting, hangers and pulleys.

Tex., Paris—The News, —job press, belting, hangers, shafting, pulleys and linotype.

Tex., Temple—J. J. Palmer—woodworking machinery, saws, belting, pulleys, hangers, bearings, shafting and sander.

Vt., Northfield — The Nautanna Worsted Co., Inc. (manufacturer of textiles)—equipment for carding room.

Va., Lynchburg — Lynchburg Fdry. Co., Peoples Natl. Bank Bldg.—pattern shop equipment.

Va., Richmond—The Wheeling Corrugating Co., 801 McDonough St.—machinery for proposed addition to factory for the manufacture of corrugated products.

W. Va., Clarksburg — Tygarts Valley Fuel Co., E. M. Prendergast, Dir.—machinery and equipment for extensive development of coal properties.

W. Va., Greenview—Greenview Coal Co., E. G. Watkins, Pres. and Mgr.—hoisting machinery and mining equipment.

W. Va., Parkersburg—Ideal Corrugated Box Co., Jeannette St.—corrugating machine.

Wis., Appleton — Kaukauna Quarry Co., c/o J. P. Frank, 803 College Ave—crushing machinery.

Wis., Chilton — A. A. Berger — sausage making, grinding and power machinery.

Wis., Crandon—The Vulcan Last Co.— power machinery for proposed shoe factory.

Wis., Fond du Lac—Combination Door & Screen Co., 180 Ruggles St.—woodworking machinery for proposed factory on Military St.

Wis., Green Bay—The Bond Pickle Co., Platten Bldg.—machinery for packing plant at Oconto.

Wis., La Crosse—Cameron Motor Car Co., 127 South 6th St.—gasoline storage tank with pump for proposed garage.

Wis., Madison—Capital Plating & Machine Co., 639 West Wilson St.—machinery and equipment for the manufacture of windshield spot lights, etc.

Wis., Madison — Madison Pattern Wks. Co., 2015 Winnebago St., W. J. Polk, Purch. Agt.—equipment for new pattern shop.

Wis., Manitowoc—Invincible Metal Furniture Co.—nickel plating machinery for the manufacture of vaults, safety deposit boxes, etc.

Wis., Menomonie—E. V. Johnson—repair machinery, gasoline storage tank, pump and air tank for garage to replace that which was destroyed by fire.

Wis., Milwaukee—J. J. Eckert, 701 56th St. (carpentry and millwork) — Universal woodworker.

Wis., Milwaukee—Federal Rug Cleaning Co., 914 Winnebago St.—cleaning equipment for proposed addition to factory.

Wis., Milwaukee—W. D. Mann, 204 Grand Ave. (machinist)—woodworking machinery (used).

Wis., Milwaukee—Wenzel & Henock Co., 498 27th St. (heating and plumbing)—unloading crane and belt driven air compressor.

Wis., Mosinee—The Mosinee Times, L. E. Osborne, Mgr.—machinery and equipment for addition to print shop.

Wis., Oshkosh—H. Thew, 53 State St. (woodwork)—band saw.

Wis., Rhinelander—S. Miller Cold Storage Co.—refrigerating and power machinery.

Wis., Rhinelander—The Northern Grain Co., O. C. Nelson, Mgr. — grinding and power machinery for proposed feed mill.

Wis., Rice Lake—Craftsman Job Printing Co.—Gordon job printing press 14 x 22 in. for power equipment (used).

Wis., Stevens Point—The F. & G. Auto Parts Co., 425 Madison St.—air compressor, gasoline storage tank and pump for proposed $40,000 addition to garage.

Wis., Superior—Twin Ports Oil Co., J. E. Vgrezilline, Mgr., — oil storage tanks and pumps for proposed filling station.

Wis., Suring—A. A. Baatz—equipment for new addition to blacksmith shop.

B. C., Vancouver—The False Creek Lumber Co., 6th Ave., W.—saw mill machinery for proposed mill.

Ont., Aylmer—J. L. Thayer & Son—complete equipment for proposed $40,000 garage and automobile repair shop.

Ont., Camperdown — Canada Oil & Gas Co., Ltd.—equipment for drilling.

Ont., Chatham—R. Baxter—equipment for saw mill, to replace that which was destroyed by fire.

Ont., Elmira—The Elmira Co-operative Creamery—equipment for proposed addition to creamery.

Ont., Toronto—Toronto Electric Comrs., Yonge and Shuter Sts.—receiving bids until Nov. 23 for overhead cranes.

Metal Working Shops

Calif., Emeryville — The Great Western Meter Co., 5701 South San Pablo Ave., Piedmont, awarded the contract for the construction of a 1 and 2 story factory, here. Estimated cost $26,850. Noted Nov. 9.

Calif., Oakland—J. E. French Co., 124 Grand Ave., awarded the contract for the construction of a 1 story automobile sales room and service garage on S. E. Bway. and Moss Ave. Estimated cost $65,000.

Calif., Oakland—N. S. Sacks, c/o H. J. Christensen, Contr., Federal Bldg., awarded the contract for the construction of a 1 story automobile school shop on 12th St. near Jackson St. Estimated cost $17,000.

Calif., Oakland—The United States Light & Heat Corp., 5432 East 14th St. is having plans prepared for the construction of the first unit of its manufacturing plant, 1 story, 134 x 160 ft., on 98th Ave. Estimated cost $50,000. Architect not announced.

Calif., Sacramento—The Latourette-Fical Co., 307 Front St., plumbing and heating contractors, awarded the contract for the construction of a shop building. Estimated cost $17,272. Noted Nov. 9.

Calif., San Francisco—L. R. Lurie, Mills Bldg., is having plans prepared for the construction of a 2 story, 62 x 137 ft. garage on Sacramento St. near Polk St. Estimated cost $54,000. A. S. Bugbee, 26 Montgomery St., Archt.

Calif., San Francisco—A. E. Perley, 240 Duboce Ave., awarded the contract for the construction of a 1 story, 60 x 75 ft. garage on 14th St. near Mission St. Estimated cost $75,000.

Conn., Fairfield—S. Lowe & Sons Co., 20 Sunfield Ave., is receiving bids for the construction of a 2 story, 40 x 80 ft. addition to its hardware factory. Estimated cost $25,000.

Conn., Rockyhill—The Connecticut Fdry. Co. awarded the contract for the construction of a 2 story, 30 x 70 ft. addition to its plant. Estimated cost $25,000.

Conn., Shelton—The International Silver Co., 48 State St., Meriden, awarded the contract for the construction of a 1 story, 30 x 40 ft. addition to its plant on River St., here. Estimated cost $25,000.

D. C. Washington—The Evening Star Newspaper Co., 11th St. and Pennsylvania Ave., awarded the contract for the construction of a 5 story paper warehouse and garage, to contain 12,000 sq. ft. of floor space, on Canal St. near 2nd St.

Ill., Chicago—T. R. Bishop, Archt., 35 South Dearborn St., is receiving bids for the construction of a 1 story, 100 x 220 ft. addition to garage for Robn Bros., 4728 Bway. Estimated cost $60,000.

Kan., Winfield—Stuber Bros. are having plans prepared for the construction of a 1 story, 100 x 140 ft. Ford service and sales station. Estimated cost $50,000. L. Schmidt & Co., 121 North Market St., Wichita, Archts.

Mass., Holyoke—The Bd. Pub. Wks., City Hall, plans to build a 1 story garage and service station. Estimated cost $80,000.

Mass., Peabody—D. Bertholdi, c/o G. A. Cornet, Archt., 10 Central Ave., Lynn, is having plans prepared for the construction of a 1 story, 45 x 130 ft. machine shop on Wilson Sq., here. Estimated cost $25,000.

Mass., Springfield — The Facto Motor Trucks, Inc., 296 Pecousic Ave., will build a 2 story, 80 x 105 ft. factory. Estimated cost $35,000.

Mass., Springfield — The Spartan Saw Wks., 41 Taylor St., awarded the contract for the construction of a 1 story, 42 x 100 ft. saw factory on Fisk Ave. Estimated cost $20,000.

Mass., West Springfield—The New England Smelting Wks., Union St., plans to build a 1 story factory. Cost between $15,000 and $25,000.

Mass., Worcester—The Parker Wire Goods Co., 18 Grafton St., plans to build a 1 story addition to its wire goods plant, to contain 30,000 sq. ft. of floor space, on Washington St. Estimated cost $75,000. Architect to be announced later.

Mich., Hancock—The Bd. Educ. will receive bids about Dec. 1 for the construction of a 3 story, 80 x 336 ft. school building, including forge, foundry, sheet metal and woodworking departments and automobile mechanics' shop. Estimated cost $300,000. G. L. Lockhart, 1353 University Ave., St. Paul, Minn., Archt.

N. Y., Brooklyn—The St. Marks Realty Co., c/o S. J. Kessler, Engr. and Archt., 529 Courtland Ave., New York, will build a 2 story, 75 x 130 ft. garage, here. Estimated cost $75,000.

N. Y., Buffalo—The Eberhardt Steel Products Co., Chelsa St., plans to build an addition to its mill. Estimated cost $5,000. Architect not announced.

N. Y., Franklinville—The Ontario Knife Co. plans to build an addition to its knife factory. Cost will exceed $5,000. Architect not announced.

N. Y., New York—The Atwell Contg. Co., c/o G. G. Miller, Engr. and Archt., 1482 Bway, will build a 1 story, 120 x 230 ft. garage on Jerome Ave. and 192nd St. Estimated cost $50,000.

N. Y., New York—The Harmon Realty Co., Inc., c/o Springsteen & Goldhammer, Engrs. and Archts., 32 Union Sq., will build a 1 story, 100 x 100 ft. garage on Freeman St. Estimated cost $30,000.

N. Y., New York—The Natl. Biscuit Co., 85 9th Ave., will soon receive bids for the construction of a 3 story garage and repair shop at 407 West 16th St. Estimated cost $65,000. J. R. Terrance, 85 9th Ave., Engr. and Archt.

O., Cleveland—The Brough Co., 3823 St. Clair Ave., bottlers, receiving bids for the construction of a 1 story, 40 x 70 ft. store building and a 1 story, 52 x 80 ft. garage on East 72nd St. and St. Clair Ave. Estimated cost $50,000. E. Brough, Mgr. J. Brugnone, 3505 Woodlawn Ave., Archt. Noted Nov. 9.

O., Cleveland—C. C. Deming, 2517 Edgehill Rd., Cleveland Heights, plans to build a 2 story, 60 x 80 ft. garage and commercial building at 3120 Carnegie Ave., here. Estimated cost $40,000. Private plans.

O., Cleveland—The International Harvester Co., Harvester Bldg., Chicago, plans to build a 10 story warehouse and service station, on East 55th St. and Julia Ave., here. Estimated cost $300,000. A. Price, c/o owner, Archt.

O., Cleveland—The Willard Storage Battery Co., 246 East 131st St., will build a 1 story, 15 x 300 ft. addition to its factory. Estimated cost $40,000.

O., Delaware — The Sunray Stove Co. plans to build a 60 x 100 ft. addition to its factory.

O., Norwood—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Nov. 20 for the construction of a 2 story, 320 x 500 ft. automobile factory on Smith Rd., here, for the Chevrolet Motor Co., General Motors Bldg., Detroit.

O., Ravenna—The Phillips Body Co., c/o Fisher Body Ohio Co., Cass St. and Blvd., Detroit, have had plans prepared for the construction of a 1 story, 40 x 100 ft. addition to its factory, here. Estimated cost $40,000. Carter-Richards Co., 923 Illuminating Bldg., Cleveland, O., Archts.

Ore., Portland—The Skyline Corp., 801 Pittock Bldg., plans the construction of a 10 story and 2 story basement, and 200 x 200 ft. office building, basement to contain heating, power and light plants, also a 500 auto garage, on 5th, 6th, Taylor and Salmon Sts. Estimated cost. $2,500,000. J. C. Gibson, Pres. Architect not selected.

Pa., Corry — The Corry Radiator Corp. awarded the contract for the construction of a 1 story, 120 x 150 ft. foundry at its radiator works.

Pa., Nanticoke — The Nanticoke Garage Co. is having plans prepared for the construction of a 3 story, 46 x 100 ft. garage, with a wing 84 ft. long, on Spring St. Estimated cost $65,000. G. T. Price, 409 Miller Bldg., Scranton, Archt.

Pa., Monessen—The Monessen Fdry. & Machine Co. plans to rebuild the portion of its shop which was destroyed by fire. Estimated cost $150,000. Architect not announced.

Pa., Newport—The Mineral Products Co. plans to rebuild its plant, which was recently destroyed by fire. Loss $25,000. J. R. Morgan, proprietor.

Pa., Phila.—L. J. Kolb, 10th and Reed Sts., awarded the contract for the construction of a 1 story 175 x 200 ft. garage at 1433 Parrish St. Estimated cost $44,000.

Pa., Pittsburgh—The Mack International Motor Truck Corp., 5911 Center Ave., awarded the contract for the construction of a 1 story, 120 x 280 ft. garage, sales and service station on Liberty and Gross Sts. Estimated cost $60,000.

Pa., Pittsburgh — The Studebaker Sales Co., 4724 Baum Blvd., is having plans prepared for the construction of a 2 story, 80 x 100 ft. addition to its garage and sales building. Estimated cost $40,000. G. H. Schwan, Peoples Bank Bldg., Archt.

Pa., Scranton—T. F. Leonard Estate, 505 Lackawanna Ave., awarded the contract for the construction of a 2 story, 80 x 130 ft. garage on Adams St. Noted Oct. 5.

Pa., Washington—H. Robinson plans to build a 3 story, 65 x 102 ft. garage on Chestnut St. Estimated cost $40,000. Architect not selected.

Pa., Waynesburg—T. Cochran, Dawson, is having plans prepared for the construction of a 2 story, 70 x 90 ft. garage, here. Estimated cost $40,000. H. W. Altman, Fayette Title & Trust Bldg., Uniontown, Pa., Archt.

R. I., Providence—Goldberger & Steiner, Olneyville Sq., are having plans prepared for the construction of a 1 story garage on Library Court. Estimated cost $40,000. G. Wolf, 88 Althea St., Archt.

Wis., Chippewa Falls—The Chippewa Valley Auto Co., 16 River St., awarded the contract for the construction of a 2 story, 124 x 130 ft. garage. Estimated cost $75,000. Noted Oct. 26.

Wis., LaCrosse—The Bergh Auto Co., 207 South 4th St., awarded the contract for the construction of a 1 story, 60 x 171 ft. garage on King St. Estimated cost $40,000.

Wis., La Crosse—O. A. Merman, Archt., 210 Linker Bldg., is receiving bids and will open same about Nov. 13 for the construction of a 1 story, 60 x 146 ft. garage on 6th and State Sts. for the Cameron Motor Car Co., 127 South 6th St. Estimated cost $40,000.

Wis., Marinette—C. Anderson & Sons Co., Cook and Merryman Sts., will build a 2 story, 50 x 75 ft. factory and machine shop on Main St. Estimated cost $75,000. Noted Oct. 19.

Wis., Menomonie—E. V. Johnson plans to build a 1 story, 58 x 176 ft. garage on Main St., to replace the one which was destroyed by fire. Estimated cost $40,000. Architect not selected.

Wis., Milwaukee—The Luick Ice Cream Co., 183 Ogden Ave., awarded the contract for the construction of a 1 story, 120 x 120 ft. garage on Van Buren St. Estimated cost $75,000. Noted Oct. 26.

Wis., Racine—The F. J. Greene Eng. Wks., 1028 Douglas Ave., awarded the contract for the construction of a 1 story, 70 x 125 ft. addition to factory. Estimated cost $15,000.

Wis., Racine—The F. J. Greene Eng. Wks., 1028 Douglas Ave., will soon receive bids for the construction of a 3 story, 53 x 100 ft. factory. Estimated cost $50,000. E. B. Funston Co., Janes Bldg., Archt. Noted Oct. 12.

Wis., Stevens Point—The F. & G. Auto Parts Co., 425 Madison St., is receiving bids for the construction of a 1 story, 35 x 102 ft. addition to its garage. Estimated cost $40,000. Private plans.

Ont., Aylmer—J. L. Thayer & Son plan to build a garage and automobile repair shop. Estimated cost $40,000.

Ont., Hamilton — The Abrasive Co. of Canada, Ltd., 858 Burlington St., awarded the contract for the construction of a 1 story, 40 x 60 ft. furnace building. Estimated cost $15,000.

Ont., Toronto—The Toronto Motor Car Ltd., 52 James St., plans to build a 3 or 4 story garage and sales room on Jarvis St. Estimated cost $100,000. L. E. Dowling, 167 Yonge St., Archt.

General Manufacturing

Calif., D'nuba—The Central California Ice Co., P and Mono Sts., Fresno, plans to build an ice plant on South M and Ventura Sts., here.

Calif., Emeryville—The Amer. Rubber Co., Park Ave. and Watt St., Oakland, awarded the contract for the construction of a 1 story factory on Emery and Park Sts., here. Estimated cost $25,000.

Calif., Livermore—The Livermore Soda Wks. has purchased a site on Lizzie St. and plans to build a soda water plant. G. F. Tubbs, owner.

Calif., Marysville—The Chamber of Commerce plans to build dehydrators for growers in Yuba county.

Calif., Marysville—Swift Bros., 2nd and E Sts., plan to build a planing mill on 3rd St.

Calif., Merced—The California Packing Corp., 101 California St., San Francisco, has had preliminary plans prepared for the construction of several large cannery buildings on 23rd St. from P to R Sts. and 22nd St. between Q and R Sts. P. L. Bush, 101 California St., San Francisco, Engr. and Archt.

Calif., Oakland—The California Packing Corp., 101 California St. San Francisco, is having plans prepared for the construction of a cannery on 1st and Filbert Sts., here. P. L. Bush, 101 California St., San Francisco, Archt.

Calif., Oakland—The East Bay Creamery Co., 18th St. and San Pablo Ave., awarded the contract for the construction of a 1 story creamery on N.E. 22nd and Market Sts. Estimated cost $24,000.

Calif., San Francisco—The Anderson Bros. Planing Mill Co., 2399 Powell St., will build a 2 story, 70 x 50 ft. planing mill on Quint St. between Burke and Custer Aves. Estimated cost $15,000.

Calif., San Francisco—The Banner Refining Co., Kohl Bldg., is having plans prepared for the construction of a refining plant, consisting of 2 buildings, oil storage tanks, etc., on Islais Creek. Estimated cost $84,000. F. G. White, Ferry Bldg., Engr.

Calif., San Francisco—The General Mfg. Co., Pacific Bldg., has had plans prepared for the construction of a 1 story box factory on San Bruno Ave. Estimated cost $40,000. W. W. Hanscom, 848 Clayton St., Archt.

Calif., San Francisco—The San Francisco Sulphur Co., 624 California St., awarded the contract for the construction of a sulphur refinery on North Point St. Estimated cost $35,000.

Conn., Harford—The Frisbie Pie Co., 363 Kossuth St., Bridgeport, awarded the contract for the construction of a 2 story, 90 x 100 ft. bakery and garage on Broad St., here. Cost between $50,000 and $60,000. Noted Oct. 26.

Conn., New Haven—The Ward Baking Co., Southern Blvd. and St. Marys St., New York City, plans to build a 2 story bakery on Lombard St., here. Architect not announced.

Conn., Waterbury — The Hamilton Bottling Wks., Burton St., awarded the contract for the construction of a 1 and 2 story, 30 x 70 ft. bottling plant. Estimated cost $15,000.

D. C., Wash.—The Corby Baking Co., 2301 Georgia Ave., N. W., awarded the contract for the construction of an addition to its bakery.

Fla., Daytona Beach—The Peninsular Ice & Cold Storage Co. will open bids about Dec. 1 for the construction of a 1 story ice manufacturing and cold storage plant. G. G. Bailey, Pres.

Ga., Athens—The National Roofing Co., Fillmore St., Tonawanda, N. Y., plans to build a branch factory for the manufacture of roofing products, here. Estimated cost $600,000.

Ill., Chicago—The Bassick Mfg. Co., 2638 North Crawford Ave., awarded the contract for the construction of a 1 story, 55 x 142 ft. factory for the manufacture of automobile accessories. Estimated cost $30,000. Noted Oct. 19.

Ill., Chicago—Dubin & Eisenberg, Archts., [illegible] West Washington St., are receiving bids for alterations and the construction of a 3 story, 75 x 35 ft. addition to factory at [illegible] West [illegible] St. for the [illegible] Sausage Mfg. Co. Estimated cost [illegible].

Ill., Chicago—The Natl. Paint & Wall Paper Co., c/o C. Hatzfeld, Archt., 7 South Dearborn St., awarded the contract for the construction of a 1 story, 47 x 105 ft. factory at [illegible] Grand Ave. Estimated cost [illegible]. Noted Sept. 21.

Ill., Chicago—The X. L. Refrigerating Co., 3634 West 39th St., is receiving bids for the construction of a 1 story, 125 x 132 ft. factory on 39th and Aberdeen Sts. Estimated cost $40,000. A. G. Lund, 453 West 63rd St., Archt.

Ind., Lafayette—The National Refining Co., Kossuth St., plans to rebuild a portion of its oil refinery which was recently destroyed by fire. Estimated cost $100,000.

Kan., Atchison—The Blair Milling Co., 360 South 4th St., awarded the contract for the construction of a 4 story, 36 x 65 ft. plant, storage capacity 50,000 bu. Noted Oct. 5.

La., La Fayette—The La Fayette Sugar Refining Co. plans to rebuild its refinery which was recently destroyed by fire. Estimated cost $300,000. Architeect not announced.

La., Sterlington (Ouachita P. O.)—The Imperial Oil & Gasoline Products Co. plans to build large additions to oil refinery and gasoline works. Estimated cost $150,000.

Mass., Brighton (Boston P. O.)—The Boston Spun Silk Co., Western Ave., awarded the contract for the construction of a 2 story weave shed addition to its plant. Estimated cost $40,000.

Mass., Brighton (Boston P. O.)—The Market Paper Box Co., 132 Market St., will build a 2 story paper box factory on Western Ave. Estimated cost $30,000.

Mass., Brockton—The Lapworth Webbing Co., Sumner St., plans to build a 2 story webbing factory on South and Crescent Sts. Archts. not announced.

Mass., Holyoke—The Massachusetts Baking Co., Commercial St., awarded the contract for the construction of a 2 story, 75 x 100 ft. bakery, including ovens, garage, etc. Cost between $16,000 and $18,000.

Mass., Westfield—A. E. and L. O. Peck, Holcomb St., will build a 1 story, 75 x 160 ft. woodworking factory on Silver St. Estimated cost $30,000.

Mass., West Roxbury (Boston P. O.)—The Armstrong Knitting Mill, 2011 Centre St., awarded the contract for the construction of a 2 story addition to its factory. Estimated cost $10,000.

Mass., Worcester—Woodbury & Co., Inc., 274 Main St., (engravers and printers), will build a 2 story, 100 x 100 ft. factory on West Boylston St. Estimated cost $28,-000. Private plans.

Mich., Kalamazoo—The Kalamazoo Paper Box Co., Kalamazoo and Pitcher Sts., plans to build a 2 story factory, to contain 15,-000 sq.ft. of floor space, on North Pitcher St. Estimated cost $200,000. Architect not selected.

Minn., Minneapolis—The Lavoris Chemical Co., 52 Western Ave., awarded the contract for the construction of a 2 story, 45 x 110 x 143 ft. office and factory building on 3rd St. and 10th Ave., N. Estimated cost $125,000. W. H. Levings, Secy. Noted Oct. 12.

N. J., Camden—The Camden Pottery Co., Mt. Vernon and Orchard Sts., awarded the contract for the construction of a 2 story, [illegible] x [illegible] ft. [illegible], containing 3 kilns. Estimated cost [illegible].

N. J., Linden—H. B. Hardenburg & Co., [illegible], awarded the contract for the construction of a 1 story, 171 x 171 ft. factory with miscellaneous buildings, including garage.

N. J., Newark—[illegible] Bros., 287 Bway., Brooklyn, N. Y., are having plans prepared for the construction of a bakery on [illegible] Ave. and [illegible] St. here. Estimated cost [illegible]. M. [illegible], [illegible] Central Ave., Engrs. and Archts.

N. J., Trenton—The [illegible] Dairy Co., [illegible] North [illegible] St., plans to build a 2 story, [illegible] x [illegible] ft. plant. Estimated cost [illegible]. W. A. Klemann, 1st Nat. Bank, Archt.

N. J., Trenton—The Enterprise Tire & Rubber Co., North Clinton Ave., plans to build a rubber factory. Estimated cost [illegible].

N. J., Trenton—The Jointless Fire Brick Co., 1130 Clay St., Chicago, plans to build a 1 story, 72 x 250 ft. brick manufacturing plant on New York Ave., here. Estimated cost $75,000.

N. Y., Auburn—Lockwood, Greene & Co., Engrs., 101 Park Ave., New York City, will soon receive bids for the construction of a weave shed, machine shop and additions to dyehouse and power plant, for the Firth Carpet Co., 62 South Division St., here. Estimated cost $140,000.

N. Y., Binghamton—The Link Piano Co., Water St. awarded the contract for altering and building an addition to its factory. Estimated cost $8,000.

N. Y., Buffalo—The Standard Milling Co., c/o A. E. Baxter, Engr., Ellicott Sq., is having plans prepared for the construction of a large flour mill, capacity 30,000 bbl. per day, on Outer Harbor.

N. Y., East Aurora—W. Zapf plans to rebuild the portion of lumber mill which was destroyed by fire. Estimated cost $45,-000. Archt. not announced.

N. Y., Jamestown—Lockwood, Greene & Co., Engrs., Hanna Bldg., Cleveland, O., will soon receive bids for the construction of a 4 story, 75 x 175 ft. combing and spinning mill, here, for the Jamestown Worsted Mills, 335 Harrison St., manufacturer of men's and women's wear.

New York—The Iroquois Natural Gas Co., Iroquois Bldg., Buffalo, plans to build natural gas plants in Hanover, Arkport, Perrysburg and Gowanda.

N. Y., New York—The Reid Ice Cream Co., 79 West 132nd St., awarded the contract for the construction of a 2 and 3 story, 90 x 200 ft. factory, also a 30 x 55 x 200 ft. shed, west of 5th Ave. from 141st to 142nd Sts.

N. Y., New York—The H. Stern Lumber Co., c/o W. H. Gompert, Engr. and Archt., 171 Madison Ave., will soon receive bids for the construction of a lumber plant on 69th St. near Ave. A. Estimated cost $100,000.

N. Y., Niagara Falls — The Acheson Graphite Co., Buffalo Ave., plans to build an addition to its graphite factory. Estimated cost $5,000. Architect not announced.

N. Y., Rochester—The Newman Bros. Grain Co., 204 Troup St., awarded the contract for the construction of a 1 and 2 story addition to its grain mill, to contain 5,000 sq.ft. of floor space. Estimated cost $25,000. Noted Nov. 2.

N. Y., Rochester—The Powertown Tire Corp., 252 East Ave., is receiving bids for the construction of a 4 story, 40 x 60 ft. addition to its service works. Estimated cost $50,000. Hutchinson & Strutz, Cutler Bldg., Archts. Noted Aug. 10.

N. C., Elizabeth City—The Crystal Ice Co. is having plans prepared for the construction of a 1 story ice manufacturing plant. Estimated cost $100,000. Ophuls & Hill, 112 West 42nd St., New York City, Engrs. and Archts.

O., Akron—The General Tire & Rubber Co. has had plans prepared for the construction of a 1 and 2 story, 40 x 180 ft. and 60 x 100 ft. additions to its factory. Estimated cost $100,000. Osborn Eng. Co., Prospect Ave., Cleveland, Engrs. and Archts.

O., Cleveland—The Double Eagle Bottling Co., 6517 St. Clair Ave., is receiving bids and will open same about Nov. 17 for the construction of a 2 story, 30 x 60 ft. bottling factory. Estimated cost $40,000. J. Potokar, Mgr. F. J. Coghlan, 1782 Alcoy Rd., Archt.

O., Columbus—R. H. Erlenbusch Sons Co., 456 South High St., has had plans prepared for the construction of a 1 story, 32 x 52 ft. ice cream factory, including special refrigerating plant, on East Livingston Ave. Estimated cost $6,500. C. W. Bellows, 69 Ruggery Bldg., Archt.

O., Conneaut—The North Eastern Oil & Gas Co., plans to build an artificial gas plant in several units, capacity 2,000,000 cu.ft. per day. A process will be used, whereby natural and artificial gas can be mixed. F. B. Dunn, Pres.

O., Delaware—The Dept. Public Welfare, Oak and 9th Sts., Columbus, has had plans prepared for the construction of a 60 x 80 ft. power house, laundry building with wings each 30 x 80 ft., water plant, small pumping station, etc., at the Girls' Industrial Home, here. Estimated cost $125,000. W. H. Duffy, Dir.

O., Delaware—The Rainbow Tire & Rubber Co., 402 Southern Hotel, Columbus, manufacturer of tubes, is building a 100 x 200 ft. plant, here. C. E. Ross, Pres.

O., Warren—The Wadsworth Feed Co. plans to rebuild its 5 story flour mill and warehouse which was destroyed by fire. Estimated cost $100,000. J. X. Wadsworth, Pres.

Okla., Oklahoma City—The New State Ice Co., 2 West 3rd St., will build an ice plant. Estimated cost $250,000.

Okla., Stamps — The Blackfoot Lumber Co. plans to rebuild its planing mill which was recently destroyed by fire. Estimated cost $60,000. Architect not announced.

Pa., Catasauqua—The Bryden Horse Shoe Co. awarded the contract for the construction of a 1 story, 60 x 198 ft. factory for the manufacture of horse shoe calks.

Pa., Corry—The Corry-Jamestown Furniture Co. awarded the contract for the construction of a 1 story addition to its furniture factory. Estimated cost $5,000.

Pa., Glassmere — The Allegheny Plate Glass Co. awarded the contract for the construction of a 1 story, 50 x 600 ft. cast house for glass factory. Estimated cost $100,000.

Pa., Jacobs Creek—The United States of America Drug & Chemical Co. awarded the contract for the construction of a 2 story, 50 x 100 ft. chemical factory. Estimated cost $35,000. Noted Oct. 19.

Pa., New Castle—The Grasselli Powder Co., Guardian Bldg., Cleveland, O., will build a 1 story addition to its factory, consisting of six buildings, here.

Pa., New Castle—The New Castle News awarded the contract for the construction of a 2 story, 30 x 160 ft. printing plant. Estimated cost $75,000.

Pa., Phila.—The Amer. Ice Co., 6th and Arch Sts., and C. L. Weir, Engr., 41 East 42nd St., New York City, are receiving bids for the construction of a 2 story, 61 x 80 ft. and a 1 story, 21 x 80 ft. ice manufacturing plant on Duncannon and Mascher Sts.

Pa., Phila.—Ballinger Co., Archts., 12th and Chestnut Sts., will soon receive bids for the construction of a 2 story 74 x 194 ft. and a 1 story 141 x 193 ft. printing plant on 56th and Chestnut Sts., for the Chilton Publishing Co., 49th and Market Sts. Estimated cost $50,000.

Pa., Phila.—The Globe Ticket Co., 110 North 12th St., awarded the contract for the construction of a 9 story, 58 x 182 ft. and 34 x 47 ft. printing plant at 112-122 North 12th St.

Pa., Phila.—The United Gas Improvement Co., Broad and Arch Sts., plans to build a 2 story, 34 x 110 ft. fuel bins, consisting of conveyors system, also loading and unloading machinery. Estimated cost $115,000. Private plans.

Pa., Pittsburgh—The F. J. Kress Box Co., 3030 Liberty Ave., will soon award the contract for the construction of a 3 story, 70 x 155 ft. addition to its box factory. Estimated cost $40,000. T. Pringle, 504 Pittsburgh Life Bldg., Archt.

Pa., Pittsburgh—The Ward Baking Co., South Bend and St. Marys Sts., plans to build a bakery on Ridge Ave. Estimated cost $1,500,000. Private plans.

R. I., Woonsocket—The Macrodi Fibre Co., Carnation St., awarded the contract for the construction of a 1 story, 60 x 150 ft. textile factory. Estimated cost $40,000.

Tex., Dallas—The Trinity Paper Mills, Dallas County State Bk. Bldg., will receive bids until Jan., 1923, for the construction of a paper mill, capacity 30 tons per day. Estimated cost $500,000.

Tex., Texas City — The U. S. Gasoline Corp. is having plans prepared for the construction of a 4 unit Knox process cracking plant, capacity 100,000 gal. per day. Estimated cost $250,000. Company Engrs. and Archts.

Wis., Janesville — The Parker Pen Co., Court and Division Sts., plans to build a 3 story, 60 x 150 ft. factory on South Bluff St., for the manufacture of fountain pens. Estimated cost $50,000. Architect not selected.

Wis., Milwaukee—The A. C. Beck Co., 1 East St., manufacturer of boxes, awarded the contract for the construction of a 2 story, 60 x 135 ft. factory, to replace the one which was destroyed by fire. Noted Oct. 12.

Wis., Milwaukee—J. Wilging & Co., 1612 Teutonia Ave., building contractors, are receiving bids for the construction of a 3 story, 80 x 120 ft. millworking factory on Burleigh St. Estimated cost $45,000. Private plans.

Wis., Walworth—The Walworth Condensed Milk Co. will build a 1 story 14 x 60 ft. addition to its condensery, and a 24 x 44 ft. engine room. Estimated cost $20,-000.

B. C., Nordin—The J. Buckley Estate plans to rebuild its saw mill which was destroyed by fire. Estimated cost $100,000.

American Machinist

Volume 57 NEW YORK, NOVEMBER 23, 1922 Number 21

The Manufacture of Rollers for Rubber Mangles

Problems Met by an English Shop in Turning, Grinding and Grooving Cylinders —Changing from Low to High Production—Single Purpose Machines

BY ALBERT CLEGG

ON NEARLY all the leading rubber plantations throughout the world the crude rubber is put through a preliminary mangling operation for the purpose of removing some of the foreign matter with which it is inevitably mixed and also for the purpose of rolling the substance into more easily transportable form. Much of this work is done on hand machines similar in every way, and no more elaborate than the common domestic mangle. In most cases, however, the rollers of the machine are of metal instead of the wooden ones of the household article. Often the rolls are of mild steel and electro-plated, so as to prevent rusting, but more usually they are of cast iron.

During the four or six months preceding the rubber harvest there is, in normal times, quite a brisk demand for this class of machinery and, since it is of the very roughest description, the price being commensurate with the crudity of finish, it lends itself very readily to quick methods of production. As regards the machine itself, the work is largely foundry work, little or no machining being done. The rollers, however, are another story. While no very great accuracy is required, the production of the rollers in the bulk offers some interesting problems in machine operation, more particularly when the comparatively low price is taken into account. If the job is properly tooled up for all its operations a good margin is possible in spite of the leanness of the selling price. Without this special consideration, it does not appear possible to avoid a loss.

Design of the Rollers

The rollers vary somewhat in both diameter and length but the most generally used size is 4 in. diameter, 20 in. long, the design being on the lines shown in Fig. 1. In many cases the rollers were ordered with helical grooves cut therein. These grooves formed a diamond pattern in the sheets of rubber, this pattern being a means of identification of the rubber from different plantations and also a means whereby the air was better able to circulate through the mass of material. In most cases the rollers were cut with a right hand and also a left hand helix, this being known as "diamond" cut, as distinct from the "spiral" cut of the single hand helix.

It should be stated that this job had drifted into the shop where the methods to be described were subsequently originated, the first orders consisting of so small a number of machines that any special methods of production were not at that particular time practicable. The orders, however, continued to come along in larger and larger batches until they were being received several times faster than the finished machines were being despatched. It became necessary, therefore, in sheer self-defence, to devise some quicker methods of dealing with the job. In the early days the spiral and diamond grooves had been cut in the lathe, and since most of them were 3½ in. or more lead with anything up to twenty starts, the rate of production will be better imagined than described. It was a slow process, consisting largely of racking back the lathe saddle for the next cut, and however hard a man might work, he had very little to show, except backache and a very ragged temper, for his efforts.

Molding

Quoting from memory the time taken to cut eighteen right and left hand grooves in a 4-in.x20-in. cast iron roller would be about six hours and the operator had no time to waste if he kept up this rate. The lathe, by the way, on which the job was done had been rigged up with the drive directly on the lead screw so that the change gears would be subjected to as little strain as possible. The machine, of course, thus drove backward, i.e. the lead screw drove the headstock spindle instead of the more usual procedure of the spindle driving the screw.

As stated, however, the outstanding orders began to bulk larger and larger, until there was about five years' work in at the then rate of production. There would be in the neighborhood of 10,000 rollers on order when it was decided that the job could be taken as a staple business, which would warrant a moderate outlay on improved methods of production.

The first consideration was the speeding up of the foundry; this consisted, in the main, of putting more men onto the job and the provision of more patterns and boxes. As will be seen from the sketch in Fig. 1, the roller was cored, with a vent pipe leading out at the side. The arbor is a square wrought iron bar, swaged down round at the ends and cast in the roller. The core was of oil sand and no attempt was made to remove it. The vent pipe was simply driven into the roller, which was then stacked on end so that any core sand that might come out had the opportunity of so doing. Otherwise the core remained in.

One little thing that helped considerably to increase foundry output on this job was the addition of a small amount of ferro-titanium to the molten metal immediately before pouring. This reduced the number of wasters due to blown holes very considerably. Prior to this and probably due to the fact that the rollers were poured on their side there had been a considerable loss. Another little idea which helped considerably to swell the proportion of good castings was the provision of a

narrow fin, about $\frac{1}{4}$ in. thick along the top of the casting. This received all the scum and other impurities and was readily broken off when the casting was being dressed. Another important factor in the increasing of the foundry output was the inauguration of a generous piece-work scheme, by means of which the moulders were able to earn nearly double pay by putting their backs into the job. Even with this rather unusual rate the cost of the castings was considerably less than under the old, leisurely, day-wage regime. Since it was output that was the principal factor and not the weekly earnings of the men, the scale of payments adopted was well worth while and justified by results.

As previously stated, the arbors were made from square-section wrought iron, the ends being forged round in a Ryder forging machine. The center holes were punched after the round ends had been forged, these holes being subsequently reamed out by a square center.

Turning Operations

At the outset the turning of the rollers was an every-day sort of a lathe job, the castings being handed over to a lathe operator who proceeded to center, square the ends of the arbor, rough and finish turn the roller and generally proceed in the manner common to any other casual type of turning job. The time taken would be about three to four hours for the 4-in. rollers with a proportionately longer time for the larger ones. Since an output of at least one hundred rollers a week was required and the turning department could not possibly put more men onto the job, it was decided to sub-divide the operations as far as possible and arrange for girls to do the work.

These operations eventually were classified as follows:

(1) Center and face arbors.
(2) Turn arbors.
(3) Rough turn outside of roller.
(4) Face ends of roller and square out corners.
(5) Diamond or spiral groove if required.
(6) Grind both ends of arbors.
(7) Grind outside of roller—clean up only.

The centering operation was done on a centering machine before the arbors were cast in the rollers, a combination toolholder being made so that the drilling, countersinking and facing operations could all proceed together. This procedure cut out the punching method and the fact that the centering was done prior to the casting of the rollers saved a lot of unnecessary weight lifting—the bar arbors being comparatively light.

Rough Turning Arbors

The next operation, rough turning the arbors, was done on an old center lathe which was fitted with a dead stop for setting the tool, and a rough-turn limit gage to control the diameter within moderately wide limits. A high spindle speed and a fine traverse were used and only a single cut was taken, the time on this and the previous centering operations being 6 and 4 minutes per roller, respectively.

Rough turning the cylindrical portion of the roller was also tried, in the first place, on an old center lathe but the results were not entirely satisfactory. One end of the arbor projected about 5 in. from the end of the roller and, since the diameter of this was only $\frac{13}{16}$ in., it was impossible to take as heavy a cut as would have been easily practicable with a more rigid mounting in the machine. Further, the old lathe had not sufficient belt power to drive a stellite tool up to its maximum cutting capacity. Even with the old lathe stellite had been found to give much better results than had been obtainable from the best brand of high speed steel available, but it was quickly apparent that an improved method of carrying the work in the machine would allow of a still higher rate of production.

A Single Purpose Roughing Lathe

A design was accordingly got out for a single purpose lathe with ample power and a collet arrangement for both head and tailstocks to support the roller by the arbor and have as little overhang as possible. It will be remembered that the core was vented by a pipe projecting through the end of the roller. The new roughing lathe was arranged with a pin driver which entered the hole left by driving the vent pipe into the roller. The drive was by fast and loose pulley through change gears for varying the speed. The pulleys were capable of transmitting 10 hp., an amount which proved ample for the purpose. The feed mechanism was also provided with fixed center change gears so that it could be varied as occasion demanded or experiment demonstrated. The tool-holder had hand cross feed only, a large micrometer dial being fitted so that definite tool adjustment could be made to compensate for wear of the cutting edge.

On the 4-in. diameter rollers the cutting speed was 100 ft. per minute and the feed $\frac{1}{16}$ in. per rev. of spindle, the stock to be removed being about $\frac{1}{4}$ in. in diameter. Under these conditions is was possible to rough turn the rollers at the rate of four per hour, this rate being a continuous day-in and day-out production. With a spurt it was possible to do them in from 10 to 12 minutes, but the average worked out at 15 minutes for a day's run.

Durability Variable

The durability of the tool varied greatly, if the rollers were true enough to ensure the cut getting well under the skin, the tool would last a couple of hours without regrinding. If, however, an eccentric casting was encountered, the cutting edge was destroyed almost immediately. The girls were kept supplied with ground tools which they very soon learned to set for themselves, more particularly since the diameter limits were of the very widest.

The next operation, that of facing square the ends of the roller, was performed in another old center lathe. The work was mounted between the centers in the usual way and in addition was supported close up to the cut by a fixed steady rest. The cut was fed by hand and very little difficulty was experienced except in the final squaring out of the corner, which was apt to prove rather troublesome because of the chilling of the cast iron at this point by its contact with the steel of the arbor. The difficulty was very largely overcome by providing for front and rear tools, the latter for the facing operation and the former for the finishing of the actual corner.

This operation was a comparatively long one, the time being about the same as for the rough turning, much of the excess of time being due to the amount of tool-grinding and re-setting made necessary by the dulling effect of the chilled metal. To obviate this trouble, a slight alteration was made in the design of the roller, as shown in Fig. 2. The ends were recessed

in the casting as at *A*, which, of course, necessitated the casting of the rollers on end. With the altered design of roller the time for ending was reduced to 8 minutes per roller, or little more than half the previous time.

The next operation tabulated above was the grooving, either spiral or diamond as occasion demanded, but it

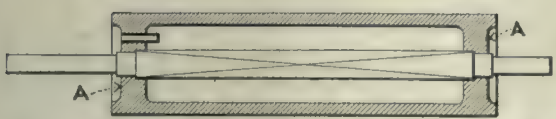


FIG. 1—PLAIN ROLLER FOR RUBBER MANGLE
FIG. 2—ALTERATIONS IN SHAPE OF ROLLER TO FACILITATE SQUARING OF ENDS

was later found desirable to introduce a supplementary operation prior to the grooving. It must be understood that quite a large proportion of the rollers were "plain," i.e., they were not grooved, and it was really to accommodate the plain rollers that the extra operation was finally introduced. This operation was a finishing cut taken with the roller running on dead centers just as it would subsequently be for grinding. It was found that with the very heavy cuts taken on the rough turning lathes it was practically impossible to obtain anything like concentricity with the center holes. This meant that considerable time was required by the grinding operation.

Cast iron is not, under the most favorable conditions, one of the best metals to cut with a grinding wheel. If the wheel is not suitable for cast iron it is almost impossible to cut with it at all—it glazes and whistles and will only remove an infinitesimal amount of stock. With a suitable wheel, with a grade on the soft side and a rather coarse grain, infinitely better results are obtainable, but even with this combination the productive rate is too slow to allow of much eccentricity of the work.

It was found that considerable time was saved on the average by taking a light skimming cut as a preliminary to grinding. The grinding operation had been quite regularly taking over half an hour per roller (average), much more in cases where the eccentricity was extra bad, and it was found that by taking a finishing cut in the lathe at a cost of not more than five minutes' time, the grinding time only averaged 12 to 15 minutes. This, of course, showed a net gain in the finishing time and, what was of still greater importance, it doubled the capacity of the hardest worked machine, the grinder, the output of which was the limiting factor in the output of finished rollers. It was only possible to allocate one grinder to the job and so it was important that this machine should be worked up to its maximum productive capacity.

As previously mentioned the original method of grooving had been by cutting in a lathe similar in every way to screw-cutting. This had been a laborious, time consuming, make-shift sort of scheme, which was very soon superseded by milling, the roller being mounted between the centers of the dividing heads and the helical grooves generated by connecting up the table feed screw of the machine to the spindle of the dividing head by change gears in the usual way. Since the helix angles were generally small, 18 to 30 degrees, the swiveling capacity of the table was not large enough to allow of the cutter being mounted on the ordinary cutter arbor.

Therefore, a universal milling head was made which itself swiveled through a complete circle and thus allowed the table of the machine to be operated in its normal straight position. This attachment was bolted to the face of the column of the machine and the cutters operated at the back of the roller, as shown roughly in Fig. 3. There were usually two cutters, ⅛ in. saws, mounted side by side on the cutter arbor with a spacing washer of suitable thickness between to give the proper groove pitch.

It was never very clear, apart from the reasons already given, what was the real object of the grooving, or rather what determined the dimensions of same. In some cases the grooves were of comparatively short lead giving what was known as "vertical" diamonds, *A*, Fig. 4, while in others the leads were long and the diamonds then had their major axes lengthwise of the roller, in which case they were known as "horizontal" diamonds *B*, Fig. 4. Again, one customer invariably would ask for grooves $\frac{3}{16}$ in. wide and deep, others would want $\frac{3}{16}$ in. wide, ⅛ in. deep, while the majority were content with what came to be accepted as standard, ⅛ in. x ⅛ in.

Not only was there much variation in the size of the grooves, but the dimensions of the resulting diamonds were just as diversified. In fact, it was never definitely certain throughout the whole course of the work, what the customer actually meant when he specified the size of diamond he required. It was usual to receive the orders in the form of so many pairs of a certain size roller, diamond grooved, with diamonds (say) 1 in.x½ in. Ordinarily this had been taken to refer, not to the actual raised diamond itself, *Bb*, Fig. 5, but to the pitch, or center to center dimensions, *Aa*. For quite a while this had been recognized in the shop as the system of dimensioning employed. Later some of the customers began to kick—they suggested that when they called for 1-in.x½-in. diamonds, they meant 1-in.x½-in. ***diamonds***, and not some hypothetical size which seemed to bear very little relation to the one called for. Other customers accepted the center to center interpretation without question so eventually we kind of drifted into a habit of taking either interpretation according to which was most convenient for the particular job in hand.

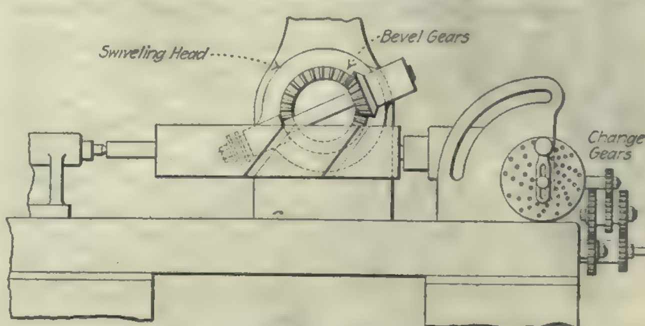


FIG. 3—MILLING MACHINE ARRANGED FOR GROOVING

In this connection it might be thought that it would have been quite a simple matter to have written or interviewed the customers and got to know definitely what was required. It should be remembered that the whole of the product was shipped abroad, the orders being booked through various merchants, agents,

shippers, etc., who knew nothing about the details of the work. And though many efforts were made to get some really definite information about the matter, nothing tangible resulted, the information we did succeed in getting being very contradictory and largely composed of the personal opinions of people who knew nothing, or next to nothing about the job. Since the demand for the product was in excess of the supply, it was possible to take liberties which could never have been taken with a more normal market.

Suppose then an order called for 4 in. rollers with 1-in.x½-in. diamonds, the vertical dimension of the diamond, the one running around the circumference of the roller, was divided into π times the diameter of the roller, or, in the above example $4 \times 22/7 \div 1 = 12.57$. This gives the number of leads required to produce the specified size of diamond. Since it is not practicable to cut fractional leads, the nearest even number is taken, 12 in this case. Had the calculated number of leads worked out to 13.5, 14 would be the actual number taken. The reason for taking the nearest *even* number is because in the grooving operation two cutters are working simultaneously and, if there were an odd number of grooves, one traverse would be taken with only a single cutter at work.

Having determined the number of leads, this is then multiplied by the horizontal diamond dimension (½ in. in this case), and the product is the lead of helix, for which the milling machine must be set up. In our example the helix would be $12 \times \frac{1}{2} = 6$ in. lead. The only dimension now required is the angle *C*, Fig. 4, and the cotangent of this angle is found by dividing the lead into the circumference or $12.57 \div 6 = 2.09 =$ cot 25½ degrees.

The time taken for milling the grooves was about 30 minutes per cut, two grooves, so that on the above roller with twelve grooves about three hours would be required *for each hand*, or six hours in all. The operator tended two machines, the usual practice being to have one machine set up for right hand and one for left hand, and change the rollers over from one machine to the other. The output obtained amounting to under ten pairs of rollers per week was entirely too insignificant to even begin to meet the demand.

The machines were given every attention, attempts

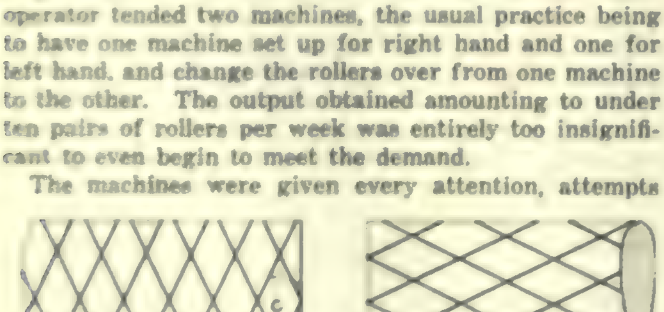


FIG. 4—TWO STYLES OF DIAMOND GROOVING

were made to increase speeds and feeds, and a double shift was put on to run both night and day, but incoming orders continued to arrive faster than the outgoing ones were delivered. For the more standardized groovings multiple tools of the chaser type were made for use in the lathe. For a twelve lead roller the tool would have six correctly spaced teeth so that the whole of one hand could be produced with two sets of cuts only. This arrangement, while being a big improvement over cutting one groove at once was not proportional in rate of production to the number of cutting edges simultaneously engaged. It was found that as the number of cutting edges were increased, the feed traverse had to be reduced—it should be remembered that cutting six ⅛-in. grooves at once meant an aggregate width of cut of ¾ in., and this width of cut was not conducive to heavy feeds when the springiness of the arbors was taken into account. It was possible, however, to do the job in from a half to a third of the time required by

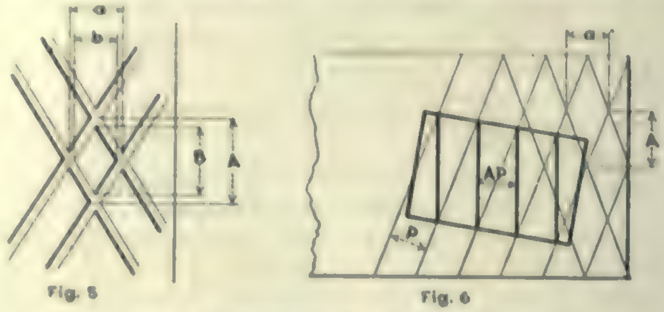


FIG. 5—DIMENSIONS OF DIAMONDS
FIG. 6—PITCHES OF DIAMONDS AND HOB

the single tool method and this brought the rate of production more nearly in line with that obtained by milling. Our lathe equipment, as previously stated, was too small to allow of above one machine being put onto the work, and further, the job was really too trying on the nerves by ordinary lathe methods.

An experimental single purpose milling machine was made with a view of building others later on if the idea proved successful but unfortunately the machine was made with too narrow a range, there were many leads that were called for which could not possibly be obtained on the machine. The design was also inherently weak, lacking in both power and rigidity which resulted in a high percentage of broken cutters.

Someone then had a brain storm, why not hob the grooves? The variation in the grooving was rather an obstacle, but it was decided that the idea was worthy of very serious consideration. After consulting some of the principal customers, it was found possible to considerably reduce the number of groove designs so that the stock of hobs required could be kept within reasonable limits. While some of the customers concurred in this standardization of the grooving, it must be admitted that it was a case of Hobson's choice, if they didn't agree to accept our standards they had to do without the goods. Most of them wanted the goods more than they wanted any particular standard grooving. We accordingly proceeded to get out a line of groovings which would most conveniently meet the limitations of the hobbing process.

Now as previously mentioned the specified dimensions of diamond referred to in the axial and circumferential measurements, as shown in Fig. 5 and Fig. 6. All calculations, however, started with the *normal* pitch, *P*, Fig. 6, this being also the normal pitch of the hob, which had to be conformed to if at all possible in order to keep the stock of hobs as low as possible. The normal pitch of the hob in turn depends on the axial pitch, *AP*, and the hob diameter, being the product of the axial pitch and the cosine of the thread helix angle. The cotangent of the helix angle is found by dividing the axial pitch into the pitch circumference of the hob.

It was essential that the number of hobs be kept as low as circumstances would allow because it was neces-

sary to make two hobs—one right and one left hand, for each normal pitch, this being due to the fact that such wide spiral angles as were required on the product could only be cut by using a hob of the same hand as the spiral itself. As both right and left hand spirals are required in the production of diamond grooves two new hobs were necessary for any special size of diamond that might be called for. As the hobs were expensive it had to be a substantial order that allowed for the making of two of them. Hence the desirability of maintaining our accepted standards as far as possible.

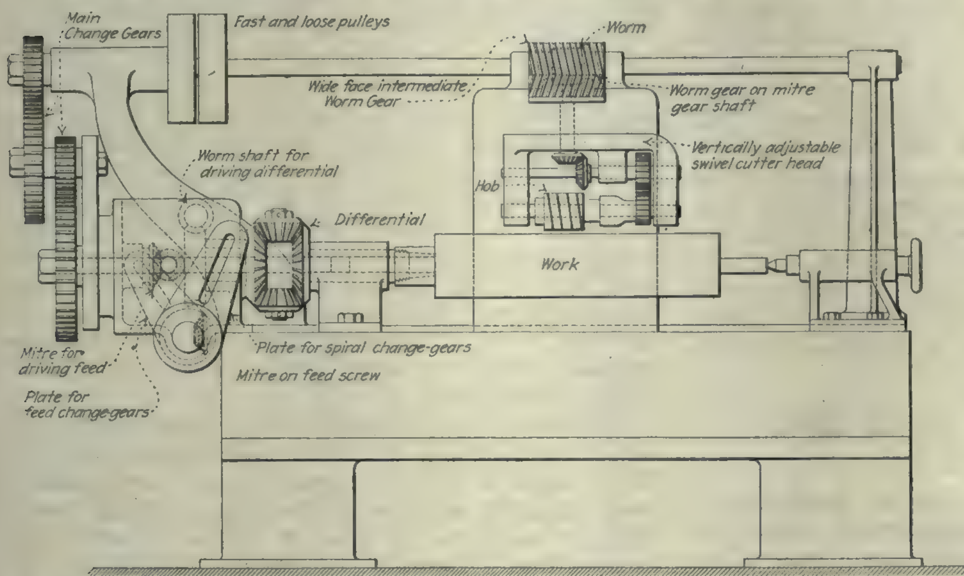


FIG. 7—HOBBING MACHINE FOR GROOVING ROLLERS

There was no standard gear hobbing machine on the market which would accommodate the lengths required in the production of the rollers, so we were compelled to design and build the machines ourselves. Fig. 7 shows diagrammatically the style of machine designed and in which, due to several causes, chief of which was the extreme urgency, there were several details of the design which subsequent experience proved to be wrong in conception. The location of the differential, for example, proved to be entirely wrong in principle, whereas such a mechanism should be designed so as to transmit as small a load as possible, with the design adopted, this unit was actually subjected to a multiplied load. In any hobbing machine, or any other machine tool so far as that goes, it is essential that definite velocity ratios be maintained under load, or at any rate, with as little spring as possible. Unfortunately, the design we produced was very much lacking in this important respect, the various transmission shafts and their supporting members were not as rigid by a long way as they might have been. The result was that there was considerable vibration and noise when the machines were working and, what was more serious, a high rate of mortality in hobs. The production was better than anything we had previously accomplished, one hand of a 4-in.x20-in. roller being grooved in 30 minutes, but we were not yet satisfied that we were getting the best attainable results and, though a new design of machine was put in hand of much more rigid construction, we were never able to proceed with the building of same until trade suddenly fell off and there was no longer so insistent a demand.

With the proposed new design a much more rigid construction was followed throughout the whole machine. Generally there was less overhang of brackets, shafts and gears, while the work spindle was made much larger in diameter and driven by a worm gear, *behind* which the differential was located. This was considered to be a most important factor—the load on the differential and the main change gears instead of being equal to, or greater than, the pressure of the cut, was only about 2 per cent of this, thus giving a much more rigid construction at this point. Had circumstances allowed of the new design being completed, there is no doubt whatever that it would have proved itself to be a marked improvement on the original design, while the operative cost would also have been considerably less by reason of the longer life of the hobs.

By working the machines night and day, using the milling machines for special sizes, we were able to reach a production of nearly two hundred pairs of diamond grooved rollers per week. This output quickly helped us to overtake our orders, after which it was quite an easy matter to meet the demand by our greatly increased productive capacity.

Another scheme for the grooving operation which was considered but never put into operation was by means of a special lathe fitted with automatic reverse to the saddle and a multiple toolholder somewhat similar to a diehead. This toolholder was to have as many cutters as there were grooves to be cut, each cutter radiating to the center of the roller and having some form of scroll exactly on the same lines as a die head, to feed and withdraw all the cutters simultaneously. The machine was to have a powerful drive, preferably through worm gear and the carriage, as stated, an automatic reverse so that it could be set for various lengths of roller. The actual cutting was to be done by a series of comparatively light cuts, about 0.006 to 0.008 in. per traverse of the carriage, the feeding arrangements of the cutter head being such that successive cuts were automatically applied and withdrawn for the idle return motion of the carriage. With a cutting speed of about 15 feet per minute and a feed of 0.006 in., it was expected that one hand could be completed in about five minutes, a rate of production which was a considerable improvement even on the hobbing process. It was also suggested that if the idea was carried a step further and a double cutter head made so as to cut one hand on one stroke and the other on the return stroke, we should be able to completely "diamond groove" a roller in five minutes cutting time, a remarkable rate of production.

An objection to the scheme was the heavy initial outlay on cutter heads, a separate one being required for each different number of leads, but if some definite standard, or two or three definite standards, could have been adopted to meet all requirements, then there were great possibilities in the idea. Another objection, which was anticipated was that the corners of the diamonds would probably be broken, more particularly

in cast iron, by the tools chipping the material. As the rollers had originally been cut in the lathe and the new scheme was only a development of the same principle, this particular objection did not appear very reasonable, we should have risked the trouble had not the slump come along and temporarily suspended our activities in this direction. The rubber trade slump came along some time before the general slump paralyzed nearly the whole of our industry, let us hope that it will also pick up first and be the harbinger of better times all around.

With the system of turning the rollers previously outlined and the hobbing process for cutting the grooves, the labor cost for a pair of 4-in.x20-in. diamond grooved rollers apart from moulding was only about a shilling. With the proposed new grooving process this would have been still further reduced. This was probably only one sixth of the original cost, a saving which allowed of a decent margin of profit, where there had previously been a substantial loss, combined, fortunately, with only a small volume of business. Had there not been a big demand, it would have been impossible to make such substantial savings because we should not have been justified in the rather heavy capital outlay which the big demand easily allowed for.

Rewards for Money Saving Ideas

By John Thomas

Some time ago I read an article in the *American Machinist* which advocated promotion as a reward for the man who contributed a money saving idea to his firm. Now promotion in such a case would be all right if we always happened to have a higher position open when we needed it, but that is very seldom the case. The longer we wait to promote a man after it should be done, the less he will appreciate it. To him the reward will appear much the same as a bill paid long after it has fallen due.

It is interesting to note just how the contribution of an idea is handled in different shops. In some shops the idea is put to use as a matter of course and no mention is made of the fact to anyone. Depending on the mental attitude of the man who furnished the idea, the net result to the firm may be good or bad. If he be a man who finds pleasure in creation, the fact that he has accomplished something beyond his fellows in the shop may be reward enough for him and he will not feel that the firm owes him anything beyond his regular pay. If he does feel that he is entitled to an additional reward, however, and does not even receive a word of appreciation, the firm has lost a valuable asset. First it loses the goodwill of an employee and next the possibility of any more ideas from that source.

In other shops attempts have been made to cover the matter by means of suggestion boxes placed about the shop and offering a money reward for the best idea of the month. The trouble with most of these places is that some firms seem to be trying to get something for nothing. For example, a reward of $10 for an idea is childish. No idea for an improvement which actually is an improvement over the existing method or plan could possibly be worth as little as that sum. If the idea does not warrant a reward of over $10 I should be afraid that it would be so close to the line that in practice its adoption might result in a loss.

What I am trying to point out is this, let us not fool our time and money away on doubtful ideas but pay an honest price for ideas that have a real and substantial value. My suggestion would be to make the reward in money and the field open to anyone. Let the high priced men show their superiority, then when a good suggestion turns up pay a definite percentage of its value as a saving.

It would be possible to have one or more men pass on all suggestions offered, estimate their cost of installations and value as a saving and then figure the size of the reward on the order in hand, or, if the product be running continuously, on the saving for a period of time. Handled in this way the reward comes out of the saving itself. The plan of offering a stipulated amount places all suggestions on the same plane as regards value, which is certainly not the truth. A saving of $5,000 should be worth at least 10 per cent or $500 to the man who was responsible for the saving.

The only trouble seems to be that most firms can't bring themselves to pay out any considerable amount of money for an idea although it may result in a saving out of all proportion to the reward. They seem to be ready and willing to spend a thousand dollars or more for an improved machine which will save the wages of one man, yet if an idea were offered which would make an equal saving they would hesitate a long time before giving up even $100.

Ordinarily, the responsibility for improvements rests with a few men and, no matter how brilliant, they will hardly think of all of the possibilities. Contrasted to these few men we have in the shop probably twenty times as many men thinking of but one or two details at one time. Naturally, one would suppose that the men who are in constant contact with the details of a job would be the first to see an opportunity for improvement. Twenty minds, even though they may not be brilliant, will approach the subject in at least twenty different ways while the one brilliant man might probably think of a dozen.

Few employers seem to realize the almost infinite possibilities of encouraging the submission of ideas for improvements from their employees. A definite plan for promoting and taking care of such suggestions should be a part of every shop organization. Practically every man in the shop has some ideas about his work that have a value. The only trouble is to discover the valuable ones. Employers who are slow to bring out the suggestions may be interested to learn that some of the greatest economical systems were devised by men in the shops. One such plan developed successfully may pay for a thousand failures.

New Bill for Reorganization of Government's Executive Machinery

Legislation emboding the administration's plan for the reorganization of the Government's executive machinery probably will be introduced during the December session of Congress. If the draft of the bill cannot be perfected in time to insure action during a session which necessarily must be devoted largely to appropriation bills, it will be taken up at an extra session which, it is believed, will be called next Spring.

It is understood that the administration bill will not provide for a Department of Public Works. There will, however, be a grouping of public works activities under the close supervision of an assistant secretary.

Tool Checking Systems in Foundries

Identification Numbers for Patterns, Loose Parts, and Core Boxes—Designating Regular and Special Patterns—Shelving and Card Indexes

BY W. J. SANSOM

IT IS CONSIDERED unusual to apply tool checking systems to foundries but it has been successfully accomplished and has brought about economical results. Either the single check or the register system (described in *American Machinist* p. 713, vol. 19) can be used and as the attendant's duties are naturally light, other work can be combined with the checking of tools to advantage. If there is a satisfactory arrangement of departments the tool checker may also check out patterns and attend to their storage. In addition, he may give out accessory materials such as chaplets, blacking and other facing materials, nails, fire clay, and so forth. He may, after instruction, make physical tests on castings, or, in the case of a steel foundry, turn up test bars in a lathe providing the machine is in or convenient to the check room. All tools such as shovels, rammers, riddles, sprinklers, pattern lifts, pneumatic tools, patterns, and in fact every tool and appliance ever used in the foundry should be under the attendant's control in exactly the same manner as the tools in the machine shop check room.

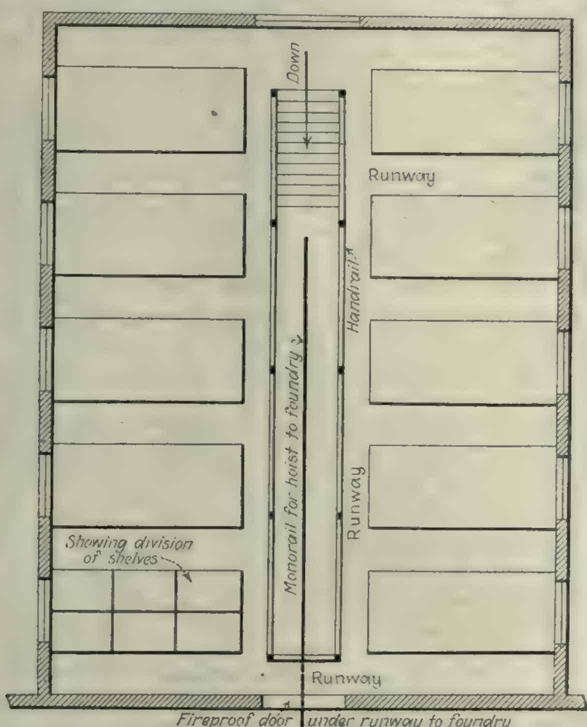


FIG. 1—PLAN OF PATTERN STORAGE ROOM

It has been a matter of great surprise to the writer to note the continued lack of system in the storing of patterns in many of the large shops. It is not unusual for a search for a particular pattern to last an hour or more. This is all the more surprising in view of the fact that pattern storing is one of the simplest of the problems confronting the foundryman and requires very little effort in its upkeep, providing the matter is taken care of in a systematic way. In many cases, the foreman of the department is the only person having any definite knowledge of what patterns are on hand and where they may possibly be found and he is not very sure of it because he depends upon memory for his information. Should the foreman through illness, death or other reason be suddenly removed from his position it would surely be a matter of great difficulty for his successor to carry on his work efficiently through lack of knowledge of a very essential portion of his equipment.

Every pattern should be given an identification number by the engineering department even though the pattern is to be used only a few times. If the part to be cast is a portion of the regular product of the shop it should be plainly marked with the number of the piece. Should the pattern be for a jig or fixture or some other special appliance, it should be given a number and, to differentiate between the standard product and special pieces, the number could be preceded by a letter. A jig pattern for instance should be identified by using the letter J to precede the number. Should there be loose or extra pieces with the pattern, each piece would be given the same number as the main portion of the patten, succeeded by a letter. As an example, a jig pattern, having one loose part would be styled J 834 for the main part, and J 834 A for the loose part.

Core boxes should be numbered in exactly the same way as the pattern and if more than one core box is used, then the same system of lettering for extra parts should be carried out. Core boxes for stock size cores should also be given a number. The numbering of patterns and core boxes is essential to the success of the system and should be attended to by the engineering department and a record made thereof.

The next point for consideration is the suitable arrangement of shelving. A plan of a pattern storage vault is shown in Fig. 1.

Each set of shelves is known by a letter and will be called a section. Sections may be built as high as conditions permit and may have any number of shelves,

PATTERN RECORD	Number	
Number of Parts	Section	Bin
Corebox		

FIG. 2—PATTERN RECORD CARD

each shelf being divided into compartment by the use of 2x4 lumber as it is not necessary to run the partition vertically from shelf to shelf and it is indeed preferable to permit a free circulation of air through the shelves besides giving the added advantage of unobstructed light. If the shelves are higher than can be reached from the floor then a runway or platform may be built

for the upper shelves with substantial steps from it to the floor.

It will, of course, be an advantage to store the lighter patterns on the upper shelves. Each compartment within the section will be given a number. Using our previous example, pattern J 384 might be stored in Section D-22. A card record must be kept of each pattern, an example of which is shown in Fig. 2.

Should a pattern be returned to the pattern shop for repairs or changes a note of this removal is made; upon the return of the pattern to storage the memorandum should be destroyed. If the foundry in which the system is introduced is a jobbing concern there will be numerous patterns left in its care by outside parties. These patterns should also be recorded in the same way as patterns owned by the foundry using the customers' pattern number on the record. It would be well to segregate customers' pattern records from those of the foundry so that it will be possible to know exactly which are customers' patterns.

Patterns are actually expensive tools and difficult to replace. A jobbing foundry that takes pains to care for them properly will be regarded with favor by the customer. Therefore an efficient pattern storage system is an asset to the foundry. This system will also lend itself admirably to the register system of disbursement described in a previous article in the *American Machinist*.

Learning the Trade Forty Years Ago

By W. S. Davenport

At about this time I received a letter from a cousin in Rutland, Vt. (who has now, by-the-way, been employed by the Howe Scale Co. for 59 years) to the effect that he had secured a place for me in a Rutland shop where buttons were made from vegetable ivory. I accepted this job and made preparations to go to Rutland at once, for, though it was not a machine shop, there would be machinery in it and anything in the way of machinery was a passion with me.

At first I was instructed in the art of sharpening, on an oilstone, the knives that were used in the button lathes, and after several weeks of this employment, was given a lathe to run. Running a button lathe, however, is no fun. The operator has to stand all day (ten hours a day, six days a week) on one foot, while with the other he operates the pedal that opens and closes the "grippers" which hold the stock; and in the meantime his hands are kept busy feeding the stock and manipulating the levers that control the knives.

After three months of this arduous labor I received a letter from the Fairbanks Scale Co., to whom I had previously applied, stating that they had a number of young men just about to begin an apprenticeship term and that if I cared to join I could come on at once. This seemed to be my long cherished opportunity to learn the trade and it is needless to say I accepted the offer immediately. I worked for the Fairbanks Co. for a month before I found out what they were going to pay me, and then I learned that it was to be one dollar a week with board and lodging at the company's boarding house.

Actually they had no regularly indentured apprentices but there were a number of young fellows working there on scale parts, running different kinds of machines, who were making more money than was offered to me as an apprentice. I was offered the choice between an apprenticeship and the kind of a job the other fellows had and, foolishly, like many boys of the present, I appraised the immediate gain against the possibilities of later benefits and so began there as the "kid" in the tool crib at the munificent wage of $1.12 per day.

During my first month I managed to gain some interesting experiences, one such being the turning of a countershaft for use in the shop. This shaft was nearly as long as the lathe would accommodate and, as I had never heard of such a device and was given no instruction with reference to it, I proceeded to turn the shaft without a center rest; the result being that it was some bigger in the middle than at the ends.

Cutting a Keyway Under Difficulties

However, after I had filed and polished the shaft all over it *looked* pretty good, so I proceeded to cut a keyway in it for a pulley, using an old screw planer for the purpose that was not at all particular about reversing in the same place on each stroke, in consequence of which the job of keyseating was not a complete success.

The man who was to use that shaft (it was a countershaft for another lathe) was anxious to get it and volunteered to assist me in putting on the pulleys and clutches. We first put in the key and then started to drive the cone pulley over it but we did not seem to be making much progress. He finally asked me if that pulley went on tight before the key was put in, and when I was obliged to admit that I had not tried it at all he was much disgusted and made various uncomplimentary remarks about my ability as a machinist.

In the Fairbanks' shop where I was at this time employed, there were many old tools in the machine shop, one of them being a "chain feed" lathe. On this lathe an endless chain ran over sprockets inside and at each end of the bed, and to the upper side of this horizontal chain the carriage was attached. At the headstock end the transverse shaft to which the sprocket was keyed protruded through the bed, and upon its outer end was a large handwheel by means of which the carriage was moved to traverse it along the shears.

Guessing at the Depth

When facing the end of a long shaft in this lathe it would be necessary for the operator to set his side tool according to his best judgment, walk to the other end of the lathe and turn the handwheel to feed the tool to the cut. As in this position he could not see what the tool was doing he had to trust to luck that everything was all right and, when he thought he had taken off sufficient stock, go back to the opposite end and take a look at it. As it never was all right the first time, he could then pace off the distance once more and try again. To do a good job in this way was quite an art, but was not in accord with what we now call "production."

Among many interesting machines designed for scale work there was one for notching the beams of railroad scales. These beams were of cast iron, planed all over, and when ready for the notches were placed in a long slot in what was called the "log" with but a small part of the upper edge protruding. The log was given a regular oscillatory movement to carry the work under the single cutter and back again, while at the end of each such movement the entire carriage was spaced forward a distance equal to one notch on the beam.

Methods of Machine Tool Design

Continuation of the Description of Feed Mechanisms—Cam Adjustments and Stops —Adjustable and Spring-Backed Rollers—Stops for Several Tools

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

WHEN A CAM is made out of a solid piece of material, there is no possibility of adjusting the cam as to the amount of its action. For instance, if we should have a face cam with a distance between the high and the low point of 2 in., then there will be a travel of 2 in. and no adjustment of this amount is possible. The same holds good if we have a drum cam in which the groove is cut into the metal itself. Any adjustment we might want will have to be obtained in some other manner. If a cam is made by fastening pieces of metal to a disk or drum, adjustment is possible in various ways. In Fig. 189, *A* is a disk to which cam strap *B* is fastened by means of a couple of screws going through slotted holes. Screws *C-C-C-C* adjust the cam strap to any desired position within the limits of the construction. Such adjustment makes it possible to increase or reduce the stroke, or to have the stroke start or finish at any desired point, always within given limits. The screws *C-C-C-C* make the adjustment more positive but can be left off where a less refined adjustment would be satisfactory.

The same kind of adjustment can be given to a cam strap on a drum cam. In addition to the slotted holes in the strap, a number of tapped holes in the disk or drum may be provided so that it becomes possible to place the strap in any desired position over the entire surface of disk or drum. The nuts for the adjusting screws *C* may be screwed into such holes and may also be placed wherever desired. When a cam controls one operation only, we will find three requirements for adjustment. Let us take for example a drum cam which pushes a slide forward and returns it again to the starting point. The requirements for adjustment are these: (1) It must bring the slide to the proper point; (2) It must have a stroke of the proper length; (3) It must act at the proper time. The third requirement is sometimes met by fastening the cam drum or disk cam to the shaft by means of set screws so that it is possible to shift the cam around the shaft any desired amount and then clamp it in position. This is a very crude and unsatisfactory method of adjustment and is, at best, only applicable to cams which do not perform a heavy duty. A better method is to have a disk permanently fixed to the shaft and to have means to attach the drum or disk cam to this disk at any point of its circumference, either by a number of tapped holes or a T-slot or a combination of tapped holes and slotted holes. As a rule it is not necessary to make this adjustment, because it is well possible to lay out the requirements of the cam to a sufficient degree of accuracy so as to be able to place the straps in the proper position or mill the disk cam to the proper shape without further adjustment.

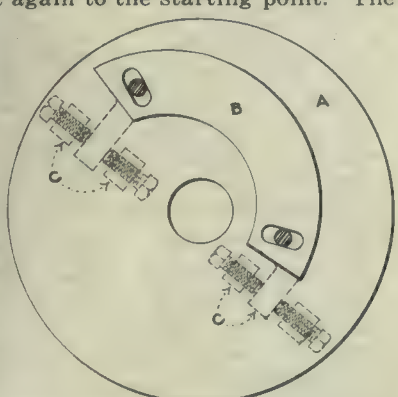


FIG. 189—ADJUSTABLE CAM STRAP

Where such adjustment is required, however, the amount of movement necessary to make up for the error in the original lay-out or in the milling, etc., is always necessarily a small amount and there is no necessity of shifting the cam through more than a very small angle. Slotted holes and bolts would meet such requirements, especially if we should again use adjusting screws such as are shown in Fig. 189. The adjustment of the stroke has been mentioned before and cannot be taken care of if the cam is one solid piece. It is possible, however, to increase or decrease the movement of the slide if we are willing to introduce intermediary members. Fig. 190 shows a construction illustrating how the amount of stroke of a cam can be increased or diminished when transferred to a slide. *A* is a cam and *B* is its groove. The roller *C* is held in one arm of a slotted bell crank and the connection *D* can be bolted to the second arm of this crank at any place along the length of the slot *E*.

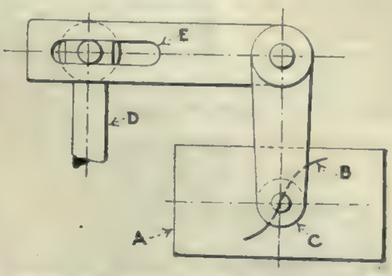


FIG. 190—SLOTTED BELLCRANK FOR ADJUSTING LENGTH OF STROKE

The most important adjustment is the one mentioned under the first item. As a rule it matters very little whether the stroke of a cam is somewhat too much. In fact, in the majority of cases the stroke of a cam is made more than is necessary for the operation and the excess of movement is called the "advance" and is, as a rule, made on high speed. Thus, the loss of time is negligible. On the other hand, the exact point at which the forward movement ceases is often of the greatest importance. Stock feed may have to be stopped at an exact point so as to get the proper length of piece or, more important still, a facing tool must work up to a certain point and this point may be limited to one or two thousandths variation. Either a counterbore may have to be made to an exact depth or a turning tool may have to come to some definite point. In such cases the adjustment should permit of great accuracy. Such adjustment can be accomplished either by moving the cam, the roller or by changing the connection between the roller and the slide to be moved. The adjustment indicated in Fig. 189 would accomplish the purpose but is not handy because this nature of adjustment is often required on account of re-setting or even dulling of the tool and, unless the cam strap to be adjusted is in a very accessible location, and preferably visible at the

same time, it would not be practical to make an adjustment to within one or two thousandths of an inch.

A good construction for this purpose is the following: The roller is placed on a stud which is not directly attached to the member to be moved but is fastened in a separate piece which can slide in that member, which is adjustable by means of a micrometer screw, and which can be clamped to that member. In some cases the member to be moved is merely a bar which holds a tool or possibly a piece of work. In such cases the bar is generally made of cylindrical shape for ease in

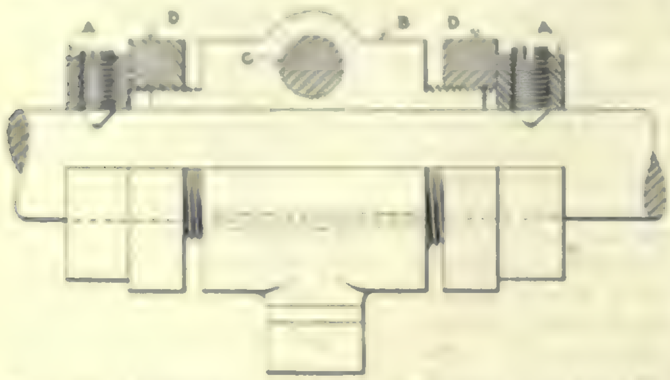


FIG. 191—ARRANGEMENT FOR ADJUSTING CAM ROLLER

machining and a collar holding the roller is clamped around it. In addition, a couple of collars are provided for extra safety against end movement. These latter collars are indicated by the letters *A* in Fig. 191. They are set-screwed to the bar or held in position in some other suitable manner. The collar which holds the roller is indicated by the letter *B*. It is split and can be clamped on by means of the bolt *C*. Extensions of this collar are threaded so that the collars *D* can be brought to bear against collars *A*. By turning both of the collars *D* the roller can be moved either to the right or to the left. A similar construction could be used to adjust the drum cam itself, should the cam be mounted on the bar.

Many other methods of adjustment may suggest themselves. We only want to mention here a case which requires special care and that is when the nature of a tool is such that very frequent and delicate adjustments are required. In that case the roller should be adjusted by means of a screw, as was mentioned before, and the screw should be provided with a small worm wheel operated by a worm with knob or small hand wheel. This gives the operator a chance to make relatively large movements with his hands for a very small amount of movement of the roller, so that he will be able to make the finest possible adjustments. Such cases, however, are rather the exception.

In the foregoing discussion of adjustments we imagined that the cam had only one function to perform. When we are dealing with such cams as we meet in automatic screw machines, we find as a rule that they must perform a number of functions. For instance, one cam may have to take care of as many as six forward and return movements of the turret, besides providing the necessary space for the functioning of other cams or mechanisms. In such cases the individual adjustment of cam straps is no longer practical. Not only would it involve too many devices, all placed on one cam drum, but the adjustment of one strap might make trouble by causing interference with other operations. Neither is it possible to adjust either the entire cam drum or the roller, because doing this might provide the proper stroke or positioning for one turret tool but it would have given the same amount of adjustment to the other turret tools, which is not desired and probably not permissible. In such cases a different method must be devised for the adjustment of all of the tools.

The tool which requires the greatest accuracy is ordinarily the facing tool. In order to make sure that the facing shall be smooth, it is customary to provide a small amount of dwell at the end of the facing cam, so that three or four revolutions of the spindle will be made without forward movement of the tool. This is really not a correct expression; we should have said "without a tendency of the cam to give the tool a forward movement." When the cam has ceased to push the tool forward we will find that there is still pressure between tool and work, due to the spring or deflection created by the feed and this deflection will cause the tool to penetrate still further, even though the cam has ceased to push it forward. The extra three or four revolutions are sufficient to obviate the effects of this deflection.

We should also notice that the deflection can never be very great, because when the slope of the cam is such that the feed is, let us say, 0.005 in. per revolution, we will find that the tool feeds very much less near the end of the stroke due to the fact that the roller must climb over the edge of the cam. In Fig. 192 an exaggerated diagram shows this condition. The feed slope is taken here at 45 deg., something we would never do for facing, but which is a condition which will bring out how the rate of feed is gradually reduced by the action of the roller. We see, then, that toward the latter part of the facing operation the amount of feed is a vanishing quantity. Nevertheless, it is the part of wisdom to provide a few extra revolutions without any feed at all. Though the foregoing method insures a smooth facing job, it does not insure an accurate position of the face. Looseness in the parts may cause the turret to advance one time a little more than the other and it has been found that the only safe way to do a really accurate facing job is to bring the turret up against a positive stop which should be located in such a manner that the turret or its slide strikes it before coming to the end of the movement which the cam would give it. Of course this would lead to breakage if there were an appreciable amount of difference between these two positions.

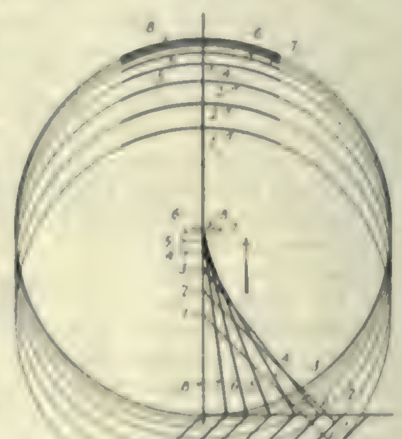


FIG. 192—DIAGRAM TO ILLUSTRATE DIMINISHING RATE OF FEED

As a matter of fact, the stop is placed so that the turret tends to advance one or two thousandths further after the stop is reached. One depends, then, on the elasticity of some of the parts to avoid breakage. For instance, where the cam is directly mounted on the shaft there will be enough spring in the shaft to provide this elasticity. For other purposes, however, it is better

not to have any elastic members in the mechanism, so that only the very small amount of compression possible in the slides, in the cam, and maybe a slight amount of deflection in the roller stud would be all the leeway we would have for the setting of the positive stop. And for this reason the following construction is recommended:

The roller is mounted on a stud which is held in a sliding member. This member cannot move backward because it butts up against a positive stop. It can move forward, however, for a short distance but is prevented from doing so by a loaded spring which pushes it back. By a loaded spring we mean the following: Suppose we have a spring which, when compressed ¼ in., exerts a pressure of 100 lb. Then it will exert a pressure of 200 lb. when it is compressed ½ in., 400 lb. when compressed 1 in., etc. If the roller slide should bear up against such a spring before it is compressed, it would not prevent the roller from moving a very short distance because almost any little pressure would be sufficient to overcome the spring.

Backing the Roller with a Loaded Spring

If, on the other hand, the spring has been compressed 2 in. before it was placed in position, it would bear against the roller slide with a pressure of 800 lb. and, unless the pressure against the tool, that is, the feed pressure, were more than 800 lb. the roller slide would not move but would act as if it were made solid with the turret slide. If we know that the feed pressure never needs to exceed 800 lb., then such a spring will permit the cam to act on the tools as if there were no spring at all. And yet, when the turret slide strikes the positive stop, the spring will permit the roller to go a short distance further. This distance is never more than a few thousandths of an inch, but, supposing it to be as much as $\frac{1}{32}$ in., then the compression of the spring would increase from 2 in. to $2\frac{1}{32}$ in. and the pressure would increase from 800 to 812½ lb. In other words, we know beforehand the maximum pressure which the cam may have to exert against the roller.

There is another advantage in this device. If a drill or other tool should break and present a positive obstruction to further movement of the tool, a wreck might result unless such an elastic medium were interposed. With the spring in position it will be possible for the roller to advance further without taking the turret along and the operator would have a chance to stop the machine before a wreck occurs.

Providing Stops for Several Tools

Though such a positive stop locates a single tool it cannot locate more than one. It may be necessary to provide stops for several tools. We may wish to counterbore, face, and turn to a shoulder. As a rule, when we have such operations to perform, we try to arrange the tools so that all three accurate operations are finished with one turret position. This insures the correct relation of the shoulder, the counterbored surface, and the faced surface one to another. All tools do not dull at the same rate, however, and, though the relation may have been perfect when the job was started, it is but a short time before the uneven wear causes a slight error to creep in. In the course of time some or all of the tools in this turret position may have to be re-sharpened and re-set and this re-setting is necessarily a lengthy operation when a high degree of accuracy is required.

If we could have positive stops for more than one turret position, there would be a chance of dividing up the operations among the different tools and each of the three accurate surfaces would become independent of the other two, so that the wear of each tool could be independently compensated for and the re-sharpening of a tool would no longer involve the maintaining of very accurate relations between a number of tools. In order to obtain such a multiplicity of positive stops we can arrange pieces between the positive stop and the turret slide, making the pieces of unequal length and adjustable.

Adjusting Individual Stops

We might arrange them in a star or small turret. The body of the turret would always bear up against the positive stop and projecting from the body we might have an adjustable set screw which can be clamped after being adjusted or which may be held accurately by a lock nut or by some other means. We might go still further and provide each of the set screws with micrometer adjustments. It would not only be possible to set each of them to the proper length but, after measuring our pieces of work and finding that it is too long or too short, say 0.003 in., we might adjust the corresponding screw that amount by means of the micrometer adjustment. The forward abutment of the loaded spring could be made to bear up against these screws. The turret in which they are located would have to index in unison with the main turret. It would, of course, be possible to leave out some of them for turret positions where great accuracy is not required.

The Production of Rustless Iron

There has been developed recently in England a "rustless iron." This material is iron to which a certain proportion of chromium has been added. A similar alloy called "stainless steel" has for some time been familiar to metallurgists. Stainless steel differs from rustless iron chiefly in that it contains small amounts of carbon.

In order to produce rustless iron, an iron-chromium alloy free from carbon, it is necessary that carbon-free iron and chromium be available. The usual forms of chromium, commercial grades of ferro-chromium, contain comparatively large amounts of carbon. The discovery of rustless iron has thus made it very important to be able to treat ferro-chromium by some process which will remove the carbon. Among the methods proposed is that of heating ferro-chromium in contact with hydrogen.

Through experiments conducted by the Bureau of Standards, of the Department of Commerce, it has been found that ferro-chromium heated in hydrogen loses carbon slowly at temperatures below the melting point of the alloy. When hydrogen is bubbled through ferro-chromium in a molten condition the loss in carbon is very rapid.

It may be possible to prepare low-carbon ferro-chromium by blowing hydrogen gas through molten ferro-chromium in a converter of the type used in the manufacture of Bessemer steel. This work is described in Scientific Paper No. 448 of the Bureau of Standards, available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c. per copy.

Direct Labor Costs versus Selling Prices

By Gordon Clark

The article on page 305, Vol. 56, of *American Machinist* by Harry Senior, with reference to looking to other items than direct labor costs for opportunities to lower selling prices, must strike a responsive chord in many of us who are more or less "fed up" on the idea that direct labor charge is the all important factor in determining the selling price of a product.

It is true that in a few industries the labor costs are a considerable portion of the selling price, but in the majority of cases the wonderful improvements in production machinery have steadily decreased the relative percentage of labor cost in the finished product. However, the direct labor items on the cost sheets seem to exert a hypnotic influence upon the average manager as he scans them in search of chances to lower costs to meet the severe competition that he encounters today. If he would spend an equal amount of time and energy in looking for savings in that "no man's land" that lies between bare costs of labor and material and the selling price of the finished product, he would find some excellent opportunities for the exercise of his acumen in the effort to lower the selling price.

Probably no series of articles recently published shed more light on this phase of the subject than did Mr. Bassett's recent articles in *American Machinist* on getting all of the production costs into the product, instead of having them tucked away under that convenient but most ambiguous term of "overhead."

In his search for the truth, after rearranging the cost system along the lines of Mr. Bassett's article, the manager might find that the pride of the shop, the big Humdinger machine purchased to clip a few pennies off the cost of machining a certain major item of the product, carried a true overhead, due to the floor space occupied, power requirement and depreciation of 480 per cent instead of the 250 which had been allotted to that division of the plant. As this fact soaks in he begins to see that the service orders for this piece, upon which they always considered they made a neat profit, were not so profitable after all.

Likewise he might also learn why a certain specialty company always seemed pleased to accept their orders for a minor machine part at quite a low figure, for the reason that they had long ago discovered that the class of machine on which this part could be made carried an overhead considerably below the 250 per cent that his own plant assumed in computing its cost on this piece.

Another item that affects the cost in some shops is the poorly selected, though extensive, equipment to handle the work in question. No one can gainsay the advantage of adequate tools and equipment that play such an important part in modern production methods, but on the other hand we cannot shut our eyes to the numerous cases of unnecessary and superfluous equipment for minor operations, the cost of which must be tacked onto every unit produced and eventually paid for by the customer.

Another place which contributes its share towards excessive costs, but in a quiet, unobtrusive manner, is the stockroom. Aside from the stocks of parts which represent a legitimate quantity needed for production there are in every stockroom more or less parts to be used for service only, some of which represent from five to fifty times the actual number that will ever be needed to service that particular part.

What is the cause of this surplus stock and what department is responsible? In a majority of cases the part has been superseded by a new part, incorporating some improvement or correcting some fault that had been reported in service. The change has been made, however, without a careful survey of the number of old parts in finished and rough stock, or in process.

One way of lessening the tendency to overstock as a result of such changes is to insist that, before any proposed change can be brought up for consideration, the following information be placed on the change sheet: (1) Number of parts in finished stock; (2) number of parts in process; (3) number of parts in rough stock; and last but not least, (4) number of parts which the purchasing department may have on order, if it is a part that is purchased either rough or finished from outside sources. This information has a decidedly healthy effect in preventing the engineering department, in a burst of enthusiasm, from crowding through changes without a thorough investigation of the stock and just what the change may mean from a dollar-and-cents standpoint.

Another cause that is often responsible for an excessive number of certain parts in service stock is the elimination of a model without taking the proper steps to balance up the stock of the various parts and comparing them before taking the model in question out of production. The service requirements on a certain model may be such that 75 per cent of the parts are seldom, if ever ordered for replacement.

Some of the suggestions offered above appear to be of a rather elementary nature, as one would imagine that the status of the stock would always receive careful attention, but a walk through the service stockrooms of the majority of our large manufacturing plants, especially those engaged in automotive work, will show that no small portion of their costs are in the form of "frozen assets" in stock.

It may sound presumptuous to intimate that our modern managers have not already given all the above items due consideration, but it is a fact that many of them have not done so. Having arrived at the bare labor cost on a part, they are content to add whatever overhead seems applicable to that class of work and let it go at that.

The selling expense of some products plays an important part in the selling price of them. The percentage received by dealers on some classes of work, such as road building and contracting equipment, run as high as 30 per cent. It must be remembered that the dealer expects to do a certain amount of servicing on this class of machinery, but even allowing for this, the purchaser of a piece of equipment at six or eight thousand dollars must realize the weakness of selling methods that exact such a heavy toll from the buyer.

In regard to the position that labor costs govern costs consider a certain make of safety razor that sold for $5 all over the country for many years. Within the last few months this same make of razor, made by the same company, can be purchased for 86 cents. Did the labor costs in this particular product undergo some phenomenal reductions, or was Mr. Einstein's exposition of the theory of relativity responsible for the reduction in price?

The Law of the Involute Curve

Determining the Lead of an Involute Curve—How Right- and Left-Hand Involutes May Be Generated—Finding the Length of Involutes

BY O. G. SIMMONS
Vice-President and General Manager, Simmons Method-Hob Company

WHAT IS AN involute curve? The writer, like many others interested in gearing, asked this question some twenty years ago. The question was answered then and is answered by many today in terms of method of procedure, somewhat as follows: Cut a circular disk from a stiff card and tack it fixedly to the drawing board. In the edge of the circle stick a pin. Attach a thread to the pin and form a loop at the other end. Wind the thread about the circular edge of the disk, pass a pencil point through the loop, and then unwind the thread with the pencil, keeping it stretched taut. If the pencil point is pressed to the paper, meanwhile, it will describe an involute curve on the board.

This was the only answer and made one no wiser after having received the information than before. Evidently it has been due to this lack of knowledge of what the characteristics of an involute curve really are that the art of gearing has been shrouded in such mystery and that authorities on gearing have been at variance regarding this particular matter of the involute.

Up to the present time, the manufacturer has been cutting the gear teeth for his product with such cutters as happen to be on hand and supplied him by the manufacturers of machine tools for generating or forming gear teeth. His interest usually has ceased upon the discovery that the theories of the authorities on gearing were complicated and this notwithstanding his realization that his gears were not giving the sort of service that modern practice demands. The manufacturer has been compelled to cut gears with such cutters or tools as were supplied him, submitting to fate and accepting the indifferent results without question.

Modern demands on machine elements, however, induced by such inventions as high speed steel, the automobile and the steam turbine are such that the manufacturer who uses gears in his machines must provide the best gears within the scientific knowledge of himself or his associates. The writer will attempt in the following pages to supply a part of this knowledge and will begin by answering the question: What is an involute curve?

In proving that the involute curve has a lead like the helix, reference is first made to Fig. 1. The numeral *1* indicates the shaft upon which is mounted the pulley *2*. To this pulley there is secured rigidly a piece of cardboard *3*, which rotates with the pulley. To the left of the shaft *1*, is located another shaft *4*, upon which is mounted a pulley *5*, similar to the pulley *2*. A belt *6* is mounted upon the pulleys *2* and *5* so that the movement of the belt will rotate the pulleys. To the belt *6* there is fixed a holder *7*, adapted to receive a marker or scriber *8*, the point of which lies in the plane of the belt *6* and to which the circles *2* and *5* are tangent.

The point of the scriber *8* is placed in contact with the cardboard *3*, and the belt *6* is moved in the direction of the arrow *U*, over a distance equal to the perimeter of the pulley or circle *2*, and the movement is then stopped. The involute curve *9* has been generated and drawn upon the card *3*, while the pulley *2* has made one revolution in the direction of the arrow. The shafts *1* and *4* have been supported at a sufficient distance apart *V* to permit cardboard *3* to turn freely.

Since the point of the scriber has been moved along the tangent line represented by the belt *6*, over a distance equal to the perimeter of the pulley *2*, the distance

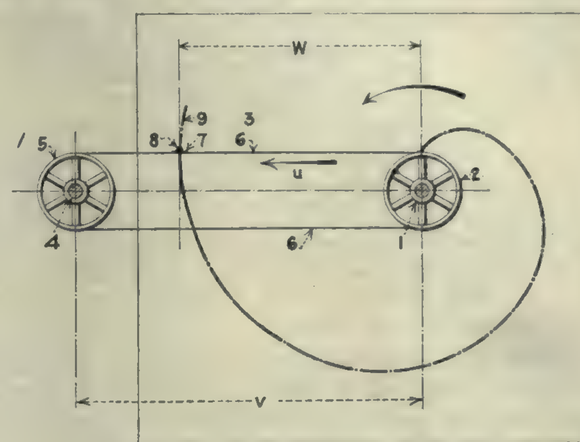


FIG. 1—INVOLUTE CURVE GENERATED BY PULLEYS AND BELT

W represents the "lead" of the involute as well as the perimeter of the pulley *2* which is the evolute of the involute curve *9*. It is obvious that for each distance *W* the scriber *8* moves, the pulley *2* will make one additional revolution. It follows, therefore, that the sum of all the distances *W* will equal the perimeter of the pulley *2* multiplied by the number of its revolutions.

From the foregoing illustration and description, the truth of the law of the involute curve will be apparent. The law may be stated as follows:

The involute of any evolute has a constant lead which, when measured on a line tangent to the evolute, is equal to the perimeter of the generating evolute.

The truth of this law has only been demonstrated in connection with an evolute in the form of a circle, for we are concerned only with the involutes of circles. These circles are the evolutes of the involute gears, as we shall later consider. It is to be understood, however, that the law of the involute can be demonstrated to hold true with an evolute of any form.

The theory illustrated in Fig. 2 is very similar to that in Fig. 1, except that in Fig. 2 we have interposed an intermediate pulley to which we have fastened the cardboard and upon which we shall generate right- and left-hand involute curves. A pulley *10* is mounted upon a shaft *11* and is adapted to rotate with or upon it. Another pulley *12* is adapted to rotate with or upon a shaft *13*. Joining these pulleys is a belt *14* which rotates the pulleys when it is moved. Between these pulleys, and engaging the belt *14*, is located a third pulley

15, adapted to rotate upon its shaft *16* when the belt *14* is moved.

A piece of cardboard is rigidly secured to the intermediate pulley *15*, so as to turn with it. A scriber *X* is placed at the point of origin or the point of tangency of the belt *14* with the pulley *15*, as in the case of Fig. 1. The belt *14* is moved in the direction of the arrow *1*, with the scriber in contact with the cardboard. The scriber *X* then generates the involute curve *1*, with a lead which the perimeter of the pulley *15* equals.

For the purpose of these abstract demonstrations, the belt is assumed to be imaginary only and without thickness. In a practical apparatus using belts, the thickness

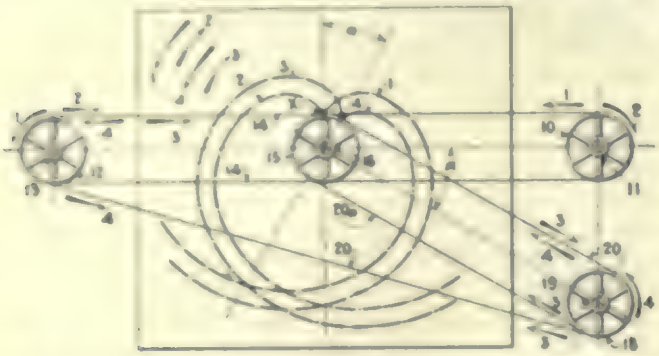


FIG. 2—RIGHT- AND LEFT-HAND INVOLUTES GENERATED FROM TWO POINTS OF ORIGIN

of the belt must be added to the diameter of the pulley and this sum would be the real diameter of the evolute, the perimeter of which would equal the lead of the involute. The reasons will be obvious later when we describe the method of generating involute curves in lathes, milling machines and similar machine tools.

The operation just described is identical with that described in connection with Fig. 1. If the pulley and cardboard are turned in the opposite direction, as indicated by the arrow *2*, the scriber *X* will generate an opposite hand involute curve *2* from the same point of origin. The lead of this curve will be equal to that of the involute curve *1*, for the reason that all involutes of equal evolutes or circles are equal.

We will now introduce still another pulley which is indicated by the numeral *18*. This pulley is located at an angle α below the pulley *10* and rotates with or upon the shaft *19*. A belt *20* is arranged upon the pulleys *12*, *15* and *18*, and the belt *14* is removed. To insure correct turning, another belt *20a* may be placed upon the pulleys *15* and *18*. The scriber *X* is placed in the same position as before and generates the involute curve *1*, when the belt *20* is moved in the direction that the arrow *4* indicates.

The movement of the belt *20* is reversed to move in the direction of the arrow *3* and the scribing point *X*, not having been changed, returns along the involute curve *1*, to the point of origin, where it ceases to generate. The point now lies upon and coincides with the circular surface of the pulley *15* until it has moved through an arc represented by the angle α, to a new origin. Upon continued movement of the belt in the direction of arrow *3*, the scriber then generates from the new origin the involute curve *3*, as the cardboard is rotated with the wheel *15* in the direction that the arrow *3* indicates.

It is now evident that the involute curve *1*, during the rotation of the cardboard, will take the position of the involute curve *4*, at the moment the scriber *X* begins to generate the involute curve *3*. When this movement is reversed to the direction of the arrow *4*, the scriber *X* generates the involute curve *4* from the same point of origin and the curves *4* and *1* coincide.

In this view, the involute curves *1*, *2*, *3* and *4* have been shown in different positions with respect to the cardboard and as being generated from two points of origin. This has been accomplished by indexing the cardboard through the angle α. From the foregoing description of the principles of movement illustrated by Fig. 2, it is apparent that all involute curves from the same circle, when of the same "hand," either coincide or are parallel to one another. Further, it is also clear that all right-hand involute curves, and all left-hand involute curves, generated from the same circle, but from different points of origin, are parallel.

From an inspection of Fig. 2, it will be clear also that if two scribers were used and placed upon the belt at a distance apart equal to the arc on the periphery of the wheel *15*, determined by any angle α, two involutes would be generated if moved one way and two of the opposite hand when the action was reversed. No reversing action would be necessary to generate a right- and left-hand involute curve, one after the other, if the scriber *X* in Fig. 2 were placed in contact with the cardboard at a point removed from the point of tangency of the belt and if the intermediate pulley and the belt were moved so that the scriber would approach the point of tangency. The scriber would then generate an involute, and upon leaving the point of tangency, with the same movement of the belt continued, would generate an opposite hand involute.

The position of the intermediate pulley with respect to the outside pulleys is of no moment in so far as the point of origin of the involute curves is concerned. The point of origin of an involute curve is at the point of tangency. The involute curve cannot possibly extend below the evolute or generating circle since the tangent line is the line of rectilinear movement, which line is tangent to the evolute. A point, such as the scriber, must have not only a certain definite movement but also

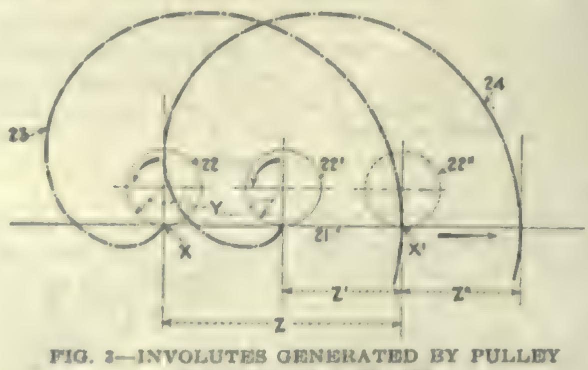


FIG. 3—INVOLUTES GENERATED BY PULLEY ROLLING ON A PLANE

the movement of such a point must be along and on the line tangent to the evolute. This line we have just defined as the line of rectilinear movement.

With reference to Fig. 3, the numeral *21* indicates a plane upon which is adapted to roll, without slippage, a circular disk *22*. A cardboard (not shown) is attached to the disk in the manner previously described and at the point *X'* on the plane *21*, the scriber is placed. The circular disk *22* is placed so that the plane

21 is tangent to it at the point X', represented by the dotted circle *22*." The disk is rotated from that position in the direction of the arrow to the position of the circle *22*, which represents one revolution of the disk. The involute curve *23* has been generated but the plane and the scriber have remained stationary.

If the disk *22* has a radius equal to Y, it is obvious that the distance measured on the plane *21* between the point of the origin X and the point of the scriber X', which is represented by the letter Z, will equal $2Y \times 3.141592$. Again, the disk *22* is placed as before to represent the circle *22*" and the latter is rotated to the position *22'*, while the plane *21* has moved in the direction of the arrow. The involute curve *24* is generated.

This principle, however, to which we referred previously when we considered the belt in Fig. 2, is dependent upon the condition that there is no slippage between the disk and the plane but that the movement is absolutely according to the ratio of lead over the perimeter of the disk. In other words, the disk must, for every revolution it makes, be just that many perimeters away from the generating point, regardless of its linear movement.

This principle is also shown in Fig. 3. In the last case described, the disk *22'* has rolled to the position shown from its original position at *22*", and has made a complete revolution, while its linear movement represented by the letter Z' along the plane *21*, means but a part of the actual distance Z. In this case, let us assume this distance equal to one-half of Z, so that: $Z' + Z'' = Z$. Evidently the combinations of relative movements between disk and plane are unlimited.

The word lead has been used herein to distinguish between the pitch of the involute and its lead for one turn of the generating circle. The pitch will be equal to the perimeter divided by the number of involutes generated from the same circle. Expressed as a formula:

N = number of involutes divided and generated from the same circle
P = pitch
L = lead

$$P = \frac{L}{N}$$

A formula for the length of the involute curve of any circle, measured along the curve from its point of origin to the generating or marking point, for one revolution of the evolute, may be expressed as follows:

X = length of the curve for one complete spire
L = lead of the involute
D = diameter of the generating circle
N = number of spires to the involute curve
$\pi = 3.141592$

$$X = (N\pi)\ (NL)$$

$$D = \frac{X}{(N\pi)^2}$$

It is evident, of course, that by transposition we may determine any of these factors.

As the foregoing principles applied to the generation of an involute curve are true, we may give a correct definition of such a curve as follows:

The involute curve is the resultant of the uniform movement of a point along a straight line tangent to a given circle and the angular movement of the line about the periphery of the circle uniform with the movement of this point and over an arc equal in length to the distance traversed by this point.

(To be concluded)

Research and Lubrication

The following paragraphs are from Research Narrative No. 44 issued by the Engineering Foundation. The contents are based upon information from Dr. Irving Langmuir, General Electric Company Research Laboratory, Schenectady, N. Y.

How large are molecules and what are their shapes? The layman frequently expresses incredulity as to practical usefulness of the refined and abstruse work of scientific research. Such incredulity is found even among technical men and other persons whose occupations or fortunes are built upon the sciences. Attempts to solve problems whose industrial importance needs no explanation often are unsuccessful until Science has gone far toward the "root of the matter."

A modern method for separating copper and certain other metals from some kinds of ores is known as the flotation process. Finely pulverized ore is mixed with water containing a small quantity of oil which forms a persistent froth upon agitation. The solid particles of ore are wet with the oil and these oiled particles adhere to the bubbles of froth. Thus the ore particles float to the top of the tank containing the mixture while the non-metallic particles of the ore, not being wet by the oil, do not adhere to the froth and fall to the bottom of the tank. The remarkable selective action of some oils on certain ores and the effects produced by small quantities of acids and other substances are imperfectly understood.

Some experiments undertaken by Dr. Irving Langmuir in the General Electric Laboratory at Schenectady, have led to the determination of the sizes of molecules of a number of substances and to the proofs of the fact that molecules could not be merely smooth, rigid spheres. It appeared that the dimensions of some molecules differed, the length, for example, in some cases, being several times the square root of the area of the cross-section. It was also evident that the active atoms, or groups of atoms, in certain molecules of a liquid when spread upon the surface of a solid or another liquid, turned in the direction of the surface of contact so as to engage the atoms or molecules in the supporting surface. This knowledge helps to explain why certain liquids will wet each other, and certain solids, but not others—in other words, will spread in a uniform film over the whole surface of contact.

These experiments were undertaken solely because of their scientific interest. Only later was it realized that they had an important bearing on the process of flotation.

These phases of the subject, it will readily be seen, are of importance also in the very practical problem of lubrication, of interest to everybody who runs a machine of any kind. For in order that he may have sold to him the right kind of lubricant, or in order that expensive machinery may not be injured, those who manufacture the lubricants should have the benefit of the chemist's and physicist's knowledge of the fundamental principles developed by such research as that of Dr. Langmuir.

But how big is a molecule? To use as an example a commonly known substance, a molecule of castor oil has a cross-section in square centimeters expressed by the fraction having 209 for its numerator, and 1 with sixteen ciphers after it for the denominator; its length in centimeters is 5.5 divided by 1 with eight ciphers;—almost too small to be conceived.

TABLE III

United Kingdom—Exports of Metal Working Machinery

Period—1908 to 1921, Inclusive

Country	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Austria-Hungary	£9,431	£1,845	£10,405	£11,980	£11,344	£10,632	£3,067	£	£	£	£	£	£
Argentine Republic	23,868	61,514	39,722	41,952	36,230	30,574	21,614	4,525	5,642	2,881	3,894	14,510	42,595
Belgium	7,091	14,962	22,589	23,336	36,042	32,128	17,173			60		203,413	272,014
Brazil	16,340	36,488	33,410	44,460	70,482	57,734	28,447	5,721	4,421	3,223	5,864	21,120	54,580
Chile	12,275	13,450	8,587	14,865	13,292	17,101	7,634	1,340	1,128	1,960	2,149	8,927	8,540
China, Exclusive of leased territory													82,693
Denmark													9,113
France	25,409	60,727	72,606	55,080	85,966	142,127	92,971	192,962	363,031	847,361	693,385	771,235	687,444
Germany	10,706	14,928	23,471	25,742	48,545	45,998	18,290						13,840
Greece													9,707
Italy	11,500	27,283	124,568	41,904	68,391	68,464	54,629	48,563	115,594	207,686	273,093	234,474	73,160
Japan, Inc. Formosa	110,628	206,524	76,284	104,501	125,078	118,060	97,509	17,424	17,626	26,245	44,098	112,084	212,658
Netherlands	2,691	15,860	9,477	16,887	24,025	17,932	18,973	11,821	7,048	3,677	674	52,960	17,506
Norway								7,647	6,510	7,093	2,338	19,931	
Portugal								1,847	6,163	8,426	8,673	37,199	38,882
Russia	8,063	28,741	27,076	59,095	54,510	85,021	272,817	273,101	377,513	804,175		30,869	23,702
Siam						5,885	15,368	1,326	3,066	2,385	1,777	4,054	9,306
Spain	7,171	15,380	19,230	11,498	17,257	20,585	18,628	15,062	17,285	20,669	22,091	94,297	154,921
Turkey													7,561
United States of America								2,335	3,728	4,730	17,483	18,852	18,413
Other Foreign Countries	33,860	62,081	61,196	75,487	72,343	76,671	71,333	44,931	21,479	24,999	20,008	99,053	201,405
Total Foreign Countries	£279,025	£559,783	£528,621	£526,787	£663,505	£728,912	£739,453	£628,605	£950,234	£1,965,550	£1,095,527	£1,723,186	£1,878,038
Australia	£29,791	£46,333	£65,143	£99,946	£107,854	£115,842	£87,413	£47,341	£54,243	£54,186	£45,778	£117,905	£296,640
British East Indies	69,491	107,998	42,596	64,238	78,400	89,239	94,807	58,317	68,608	64,945	80,386	278,854	840,710
British West Indies													4,262
Canada	4,448	5,410	16,564	16,557	25,192	24,804	35,461	12,230	5,372	4,006	14,667	29,514	6,845
Ceylon													6,213
Egypt								2,716	4,273	5,169	12,314	9,700	10,257
Federated Malay States													4,945
Hongkong								1,593	5,374	1,364	1,706	31,894	79,541
New Zealand	13,130	10,239	19,334	14,315	18,877	13,726	16,078	9,836	6,737	4,287	3,250	17,891	39,260
Straits Settlements													13,376
Union of South Africa	4,564	15,763	27,013	27,124	22,479	22,820	25,870	12,361	10,218	5,666	17,171	46,911	95,776
Other British Possessions	15,932	22,959	15,333	10,523	18,634	17,457	21,105	6,485	11,849	6,504	9,537	29,711	85,499
Total British Possessions	£137,356	£208,702	£185,983	£232,703	£271,436	£283,888	£280,734	£150,879	£166,624	£146,127	£184,809	£562,380	£1,483,324
Total	£416,381	£768,485	£714,604	£759,490	£934,941	£1,012,800	£1,020,187	£779,484	£1,116,858	£2,111,677	£1,280,336	£2,285,566	£3,361,362

Value of £ at parity is $4.8665

TABLE IV

United Kingdom—Imports of Machine Tools

Country	1908 Quantity Tons	1908 Value £	1909 Quantity Tons	1909 Value £	1910 Quantity Tons	1910 Value £	1911 Quantity Tons	1911 Value £	1912 Quantity Tons	1912 Value £	1913 Quantity Tons	1913 Value £	1914 Quantity Tons	1914 Value £
Germany	.....	....	71	7,093	83	8,603	221	14,943	163	13,750	218	20,450	429	31,337
Belgium	.....	....	22	1,356	31	1,647	42	1,522	35	1,920	24	1,452	.....	....
France	.....	....	20	1,275	24	1,403	23	1,492	56	2,719	34	2,902	44	3,263
United States of America	798	99,014	476	68,293	397	66,078	1,488	192,863	2,448	260,100	3,411	324,832	4,162	376,605
British Possessions	.....	119	1	53	4	237	3	125	.....	34	12	978	41	2,892
Other Foreign Countries	189	16,494	39	3,085	32	4,010	38	3,274	43	4,120	153	10,826	157	12,952
Total	987	115,627	629	81,155	571	81,978	1,815	214,219	2,745	282,643	3,852	361,440	4,833	427,049

Country	1915 Quantity Tons	1915 Value £	1916 Quantity Tons	1916 Value £	1917 Quantity Tons	1917 Value £	1918 Quantity Tons	1918 Value £	1919 Quantity Tons	1919 Value £	1920 Quantity Tons	1920 Value £	1920 *Number of Pieces
Sweden	......	....	......	....	......	....	......	....	......	....	315	57,730	397
Germany	......	4	1	43	1	57	......	....	10	1,869	685	119,237	1,153
Netherlands	......	....	......	....	......	....	......	....	......	....	96	20,923	230
Belgium	......	....	......	....	......	....	......	....	......	....	36	8,413	43
Denmark	......	....	......	....	......	....	......	....	......	....	360	59,773	451
France	37	3,452	52	7,860	37	8,194	16	3,339	67	14,761	298	48,648	717
Switzerland	......	....	......	....	......	....	......	....	......	....	76	24,641	371
United States of America	20,465	2,099,076	21,443	2,849,281	15,645	2,616,286	19,088	3,771,994	16,630	3,860,979	10,839	2,576,073	13,092
British Possessions	88	11,914	225	22,160	43	7,793	93	40,427	94	15,770	105	23,272	116
Other Foreign Countries	152	13,937	262	32,402	134	22,495	182	42,504	297	69,097	458	81,332	1,399
Total	20,742	2,128,383	21,983	2,911,746	15,860	2,654,825	19,379	3,858,264	17,098	3,962,476	13,268	3,020,042	17,969

1921—figures showing imports of metal working machinery by countries are not yet available.
The gross amount imported was 3,012 long tons, valued at £632,205.

*The number of pieces was not shown prior to 1920. The 1920 statistics show the various classes of metal-working machinery, such as Drilling and Grinding Tools, Lathes, Milling, Planing and Shaping machinery, Presses, Punches, Shearers, and parts. Prior to 1920 the enumerated classes of machinery were classified under the general heading "Machine Tools."

Johnson's Plan for Buying Special Machines

By John R. Godfrey

I was in Johnson's office not long ago while he was making a deal for a new machine. His bargain with the maker, his line of reasoning, and his effort to be fair to the other fellow were so unusual in the buying of machinery that I am going to pass them on for the careful consideration of the readers of *American Machinist*. It seems that there had been a few interviews before but this summed them all up and the machine builder got a real thrill, if his actions were any indication of his feelings. Johnson did most of the talking, as usual, but as long as he hands out some real dope, I'd rather listen anyhow.

"So you think you've got a plan for that special machine for drilling our cylinder blocks at one setting. That's what I've been after for some time Mr. Brown. Now if we can get together on price, we'll be cutting our drilling cost into mincemeat in a few months. I know it's a delicate subject, on special machines, but spit it out so we can get busy discussing it."

"Mr. Johnson, I'm afraid our price will seem high but there's a lot of work designing such a machine. It upsets our regular shop routine even if we are not very busy just now and it isn't likely we shall ever build you more than one machine. That's the trouble with building special machines that have such great productive capacity. We've figured it down pretty close because we need the work and ——."

A Backbone Stiffener Needed

"Now, Mr. Brown, let's stop talking price a minute and let me get a few things off my chest. I've been thinking a lot about this machine and a few others I want built, and I've a notion we can get together on a new basis. Some of you machine builders have been highway robbers but most of you need to put a stiffening compound in your backbone when it comes to special machinery. If course I know I ought not to tell you this 'til after I've squeezed you down to the last penny, if at all, but my durned old New England conscience, or what passes for it, got to working awhile ago and I've got to tell you how I feel. I thought I had it pretty well chloroformed but it came to life again last week. I'm afraid it will cost me real money. But it simply won't stay quiet. So here goes.

"I sent for you awhile ago, told you our problems and gave you a blueprint with a flock of holes shown on a cylinder block. Looked like a bum target made by a load of buckshot. Using this to shoot at you've dug into the past experience of your whole outfit and designed a machine that will do the work in twelve seconds according to your estimate. That probably means ten seconds when we get it limbered up because I've always noticed that you play safe in such matters, and I like you better for it.

How Corliss Got His

"I don't know how you figure your price, whatever it is, but I'll bet it isn't enough to let you out whole and pay any return on the capital you've invested in the way of brains. And the deuce of it is I probably can't afford to pay what it's worth in cold cash right off the bat. So I'm going to tell you first a bit of history and then make you a proposition.

"You know something about the Corliss engine even if most of them have become ancient history. But they were new once, so new and so costly that it wasn't easy getting orders for them even in the face of their proved economy. So George Corliss doped out a form of contract by which he took his money out of the savings in coal over the engines he replaced. He charged a good price for his engines, as he should, but he made even the tightest wad in the cotton mill business pay for it out of the savings in fuel.

"So here's my proposition to you, Mr. Brown. You make me a price which covers material, labor, overhead and a fair profit, a usual profit on a standard machine. Cut off whatever you have tacked on for brains and know-how in getting out this machine. Then we'll make another contract that will give you ten per cent of the net saving on the work done for five years, unless the machine is replaced before that time. In other words we pay you cash for the machine and pay you a royalty on the saving due to the brains you put into it and the experience behind it. If the machine saves what you say it will, and I don't doubt it a bit, you'll have a nice little royalty check coming your way every six months. The more it saves the more you get out of it. Sort of puts you on piece work, you see!

Regular Prices Plus a Royalty

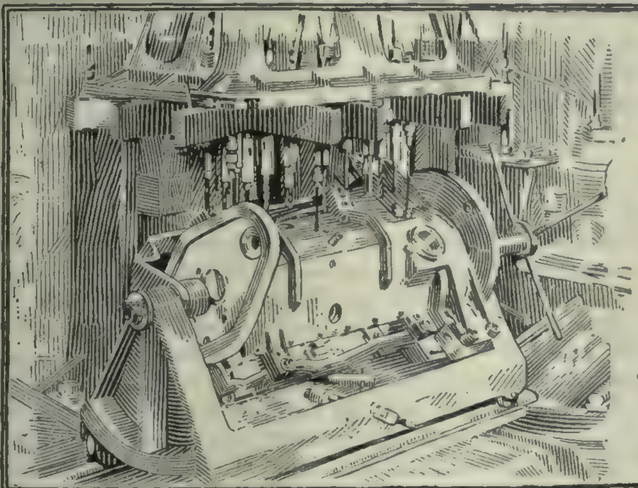
"This is somewhat different from the plan of leasing machines as is done in the shoe business and a few other lines. Don't see how that could work out in such a case as this. Then, too, a manufacturer doesn't exactly cotton to the notion of having leased machines in his shop. Besides it would take more capital than the average builder of special machines could dig up. And I believe the royalty plan is better and fairer. What say, Brown?"

"Say, Mr. Johnson! I'll say, yes, right off the bat. You've sort of given me a real surprise party, and a mighty agreeable kind, too. I've been so used to fighting for a fair price on special machinery that your proposal sort of takes my breath away. It's the fairest plan I've had handed to me yet and you can bet you'll get just the best machine we know how to build."

After Brown had gone out with a face that beamed like a full moon, Johnson turned to me and said, "I suppose my friends who call themselves financiers will say I'm seven kinds of a d. f. or should have some alienist examine me for softening of the convolutions we call brains. But I've studied that special machine business a lot and I don't see anything wrong with my scheme. And if you do, you ought to have shouted before Brown got away."

I'm wondering if Johnson's scheme might not be worked on a number of high production machines, even if they are not special in the true sense of the word. A big first cost almost always acts as a dampener to a buyer's enthusiasm for new machinery, especially when a board of directory has to pass on the purchase. Seems to me it would make it much easier to sell a big, highly organized machine that we now have to sell at a very high price. Think I'll suggest it to Johnson the next time I see him.

Of course there is always the question of whether or not the other fellow will play the game squarely. But we usually find that the man who doubts it will bear watching himself. It's mighty easy to suspect the other chap of doing what we might be tempted to do ourselves. If the great majority of men were not honest we'd have a hard time doing business in almost any line.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Bending Dies Continued—Progressive Piercing, Blanking and Bending—Design of Strippers and Plungers—Closing-in Devices—Double Bending Dies

IN CERTAIN kinds of bending operations it is necessary to use a punch and die with guide pins of the sub-press type. The expense is not always warranted, however, and when this is the case small dowel pins may be used to answer a similar purpose. An example of this kind is shown at *A* in Fig. 473. Here the work *B* is formed with a radius having two flat portions at each end as indicated. The die *C* has two aligning pins *E* assembled in it so that they fit the two holes *F* located in the punch. This arrangement permits the punch and die to align themselves accurately, yet they are also held rigidly while the operation is taking place.

In the example *G* the work is somewhat irregular, yet the operation of bending is performed at one stroke of the press. The work is laid on the die and the punch strikes it, making the form shown. It is unnecessary for the punch and die to cover the entire length of the stock being bent, as it is permissible to have the stock project over the ends of the punch or above the edge of the die as indicated. In the example *H* a punch and die are shown for bending a rectangular piece. The small bends at *K* have been previously made in another operation, and the bends *L* are to be made in the die shown. This is a very simple bending operation which requires no lengthy description. The example *M* shows a simple method for bending a square piece of work. The ends here have also been bent in a previous operation and this punch and die are used for the final operation. In the example *N* the last operation completes the work and forms the blank into a complete square. The punch in this case has a projecting form *O*, and as the punch rises from the die the work is withdrawn with it.

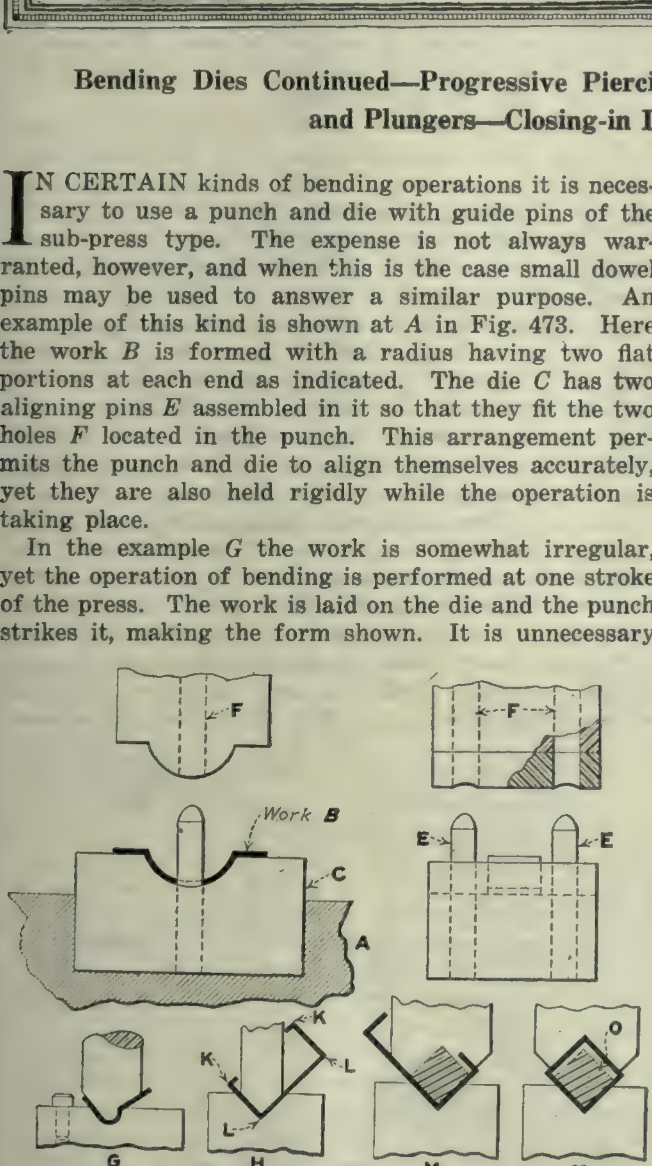


FIG. 473—EXAMPLES OF BENDING OPERATIONS

For the authors' forthcoming book. All rights reserved.

Strippers and Plungers for Bending Dies

A bending die may often require a stripper or spring plunger in order to assist in removing the work after it has been bent to the desired form. Fig. 474 shows at *A* a die of this kind having an ejector *B*. As the punch carries the work down into the die this plunger is forced downward until it reaches the bottom, at which time it is so located that it acts as a part of the die itself in forming the work. When the punch recedes, the plunger springs up and ejects the work. Another type of die having a plunger which acts as an ejector is shown at *C*. This die is for bending a piece of work into U-shape, and the die is arranged so that as the punch *D* strikes the work it carries the plunger *E* down with it until it locates on the surface *F*, thus forming the bottom of the die. When the punch rises from the die the work is forced upward by means of the plunger, which is restrained in its movement by the screw *G*.

The location of any piece of work in a bending die is of great importance, as any inaccuracies in location will result in uneven bending. There are many forms of locating pins and plates for work, and these forms vary according to the shape of the part which is to be bent. At *H* a die is shown for producing the part shown at *K*, the work in this case fitting the upper part of the die and locating against the plate *L*. The location of a plate of this sort is often difficult to determine, as the amount of stock drawn down when the bend is being formed is likely to vary. For this reason it is a good idea to make up a few trial blanks before locating the stop permanently, in order to make

sure that its position is correct. The type shown at L is a stripper stop which is fastened to the top of the die by the two screws indicated. These stops are often held in position by dowels when accuracy is essential. The height of the space is not particularly important, and it can be thicker or thinner than the stock providing there is no interference with the punch.

Another method of locating work for bending is

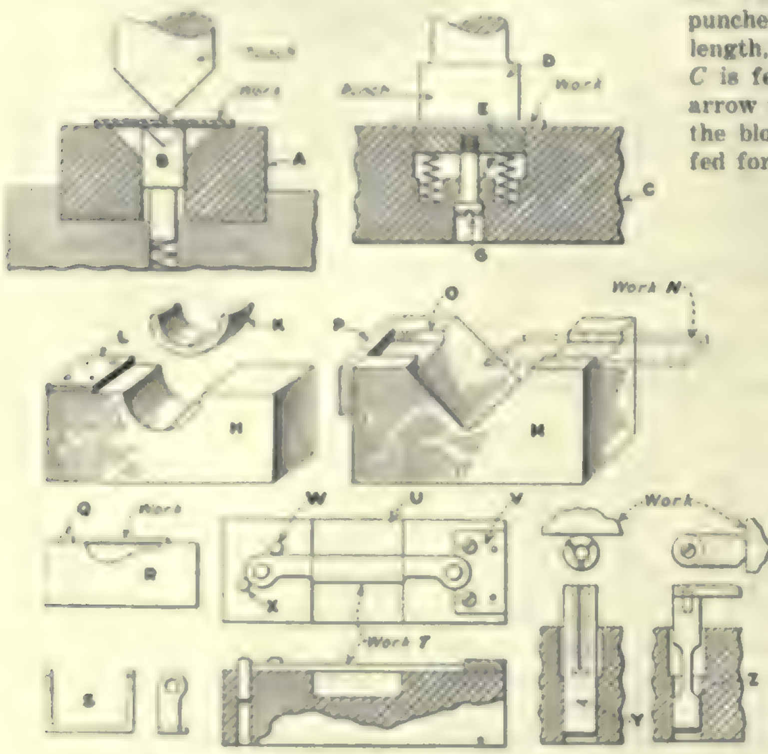


FIG. 474—METHODS OF LOCATING WORK FOR BENDING OPERATIONS

shown at M. The work N fits a slot on the top of the die, which is cut out as shown at O to the thickness of the stock. The stock is positioned by striking against the plate P, thus locating it correctly for the bending operation. In the example R a pin Q is used for obtaining the proper end location. This is a very simple method of locating, and it has been found satisfactory for a great proportion of work.

In the example at S the work has two bends at right angles, thus forming the stock into U-shape. This example is slightly more complicated than those previously shown, the blank being located at one end in a nesting plate V, while at the other it strikes against two pins W and X. The sectional view of the die shows the position very clearly. There is a point of importance which must be mentioned in connection with the location of work of this kind between positive locating points. This is the variation in the length of the blank which is likely to occur after blanking dies have been in use for some time. The variation is often due to the spread or enlargement of the opening in the die.

If great accuracy is required it is necessary to provide for this variation in the size of the blank by using a permanent rest at one end of the work, while the other may be located against a spring pin similar to that shown at Y. This pin is provided with three slots and has a hole drilled in it. It is pressed into the die as shown, and a counterbored hole slightly larger than the pin permits the latter to spring to take care of various lengths of stock. Another type of spring pin is shown at Z. Here the pin is cut down so that it is very thin at the center and it is pressed into a counterbored hole such as that previously mentioned. This type of pin will spring sufficiently to take care of considerable variation in the blanks.

Progressive Piercing, Blanking and Bending

In Fig. 475 is shown a die for producing the work at A. This die is of the progressive type, as it not only punches the hole B and cuts off the stock to the required length, but also bends the work into shape. The stock C is fed into the die in the direction indicated by the arrow until it reaches the correct position at the end of the block D. The hole is then punched and the stock fed forward until it strikes at E. An enlarged section of this locating point is shown at F in order to make the matter clear. As the ram is brought down the forming punch G forms the blank, the punch H cuts it off to length and punch K pierces the hole. The amount of stock that the punch H cuts out is the only scrap produced.

It will be noted that the die E is provided with a spring pin L which forces the work out of the die after the piece has been formed. This ejector occasionally sticks and does not work smoothly, and as it is placed in the die in order to insure the safety of the operator, it is well to caution him not to use his hands in removing the work. If the part should stick and not come out properly, a piece of wood can be provided as an ejector. A die of this sort is adaptable to an inclinable press, so that the finished parts will fall out on each stroke of the press and will not require the use of an ejector.

Very often the shape of the work being formed is such that it is smaller at the upper part or opening than it is at the bottom or forming part. When this is the case it is necessary to bend the work in a die having members which close in and form it to shape. There are many devices used for this kind of a bending operation, and they are operated in several different ways. In Fig. 476 a piece of work is

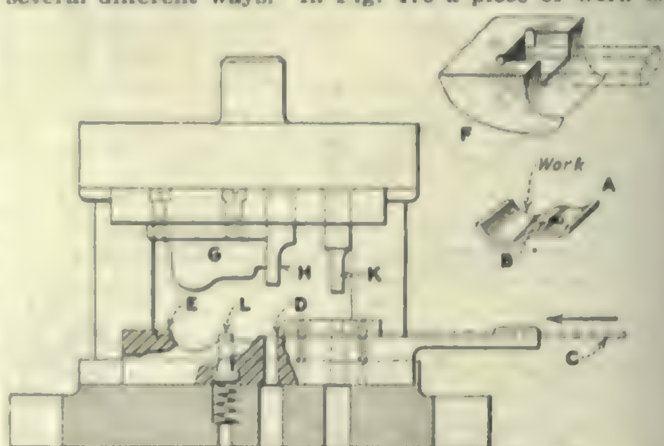


FIG. 475—COMBINATION BENDING AND PIERCING DIE

shown at A which is smaller at the upper than at the lower end. Therefore a plain bending die would not give the desired results, and it is necessary to design a die of the closing-in type.

Two methods of forming this piece are shown in the illustration. In the first of these the work B is the

blank which rests on the two arms *C* and *D*. The punch strikes the work in the center and carries it down so that it is partially formed, at which time the punch *E* strikes the surfaces *F* on the two rockers and carries the forming plates *C* and *D* down until they strike the bottom of the die *G*. In the example *H* the die is

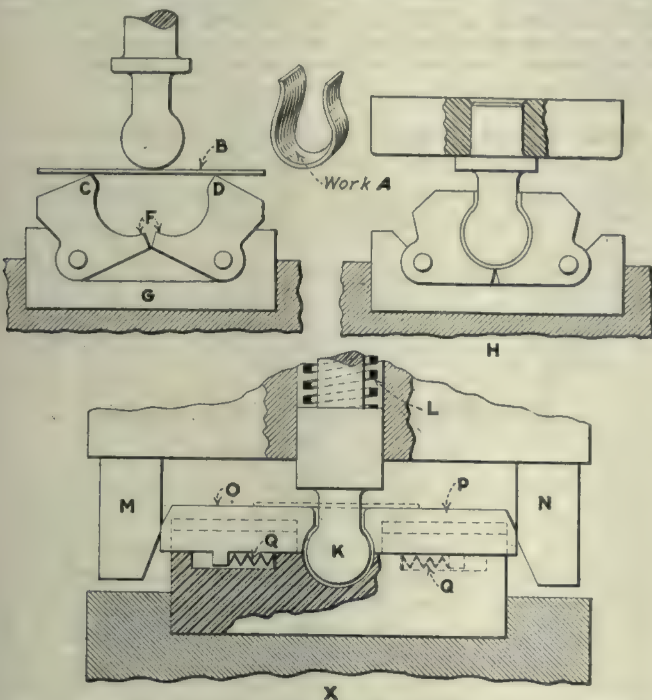


FIG. 476—TWO EXAMPLES OF CLOSING-IN BENDING DIES

shown in the closed position, and it can be seen that the work has been completely formed. As the punch withdraws, the two plates open up while the blank remains on the punch. It can be very readily removed from the punch and the next blank placed in position.

In this example, the parts *C* and *D* are so made that when the punch first starts to supply pressure on the blank, the pressure produced by the blank is outward and does not tend to close the die until the punch has reached the surface *F*. Some forms are so shaped that spring pressure is required to hold the parts up until the punch has entered sufficiently to produce the closing-in action.

Another type of die for the same piece of work is shown at *X*. The punch *K* carries the work down into the die, forming it into U-shape, and after it has struck bottom it is permitted to push up into the punch holder, where it is backed up by a heavy coil spring *L*. As the punch continues descending, the two arms *M* and *N* strike the closing-in forming plates *O* and *P*, thus producing the final form of the work. The angle on the forming plates and arms is determined by the amount of bending required. Care should be taken not to make too steep an angle on these parts. As the punch holder rises, the springs *Q* force the forming plates *O* and *P* out to their normal position and then the work is raised out of the die on the punch, from which it is removed as in the previous example.

Many pieces of work which require bending are of such form that they cannot be made in one operation, and while it is not desirable to use separate dies for the various bends, it is very often practical to construct a die which will take care of several forming operations. Fig. 477 shows two dies of this type. The upper die is used for producing the part shown at *A*. While it would be possible to form this part in a die similar to those shown in Fig. 476, it is sometimes found that the stock is of such grade and thickness that a solid die can be used to greater advantage. In this case the part is laid on the die as shown at *B* and stops against the plate *C*. As the punch comes down, the work takes the position shown by the dotted lines at *D*, and is then carried down into the opening until it is formed as shown at *E*. This example does not show an ejector, although on long bends of this kind one can be provided in order to facilitate the removal of the work.

After this operation the work, shown at *G*, is set over a projecting plug *F*. The plug is supported in the position shown by means of springs and is free to float up and down according to the pressure applied to it. As the punch holder *H* is brought down toward the die, the forming block *K* strikes the work and carries it down until it strikes against the block *L*; and as the die is finally closed the work is formed in the shape shown at *M*. As these dies are closing in, the point N on the block *K* tends to hold the work from springing on the plug *F* when the pressure is applied. At *O* the dies are shown in the closed position. Dies having several bends are often made on this principle, the arrangement being such that on each stroke of the press one complete part is finished.

The dies shown in the lower illustration are used in forming the part shown at *P*. If an attempt were made to bend this part in one operation, the bend is of such irregular shape that the stock would tend to draw unevenly, and it is therefore necessary to use two operations to complete the form. The work is first laid on

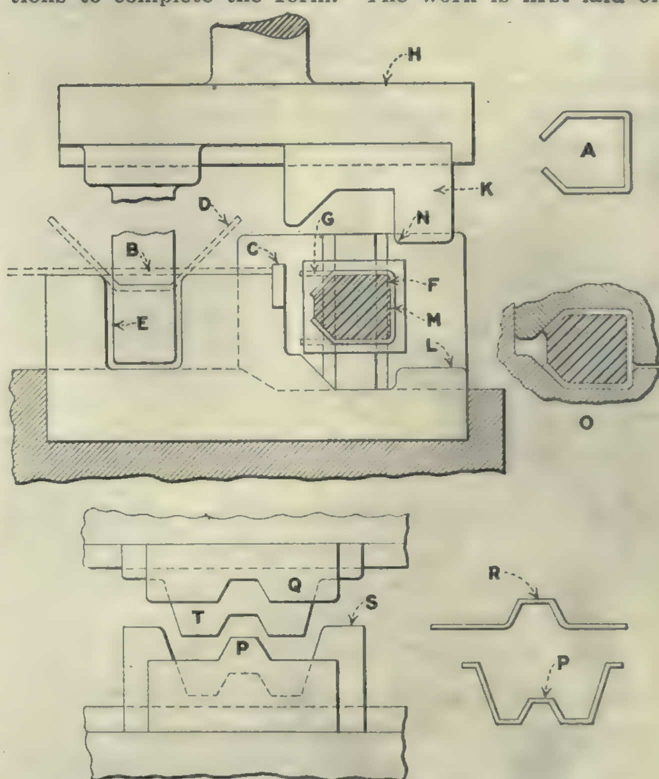


FIG. 477—TWO EXAMPLES OF DOUBLE BENDING DIES

the die, and as the upper forming punch *Q* is brought down, the part is formed in the shape shown at *E*. After this form has been made the work is placed on the die *S*, and the forming punch *T* performs the final operation which produces the part shown at *P*. This type of die is very useful for bending long narrow work, and if desired the stock can be cut off at the same time by providing a suitable punch and die.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Spring Winding by Hand

By C. J. Dorer

In the accompanying illustration is shown a novel and extremely simple method of spring winding. Very often it is desirable to have a spring of certain size when a lathe or similar machine, such as commonly used for spring winding, is not available. The method here shown will produce the desired spring of even diameter and pitch.

Procure a rod *C*, of slightly less diameter than the inside of the spring to be made and slot one end as shown at *H*. The depth of this slot should be about three or four times the diameter of the spring wire and wide enough to accommodate it. To the other end of the rod fasten a hand vise, *D*, or a convenient wrench or dog. Place the rod between two soft jaws, *B*, or a vise, *A*, and clamp just tight enough to hold the rod in place.

If soft jaws are not available, two pieces of hard wood, maple or oak, will serve as well. When starting to wind, the slotted end of the rod should be at a point *I* and the slot in a vertical position. Place the end of the wire *E* in the slot and turn the rod a full one-half turn. Then pull the wire toward the opposite end.

When starting the first turn, the wire digs into the jaws and should be steadied by the hand which is doing the turning as there may be a tendency to jerk. At this time the pitch of the spring is determined and the amount the rod is forced ahead on the first turn determines the pitch. From then on the spring threads its way between the two jaws and an even pitch is obtained. After winding, when the jaws are removed, a series of uniform and evenly spaced depressions will

HOW TO WIND SPRINGS BY HAND

be seen on each jaw and, if the vise has not been too tightly clamped, will not injure them for further use.

When fine wire is being used, it is possible to continue turning after the first turn or two without any difficulty. In the case of heavier wire, such as 0.045 in., it is better to open the vise jaws slightly. Otherwise the turning of the rod becomes more difficult as the spring is wound and is apt to snap off the end which is in the slot. The setting of the vise jaws depends entirely upon the size of the wire.

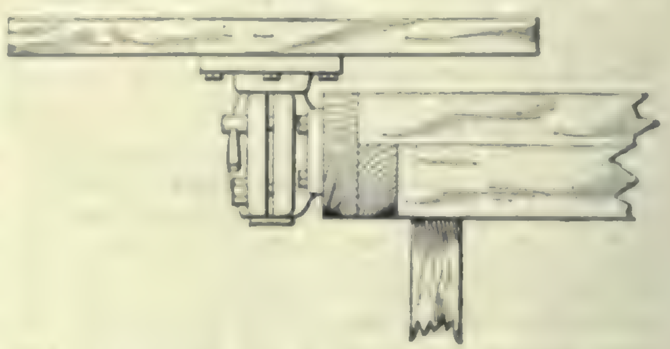
The sighting of the pitch requires a little practice. If the spring is to be close wound, the wire should be held perpendicular over the starting point, otherwise it should be held over toward the crank end of the rod. If a spring of coarse pitch is desired, pressure should be brought to bear on the rod by the hand which is turning it, so as to force it ahead on the first turn or two.

Care should be taken not to let the rod slip. If it does, it is best to start over, but this will not happen if the vise is properly set.

Revolving Table for the Bench

By Joe V. Romig

Any tool or attachment which will lighten a man's labor, will increase his productivity. When a mechanic overhauls or repairs a small machine tool, etc., he usually places it on his work bench and must continually shift his position for the reaching of interior parts, by sliding it around on his bench top. If the machine is heavy or unwieldy, this labor soon tires him out and



REVOLVING TABLE ATTACHED TO BENCH

robs him of his greater work ability. In a small shop the writer once saw the revolving table, shown in the sketch. The mechanic was repairing an old typewriter, and it was a pleasure to see him swing the table around to conveniently reach any part of the work. Assembly work on many small units, and sometimes on heavy parts, can be done profitably by using the same device.

The construction of the table is extremely simple. A flat board of about 1 in. in thickness, makes the top, to which is screwed a 1½-in. pipe flange, as per sketch. Into the flange is screwed a short section of 1½-in. pipe filed smooth. The pipe rotates in an ordinary split pillow block, fitted with a clamping handle, by the aid of which the position of the table can be locked when desired. When not in actual use, the table can be pulled out of the bearing and laid away.

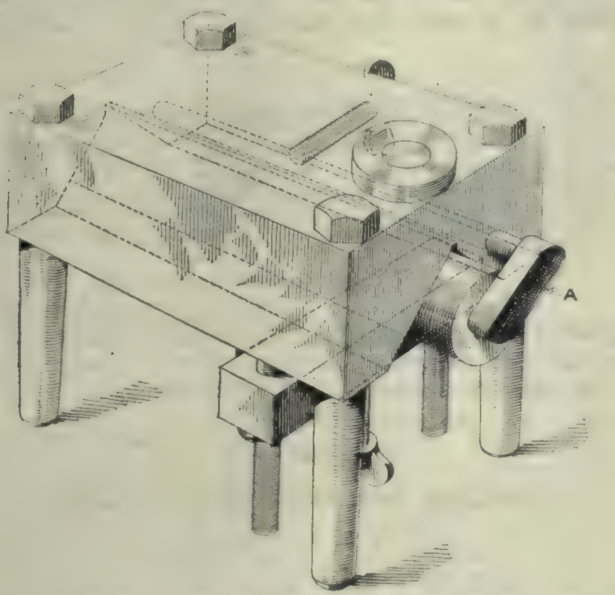
Soliloquies of Old Mac

To hold small round, square or hexagon stock in a large 4-jawed chuck, run two opposed jaws down to the work and then place short pieces of square stock, or tool bits, between the remaining jaws and the work.

Jig for Drilling Cross Holes in Cylindrical Work

By L. E. Schaeffer

The accompanying drawing shows a jig designed by the writer for drilling cross holes in cylindrical work. An important feature of this jig is that the hole for the bushing is in the V-block, and if the jig is correctly



JIG FOR DRILLING CROSS HOLES IN CYLINDRICAL WORK

made the cross hole must be central in the work. There is no way in which the bushing can get out of alignment with the work, as in the case where the bushing is held in a yoke over the top of the jig. The adjustable stop *A* enables holes to be drilled the same distance from the end in any number of pieces.

Holding a Hammer Head on Its Handle

By Andrew J. Schwartz

Due to a near accident sometime ago I became interested in the methods of holding a hammer head on a handle, and I devised the scheme shown in Fig. 1.

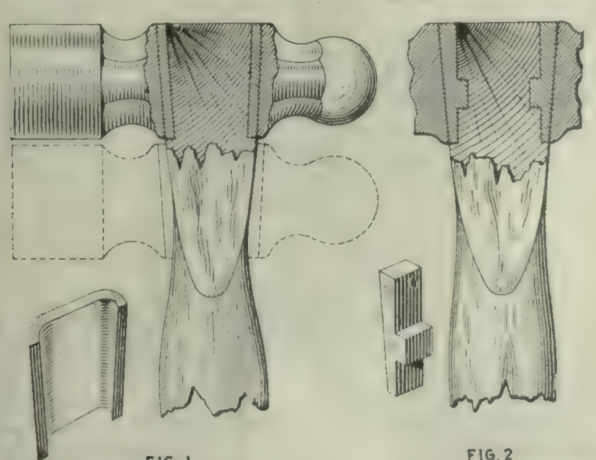


FIG. 1—THE WRITER'S METHOD. FIG. 2—A METHOD PATENTED 40 YEARS AGO

So well pleased was I with the idea that I applied for a patent, but was much surprised when the Patent Office revealed a copy of a patent, Fig. 2, dated about 40 years ago embodying practically the same idea.

In Fig. 1 the eye of the hammer is shown as flaring outwardly and the handle is formed with a correspondingly flaring end. As the dimension of the handle at the widest part is not larger than the smallest opening in the hammer head, the handle may be pushed through the eye as shown by the dotted lines. The wedges are made of sheet steel and fit the inclined sides of the handle and hammer head so that when driven home they make a good fit. Why do not some of our manufacturers make many of the good things on which the patent rights have expired?

Choosing and Grinding Chisels

By G. A. Luers

Normally the mechanic picks out a large or small chisel without considering its purpose, bevels both edges and goes to work on brass or steel. Use a light chisel for brass, where resistance is less and a heavy chisel for steel with its greater resistance. Grind the edge of a chisel used for cutting out brake band rivets, which are copper and have a comparatively shallow head, with a bevel on one side only, as shown in Fig. 1. It will

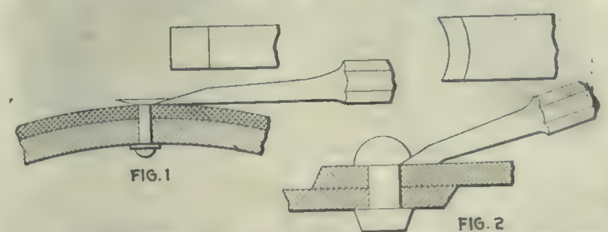


FIG. 1—CHISEL GROUND FOR CUTTING OFF HEADS FROM COPPER RIVETS

FIG. 2—CHISEL GROUND FOR CUTTING OFF HEADS FROM STEEL RIVETS

be found that the rivet heads can be flicked off with one blow of the hammer without chewing them up.

For steel rivets, grind the center of the chisel concave, as shown in Fig. 2, and the tendency for the chisel to work offside while hammering will be avoided. Chiseling is a comparatively tiresome task but this is avoided to a great extent by choosing the proper chisel and grinding it to suit the work. A soft or dull chisel should not be tolerated in any shop.

Formula for Tap Drill Size—Discussion

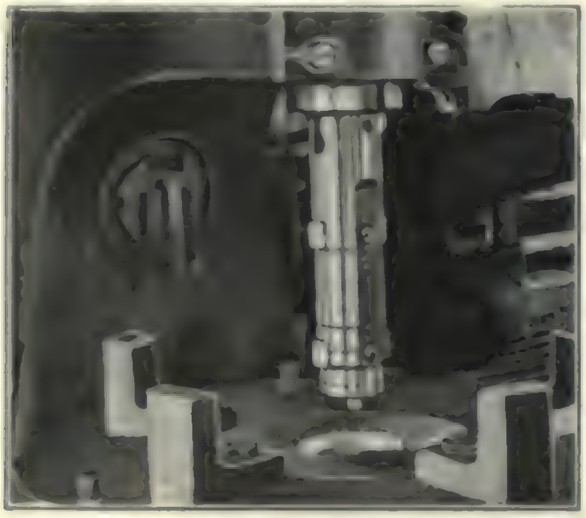
By Robert H. Barnes

In the article, "Formula for Tap Drill Size," which appeared on page 621 of *American Machinist*, William S. Rowell states that he has never seen in print the formula $\frac{1.3}{P}$ for determining the whole depth of a U.S.F. thread. I should like to refer Mr. Rowell to page 41, paragraph 27, Part 2 of Palmer's Practical Mathematics, for a discussion of this formula, and incidentally of two others in general use, that of $\frac{1.732}{P}$ for the double depth of a common V thread, and of $\frac{1.28}{P}$ for the Whitworth thread. These formulas have been used by the students in the Rochester Shop School for several years and have proved satisfactory on work where absolute accuracy was not required.

Tool for Boring Car Wheels

By C. Sackett

In placing new car wheels on axles from which condemned wheels have been removed, the wheels must be bored to fit the wheel seats, allowing for a forcing fit. As the wheel seats on different axles vary somewhat in diameter, the finish boring tool must be set for each wheel bored. The tool shown in the car-wheel boring machine is of the Davis expansion type and the ease of setting the cutters greatly facilitates the work.



MULTIPLE TOOL FOR BORING CAR WHEELS

Two sets of cutters and one single cutter are carried in the bar. The lower set does the roughing, the set in the center takes the finishing cut, while the single cutter at the top chamfers the hole. The boring and chamfering are thus completed at one pass of the bar through the wheel hub and the time, floor to floor, is 3½ minutes. The tool as shown is in use at the Savannah shops of the Central of Georgia Railway.

An Improvised Clamp

By Harry Moore

The illustration shows a "heel" clamp that was made by one of our road men from odds and ends found in the bottom of his kit. It is not to be recommended as a substitute for the regularly manufactured article, but it shows what one may do in an emergency when and where proper tools are not available.

A machine screw, a wing nut and four washers comprised all the material that was required. The edge of one of the washers was bent up at a right angle the amount so turned up being, of course, equal to the thickness of the work to be held. The time necessary to dig the component parts out of the bag and to catch one of the washers in a vise and to give it a couple of swats with a hammer covered its making—less than is required to describe it.

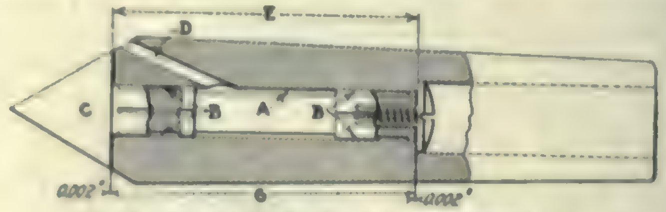
AN EMERGENCY "HEEL" CLAMP

An Antifriction Tailstock Center

By Herbert A. Althens

The accompanying sketch illustrates an antifriction tailstock center designed and used by the writer. At A is an oil well and at B are four grooves to carry oil from the well to all parts of the revolving member C. The oil well can be filled through the hole D.

The distance E, on the revolving member, is about 0.002 in. greater than that at G on the stationary



ANTIFRICTION TAILSTOCK CENTER

member, so when the parts are assembled there will be enough play to prevent sticking. With a center of this type, there is no danger of burning the center holes in either the work or the mandrel.

Checking Inverted Spline Broaches

By H. R. Sleeper

It is sometimes desirable when milling or grinding inverted spline broaches or multiple spline shafts to check the indexing. The following formula, which the writer has used for several years in broach design, may be of interest to other tool designers and tool makers. Referring to the accompanying illustration:

$A = \frac{1}{2}$ the width of spline;

B = Radius of broach, or shaft to be milled;

$a = \dfrac{\frac{360}{N}}{2}$, when

N = number of splines to be milled.

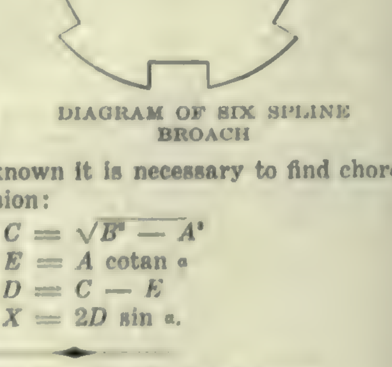


DIAGRAM OF SIX SPLINE BROACH

With these values known it is necessary to find chord X, the desired dimension:

$$\text{Now, } C = \sqrt{B^2 - A^2}$$
$$E = A \text{ cotan } a$$
$$D = C - E$$
$$X = 2D \sin a.$$

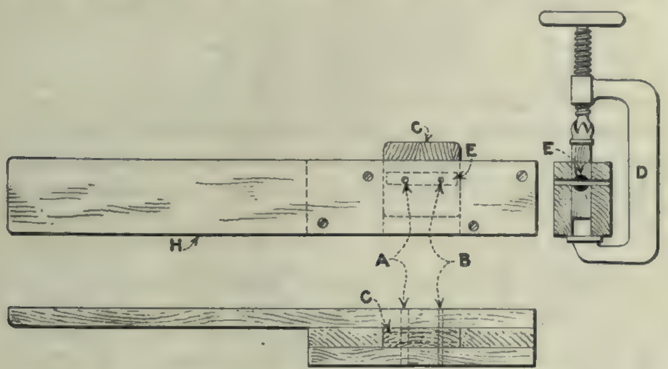
An Improvised Wire Straightener

By William S. Rowell

Having a number of pieces of music wire 24 in. long to straighten, the device shown herewith was made. Five pieces of wood, a piece of $\frac{3}{16}$-in. brass wire, four wood screws and a C-clamp comprise all the parts and one-half hour's time sufficed for the assembling. In operation, one end of the wire to be straightened is held in the chuck on a lathe and the other end passed through one of the holes A or B according to size.

With the straightener close up to the chuck and the lathe running at a moderate speed, pressure enough to bend the wire slightly is put on the slide *C* by the Clamp *D*.

The straightener is then moved along the wire fast enough to prevent permanent waves being left in the wire, part *H* resting against the lathe bed to keep the straightener from turning. The $\frac{3}{16}$-in. brass wire is inserted in the slide, as shown at *E*, and the holes *A* and *B* are drilled through it to make a better wearing surface than would be afforded by the wood. The results obtained by the use of this device were so good that it was afterwards used to straighten nickel-steel wire much larger in diameter than the music wire referred to.

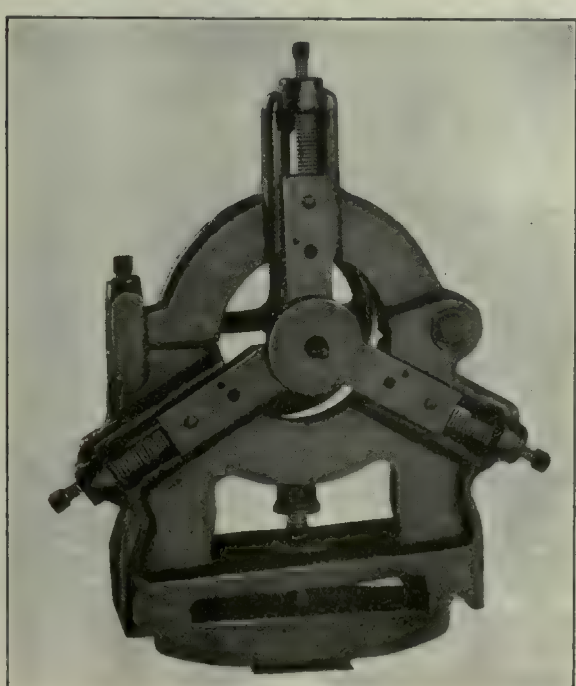


AN IMPROVISED WIRE STRAIGHTENER

Increasing the Distance Between Lathe Centers

By Joran Kyn

When work is a little too long to go between the centers of a lathe, the tailstock can be taken off and a bushing carrying a center placed in the jaws of the steadyrest, as shown in the illustration herewith. The center is formed on the end of a screw fitted to a tapped hole in the bushing and can be adjusted to suit the work by the hand wheel attached at the rear.

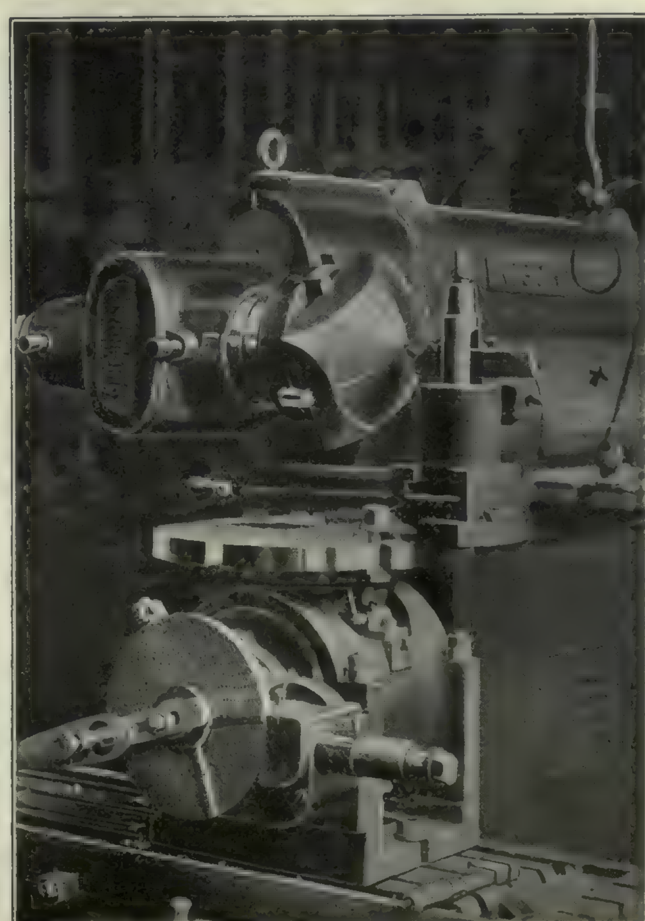

A SHORT TAILSTOCK

As the steadyrest occupies much less room on the lathe bed than the tailstock, the use of this device allows work several inches longer to be accommodated between the centers. While it has a much shorter bearing on the lathe bed and is not as rigid as the regular tailstock, because the thrust of the cutting tool is usually toward the headstock, it answers very well for ordinary work but would, of course, hardly be satisfactory for heavy cuts. In common with many other improvised devices, it must be used with judgment in order to be satisfactory. This device is in use in the Savannah shops of the Central of Georgia Railway.

Turning a Spherical Surface with the Milling Machine

By A. Nelson

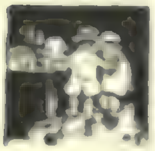
Being in need of a clamping block with a spherical surface and not having a radius turning attachment of any kind for any of our lathes, we rigged up the simple outfit shown in the illustration to do the work.


SPHERICAL TURNING IN THE MILLING MACHINE

By taking the compound slide off an old lathe that had a high toolpost we obtained the necessary height for clearance between the dividing head and the work, and also provided a very close adjustment for the radius by means of the slide.

By altering the position of the tool so that it would stand on the other side of the center of rotation a concave surface could as readily have been produced.

Editorial



TREATING of prospective customers used to be a great game in the machine tool industry, especially for the customers. The only kind of treating you'll find nowadays is heat treating, and it certainly does the recipient a whole lot more good than the pre-Volstead variety. The world is growing better.

The American Machinist Is Forty-five Years Old

FORTY-FIVE YEARS ago this month the first issue of the *American Machinist* left the press to carry its message to the young and feeble machinery industry. It was very different in appearance from the present magazine. The page was larger, the type smaller, the contents very much less. But it was animated by the same spirit of service that has guided its various editors and publishers ever since and which immediately obtained a hold on the affections of its readers that has never been shaken.

Some of these older readers, and many of the younger ones, have taken the trouble to write in to us and tell us what they liked about the paper and what they didn't like. Without this hearty and valuable co-operation it would be an impossible task to keep on improving our pages. We want to take this opportunity to renew our thanks to those good friends.

Times have changed since our last birthday editorial was written. The industry had only then past the bottom of the business depression and profitable operation was a thing of the future. General business has caught its stride since then and most of the usual lag period between general prosperity and activity in the machine industries has become history. Even the machine tool builders, the last link in the manufacturing chain, have reached a point where the scarcity of good machinists is becoming a problem.

From the technical standpoint two events in the past year stand out as of vital importance to machinery builders and users. The first is the appointment of the joint standardization committee of the American Society of Mechanical Engineers and the National Machine Tool Builders Association to take up the standardization of such items as tool holders and tool posts, T-slots, spindle noses and tapers.

The other is the rather modest beginning of a research program which cannot but have its effect on an art that has made so little use of science as has that of metal cutting. Except for the introduction of several new cutting alloys and the increase in the size, power and capacity of our machines there has been little progress in the last generation in the actual removal of metal. Perhaps we have reached the ultimate in the art of cutting metals but in view of the achievements of the last decade in such fields as radio telephony and aeronautics it hardly seems likely.

A prophet is not without honor save in his own country. Yet we have the temerity to predict that, if a real research program be carried out, by the time the *American Machinist* reaches the half century mark, its pages will have told of developments beyond the wildest dreams of its first readers and even far exceeding the expectations of many of its younger ones.

We have referred to standardization and research as technical functions but as a matter of fact their economic bearing is at least equally significant. One has but to note their economic effect on such an industry as the automobile industry, where they have been employed in a small way, to see the possibilities in other fields.

Cylinder Lapping and Motor Balancing—Two Problems in Automobile Practice

THERE IS A FEELING among some production men that lapping may come back as a final finishing operation for cylinders. Whether it will eliminate cylinder grinding, or only supplement it, is a disputed point among its advocates. Where it replaces grinding, the use of the abrasive brick or stone, held in a suitable head, seems to be very successful, although some use a cast iron lap and an abrasive powder. When used as a final finish after grinding, only a very little lapping is done and a very fine abrasive is used.

The attempt to secure better running motors has led to much greater care being taken in balancing crankshafts and in selecting pistons, pins and rods of equal weights. Not only is the weight of the whole rod considered, but the weight of the big end, which affects the revolving weights, is also measured separately and rods are sorted into sets with this in mind. But even with all that precaution motors do not always run smoothly. There are certain speeds at which vibration occurs, even in some of the best built cars.

It sometimes happens that motors run well on the test stand but develop vibration at certain speeds when mounted in the chassis. There seem to be speeds at which the motor vibration synchronizes with vibrations of the chassis, and the combination is very objectionable to the driver and the passengers. This and other problems still confront the designer of the automobile.

Just Suppose

JUST SUPPOSE that you are a machine tool salesman and that you approach the works manager of a large plant with a new machine tool having wonderful production possibilities.

You, of course, put up a good selling talk explaining the many advantages of this machine, and show the prospective customer wherein he can greatly reduce his manufacturing costs and cut down overhead expenses by replacing his old, worn-out equipment with these new machines.

Just suppose that the works manager agrees with you and gives you a sizable order for new machines to replace those which have long since passed the stage of dividend earners, and which are to be disposed of, not to a second-hand machinery dealer, but to a junk dealer.

Isn't it a "grand and glorious feeling"?

Of course, this could never happen, but—

Just suppose.

Shop Equipment News

Cincinnati 12-Inch Plain Cylindrical Grinding Machine

The 12-in. plain cylindrical grinding machine now made by the Cincinnati Grinder Co., Oakley, Cincinnati, Ohio, resembles the former model, which was described on page 42, Vol. 38 of *American Machinist,* in general appearance only, as the working mechanism has been almost entirely redesigned. Front and rear views of the present model are shown in Figs. 1 and 2.

The machine is intended for grinding straight or tapered spindles, shafts, rolls, tubing and work of like character within its range which can be revolved on centers. It is made in 12-in. swing and 18, 24, 36, 48 and 72-in. work lengths, with either belt or motor drive. The 24-in. length machine weighs about 6,000 lb. and occupies a floor space of 67½ by 114 inches.

The spindle is driven directly from the countershaft by a long, wide belt and no jackshaft nor short belt are employed, as formerly. The bearings are constructed to carry the belt pull without influencing the accuracy of operation of the spindle and wheel.

As can be seen, the control is centralized on the front of the machine within easy reach of the operator when in his normal operating position. The machine is built on the unit system, each unit complete in itself, being assembled in its entirety on the bench and then placed in position on the main structure. This construction permits of easy removal of any unit for adjustment or repairs without disturbing the alignment of any other unit. Each unit is provided with a central oiling station. The base, wheel slide, pedestal and water tank are cast integral with each other, forming a massive understructure for the entire assembly.

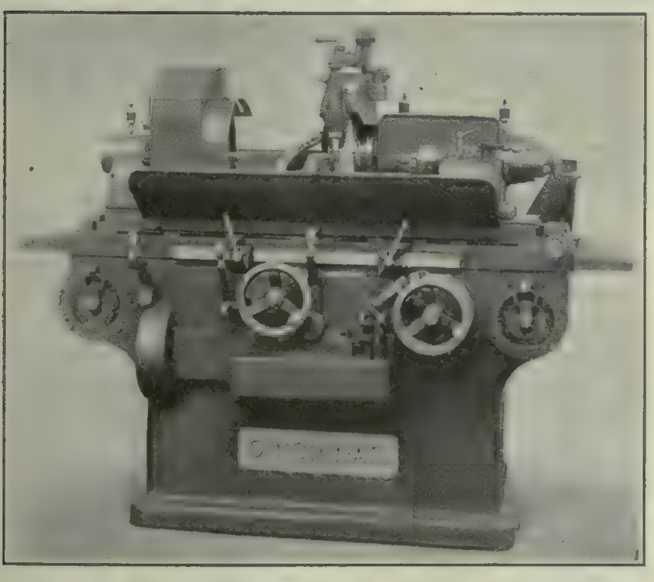


FIG. 1—CINCINNATI 12-INCH PLAIN CYLINDRICAL GRINDING MACHINE

The work is revolved by means of a belt-driven headstock embodying in its construction a spring idler to give the proper belt tension. Six work speeds are provided for the spindle and six for the table, all of which speeds are obtained through a single gear box, Fig. 3, mounted on the rear of the machine. The gears in this speed change box are made from hardened bar stock and slide on solid splined shafts. The employment of the gear drive eliminates belt slippage and furnishes a very convenient and rapidly operated means of changing speeds.

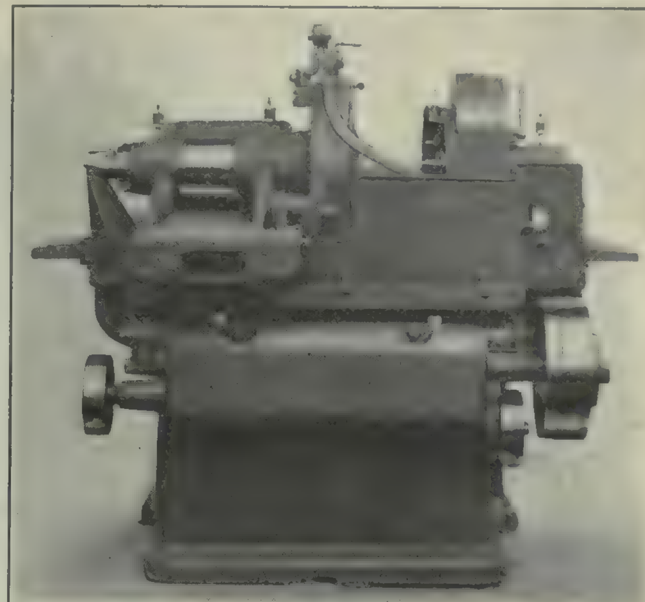


FIG. 2—REAR VIEW OF CINCINNATI CYLINDRICAL GRINDING MACHINE

The automatic reverse plate on the front of the machine is of the load and fire type, so made that the gears at all times run in a bath of oil. The plate carries the table control lever, which also controls the table traverse handwheel. When the lower traverse to the table is engaged by means of the traverse lever, the handwheel is automatically disengaged and remains stationary during the travel of the table. When the power traverse is disengaged, the handwheel is automatically engaged so that the table may be traversed by hand. The table clutch lever also controls a variable tarry device or table dwell at the end of the table stroke, which is used when grinding shoulder work. The cross feed may be either hand or automatic, and the range is sufficient for quickly reducing stock or for producing an extremely high finish, to suit the nature of the work.

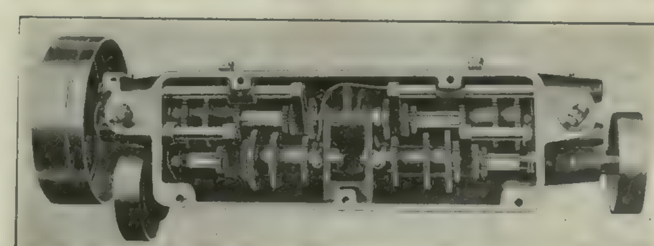
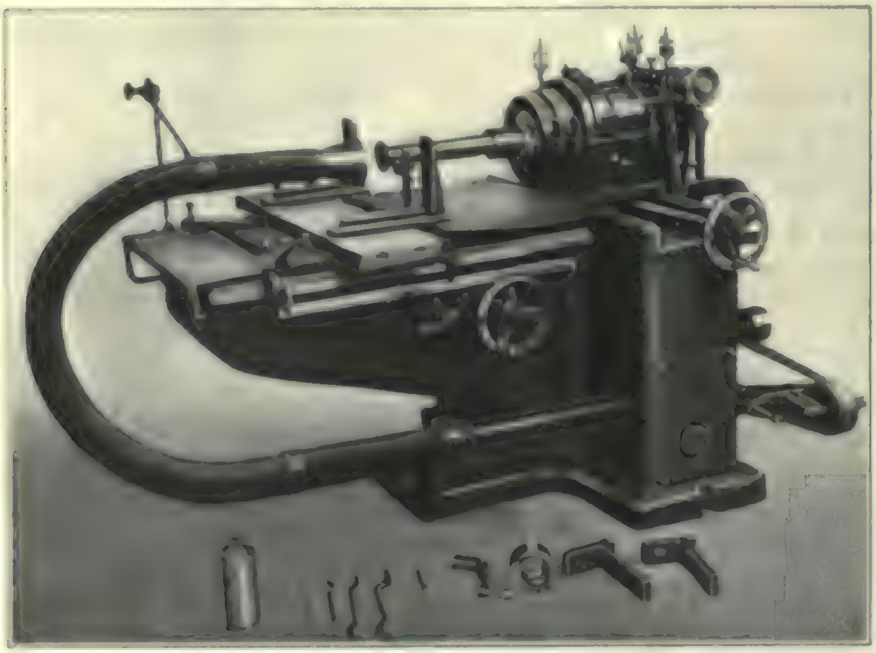


FIG. 3—INSIDE OF SPEED-CHANGING GEAR-BOX UNIT

Madison Cylinder Grinding Machine

Manufacture of the Madison cylinder grinding machine has been taken over by the Gisholt Machine Co., Madison, Wis. The machine, a general view of which is shown in the accompanying illustration, is adaptable to practically all kinds of automotive cylinders with the use of the standard equipment only. It can be employed on either open-head or closed-head cylinder blocks.

The wheel spindle is of the two-piece type, made of special alloy steel, heat-treated and ground, and carried in a double eccentric sleeve. It is full-floating and is, therefore, free from strain from the driving belt. No unnecessary overhang of the wheel need be employed. For average work the outer spindle can be short and rigid; a longer spindle may be employed where it is required. The spindle runs in an adjustable bronze bearing and a self-aligning ball bearing which takes up the end thrust also.



MADISON CYLINDER GRINDING MACHINE

Large bronze bearings in the headstock support the eccentric sleeve, which in turn carries the spindle. The rotary motion of the eccentric sleeve is obtained through a wormwheel drive that gives smoothness of motion. For convenience in starting and stopping, the drive is controlled through a powerful friction clutch driven by an endless belt. The eccentric adjustment of the spindle, which can be accomplished while the head is in motion, is made by means of a worm and ratchet gear device. A micrometer dial is provided so that the final adjustment to size can be accurately and easily obtained.

So that wheels can be changed without being trued up each time that they are placed in the spindle, the grinding wheel is mounted on an independent collet. The main driving belts are so arranged that an even tension is maintained without the use of weights or springs, regardless of the position of the headstock on the bed. The headstock is mounted on a carriage which has a transverse motion directly on the ways of the bed.

The work is held on a table which, in turn, is supported by a heavy knee. This knee can be adjusted vertically, while the horizontal adjustment of the wheel to the work is obtained by the movement of the carriage. The table carrying the work can be moved parallel to the wheel spindle to feed the cylinders to the wheel. Adjustable stops are provided to automatically trip and reverse the feed. The large vertical adjustment of the knee enables grinding cylinder blocks of a large range of sizes and types. The work is held between the ways or directly over them so that it does not overhang.

A heavily ribbed cabinet-type bed is employed. Aprons mounted on rollers protect the ways from dust. Each oil hole is also protected from dust. An exhaust fan is mounted in the base of the machine, so that it is out of the way and well protected. A rubber hose of large diameter carries the dust away from the wheel.

The cylinder block is ordinarily clamped to a pair of parallel supports, one at each end of the block. Two small jacks placed in the center of the overhanging portion of the cylinder hold the block steady. To centralize the wheel to the bore, the handwheel on the knee is used to raise or lower the work, and the handwheel on the bed to move the wheel horizontally.

The capacity of the machine may be judged by the dimensions that follow. The vertical distance from the top of the platen to the center of the spindle can be varied from 2¼ to 9 in. The extreme cross travel of the headstock is 27 in., and the longitudinal travel of the table 22 in. Feeds of 4.8 and 9.2 in. per minute are provided for the table, and speeds of 5,000 and 7,000 r.p.m. for the wheel spindle. Three horsepower are required to operate the machine. The floor space occupied is 71 x 57¾ in. in size. The shipping weight with the countershaft included is 2,600 pounds.

Stevens "Speed Up" Garage Tools

Several time-saving devices for use about the garage for repairing automotive engines have recently been added to the line of "Speed Up" tools marketed by Stevens & Co., 375 Broadway, New York, N. Y. At the left of Fig. 1 is shown a reseating tool by which the valves on all 45-deg. removable-head motors can be reseated regardless of their size. It is not necessary to change pilots or cutters for different sizes of valve ports, and there are no separate parts to become detached and lost.

The pilot is made in one piece and stepped off for four sizes of valve stems, 5/16, 3/8, 7/16 and 1/2 in. Each step is slightly tapered, so as to obtain a snug fit in the valve guide. The pilot telescopes into the handle and is forced outward by means of a coil spring, so that it quickly seats itself in the valve guide. The inside edge of the tool-steel cutter is 1¼ and the outer edge 3 in. in diameter.

A sleeve for fitting rings to pistons without injury to the pistons, the rings or the fingers of the operator is illustrated on the right side of Fig. 1. The sleeve can also be used when slipping assembled pistons into the cylinder block. It serves to keep the rings compressed and the ring joints properly spaced. This application is also illustrated. The sleeve is split, and is

made of tempered steel in five sizes to fit diameters from 2⅝ to 5⅛ inches.

A vise for holding pistons is shown at the top of Fig. 2. Work such as speedometer heads, clocks, ball bearings and universal-joint parts also can be held in the vise, without danger of injury as might occur if an ordinary machinist's vise were employed. Four points of contact on the work are provided, the jaws being lined with lead. One jaw is fastened to the base, on which the piston rests directly, and the other jaw is movable by means of a screw and handwheel. The base of the device is 10½x5½ in. in size, and work up to 5½ in. in diameter can be held. The weight is 13 pounds.

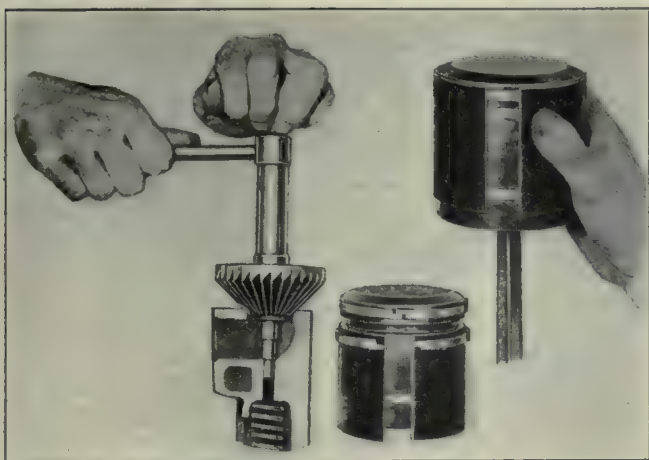


FIG. 1—STEVENS "SPEED UP" VALVE RESEATER AND PISTON SLEEVES

In the illustration a piston is clamped in the vise and the grooves are being cleaned by a special cleaner made for that purpose. The cleaner consists primarily of a metal band, on the inside of which are four V-shaped points that fit into the piston groove. The cleaner is turned around the piston and at the same time raised up and down, so that both the bottom and the side walls of the groove are cleaned of carbon. This operation can be very quickly performed. The tool is made in two sizes, one for pistons 3¾ in. in diameter and over, and the other for smaller ones.

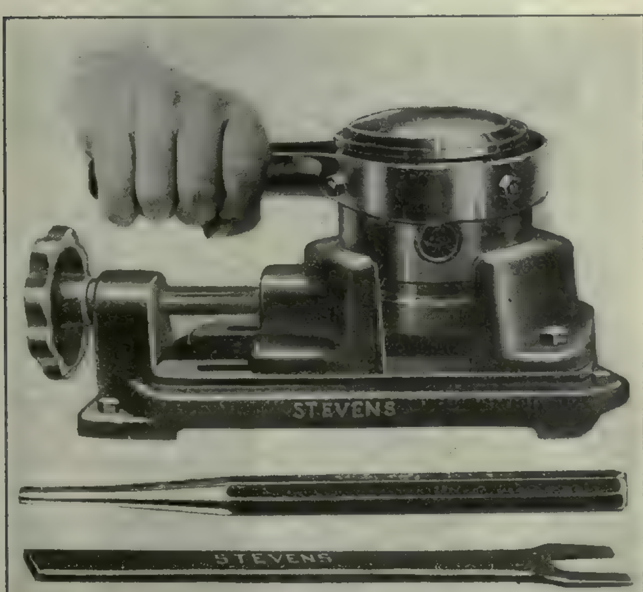


FIG. 2—STEVENS "SPEED UP" PISTON VISE, GROOVE CLEANER, PUNCH AND PRONGS

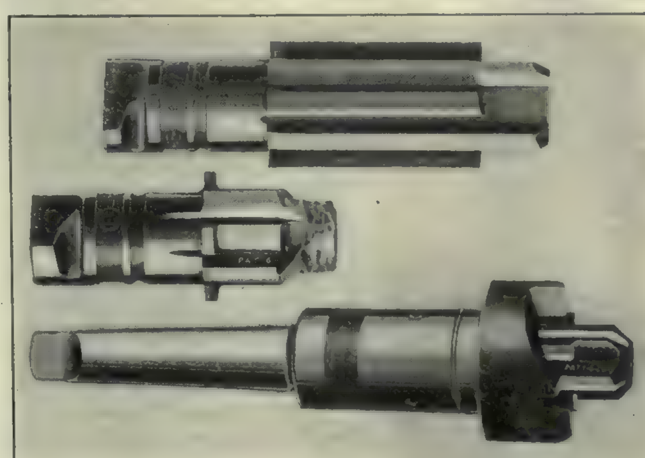
A set of Giant punches 12 in. in length for general use when lining up holes in assembling, and when driving pins and bolts that are difficult of access, also has recently been added to the line. The points of the punches are formed straight for a length of 1½ in., so that they can follow into a hole without hindrance. The punch can be seen in the center of Fig. 2.

The punches are made of tempered chisel steel in three sizes, having point diameters of ⅜, 5/16 and ¼ in., respectively. Octagon stock ¾ in. across the flats, is used for the two larger sizes and ⅝ in. for the smallest. The punches can be furnishes singly or in a set packed in a wooden box.

The tool shown at the bottom of Fig. 2 is a utility prong for general use when repairing parts. It is particularly applicable to such work as compressing springs and prying parts when assembling or disassembling mechanisms. Its overall length is 16 inches.

Eclipse Interchangeable Multi-Diameter Tool

The Eclipse Interchangeable Counterbore Co., Detroit, Mich., has recently placed on the market multi-diameter counterbore cutting tools having separate blades to cut each diameter. The tools are intended for use with the regular interchangeable counterbore made by the concern, to replace the tools having all the diameters on one set of flutes. They are for use on automotive engines especially for machining core holes to receive Welsh plugs, and for machining spark-plug holes. The principle may be employed when machining any number of diameters, and the tool has been made for finishing as many as six diameters by means of one cutter.



ECLIPSE INTERCHANGEABLE MULTI-DIAMETER TOOL

The construction of the cutting tool can be seen in the view at the top of the accompanying illustration. This tool is for cutting two diameters, and is equipped with two sets of blades. The small diameter blades extend the full length of the tool and are placed between the blades that cut the large diameter. Since only blades of equal length bore any given diameter, greater rigidity is claimed.

The principal feature of the tool is its long life. It is possible to grind both diameters all the way from the forward end to the rear, so that the tool appears as shown in the center of the illustration when it has been

used to its limit. The life is equal to that of the full length of the blades that cut the largest diameter. Its life is thus much greater than that of the counterbore in which both diameters are on the same blades, as such a tool must be discarded when the length of the small diameter blade has been ground away. It is not possible to grind further without decreasing the diameter of the small end.

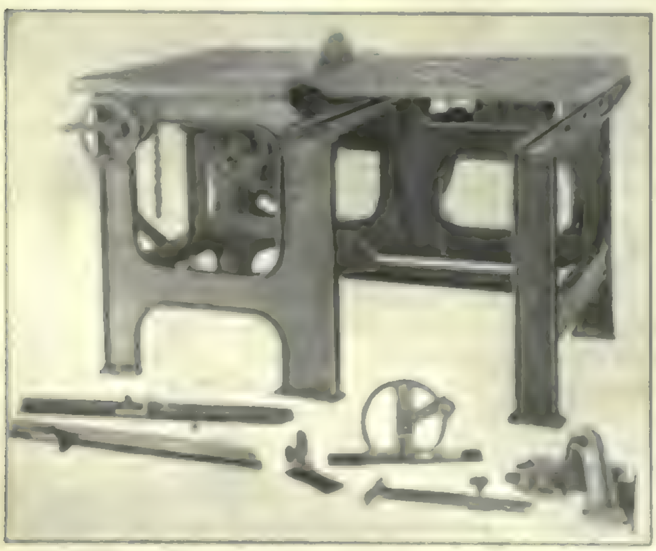
The cutters are interchangeable with the regular cutters employed in the counterbore made by the concern. At the bottom of the illustration can be seen a view of the tool assembled for cutting three diameters, the adaptability of the system being well illustrated.

Hooker Universal Saw Bench

A fully universal bevel and miter saw bench equipped with a tilting arbor and sliding table is shown in the accompanying illustration. The machine, which is designated as the No. 1, has recently been brought out by the Hooker Manufacturing Corporation, St. Johnsbury, Vt. It can be quickly changed for performing different classes of work. The saw can be raised or lowered perpendicularly by turning a handwheel, a feature that adapts it for grooving or rabbeting. By turning the handwheel on the front of the machine, the saw can be tilted from the perpendicular to any angle up to 45 degrees.

The frame is rigidly constructed, but allows easy access to all parts of the machine. The left-hand table is movable sidewise and adjustable to the position of the saw. It is supported by hinges at the back, so that it can be raised and tipped out of the way. The right-hand table runs on rolls fitted to the track, so as to carry the work to the saw. It also has a sidewise adjustment, so that a dado head can be employed in place of a saw.

The yoke carrying the saw arbor is guided in a circular groove. It can be raised or lowered by an elevating screw operated by a handwheel on the front of the machine. The saw can be raised or lowered when in a tilted position, and still remain at the same angle at which it is set. The saw arbor is provided with a ball thrust bearing between the saw collar and the box. It is ordinarily furnished with babbit bearings, although ball bearing boxes may be provided. Saws from 6 to 18 in. in diameter can be used, the latter size allowing stock up to 6½ in. thick to be cut, a capacity large enough for general work.



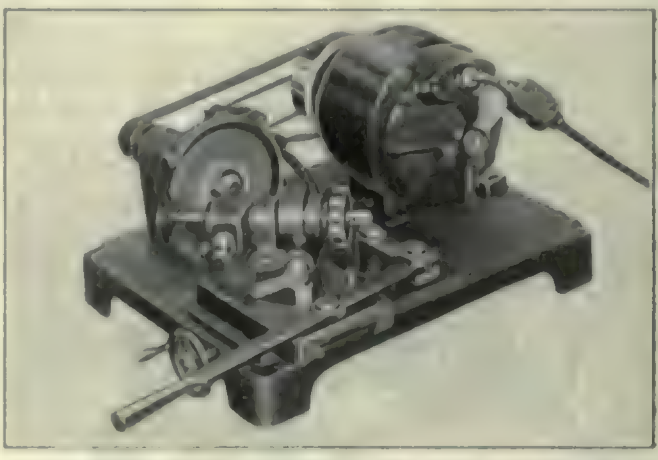
HOOKER UNIVERSAL SAW BENCH NO. 1

Tight and loose pulleys, the latter pulley being equipped with phosphor-bronze bushings, can be provided on the countershaft when belt drive is desired. For motor drive, a 3-hp. motor is supported by brackets on the rear of the frame and connected directly to the countershaft by means of a flexible coupling. Since the motor is not built in, any standard design can be employed. The saw arbor is driven from the drum on the countershaft by means of a belt provided with an idler for tightening it. The speed of the countershaft is ordinarily 1,200 r.p.m., while 3,600 r.p.m. is the speed of the saw arbor that is obtained with the size of driving pulleys usually employed.

The machine is furnished with an adjustable rip gage, an adjustable miter gage, two adjustable stop gages, and two cut-off gages. It requires a floor space of 72 x 58 in. The net weight of the belt-driven machine is 1,100 lb., and that of the motor-driven machine 1,350 lb. The gross weights are 1,250 and 1,550 lb., and the size of the export packing cases 125 and 150 cubic feet.

Franklin Portable Valve Grinding Machine

A portable machine for grinding automotive poppet valves to a fixed angularity, and for grinding reseating cutters adapted for cutting valve seats to the same angularity as that of the valve, has recently been developed by the Franklin Machine & Tool Co., Springfield, Mass. The machine is designated as the Model C and is shown in the accompanying illustration. It is intended especially for repair shop work to enable rapid finishing of valves.



FRANKLIN MODEL C VALVE GRINDING MACHINE

The machine can be assembled by the manufacturer for grinding valves to any desired angle, but it is not adaptable for adjustment from the angle to which it was originally set at the factory. It is thus a single-purpose machine. The motor, which is manufactured by the Westinghouse Electric & Manufacturing Co., is mounted on a low, flat base. It is located far from the grinding wheel, the cross slide, and the valve rotating members so as to prevent motor vibration from affecting the accuracy of the grinding operation. A hand lever serves for reciprocating the slide carrying the work, so as to move the valve across the face of the wheel. A handwheel provides the feed toward the wheel.

Oakley No. 1 Cutter Grinder

The No. 1 cutter grinder shown in Fig. 1 has recently been placed on the market by the Oakley Machine Tool Co., Middletown, Ohio. It is especially fitted for work in small plants having only one or two milling machines and a small toolroom. It will handle all of the work encountered there, but is not as expensive as a machine having a large range and a great number of attachments. The machine is similar in characteristics to the Nos. 2 and 3 Oakley cutter grinders, the latter of which was described on page 786, Vol. 53 of *American Machinist*.

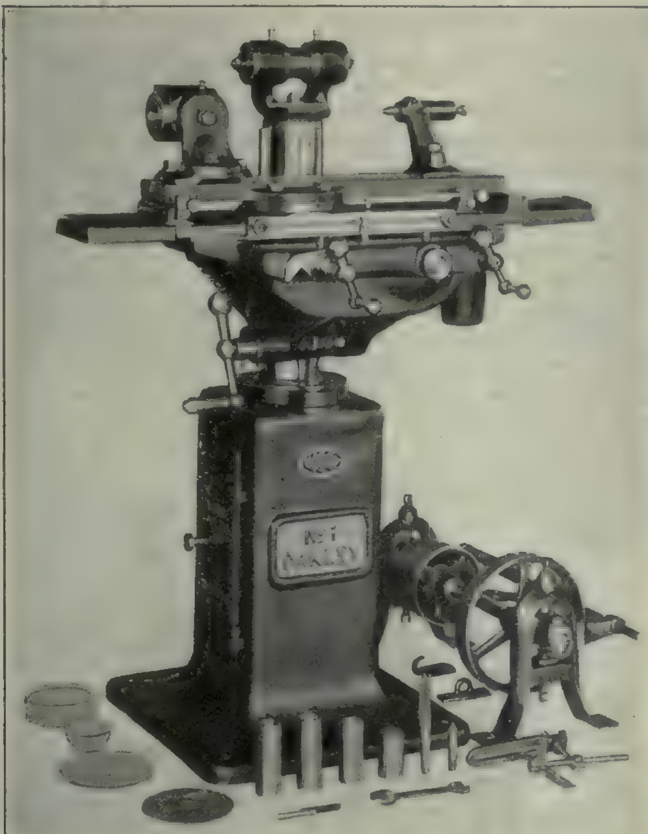


FIG. 1—OAKLEY NO. 1 CUTTER GRINDER

The bearings of the saddle and slide are made with one flat and one V surface. They are very liberally proportioned, so as to add to their life, and their construction is such that the slide can be easily removed for cleaning. The table is supported in the middle and at both ends, with provision for taper adjustment in inches or degrees. A large knee with a long bearing on the column supports the saddle. The lightest portion of the machine is swivelled instead of the heavy working parts. Thus, the table position can be maintained and the wheel head swivelled on the column through 180 deg. in either direction. The wheel spindle runs in ball bearings, is driven by belt from an overhead countershaft and carries two wheels in the usual manner.

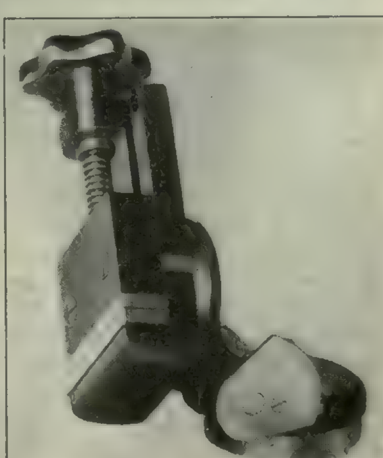


FIG. 2—OAKLEY UNIVERSAL VISE

A fast or slow table movement can be obtained by means of a slip gear that can be reached from the operating position. The operating levers are so arranged that the machine can be manipulated from either side. The longitudinal movement provided is 12 in. in length, the cross movement 5¾ in., and the vertical movement 9 in. The machine takes 15 in. between centers, provides a swing over the table of 8 in., and can sharpen face mills up to 10 in. in diameter. The maximum distance from the table to the spindle is 8¾ inches.

Various attachments are furnished with the machine to adapt it to the jobs encountered in the average toolroom. Attachments to suit special requirements can be fitted. In Fig. 2 is shown a vise having a wide adaptability that is furnished for the machine. The vise is completely universal and can be swivelled through any angle required. When performing surface grinding on work that must be held flat and very rigid, the vise proper can be detached from the swivel and used directly on the table of the machine.

American Pipe Tool Co. Portable Pipe-Vise Stand

A portable stand for the use of plumbers, steamfitters, electricians and pipe-fitters for supporting a pipe vise has recently been placed on the market by the American Pipe Tool Co., 123 South Jefferson St., Chicago, Ill. The stand is shown in the accompanying illustration fitted with a pipe vise. It is made of malleable iron, and provided with a shelf for holding tools. The pipe bender is a part of the body casting, and the legs are easily attachable and detachable. The legs are provided with holding points and feet to prevent slipping.

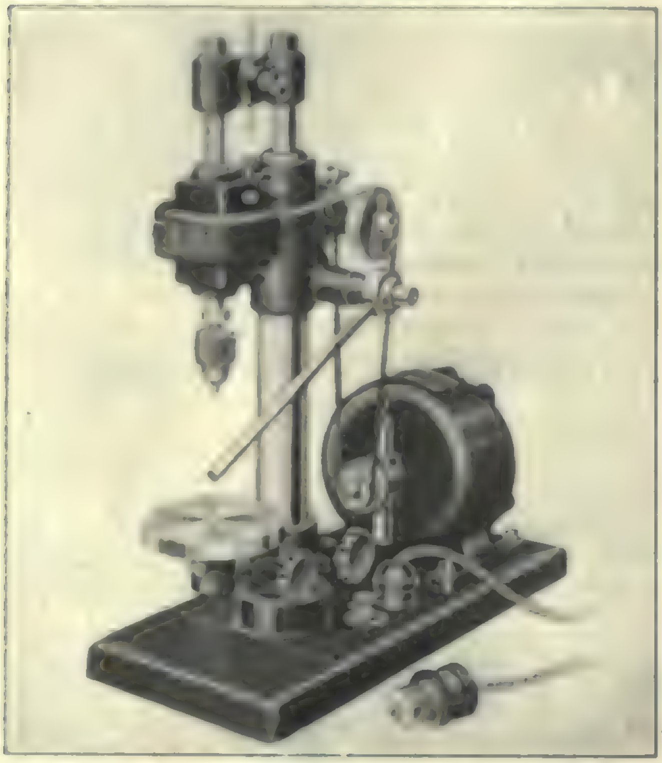
"AMERICAN" PORTABLE PIPE-VISE STAND

The stand can be drilled for holding any type of hinged or chain pipe vise having a capacity up to 2½ in. Its weight complete with the vise is about 50 pounds.

Muehlmatt Sensitive Drilling Machine

Adolph Muehlmatt, Lion Bldg., 5th and Elm Sts., Cincinnati, Ohio, has just placed on the market a sensitive drilling machine suitable for precision tool and manufacturing work within its capacity. Owing to the fact that there is nothing at the front of the machine to catch hair, the machine is well adapted for use in plants employing female operators.

As may be seen in the illustration, the machine and motor are entirely separate, making it possible to substitute another motor at any time, or to drive the machine from overhead. The base rests on three rubber contacts, which with the 55 lb. weight of the machine, make it stay firmly in position on the bench, without the necessity of using bolts or clamps. The spindle is $\frac{7}{16}$ in. in diameter, is hardened and ground and has a vertical travel of 2 in. controlled by adjustable stops. The idler pulley bracket is adjustable by means of a thumbscrew, giving any desired tension to the drive belt, which goes directly to the spindle.



MUEHLMATT SENSITIVE DRILLING MACHINE

The column is of steel, $1\frac{1}{4}$ in. in diameter and 13 in. high. The table is adjustable radially as well as vertically. There is a 4-in. space between the table and chuck, and 8 in. between the base and chuck. The chuck takes any size of drill up to $\frac{1}{4}$ in. The feed is of the ratchet-lever type, so that the operator may readily get the position desired for the hole. The construction of the table bracket makes it easy to remove the table and fit jigs of various kinds in its place, if desired.

The spindle speed is from 1,500 to 2,500 r.p.m., but any speed up to 8,000 r.p.m. may be had on order. The front pulley guard is easily removable in order to shift the belt when changing speeds. The motor switch is made especially for this machine. The excess of used oil is thrown off into chambered recesses and then runs down by gravity. With this construction and ordinary caution in oiling, the machine will not sling oil even when running at its highest speed.

Atlas Power Screw Press No. 63

A power-operated screw press that has recently been placed on the market by the Atlas Press Co., Kalamazoo, Mich., is shown in the accompanying illustration. The press, which is designated as No. 63, is intended for pressures up to 50 tons. For work from 25 to 30 tons, the ram speed is about 7 ft. per minute, although the speed varies with the amount of pressure applied.

The drive of the press is operated through a marine type of clutch. The machine is illustrated with control by means of a handwheel on the front of the head. However, operation is regularly obtained by means of a hand lever on the right-hand housing, the position of the lever being adjustable, so that it can be most conveniently placed for the operator. All working parts of the drive are mounted on the back of the head, where they are easily accessible.

The screw is 3 in. in diameter and 48 in. long. It is ordinarily furnished with a 2-in. lead, double Acme thread. It can be furnished with a single thread, so that the clutch can be released and the pressure held without consuming power. The thrust on the screw is carried by heavy S.K.F. ball bearings, and the thrust

ATLAS POWER SCREW PRESS NO. 63

on the worm by radial and thrust ball bearings. The remainder of the bearings are S.K.F. ball bearings.

The base of the machine is provided with T-slots and a keyway, so that jigs and fixtures may be accurately located. A hole can be cored in the center. Special bases and fixtures can be supplied to suit special work. The capacity between the upright is $37\frac{1}{2}$ in., and from the screw to the base 32 in. The ram has a maximum movement of 24 in. A motor base can be secured to the rear of the machine base, when individual motor drive is desired. A 5-hp. motor running at 1,200 r.p.m. is ordinarily employed. An hydraulic pressure gage can be supplied. The machine requires a floor space of 27 x $48\frac{1}{2}$ in., and is 76 in. high overall. Its shipping weight is 2,900 pounds.

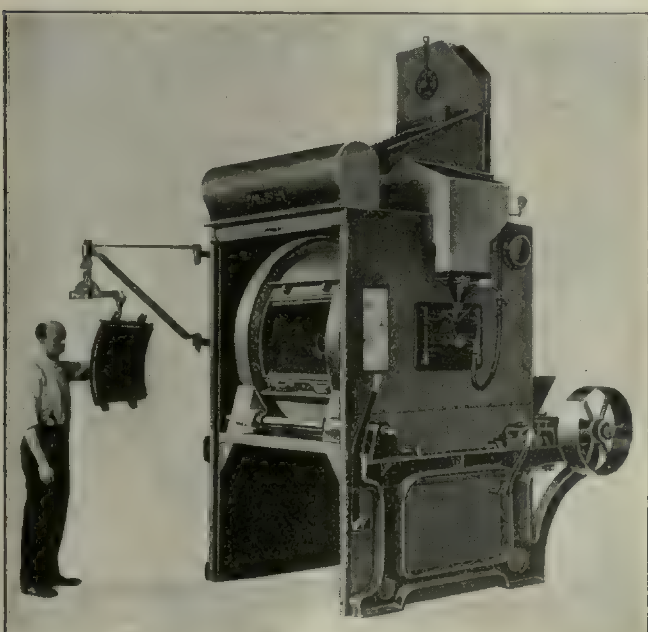
Pangborn Large Barrel-Type Sandblasting Machine

A barrel type of machine for cleaning work by means of a sandblast is shown in the accompanying illustration. The machine has recently been placed on the market by the Pangborn Corporation, Hagerstown, Md. It is similar in construction, although much larger than the barrel sandblasting machine described on page 778, Vol. 55 of *American Machinist.* It can be furnished with drums of two sizes, one 30x40 in., and the other 50x40 in., which makes the machine available for work from small size to that as large as is feasible for barrel cleaning.

The nozzles in the machine are made adjustable in both horizontal and vertical positions, so that the most effective location can be secured. This action is necessary because of the fact that the cleaning capacity of a sandblast is governed by the distance of the nozzle from the work and its angle to the work. The adjustment provided for the nozzles allows for accommodating different classes of work, as regards both the size of the pieces and the "ride" within the barrel due to the rotation.

A mechanical separator gives constant separation of the abrasive for reuse. It consists of a ribbed roller driving against a shaft protected by heavy rubber tubing, the latter taking all of the wear and being quickly and cheaply replaceable.

Every moving part is so made as to withstand continuous service, and to give long life to the press. The barrel itself is reinforced at the door opening, with plates and angles both inside and out. Steel tires pinned to the head castings and driving on manganese steel



PANGBORN BARREL SANDBLASTING MACHINE

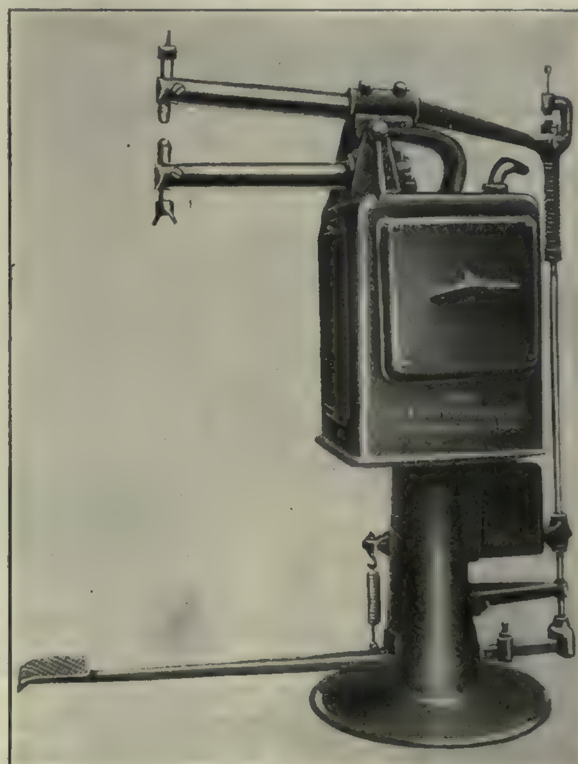
rollers, the front rollers being idle and equipped with roller bearings, provide even traction with but little wear. The driving sprockets are steel and the chain runs in a bath of oil, which is inclosed to exclude dust. The clutch is simple and positive in its action, so that the motion of the drum can be easily engaged and disengaged.

It is stated that in the design of the machine economy of operating cost has been given the greatest consideration, from the viewpoints of both the increased efficiency of the blasting acting and the durability of the equipment itself. Great economy is claimed when cleaning in bulk work adapted to this method.

"U. S." Electric Welding Machine

The U. S. Electric Welder Co., 327 Permanent Bldg., Cleveland, Ohio, has recently placed on the market the welding machine shown in the accompanying illustration for use on light and medium stock. The machine can weld rough oxidized as well as smooth stock. About 4 sec. per weld are required for $\frac{3}{16}$-in. material, while the production when welding two $\frac{1}{16}$-in. bright steel sheets is stated to be 4,000 welds per hour.

The machine is made in two sizes, having kva. capacities of 12.5 and 18, and horn sizes of 2 and 2½ in.,



"U. S." ELECTRIC WELDING MACHINE

respectively. Various lengths of horn can be furnished. The machine is designated as the S.A.F. and as the S.A.M. when equipped with a motor. The former style in the 12.5-kva. size and equipped with a 12 in. length of horn is illustrated.

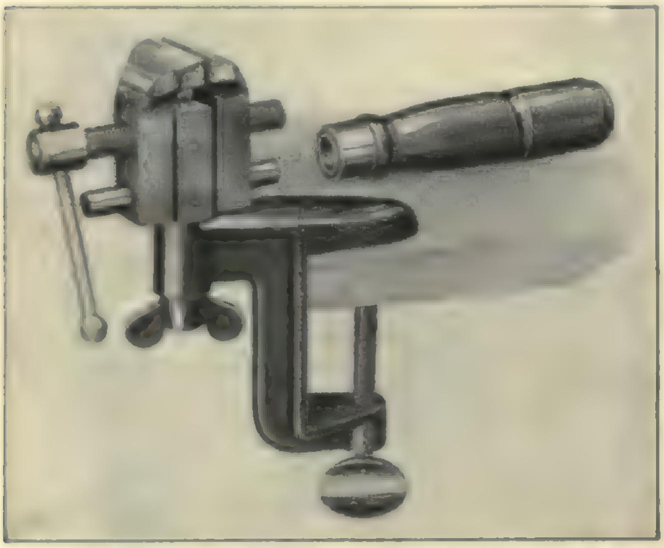
The machine is equipped with a "U. S." welding transformer of the type described on page 468 of *American Machinist.* The internal automatic reactance prevents breakdown and overload, and enables the machine to handle heavy stock without overheating. The automatic switch is equipped with a magnetic blowout and removable contacts, and it is entirely inclosed. A 5-point pivot switch provides for different voltages at the welding point. All conductors carrying the line voltage are inclosed.

The welding points are water-cooled. Pressure is placed on them by means of the treadle at the front of the machine acting through a system of links. Heavy pressure on the point can be obtained when desired, because the moving parts are all strongly made.

Starrett Combination Hand and Bench Vise

A general utility vise suitable for use both in the hand and attached to a bench, has recently been placed on the market by the L. S. Starrett Co., Athol, Mass. The vise, which is designated as No. 86, is shown in the accompanying illustration as arranged when clamped to a bench, although the detachable handle can be seen.

A large strong clamp is furnished for use when the tool is employed as a bench vise. It can be attached



STARRETT COMBINATION HAND AND BENCH VISE

to benches having thicknesses from ½ to 2¼ in. The construction is such that the vise can be adjusted to any position throughout a complete circle, and then locked. The change from the bench mounting to the handle, and *vice-versa*, can be quickly effected.

The use of the ball-end handle for tightening the jaws, instead of a wing nut, enables bringing into play a large leverage, so that one objection to hand vises is eliminated.

The jaws of the vise are tempered and polished drop forgings, 1½ in. in width. They provide a maximum opening of about 1½ in. for the vise.

"Duraloy" Chrome-Iron Alloy

An alloy of chromium and iron known as "Duraloy" has recently been placed on the market by the Cutler Steel Co., Pittsburgh, Pa., with a general sales office in the Hudson Terminal Building, New York, N. Y. The chief feature of the alloy is resistance to oxidation, corrosion and abrasion, although it possesses other properties that adapt it to special uses.

The alloy can be furnished commercially in practically every form, including castings, rolled or forged bars, sheets, wire and tubing. The physical properties can be made to suit the conditions, varying with the analysis, treatment, and method of manufacture. Properties ranging from those somewhat better than cast iron to those of commercial alloy steels can be imparted to the metal. The uses for which the alloy can be employed are thus very numerous.

The metal contains a high proportion of chromium, but the content of chromium and of the other elements can be varied considerably, according to the properties that are desired. Duraloy castings are clean, close-grained and free from blowholes and segregations. They can be furnished in different degrees of hardness. In the rolled form the metal responds to heat-treatment in a manner similar to alloy steels. Bars or sheets can be supplied sufficiently ductile to permit of bending, punching, forming, and stamping. They are subsequently treated to increase the hardness and the wearing properties.

The Brinell hardness of the alloy can be varied from 170 to 600. The ultimate tensile strength of the cast alloy varies from 40,000 to 90,000 lb. per square inch, and of the rolled or forged alloy, from 80,000 to 130,000 lb. per square inch. A property of Duraloy that makes it adaptable in cases where severe service is encountered is the retention of a large precentage of its original tensile strength even at very high temperatures.

Although the machining qualities vary with the treatment given the steel, Duraloy can be furnished as easily machineable as medium carbon steel. Rolled sheets and bars can be readily machined after annealing. Castings can be supplied soft enough to permit of threading, tapping, drilling and other machining operations, but they can also be furnished so hard that it is possible to finish them only by grinding.

Duraloy can be welded by either the oxy-acetylene or electric arc methods, although it cannot be hammer welded. Preheating is found advantageous, particularly in the case of castings. Since the metal does not oxidize, it cannot well be cut by the oxy-acetylene cutting torch.

The alloy will resist oxidation up to 2,100 deg. F., and there is practically no loss of weight at this temperature. The metal does not warp nor crack at high temperatures, so that it is especially adapted for use as parts of furnaces and heat-treating equipment. It can be employed wherever high heat must be withstood, but at the same time physical strength is required. Examples of parts that must have such properties are gratings, doors and counterweight chain used for furnaces.

The alloy will resist atmospheric and salt corrosion indefinitely. It is especially resistant to nitric acid solutions, organic compounds and acid mine water, so that it can be employed for pump parts and apparatus for chemical plants. Since the alloy is resistant to anything of a highly oxidizing nature, such as molten cyanide and heat-treating salts, it may be employed for the lining of pots to hold such chemicals. The resistance to furnace gases varies with the nature of the gas. The alloy will take a high polish and is rust and stain proof. Pots and protective coverings made of it can easily be kept clean.

Both hardness and toughness are combined in the material, so that resistance to wear and abrasion is given. The wearing qualities are stated to be considerably better than those afforded by a steel having the same Brinell hardness. When prepared to give resistance to abrasion as its chief property, Duraloy is superior to the hardest chilled iron and to manganese steel, it is stated. Its properties in respect to abrasion makes it adapted for such uses as in balls and races for grinding, extrusion and drawing dies, liners for ore and coal chutes, and tips for piercing metal tubing. It is stated that the metal has been so tested in a variety of uses that its performance under different conditions can be readily predicted.

Bullard Automatic Machine for Boring Pipe Couplings

The production of the average small couplings used in pipe installations for steam, water and similar purposes would hardly be considered in the light of a difficult or complex shop problem; but when these couplings run to large sizes, 12 in. in diameter and larger, and the necessity exists for preserving exact alignment of the pipe sections joined by them—as, for instance, the casings of oil wells—the job of making them in the quantities necessary to meet the demand and with a degree of accuracy to fulfill the exacting requirements in the matter of alignment becomes one that is worthy of careful consideration by the designing engineer. The couplings are usually forged, or at least lap-welded, and in order to insure the alignment of the ends a boring operation is necessary before they receive the tapered threads into which the pipe sections are screwed. To meet the conditions and to attain a rate of production that is commensurate with the demand requires a machine especially designed for the purpose. Such a machine capable of taper-boring, counter-boring, facing to length and chamfering both ends of a coupling simultaneously, and of automatically loading and discharging the coupling as the work proceeds, without attention from the operator other than to keep the loading rack supplied with work and to clear away the finished pieces as they accumulate in front of the machine, is shown in the illustrations given herewith.

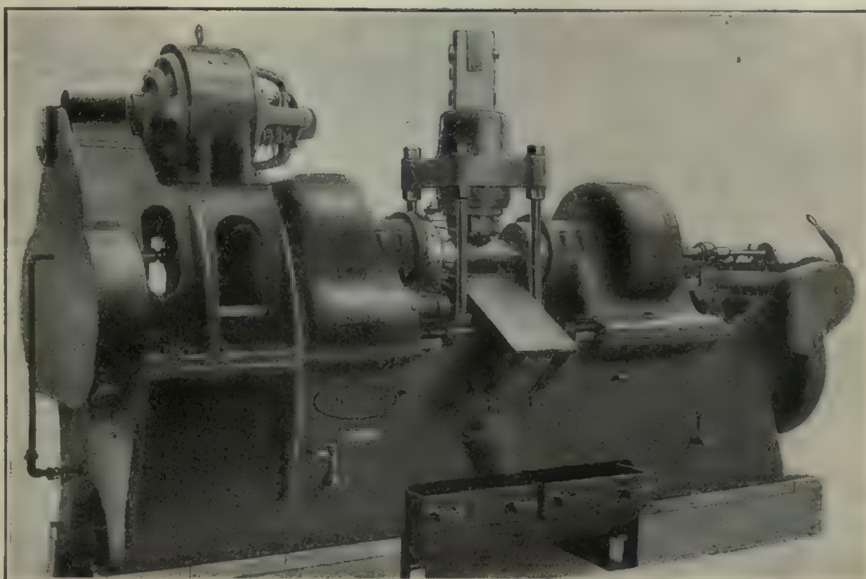


FIG. 1—BULLARD MACHINE FOR BORING LARGE PIPE COUPLINGS

The machine has been designed and placed on the market by the Bullard Machine Tool Co., Bridgeport, Conn. It is self-contained and is driven by two independent motors; the main drive a variable-speed motor of 25 hp. maximum, and the secondary drive a variable-speed motor of about 5 hp. A further requirement is a supply of air at a pressure of 75 to 80 lb. per square inch, that may be obtained from a small independent compressor or taken from the shop lines, as circumstances dictate.

A front view of the machine is shown in Fig. 1 with a 6-in. coupling in place in the jaws of the pneumatically operated chuck, and boring heads of corresponding size attached to the driving flanges, which form an integral part of the driving spindles at the inner end.

The main spindles are carried in substantial parallel bearings of bronze, 8 in. in diameter by 14 in. long, located in the two sliding heads. These heads have a longitudinal movement upon the bed, actuated by barrel cams directly under each head mounted upon a shaft that extends the length of the machine within the bed. The cams are so calculated as to cause the heads to advance to and recede from the work simultaneously. The rotative movement of the spindles is derived from the main driving motor, mounted upon the housing over one of the heads, and the speed of rotation is adjustable by means of the motor control to meet varying requirements imposed by diameter of work and toughness of material. The longitudinal shaft carrying the barrel cams that operate the heads derives its movement from two sources. During the slow advance of the heads when the tools are at work, the camshaft is driven by the main driving motor, and the rate of feed, therefore, automatically corresponds to the speed of rotation of the cutters. The ratio of feed to speed is susceptible to further variation by means of change gears which provide for faster or slower relative feeds.

After the tools have completed their cuts, the secondary motor furnishes the power for subsequent functions. The heads are withdrawn quickly, the air chuck opens, the loading mechanism operates to eject the finished piece and to replace it with an unfinished one upon which the chuck jaws close. These latter movements are controlled by dogs on the timing disk which is mounted on the end of the camshaft and power is transmitted through the camshaft by the secondary motor mounted upon a shelf at the rear of the machine. In Fig. 2, which shows the loading side of the machine, the air cylinder that operates the chuck may be seen mounted on the bed. The piston rod passes through both heads, being connected above through the medium of a lever of the first class to the upper chuck jaw, while below a lever of the second class transmits the movement to the lower jaw. Thus a single movement of the piston causes the jaws to withdraw in opposite directions, and a reverse movement again closes them upon the work.

No floating or compensating leverage is needed to bring the work to center. Once set central by means of the adjustments, any round piece must be exactly centered by the chuck because of the fact that the jaw movements to and from the center are equal and positive. The chuck could not grip in any other position, regardless of varying diameters. The work is held between the chuck jaws by air pressure alone. With a gage pressure of 80 lb., the gripping pressure upon the work is approximately six tons.

Air is admitted to and exhausted from the cylinder by means of a two-way valve located back of the bracket shown at the lower right in Fig. 3 and operated by the spring finger on the periphery of the cam disk. This cam is keyed to the protruding end of the longitudinal shaft that carries the barrel cams within the base of the machine. Besides the spring

finger, the position of which is fixed, there are circumferentially adjustable dogs upon this cam disk to operate a clutch tha. changes the drive of the camshaft from the slow feeding movement imparted by the main-drive motor to a fast traverse deriving its motion from the secondary motor, and *vice versa*. The

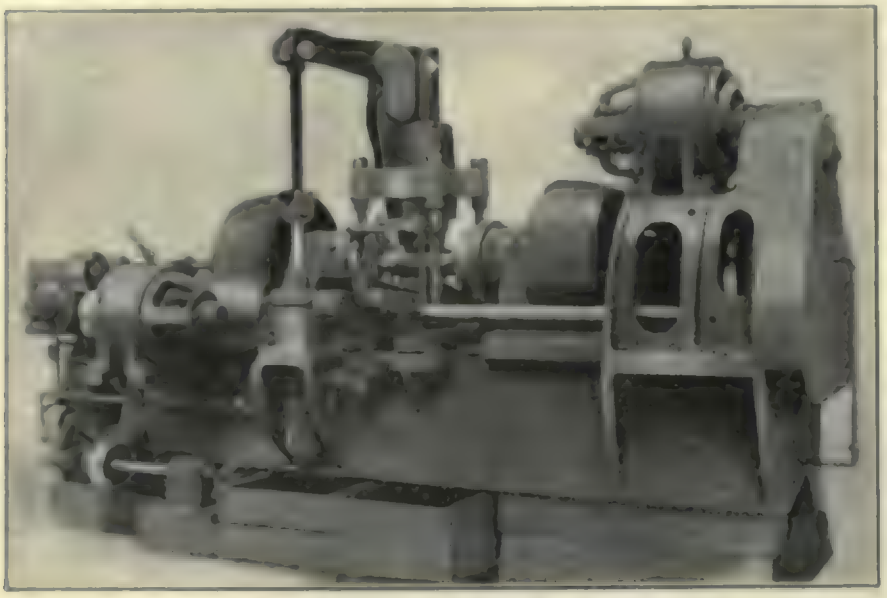


FIG. 2—REAR VIEW OF BULLARD MACHINE

clutch handle shown at the top enables the operator to make this change manually at will, and to stop, start or maintain the rapid traverse in operation throughout the complete cycle independently of the cam, as may be desirable when setting up the machine or resetting tools.

The main spindles rotate in opposite directions at equal speeds and the heads advance to the work simultaneously. As the work performed by one cutter head is the exact duplicate of that performed upon the opposite end of the coupling by the other head, the pressures of both feed and cut are balanced and the chuck relieved of the duty of holding against excessive pressures. Ball thrust bearings upon each of the main spindles absorb the pressure of the cut and minimize frictional resistance.

Each cutter head is provided with three pairs of cutting tools made from standard $\frac{3}{4}$-in. square-sectioned bars of high-speed steel, stellite or other material, and these tools counterbore, face and chamfer the respective ends of the couplings. A fourth pair of tools in each head does the taper boring, and the manner in which this is accomplished is perhaps the most ingenious feature of the machine.

In each cutter head there are two diametrically opposed longitudinal slots, each slot carrying a swinging sector that is pivoted at the end next to the driving flanges and free at the other end to swing outward radially. At the outer end provision is made for holding a toolbit similar to the other tools. The main spindles (and also the cutter heads) are hollow, and through each there passes a former-bar that is square in section and tapered upon two opposite sides to correspond to the taper required in the work. The former-bars rotate with the cutter heads, but during the time of cutting they are held against endwise movement. The free ends of the swinging sectors in the cutter heads bear upon the tapered sides of the former-bars, and as the cutter heads advance the sectors gradually close together by reason of the pressure of the cuts upon the points of the tools. The taper of the bar is thus duplicated upon the inner surface of the work.

The cycle of operations of the machine is as follows: The chuck jaws close upon the coupling, the heads advance by rapid traverse to the beginning of the cut, and during this movement both former-bars are still more rapidly advanced by means of amplifying levers until they meet at the center of the work, where they are held in position.

One of the adjustable dogs on the timing disk shown in Fig. 3 now changes the movement of the camshaft and camdrum from rapid traverse to feed. The heads advance at feed toward the center of the coupling, one head slightly in advance of the other. The foremost head passes beyond the center of the coupling and as it retires, the second head continues to advance beyond the center overlapping the cuts to assure complete finish throughout the coupling. Camdrum speed now changes again to rapid traverse, quickly withdrawing the heads. The former-bars are returned with the heads, the jaws open and the loading mechanism operates to eject the finished piece.

The drive from the main motor to the spindles and camshaft is through gears of special alloy steel, heat-treated. All gearing is enclosed and runs in oil. The oiling system includes continuous oiling to main spindles and all important bearings. Special provision

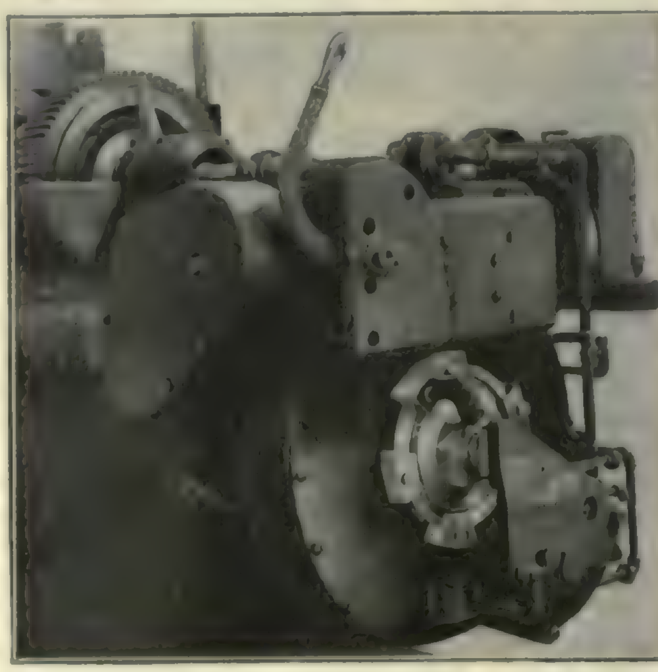


FIG. 3—THE OPERATING CAM

is made to exclude cutting compound from the bearings. The secondary motor drives the rapid traverse and automatic movements through an endless belt provided with a suitable belt-tightener. This motor also drives the pump for circulating the cutting compound.

The former-bars are hollow and are so connected at

their outer ends to the circulating system that two streams of ample volume are constantly delivered to the center of the coupling, serving the double purpose of lubricating the tools and washing out the chips. A tank for the cutting compound and removable pans for the chips are included in the equipment. The accessibility of the pans, which can be easily reached from either the front or the back of the machine, can be observed by referring to the first two of the illustrations.

Separate chuck jaws and separate cutter heads are required for each size of coupling. The cutter heads are attached by bolts and are keyed to the driving flanges and can be quickly changed. No other adjustment is required than changing chuck jaws and cutter heads for each size of coupling, and setting the adjustable dogs on the cam disk to make the speed and feed changes at the right instant.

The capacity of the machine is for couplings from 6 to 12½ in. in diameter, pipe size. For the larger sizes the cutter heads are provided with four swinging sectors and the former-bars are correspondingly tapered upon four sides.

A variable-speed motor ranging from 400 to 1,600 r.p.m. provides for spindle speeds from 10 to 40 r.p.m. Change gears enable the feed ratio to be changed from 0.025 to 0.075 in. per revolution of the spindles. The machine weighs approximately 24,000 lb., occupies a floor space of 8x12 ft. and stands 5 ft. 6 in. in height.

"Commercial" Rust Remover and Pickling Compound

A preparation of foreign invention which is being used at the present time in Europe for the removal of rust and corrosion on all metals, as well as in sulphuric acid baths for pickling purposes, has recently been placed on the American market by the distributors, Peter A. Frasse & Co., Inc., 417 Canal St., New York, N. Y.

When cleaning metals or metal parts of rust or corrosion, one part of the "Commercial" rust remover to twenty-five parts of water is sufficient to loosen and remove any rust regardless of its age or condition. The part is merely immersed in a bath of the remover, and need not be heated nor scraped. Thus no labor nor mechanical treatment is required, so that the cost of removing the rust is slight. The bath works rapidly, so that the surface of the metal is soon left entirely free of corrosion.

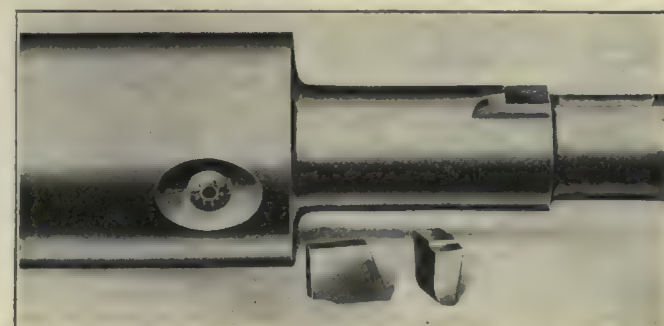
The rust remover does not consume nor attack the metal itself, as its action is entirely confined to removal of the rust and corroded portions. Thus, parts containing fine threads and teeth can be completely freed from rust without any decrease in size. The same solution can be used over and over, by merely adding a little of the compound occasionally. The cost of maintaining the bath is thus very low. The compound is not inflammable nor explosive, and hence can be used with safety near an open fire.

The "Commercial" rust remover and pickling compound is of particular use also in plants employing sulphuric acid and hydrochloric acid baths for removing scale. By the addition of 1 or 2 per cent of the compound to the bath, the formation of hydrogen, which is usually considered to cause pickling brittleness in steel, is prevented. The presence of the compound neutralizes the action of the sulphuric acid bath in consuming the metal which has already been freed from scale. It thus prevents loss occurring from overpickling. In the same way, a large saving of sulphuric acid required in the bath is effected.

Damage done to pickling apparatus, baskets, chains and equipment about the plant is considerably lessened by the use of the compound in the pickling bath. In addition, objectionable fumes from the bath are prevented. The compound may be furnished in quantities from one pint to that as large as desired.

Manufacturers' Equipment Co. Expansion Boring Bar

An expansion boring bar of simple construction, the working parts of which are shown in the accompanying illustration, has been developed by the Manufacturers' Equipment Co., Waller Ave. and Fillmore St., Chicago, Ill. It is stated that accuracy has been the first consideration in the design of the bar, and that the cutters can be adjusted to 0.0001 in. It is also stated that the



M. E. C. EXPANSION BORING BAR

cutters can be removed from the bar after setting and replaced without variation from size, which makes it possible to remove the cutters from the bar after a hole has been bored and replace them after the bar has been withdrawn from the hole, in cases where this is necessary. No care is necessary to return the cutters to the slots from which they were removed, as the same setting will be obtained by changing the cutters to opposite sides of the bar.

Micrometer adjustment is provided, each revolution of the dial indicating an expansion or contraction of the cutters equal to 0.010 in. As the cutters are moved outward in a direction at right angles to the axis of the shaft, practically all thrust is taken by the solid body of the bar. A radius on the back of each cutter fits into a corresponding seat in the body of the bar, a construction that tends to eliminate vibration or chatter. The locking mechanism consists of a tapered screw which forces a clamping block against the cutters, the block being so designed that the pressure is equalized, thus holding both cutters firmly in position.

The bar is made of heat-treated alloy steel, and the pilot is hardened to minimize wear. Cutter blades can be furnished in any kind of material desired; and they are of such simple design that they can be made in any shop. All working parts are of steel, hardened and ground, and will last the life of the bar. The mechanism is entirely inclosed in the bar in such a manner that no dirt, water nor oil can enter, and grease can be packed in the mechanism by removing a screw. Bars can be furnished in any size from ⅜ in. up.

News Section

Mechanical Exhibit Will Have New Features

The first National Exposition of Power and Mechanical Engineering, to be held from Thursday, December 7th until December 13th, except for the intervening Sunday, will emphasize the need for greater power developments and fuel economies by the display of modern apparatus used in the combustion of fuels, in the production and use of power, and in the allied engineering arts. Competent engineers will be present at the various exhibits to explain the apparatus and to consult in its application to any particular problem.

The Exposition will be made up of an impressive array of exhibits of prime movers and steam generating devices, stokers, pulverized fuel apparatus, refractories, water purifiers, feedwater heaters, economizers, superheaters, blowers, valves, piping, pipe covering, pumps, recording instruments, belting and lubrication. All devices for the power house will be on show.

The educational features of the Exposition will be strengthened by the exhaustive program of motion pictures which have been secured in co-operation with the U. S. Bureau of Mines and various manufacturers, the titles of which are as follows: A Close-Up of Stoker Combustion, Making Vertical Transportation Possible, Everlasting Power: The Construction of the Caribou Hydro-Electric Power Plant in the Sierra Nevadas of California, Cottrell Electrical Precipitator in Action, The Story of Coal, The Story of Petroleum, The Story of Sulphur, The Story of Ingot Iron, Saving Coal at Home, The Story of Asbestos, Rock Drilling, The Story of Abrasives, The Story of Heavy Excavating Machinery, The Story of Natural Gas, Oxygen, The Story of an Electric Meter, The Story of a Watch, The Story of an Automobile, The Story of Steel, The Manufacture of Cast Iron Pipe, Water Power, and Electric Transportation.

The Exposition is to follow the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. Invitations have been extended to these societies and also to the American Society of Safety Engineers, Stoker Manufacturers Association, American Institute of Electrical Engineers, American Economic Association, American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, Society of Industrial Engineers, Society of Welding Engineers, American Society of Heating and Ventilating Engineers, National Electric Light Association and the Building Managers and Owners Association.

The committee which is guiding the exposition consists of Irving E. Moultrop of the Edison Electric Illuminating Company of Boston, Chairman; Dexter S. Kimball, President of the American Society of Mechanical Engineers; Alexander G. Christie, Chairman Power Division A.S.M.E.; Fred Felderman, National President National Association of Stationary Engineers; Milan R. Bump, Past-President National Electric Light Association; N. A. Carle, Vice President Public Service Production Company of New Jersey; E. B. Katte, Chief Engineer Electric Traction N. Y. C. R.R. Company; Fred R. Low, Editor "Power"; David Moffat Myers, Consulting Engineer; Calvin W. Rice, Secretary the American Society of Mechanical Engineers, and the managers, Charles F. Roth and Fred W. Payne, with offices in Grand Central Palace, New York.

Federal Business Associations Are Being Formed

Under the direction of the Bureau of the Budget a definite effort is being made for the first time to increase the efficiency of our great federal business machine by bringing together, in the larger cities of the country, all officials of the Government in whatsoever department they are engaged. The work is under the personal supervision of General Herbert M. Lord, director of the Bureau of the Budget and Colonel H. C. Smither, his chief co-ordinator. According to the plan, Federal Business Associations are to be organized in the larger cities for the purpose of bringing about a closer co-operation and co-ordination in carrying on the Government's business.

In these associations it is expected that economies will be realized from the interchange of transportation facilities, the consolidation of purchases, the storage of supplies, and the co-ordination of many other activities to the common advantage of each of the different departments concerned. It is expected that the association will make possible the elimination of much duplication and a reduction in the expense of operation of the government.

The first Federal Business Association was formed in Chicago. At the organization meeting it was found that few Federal officials stationed in that city were acquainted with officials representing departments and bureaus other than their own. Other associations have been formed in Detroit, Milwaukee and Boston, and have already been in existence sufficiently long to prove their utility. It is now planned to carry the organization into Philadelphia, Baltimore and other large cities.

Ethan Viall Addresses Engineers at the University of Cincinnati

On Friday, November 10, Ethan Viall, Ohio editor of the *American Machinist*, gave a talk before three classes of engineering students at the University of Cincinnati. This revives and old custom which had been discontinued since Mr. Viall left Cincinnati some years ago to come to New York. Mr. Viall's talks have always been well received by the undergraduates.

Duluth Shipbuilding Plant Will Repair Railroad Cars

According to a report from Duluth, a company to be composed of Duluth and eastern capitalists is being organized to take over and operate the McDougall-Duluth shipbuilding plant in that city. The promoters propose to utilize the plant as a large railroad repair shop that would almost, at the outset, afford employment for from 2,000 to 2,500 men.

Capt. A. B. Wolvin has been engaged in the project during the last three months and he has received assurances that the Northwest railroads would furnish cars for repairs to the extent of $4,000,000 annually and terms upon which $2,000,000 worth of work would be carried through have been tentatively agreed upon. In addition, the plant has been guaranteed a large amount of marine work.

It was found upon examination by Capt. Wolvin and a party of engineers that the plant can be readily converted for railroad car repair shop purposes and that it would be available at once to undertake the repair of thousands of bad-order cars held by the Northwest roads. Figures obtained by the investigators showed that the original cost of the plant, built during the war period, was over $7,000,000; that its present replacement cost would be in the neighborhood of $4,000,000 and that it can be bought from its present owners, headed by Julius H. Barnes, at around $2,000,000.

A.E.S.C. Calls Conference on Numbering of Steel

A conference to consider the desirability of providing a system of designating qualities or kinds of steels by code numbers, has been called by the American Engineering Standards Committee at the request of the U. S. Bureau of Standards. The conference will be held in Room 704, Department of Commerce Building, Nineteenth Street and Pennsylvania Avenue, Washington, D. C., at 10 a.m., Dec. 6.

The subject of this conference is a matter of great importance to all manufacturers of steel and to all users of steel in large quantity. This conference will attempt to determine the desirability of applying a uniform numbering system to forging steels, casting steels, structural steels, including plates, tool steels or other steels not so classified.

While the American Engineering Standards Committee has invited to this conference representatives of all technical and industrial associations known to be interested in the subject, any organization which feels that it should be represented in the conference, but has received no formal invitation, is urged to communicate with the American Engineering Standards Committee, 29 West 39th Street, New York City.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

FOR the last two months or more in these letters it has been repeatedly pointed out that a period of secondary inflation was impending and that the logical effect would be an advance in commodities and a decline in the value of securities. Events have justified this prognosis, for stocks are on the average distincly lower than they were sixty days ago, and bonds have likewise declined. But most staple commodities, including cotton, wool, silk, rubber, wheat, sugar, hides and paper, have advanced.

Because it has been under quasi-governmental control coal has not shared in the upward movement and a seasonal suspension of building operations, hastened by the railroad congestion, has held steel, copper and lumber in check.

Last week I called attention to the election of the progressive candidates in the Middle West and the power that they would wield in Congress by coalition or co-operation with the farmers "bloc." I suggested that the result might be some anti-capitalistic legislation or gestures that would lessen corporate profits and earning power.

A sub-conscious appreciation of this possibility seems to have been reflected in the stock market by the decline recorded last week. The word subconscious is advisedly used, for most of those who speculate in stocks thoughtlessly follow the few unseen and often unknown leaders who really think and act upon conviction.

As to whether these major influences will be unremittingly operative no one can say. They are as yet chiefly psychological in their incidence. They have affected the minds of habitual speculators and led students of economic affairs to revise their opinions, but the great mass of the people have not thus far sensed their significance, and the usual trade reports indicate an uninterrupted flow of business.

Most merchants are therefore expecting an active Christmas season with large sales, and one very prominent dry goods dealer in the Middle West wrote me last week that he looked for "a mild prosperity that would last until next autumn." He may be right, but much depends upon what the present Congress does when it resumes work Nov. 20 and whether President Harding calls the new Congress together before December, 1923, prior to which date it will not otherwise convene.

Normally the stock market should have a substantial reaction upward following the almost continuous decline of the last two months, and normally a halt in the upward movement of commodity prices would be in order.

These are, however, unusual times. During the war and the post war period the people of the United States have been studying economic questions intensively. The popular magazines have found that their readers were as much interested in commercial and financial articles as they were formerly in short stories. The newspapers are devoting more space than ever before to business reports and throughout the entire country there is a quickening of interest in the operation of economic law.

It is therefore possible that the interval between cause and effect in business may be shortened and that having become mentally more alert men will more promptly discount a change.

Some years ago Frank Vanderlip said we were a nation of economic illiterates. The statement is no longer true. We have learned at least the A. B. C. of economic science but a little learning is a dangerous thing and it remains to be seen how we will apply the rudimentary knowledge that we have latterly acquired.

The unrest of the people as expressed in the recent elections is a factor to be reckoned with. It is only four years since the armistice, and until the wounds of the world war are healed it is altogether probable that we shall have recurring spells of economic aberration to disturb us, just as our fathers were vexed by the Greenback craze of the 1870's which followed the Civil War.

Upon the theory that what we have learned will make us cautious about going to extremes I should say that for the immediate future stocks are low enough and commodities about as high as they are likely to go except as they may be affected by special rather than general influences.

But we must not deceive ourselves. The unrest of the people as expressed in the recent elections is a factor to be reckoned with. It is only four years since the armistice, and until the wounds of the world war are healed it is altogether probable that we shall have recurring spells of economic aberration to disturb us just as our fathers were vexed by the Greenback craze of the 1870's which followed the Civil War.

The expectation of some such movement has become so general that it has been already christened the "new liberalism" and there are many guesses as to who will be its leader. Borah, La Follette, Hiram Johnson and Brookhart are among those named, but Henry Ford is mentioned oftener than others.

Speaking in New York last week Carl Ackerman asserted that Ford was the financial backer of the Farm Labor movement and that he had spent more money in the last campaign than any other person in the country.

Inasmuch as business thrives only when conditions are reasonably stable a boom is not to be expected when the outlook is so uncertain. In writing thus I do not mean to be pessimistic. My purpose is rather to avert the consequences of the probable by counseling preparation.

In Europe confusion again prevails. The news from England indicates that Lloyd George has been badly defeated and a new pilot for the British ship of state must be selected. The tories are elated, but from a non-partisan standpoint the political uncertainty seems to be increased.

Germany appears to be rapidly approaching the Niagara of deflation and now that the mark is worthless she may be carried over the falls at any moment. The Reichsbank has advanced the discount rate to 10 per cent and the ministry headed by Chancellor Wirth has resigned.

French francs are still under seven cents, French dollar bonds are weak and lower in New York and it looks as if another internal loan would be necessary to balance the French budget. All this suggests a further reduction in the purchasing power of Europe that will not help our export trade.

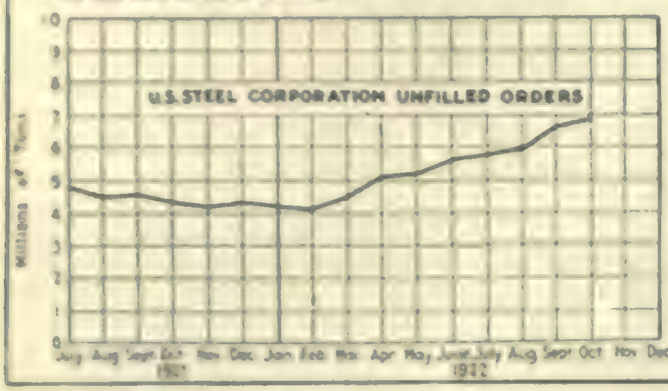
The Turko-Allied imbroglio about Constantinople is beyond American ken, but it is doubtful whether it is as serious as the newspapers would lead one to suppose. The brightest spot in the world this week is the Argentine, where a boom based upon the excellent crop prospects seems to be developing.

But the good news from the Argentine is somewhat obscured by the Chilean earthquake and its toll of death. Conditions in Cuba appear to be better. A good sugar crop is promised upon the strength of which the long deferred loan of 50 million dollars will probably be arranged. But as an offset an important bank failure is reported from Mexico.

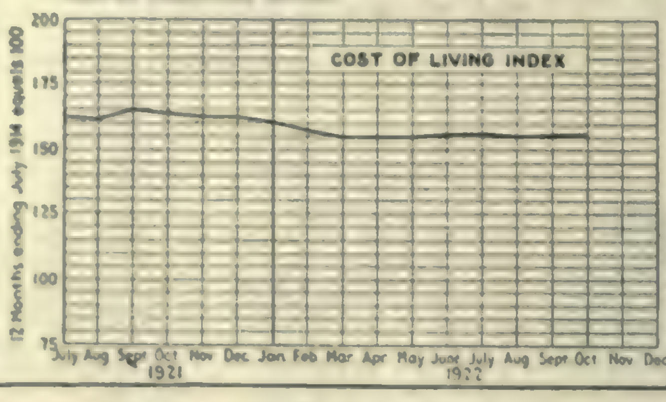
On the whole the outlook is spotted. Good here and bad there. The weekly statement of the Federal Reserve System shows a decline of 1.2 per cent in the reserve ratio, which stands at 75.2 as compared with 76.4 a week ago. The gold supply is reduced by about $7,000,000 as a result probably of exports to Canada as well as of the continued disbursements of yellow-backs by the banks. The other changes are not important.

The money market is firmer and 4½ per cent is the lowest rate at which the very best commercial paper can be sold. Rates are tending upward, chiefly because the railroad congestion delays the distribution of goods in transit.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the U. S. Steel Corporation on October 31, 1922, totaled 6,902,287 tons as compared with 6,691,607 tons on September 30. The tonnage on order at the close of October represents the largest total at the end of any month since February, 1921, at which time unfilled orders totaled 6,933,867 tons. Beginning with March of the current year, an increase has been shown in each thirty-day period ranging from 140,630 tons in July to as high as 741,502 tons during September. Railroad requirements and building construction demands continue as the chief features of the increase.

Metal product shares in the New York stock market advanced during October, the average price of ten representative issues reaching $79.50 per share as against $77.23 per share in September. The month was marked by an advance to an average of $83.15 per share for the week ending October 23, from which point there was a gradual decline to $76.80 for the week ending October 30. The chief features were the shares of the can and electrical companies all of which have a large volume of business on order.

Railroad rolling stock condition attracted no little attention during the month of October, chiefly on account of the car shortage which has been mounting upward rapidly for the past few months. With 141,252 cars short of requirements on American roads for the week ending October 8, the increase has continued until it reached the record shortage of 179,239 cars on October 31. The average for the month was 160,787 cars as against the September average of approximately 100,000 cars. Car surplusage declined in corresponding proportion, the average for the month being 4,475 as against 21,000 in September. Cars in bad order decreased from 321,674 or 14.1 per cent of the total to 249,960 or 11 per cent. Heavy demands upon the railroads for cars for coal, grain and merchandise loading continued during the month.

Comparative Prices of Shop Supplies

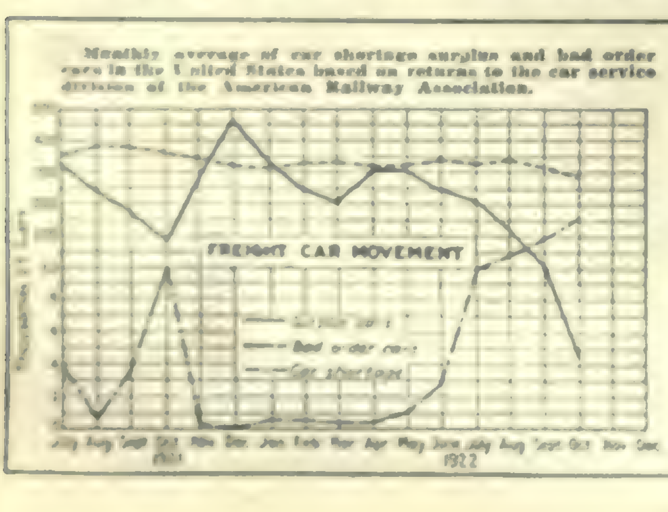
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0295	$0.0295	$0.0273
Cold finished shafting	per lb.	0.0378	0.0378	0.0373
Brass rods	per lb.	0.171	0.1700	0.15
Solder (½ and ½)	per lb.	0.24	0.23	0.20
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.59	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50% @ 65–10%	50% @ 60–10%

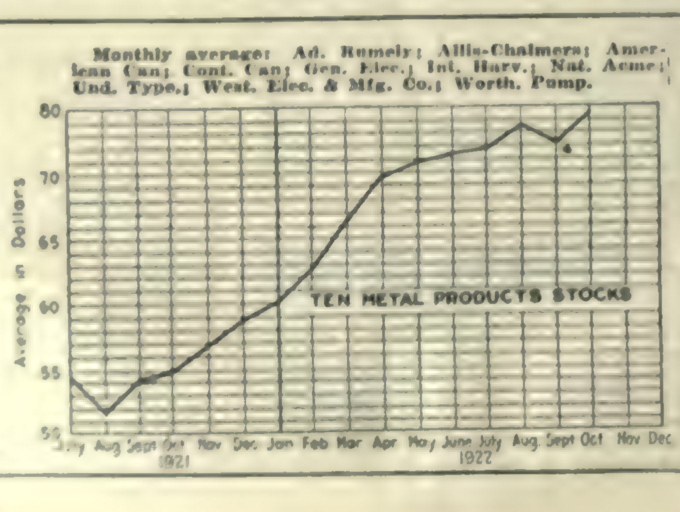
Cost of living among wage earners' families in the United States on October 15, was 57.1 per cent higher than in July, 1914, according to figures collected by the National Industrial Conference Board. Between September 15 and October 15 there was an increase of 1.5 points or one per cent. The changes in the budget within the month were continued slight increases in the average cost of food, clothing and coal. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and October, 1922, the cost of living dropped 47.4 points or 28.2 per cent.

Commercial failures in the United States last week, according to reports furnished by Bradstreets, numbered 378 as compared with 374 in the week previous and 474, 307, 110 and 132 for the corresponding weeks of 1921 and 1918.

Monthly average of car shortage surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



National Personnel Association Holds Three-day Forum on Human Factor in Industry

Development of organized effort to study the human factor in commerce and industry and to apply the principles and practises arising therefrom to the realities of American industrial life marked a three-day national forum of personnel experts held in Pittsburgh, Nov. 8, 9 and 10, under the auspices of the National Personnel Association. Many of the country's principal manufacturing and mercantile enterprises, public service corporations, universities, engineering societies and civic bodies were represented.

Among the notable reports presented to the convention was one dealing with "Co-operation With Engineering Colleges," prepared by a committee, of which W. E. Wickenden, American Telephone and Telegraph Co., New York, is chairman, and of which F. L. Bishop, dean of engineering, University of Pittsburgh and G. H. Pfeif, secretary of the educational committee of the General Electric Co., are members. Outlining ways and means by which assistance, through the association, can be rendered by industries to engineering colleges, the report said, in part:

Value of Engineering Education

"The engineering colleges have a strong claim on the assistance of the industries in return for services rendered. The schools have made inestimable contributions to scientific knowledge from which the industries have profited without cost. Education has increased earning power and so has made possible the markets on which many industries depend for existence. The colleges have expended on each engineering graduate from $800 to $2,000 above all fees received. The industries profit by this training and would be compelled to provide costly substitutes for it if it were not available."

The Committee on Shop Training, headed by R. L. Sackett dean of engineering, Pennsylvania State College, presented a report asserting that "the standards of workmanship are higher and so are the moral standards" since the war. "The resumption of production," the committee found, "is proving again that we have a shortage of skilled workmen. Industries are picking the men whom they employ with more discrimination than was possible during the war. At no previous time has there been the same appreciation by wage-earners of the value of practical education which pertains more or less directly to their job."

Economics of Immigration

Immigration was a principal topic of the convention. Magnus W. Alexander, managing director of the National Industrial Conference Board, discussed "Our Immigration Policy and its Social and Economic Effects." "The Immigrant's Point of View" was the subject of Michael I. Pupin, immigrant, inventor, consulting engineer and professor of electro-mechanics in Columbia University. W. W. Kincaid, Niagara Falls, N. Y., delivered an address on "Nationwide Co-operation in Personnel Work," and E. K. Hall, vice-president of the American Telephone and Telegraph Co., on "Management's Responsibility for and Opportunities in the Personnel Job."

The Committee on Trade Apprenticeship Progress recommended that a system for developing sufficient training courses be centralized under a national organization that would embody representatives from the manufacturing, educational and publishing institutions, and sub-organizations to introduce and supervise the work in different sections throughout the country.

The Committee on Economics for Employees, Dr. Lee Galloway of New York University, chairman, reported on an investigation of methods of training in industrial economics, saying:

"The newness of the subject calls for a double analysis—an intellectual analysis of the science of economics for purposes of adjustment of the teaching method to the new goal in view and a practical analysis of the industry to establish the right points of contact between the worker's interest and the principles of economics."

The Committee on Industrial and Public School Relations recommended that committee work along this line be continued and suggested that future committees be composed of approximately an equal representation from the public schools and industries.

J. D. MacDonald, Ohio State University, was chairman of a committee reporting on foreman training methods. The committee said that foremanship training to be really effective must be a continuous process, adding:

"Doubtless the work of the next few years will be not so much the development of new methods as better application of the methods already outlined to the conditions for which they are best suited."

Discussing the development of men for executive positions, a committee, headed by C. R. Dooley, manager of personnel and training, Standard Oil Company of New Jersey, said that "companies having had training courses for several years invariably report that the effort and expense involved are justified by the results."

Job Analysis in Reducing Costs

The Committee on Job Analysis, of which Harry Arthur Hopf of New York is chairman, in a report dealing throughly with the nature and scope as well as with the practices of this process, concluded: "Job analysis has proved a valuable means of reducing operating costs not only indirectly, through scientific hiring, training and promotion, but also directly, by means of the production standard and the analysis by function of salary expense."

During the past few years there has been a greater tendency toward the centralization of employment functions in one person or a group of persons, it was reported by the Committee on Employment and Labor Turnover, R. E. Von Kersburg of New York, chairman. The report said:

"From time immemorial, employers have made an inventory of their merchandise once or twice every year, so that they might determine whether their business was profitable or otherwise. Until quite recently little or no consideration was given to the human element in business. It was not long ago that hiring, training, and firing of employees was done in a haphazard sort of way. Has successful merchandising ever been conducted this way? Industry has awakened to the fact that it is necessary to give the same if not more consideration to the human element in industry."

The increased application of pension plans in the past ten years argues that their value is established in the minds of business men, said a special report on pensions for industrial and commercial employees.

Employee publications have proved their worth, said another report, saying that it is vitally important that these publications should embody sound personnel philosophy and practice. George F. Quimby, industrial service secretary, Associate Industries of Massachusetts, was among the other speakers, discussing "Training Immigrant Workers."

Disabled Soldiers Learning Trades and Agriculture

Over 101,000 disabled veterans are being rehabilitated under the U. S. Veterans' Bureau. These men are roughly divided into the following classes: trade and industrial training, 33 per cent; professional education, 14 per cent; agriculture training, 12 per cent; business and commercial training, 26 per cent; pre-vocational training, 15 per cent. They are being trained in established institutions, training schools, colleges and also are receiving training "on the job" in industrial establishments.

The opening of the first U. S. Veterans' Bureau Vocational schools at Chillicothe, Ohio, marks the inauguration of a new system in the rehabilitation program. This school is conducted under the supervision of the government. The men in training reside at the institution which allows closer contact between the Veterans' Bureau and the trainees.

In order that proper instruction may be given to the students, machinery and laboratories have been installed. The whole vocational school system at Chillicothe is under government control and supervision.

Among the trades now being taught are auto mechanics, carpentry, cabinet making, upholstery and body work on automobiles, electrical work, sheet metal work, general mechanics, machine shop work, drafting and vulcanizing.

The men who graduate must pass satisfactory tests and must demonstrate their ability to carry on in their chosen vocation before the government will allow them to accept employment.

The government has provided the methods and funds needed in the rehabilitation program; the vocational handicapped veterans are availing themselves of this opportunity of re-education; commerce, agriculture, industries and the professions are being asked to assist in this plan of salvaging the human wastage of war. The co-operation of the Nation's employing bodies are vital factors in the ultimate success of the undertaking.

Employers who can offer employment to disabled soldiers who have been trained in trades at the U. S. Veterans' Bureau schools, or who desire definite information on men trained in the various trades should write to Col. Charles R. Forbes, Director of the U. S. Veterans' Bureau, Washington, D. C. or Employment Section U. S. Veterans' Bureau 111 No. Canal St., Chicago, Ill.

Business Items

The Reed Prentice Co., Worcester, Mass., has purchased outright the property, good will, equipment, etc., of the Whitcomb-Blaisdell Machine Tool Co., and the Becker Milling Machine Co.

The Decker-Mitchell Engineering Co., Cleveland, Ohio, manufacturer of special production machinery and tools, has recently taken over the plant of the Cleveland Precision Tool Co. and will use the increased capacity for screw machine products, piston pins, hardened bushings and front axle king pins.

The C. F. Bulotti Machinery Co. has moved into its new storeroom at 67-71 Main St., San Francisco. The new location is in the heart of the machine tool district and gives ample room for display as well as office facilities and immediate shop repair work. This firm has made very rapid progress within the last year and are now recognized as one of the leading machine tool houses in central California.

The Crouse Clear Vision Gasoline Pump Co., Wichita, Kan., according to an announcement by its president, Emery Crouse, will erect a new foundry at a cost of $20,000 to supply castings for the company's pump products.

The Rolls-Royce Co. of America, Inc., has issued $2,000,000 seven per cent 15-year gold bonds out of a total authorized issue of $3,000,000 the proceeds to be used partly for refunding and partly for additional working capital.

The Standard Wire Co., 1 West Grant St., New Castle, Pa., suffered a loss of $50,000 by fire last week, the plant being completely destroyed.

The Garlock Walker Machinery Co., Ltd., Toronto, Canada, through John L. Thorne, authorized trustee for the estate, announces that a final dividend is intended to be declared and that all claims must be established to the satisfaction of the court on or before Dec. 15, 1922.

The New England Collapsible Tube Co., New London, Conn., manufacturer of tubing, etc., has recently increased its capital stock from $40,000 to $250,000.

The Manufacturers' Polishing and Plating Supply Co., of Bridgeport, Conn., has recently been incorporated under the laws of Connecticut to conduct a manufacturing business in plating, polishing supplies, buffing wheels, lathes, and other machinery and tools. The capital stock of the company is $100,000, and it will start business with $25,000. The incorporators are: H. H. Bristol, 21 Academy St., Wallingford, Conn., F. Thomas Bristol of Brooklyn, N. Y., and P. E. Picotte, New York City.

The Reid Air Spring Co., of New Haven, Conn., has been incorporated with a capital stock of $100,000, to manufacture air springs, automobile parts, tools, etc. The incorporators of the firm are: Edward Reid, 537 Orange St., New Haven; Louis, Nathan and Morris Goldman, all of New Haven also. The firm will commence business with $54,000, and will operate a factory in New Haven.

The R. & O. Tractor Equipment Co., of New Haven, Conn., has recently incorporated under the laws of Connecticut, and will make metal articles and tractor hitches, etc. The capital stock is $25,000, and the incorporators are: Harold L. and A. M. Read, of New Haven; Harold W. and Emma Osborn, Oxford, Conn.

The Lawrence Machine Co., Island St., Lawrence, Mass., manufacturing machinists, etc., has removed the business into a new and most modern plant at 341 Market St., South Lawrence.

The Willys-Overland Co. and subsidiaries shows estimated earnings of $4,099,675 for the quarter ended Sept. 30.

Kirk, Roche and Co., which opened a sheet metal plant at 338 Seventh St., San Diego, Cal., a few months ago, has taken larger quarters at 546 Market St., in that city. The firm specializes in restaurant equipment, furnaces, heating and ventilating, skylight and cornice work. Its members are Clement P. Kirk, formerly with the Ingle Manufacturing Co., and T. F. and J. J. Roche. This firm will be glad to have catalogues and quotations from manufacturers of equipment for such a plant as theirs, as they will be in the market for some new sheet metal work machinery soon.

The Chalmers Motor Corporation receiver's sale, according to reports, on Dec. 7, under the terms of the final decree entered in the Federal court on the petition filed by the Fisk Rubber Co. and the Metropolitan Trust Co. of plant and properties are to be sold at New York.

The New Process Gear Co. plant at Syracuse, N. Y., has been purchased by W. C. Durant, president of Durant Motors, Inc., for $2,100,000. The sale has been confirmed by Federal Judge Cooper who, previously, rejected a bid of $1,904,000 made by T. W. Warner of Toledo.

The Rockford Milling Machine Co., Rockford, Ill., has appointed J. C. Austerberry to sell Rockford milling machines in the Detroit district.

The Co-operative Machinery Co., Cleveland, Ohio, has been appointed exclusive dealer in the Cleveland district by the Rockford Milling Machine Co., Rockford, Ill., for its line of milling machines and tools.

The Western Iron Stores Co., Milwaukee, Wis., has been appointed exclusive dealer in the state of Wisconsin by the Rockford Milling Machine Co., Rockford, Ill., for its line of milling machines and tools.

The New England Smelting Works, Inc., opened its new plant at West Springfield, Mass., Nov. 13, built to suit the needs of its business in producing type metal, babbitt and brazing spelter.

The Martin-Parry Corporation of York, Pa., manufacturer of commercial automobile bodies, is preparing to open an assembling plant in Baltimore. The plant will be at Fallsway and Monument Sts., where the building formerly occupied by the Baltimore Manufacturing Co. is undergoing interior reconstruction. The plant will occupy about 12,000 feet of floor space and will be open for business early in December.

The Federal Tire Co., Charles and Barre Sts., Baltimore, Md., has taken the 45,000 square feet of space in the adjoining building formerly occupied by P. Lorillard, and is installing $40,000 of new machine equipment. The expansion will enable the firm to increase its volume of production by about one-third and will mean the increase of its present force by 150 additional operatives.

The San Diego Pulley Co. has been formed at San Diego, Cal., by George C. Zink and Franklin S. Pierce, with offices at 121 Broadway, to do business as sales agents and distributors of builders' hardware and mechanical equipment for buildings.

Westgate Metal Products Co., of Oakland, Cal., manufacturer of cooking cabinets and gas stoves has opened salesrooms at 1218 Market St., San Francisco.

The Cutler Steel Co., Pittsburgh, Pa., has purchased the plant of the National Steel Castings Co. in New Cumberland, W. Va., and will operate it, commencing early in January.

The American Electroplating Works, Inc., of Somerville, Mass., has recently been incorporated with a capital consisting of 100 shares of stock, no par value, to engage in the electro-plating business. John J. Walsh, Ames Building, Boston, Mass., is the treasurer of the company.

Louis Miller, machinery dealer, of Boston, Mass., has recently filed a voluntary petition in bankruptcy in the United States District Court at Boston, showing his liabilities at $48,699, and assets of but $1,200.

Personals

W. W. Sayres, formerly representative of the Link-Belt Co. in the Chicago territory, and later in charge of the locomotive crane department, has been promoted to the position of chief engineer of the company's Philadelphia works and eastern operations, with headquarters at Philadelphia.

H. Goldberg, for the past few years associated with the American Pipe and Supply Co., Philadelphia, and for more than eighteen years connected with the tool and equipment business, has recently organized a pipe supply concern under his own name at 305 Cherry Street in that city.

William H. Blount, until recently superintendent of Sleeper & Hartley, Inc., Worcester, Mass., has organized the Arey & Blount Electric Co., and will manufacture electric devices in Worcester.

Frank L. Wilder, 1188 Main St., Bridgeport, Conn., has been appointed temporary receiver of the Paterson Forge Co., of Bridgeport.

J. C. Austerberry of Detroit has been appointed sales agent for the Rockford milling machines in that district.

Ronald P. Boardman, who has been supervising the advertising for the Hart & Cooley Co., New Britain, Conn., has recently accepted the position of advertising manager of Landers, Frary and Clarke of that city.

John B. Foster has taken charge of the iron and steel department of the

David J. Joseph Co., Cincinnati, Ohio. Mr. Foster has been head of the John B. Foster Co. of Cleveland and formerly was connected with the National Trading Co. of that city. He will make his headquarters in Youngstown, Ohio.

A. H. HUNTER, president of the Atlas Steel Corporation, has resigned. Mr. Hunter will retain his stock interest in the corporation.

W. H. WARREN, formerly general manager of the Brier Hill Steel Corporation, Youngstown, Ohio, has been named general superintendent of the Trumbull Steel Co., at Warren, Ohio.

JOHN F. MILLER, vice-chairman of the board of directors of the Westinghouse Airbrake Co., Wilmerding, Pa., has been elected a member of the board of trustees of the College of Wooster, Ohio.

RAYMOND K. BOWDEN has been appointed instructor in metallurgy at the Carnegie Institute of Technology, Pittsburgh, Pa. Mr. Bowden was formerly with the Central Steel Co. of Massillon, Ohio, and the Crucible Steel Co. of America at Pittsburgh.

HARRY W. IRWIN has accepted the position of the superintendent of the Universal Steel Co. at Bridgeville, Pa. Mr. Irwin came to Canton in 1901 and entered the employ of the Stark rolling mill. For several years he was superintendent of the Canton Sheet Steel Co.

C. C. UPHAM, chairman of the board of directors of the Diebold Safe and Lock Co., Canton, Ohio, has been elected president of the company to fill the unexpired term of the late John C. Welty. Mr. Upham will continue to serve as chairman of the board.

O. E. QUERE, formerly with the Niles Steel Products Co., Niles, Ohio, has been appointed assistant general manager of sales of the Ashtabula Steel Co., at Ashtabula.

A. E. HUGHES, for the past eight years connected with the Brier Hill Steel Co., Youngstown, Ohio, and lately superintendent of the Western Reserve plant at Warren, has resigned to become general superintendent of the Ashtabula Steel Co., at Ashtubula, Ohio.

L. L. ROGERS has resigned from the position of manager of the advertising and printing department of the New Home Sewing Machine Co., Orange, Mass.

ADDRESS WANTED

Will anyone knowing the whereabouts of William H. Addis, formerly connected with the Link Belt Company, Indianapolis, and later located in Los Angeles, communicate with Mr. B. Rich, 1043 East 12th St., Brooklyn, N. Y.

Obituary

CHARLES E. HERRICK, for many years proprietor of the Herrick Machine Co., and for some time manufacturer of the Nonotuck bicycle, at Northampton, Mass., died in that city Oct. 10 at the age of 79 years.

GEORGE F. SMITH, at one time vice-president of the H. D. Smith and Co., Plantsville, Conn., and one of the best known manufacturers of Connecticut, died at his home in Southington, Conn., November 12, at the age of 92 years. For the past few years Mr. Smith has led a retired life.

VIRGIL F. SCHWAIN, for six years superintendent of the Atlantic Foundry Co., Akron, Ohio, died recently at his home in that city at the age of 45.

CHARLES G. COOPER, founder of the C. G. Cooper Co., machinery manufacturer, died recently at his home in Mt. Vernon, Ohio.

JACOB F. SNYDER, vice-president of the Hess-Snyder Co., machinery manufacturer, died at his home in Massillon, Ohio, recently. Mr. Snyder, who was 77 years of age, was one of the pioneers in the Massillon steel and machinery industry. He entered the manufacturing business in 1872 when he became associated with F. H. Snyder and Bros., in operating a general foundry. Ten years later the firm of which he was a member consolidated with J. H. Hess and Bro., furnace manufacturer.

FRANK ENGELHARD, proprietor of the Hercules Float Works, Springfield, Mass., died in that city Oct. 31, at the age of 79 years. He had taken out thirty patents for copper floats, automatic lighting devices, electroplating apparatus, etc.

Pamphlets Received

Union Scale of Wages and Hours of Labor, May 15, 1921. Bulletin No. 302, of the Bureau of Labor Statistics, U. S. Department of Labor, just issued, contains the union scale of wages and hours of labor of 930,903 members of organized trades and occupations in 66 of the principal cities of the United States, as of May 15, 1921.

The Interallied Debts as a Banking Problem. The Chase National Bank, New York City, has just published its economic bulletin No. 5, of Vol. II in which the Interallied Debts from the standpoint of a banking problem are discussed by Benjamin M. Anderson, Jr., Ph.D., Economist of the Chase National Bank. Interesting points of view are given on the debt funding commission, the manner in which the banker views the reparations, international payments through the export of goods and a discussion of the recent statements of Mr. McKenna and Mr. Hoover on the great question.

Budgeting for Business Control. This pamphlet just issued by the U. S. Chamber of Commerce, asserts that the main object and purpose of a budget is to secure internal control of a business. The manufacturer, it is declared, is taking a big step forward to that end if, at the beginning of the year, instead of entering the new period without definite plans or purpose, he charts his course as far as possible through the compiling of a budget. Copies of the pamphlet may be had by addressing the Fabricated Production Department, Chamber of Commerce of the United States, Washington.

The Western European Division and American Business. A small folder describing the organization of the Western European Division of the Department of Commerce, its functions and the aids which it can extend to American manufacturers. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

China Trade Act, 1922. Trade Information Bulletin No. 74 of the U. S. Department of Commerce contains the China Trade Act and sets forth the regulations and forms for application for certificate of incorporation, certificate of property value, certificate of amended articles of incorporation, certificate of authorization for dissolution, certificate of authorization for extension and annual reports.

Foreign Trade of the United States for the Fiscal Year 1921-1922. Trade Information Bulletin No. 59 of the U. S. Department of Commerce, prepared by the Division of Research and just issued, contains complete statistical data on the foreign trade of the United States for the fiscal year 1921-1922.

Trade Catalogs

Screw Machines. Brown & Sharpe Manufacturing Co., Providence, R. I. The company is now placing before the trade its new screw machine catalog No. 23-G, of 197 pages, just off the the press, in which is described its complete line of automatic, wire feed and plain screw machines, their attachments and tools. The arrangement of this catalog is entirely new and the arrangement is excellent. The detailed descriptions of the automatic, wire feed and plain screw machines are arranged in this order in the first part of the book. Following the descriptions of these machines there are condensed tables of general specifications in a form which will prove convenient for comparative purposes. Next, in order, are complete specifications of all styles and sizes of machines, arranged in the order mentioned above. This grouping of specifications in one section instead of having them distributed throughout the descriptive matter should prove an advantage in finding any desired specification.

Industrial Helical Gears. The R. D. Nuttall Co., Pittsburg, Pa. A new publication of nineteen pages, known as Bulletin No. 34 has just been issued by this company. With an excellent arrangement, the publication describes the Nuttall Helical gears for industrial service and gives illustrations of characteristic installations. Booklet 36 of this company, which is also a new publication, is entitled "Proportion of Industrial Gears." This publication is one of exceptional value, as it makes possible for an engineer, the calculation of the sizes of gears for any given drive. Eight double page charts are bound into the booklet for use in making calculations.

Duraloy. The Cutler Steel Co., Pittsburgh, Pa. This company has just issued a new folder, known as Bulletin No. 221 describing its Duraloy product, a chromium iron alloy. The product is the result of a development to produce a low cost alloy to resist oxidation. The bulletin contains a complete general description of the alloy, setting forth its physical properties.

Forthcoming Meetings

National Founders' Association, Fall meeting, Hotel Astor, New York City, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Taylor Society, Annual meeting, November 22, 23 and 24, 1922, at Engineering Societies Building, 29 West 39th St., New York City.

Eighteenth Annual Automobile Salon. Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922. Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers. Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Zinc, in carlots, 7½c. as against 7¾c. per lb. in New York warehouses. Copper tending upward. Lead quiet but prices firm. Aluminum ingots, ton lots, advanced 2c. per lb. during week. Scrap brass, heavy, up 3½c. in Cleveland, despite declines in dealers' purchasing prices of old metals, in that market.

Demand quiet for steel structurals, but prices firm at $2 per 100 lb., base. Plate inquiries better, however, principally for tank construction; quotations, $2@$2.10, f.o.b. Pittsburgh.

Declines—Pig iron, coke and scrap prices all tending downward. No. 2 foundry iron down $3.27 at Pittsburgh and $4.50 per ton at Birmingham. Tin, 36⅞c. as compared with 38c. per lb. at New York warehouses. Scrap copper, light brass and No. 1 yellow brass turnings, down ½c. per lb. in Cleveland.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.55
Northern Basic	31.27
Southern Ohio No. 2	31.71
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.27
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.14
Virginia No. 2	37.17
Basic	28.26
Grey Forge	29.64
CHICAGO	
No. 2 Foundry local	30.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.50
Basic	28.00
Bessemer	31.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	[illegible]	4.29	3.80	4.10
No. 16	[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	[illegible]	4.70	4.20	4.70
Nos. 22 and 24	[illegible]	4.75	4.25	4.70
Nos. 25 and 26	[illegible]	4.80	4.30	4.75
No. 28	[illegible]	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.35@3.60	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.70	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.00	5.30	4.80	....
Nos. 22 and 24	3.90@4.15	5.45	4.95	5.45
No. 26	4.05@4.30	5.60	5.10	5.55
No. 28	4.35@4.60	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—W rehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	36.87½
Lead (up to carlots), St. Louis 6.90@6.95; New York	7.50
Zinc (up to carlots), St. Louis 7.35@7.40; New York	7.87½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	22.70	23.00	23.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.75	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.75	7.00
Zinc	3.00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.00	7.25
IC, 14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$7.25@7.50	
Coke, prompt foundry, Connellsville	per net ton	8.00@9.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.60	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Fla., St. Petersburg—T. D. Orr—machine shop equipment.

Ga., Atlanta—R. M. Dodd, 12 Walton St. (machinery)—one wood turning lathe and one power drill.

Ill., Chicago—Chicago Metallic Mfg. Co., 142 West [illegible] St.—vertical miller and surface grinder with magnetic chuck (used preferred).

Ill., Chicago—Chicago Milwaukee & St Paul Ry. Co., Ry. Exchange Bldg., G. H. Wasler, Purch. Agt.—two 10 in. full swing, side carriage turret lathes, 9 in. hole through spindle, equipped with four-jaw extra heavy Universal chuck, with complete set of chucking and bar tools arranged for motor drive; one 2½ x 6 in. cone drive flat turret lathe with 6 tool holders; one 24 in. x 10 ft. engine lathe arranged for belt drive; one 18 in. x 8 ft. heavy duty geared head engine lathe, arranged for belt drive; one 2½ x 26 in. rigid turret, cone drive flat turret lathe with 6 tool holders; one 18 in. x 8 ft. heavy duty geared head engine lathe; one 36 in. x 16 ft. heavy duty triple back geared instantaneous change gear engine lathe; one 66 in. heavy duty motor driven driving box boring mill; one 54 in. vertical adjustable rotary milling machine; one 48 in. x 12 ft. horizontal milling machine; one extra heavy double pinion-drive heavy duty vertical boring and turning mill to take 62 in. under tool holders, spindle travel 42 in., arranged for variable speed motor drive; one 36 in. heavy duty draw cut shaper arranged for motor drive; one 36 in. motor driven heavy duty draw cut pillar shaper; one 38 in. heavy duty back geared crank shaper arranged for single pulley drive; two 66 in. heavy cabinet base, automatic guide bar grinders, sectional wheel equipped with T slot carriage 3 speeds, 32 in. steel chuck and sectional wheel arranged for motor drive; one motor driven 90 in. locomotive journal turning, quartering and pin turning machine; one 15 ton, 30 ft. span electric traveling crane (used); one motor driven 1½ in. wedge grip bolt and rivet header; one electric flue welder; one 1,100 lb. single frame guided ram steam hammer; one 6 in. high duty, single pulley drive Universal radial drill.

Ill., Chicago—L. O. & Machine Co., 6008 State St.—stamping and dies, also machinery for making same.

Md., Forest Hill—G. W. Morse & Sons—one heavy duty boring machine.

Mass., Boston—C. Lerner, 427 Shawmut Ave.—machinery, small tools and equipment for proposed garage.

Mass., Boston — Richardson, Wright & Co., 65 Beverly St. (manufacturers of metal furniture)—drill press with 20 in. lever feed, round base (used).

Mass., Peabody—D. Bertholdi, c/o O. A. Cassel, Archt., 10 Central Ave., Lynn—equipment for proposed $25,000 machine shop on Wilson Sq., here.

Mass., Turners Falls—John Russell Cutlery Co.—one ring wheel grinder, Springfield No. 16, or similar machine.

Mass., Weymouth—Brooks-Skinner Co.—machine shop and sheet metal workers' tools for proposed factory for the manufacture of metal garages.

Minn., St. Paul—All-American Steel Casket Corp., c/o J. A. Burrichter, Church and St. Peters Sts.—machine tools for the manufacture of steel caskets, etc., for proposed factory at [illegible].

N. Y., Buffalo—E. E. Harris & Co., 22 [illegible] St.—equipment, including 1,000 gal. gas tank and pump, for service station on Kensington Ave.

N. Y., Geneva—J. J. [illegible]—lathe to swing 18 in. for [illegible] and turning, punch press, grinder and polishing jack.

Pa., Allentown—H. [illegible], 244 East Walnut St.—[illegible] press drill.

Pa., Lancaster — H. Hugh, Lime and [illegible] Sts.—machine and repair shop equipment.

Pa., Phila.—W. Wilson, 14 South 17th St. (machinist)—Star screw cutting lathe with motor.

Pa., Warren—Union Oil Co., West End—machinery and tools for large garage and service station.

Tenn., Memphis—Memphis Machine Wks., 171 Vance Ave. (heavy iron and machine work, saw mill and other mill machinery)—machinery for proposed addition to plant.

Va., Richmond—Chesapeake & Ohio R.R., 825 East Main St., R. M. Nelson, Purch. Agt.—one lathe, 6 x 16 in. bed, Lodge & Shipley (or its equal); one 3 x 36 in. Jones & Lamson flat heat turret lathe, motor driven, complete with motor leg and idler; one pointing tool; one centering tool; one drill chuck; one 2 in. automatic die with 9 sets of chasers; one openside turner; one 14 in. 3 jaw chuck; one 3 jaw special chuck; one 20 x 10 in. bed, Lodge & Shipley lathe (or its equal), complete with direct connected motor drive by short volt. motor to be wound for 440 volt, 3 phase, 60 cycle General Electric or Westinghouse with starting switch; one 24 x 10 in. bed, Lodge & Shipley lathe (or its equal), complete with direct connected motor drive by General Electric or Westinghouse 440 volt, 3 phase, 60 cycle a.c. motor.

Va., Richmond—McCooks Machine Wks., 906 East Cary St., A. McCook, Purch. Agt.—lathe, drill press, cylinder grinder and other machinery.

Va., Richmond—Trowbridge & Bowery, 1540 East Cary St. (automobile repairing)—lathe, drill press and bench vise.

Va., Richmond—White Motor Repair Co., 1919 East Franklin St.—arbor press and air pressure system for cleaning.

W. Va., Buckhannon—Belgrade Glass Co.—machine shop equipment to replace that which was destroyed by fire.

W. Va., Shinnston—Alley Glass Co.—machine shop equipment.

Wis., Appleton—Manthey & Puth, Washington and Morrison Sts.—automobile repair machinery for proposed $40,000 garage on College St.

Wis., Conover—G. C. Dobbs—automobile repair machinery for new garage.

Wis., Green Bay—J. A. Pinskowski, 445 South Jackson St.—automobile repair machinery for proposed $40,000 garage.

Wis., Milwaukee—P. O. Erdmann, 708 12th Ave. (automobile repairs)—drill press and emery wheel.

Ont., Tilsonburg—Wilkie Products Co., 212 Pitts St.—tools and metal working machinery for the manufacture of automotive specialties.

Ont., Windsor—The Windsor Tool & Machine Co.—machinery for the manufacture of tools for proposed machine shop at Tilsonburg.

Machinery Wanted

Calif., Fresno—W. M. Murphy Motors Co., 1919 Calaveras St.—overhead traveling crane for automobile repair shop on Van Ness Ave.

Conn., Bridgeport—M. J. Dowling & Co., 576 Gurdon St., (building specialties)—complete small printing press outfit (new or used).

Conn., Dayville (Killingly P. O.)—Assawaga Woolen Co.—machinery for addition to mill.

Conn., Hartford—Bacon Bottling Wks., Morris St.—bottling equipment for new plant.

Conn., Hartford—Hartford Despatch & Trucking Co., 105 Albany Ave., A. Mooney, Purch. Agt.—conveying equipment for proposed warehouse.

Conn., Hartford—United Bottling Wks., 75 Chestnut St.—bottling equipment for new plant.

Fla., McIntosh—McIntosh Utilities, Inc., N. A. Russell, Treas.—machinery and equipment for proposed $50,000 cold storage and refrigeration plant.

Ga., Brunswick—Maritime Industries Co.—one 72 in. diameter, log, cut off saw; one Mandrell topsaw, 2$\frac{7}{16}$ in. x 8 ft.; also conveyor chains ¾ x 6.

Ga., Macon—T. L. Ross Lumber Co.—complete portable saw mill outfit, slab burning boiler preferred.

Ga., Rome—Battey Mchy. Co., West 2nd Ave.—10 ton steam roller machine to develop 15 hp.

Ill., Chicago—Aetna Sand & Gravel Co., 11 South La Salle St.—stone crusher, one 18 x 72 in. boiler for steam, and one 12 x 54 in. locomotive boiler.

Ill., Chicago—Commercial Battery Box Co., 2054 Clybourn St.—16 or 18 in. planing machine.

Ill., Rockford—Washburn Co., 1802 Preston St.—iron working machinery.

Ind., Fort Wayne—The Fort Wayne Corrugated Paper Co., Murray and Barr Sts.—machinery and equipment for proposed plant at Hartford City.

Kan., Arkansas City — Arkansas City Sand Co., Home Natl. Bank Bldg., N. C. Dunn, Purch. Agt.—one yard revolving shovel.

Kan., Augusta — A. M. Crain (cabinet maker)—scroll saw.

Kan., Wichita—Crouse Clear Vision Gasoline Pump Wks., 822 East Harry St., E. Crouse, Purch. Agt.—furnace for 16 x 40 ft. foundry for making castings.

Kan., Wichita — Wichita Tribune, 2401 Rosenthal St., P. Elgin, Purch. Agt.—small power newspaper press.

Ky., Louisville — Gibbs-Inman Co., 825 West Bway.—machinery and equipment, including motors, transmission equipment, etc., for $110,000 printing plant.

La., Baton Rouge—A. J. Rodriquez, 702 St. Ferdinand St.—machinery and equipment for the manufacture of spring wheels for automobiles and auto trucks.

Mass., Hyde Park (Boston P. O.)—B. R. E. Mfg. Co. (woodworkers' and plumbers' specialties)—conveying machinery, etc., for new kiln at 53 Walter St.

Mass., Millbury—The Felters Co., West St. (woolen mills)—machinery and equipment for new dyehouse.

Mich., Detroit—Bd. Educ., 1354 Bway. Ave., C. A. Gadd, Business Mgr.—one wood trimmer with stand to cut 4½ in. deep and 8½ in. long, equal to Fox 4A or Oliver 9; one 14 in. single geared crank shaper or back geared shaper; one saw guard for 18 in. circular saw, to be mounted on iron table.

Mich., Detroit—C. B. Bohn Fdry. Co., 3651 Hart Ave.—equipment for proposed addition to foundry.

Mich., Detroit—United States Radiator Corp., 133 Grand River Ave. and Corry, Pa.—cupola blower.

Mich., Muskegon—The Central Paper Co. 42 in. x 1,500 ft. steel watering tank, 30 steel tanks, belt conveyors, hand operated cranes, steel sash and rolling steel shutter.

Minn., Minneapolis—Carter-Mayhew Mfg. Co., 607 5th Ave.—electric traveling crane.

Minn., Red Wing—Red Wing Milling Co. (flour milling, etc.)—modern power milling machinery for branch at Brodhead, Wis.

Miss., Lumberton—Ashbrook Veneer Co., C. Ashbrook, Pres.—rotary cutters, transmission machinery and other lumber and veneer mill equipment, including electric motors.

Mo., Carthage—J. J. Ansell & Co. (planing mill)—pony planer, sawing machinery, belting, sander, hangers and bearings.

Mo., St. Louis—Johnson, Stephens & Shinkle Shoe Co., 4242 Laclede Ave.—equipment for shoe factory at 4264 Laclede Ave.

N. J., Gloucester City—Superior Thread & Yarn Co.—three 40 in. revolving flat cotton cards; two 40 in. revolving flat breaker cards with automatic feeds.

N. Y., Buffalo—Boehm Bros., Inc., Niagara Life Bldg.—machinery and equipment for carpenter shop at 101 Norfolk St.

N. Y., Buffalo—Culliton Ice Cream Co., 172 Guilford St.—machinery for ice plant on Halbert St. and Jewett Ave.

N. Y., Buffalo—E. J. Emanuel, 464 William St.—candy making machinery for factory at 2178 Bailey Ave.

N. Y., Buffalo—Island Warehouse Co., Ganson St. and City Ship Canal—machinery and equipment for proposed $500,000 flour mill.

N. Y., Buffalo—A. Plotkin, 1040 Elmwood Ave.—woodworking and light manufacturing machinery for proposed small shop at 70-72 East Eagle St.

N. Y., Buffalo—R. W. Sellers, 170 Auburn Ave.—candy making machinery for factory at 442 Niagara St.

N. Y., Buffalo—Urban Milling Co., 200 Urban Ave., G. B. Urban, Pres.—machinery and equipment for packing and storing flour.

N. Y., Elmira—W. Jenkins, Lower Maple Ave.—quantity of (good) 8 in. leather belting.

N. Y., Elmira—H. Sutter, 428 Erie St.—machinery and equipment for the manufacture of radio apparatus.

N. Y., Fayetteville—Manlius Publishing Co.—magazine for model K linotype (used).

N. Y., Rochester—L. P. Gunson Seed Co., foot of Ambrose St.—machinery and equipment for addition to seed plant.

N. Y., Syracuse—Onondaga Litholite Co., 102 Beech St. (manufacturer of composition stone products)—machinery and equipment for one story addition to plant.

N. Y., Wellsburg—W. Walsh—one power, belt driven hay pressing machine.

O., Cleveland — A. S. Gilman Printing Co., 623 St. Clair Ave., N. E.—printing machinery and equipment for proposed plant, to contain 80,000 sq.ft. of floor space, at Niagara Falls, N. Y.

O., Cleveland—Guide Motor Lamp Co., 2130 West 110th St.—annealing furnace for the manufacture of brass shell work.

O., Columbus—Doddington Co., 451 West Broad St., (mill work), T. A. Jones, Genl. Mgr.—several rip saws, 2 cutoff saws, 3 joiners and general woodworking machinery; also 20 motors from 3 to 25 hp. for new plant on Duerr Rd.

O., Columbus—W. J. Kaiser, 119 East Chestnut St. (sheet metal works)—metal working machinery to enlarge shop.

O., Eldorado—The Bee— 12 x 18 in. job press, 24 in. paper cutter and 8 page folder for power equipment.

O., Kent—The Falls Rivet Co.—machinery and equipment for proposed 1 story addition to plant.

O., Williamsburg—Queen City Shoe Co.—machinery and equipment for proposed shoe factory.

Okla., Newkirk—T. Fry—woodworking machinery, including saw, wood lathe and planer for power equipment.

Pa., Allentown—Allentown Apron Co., 339 Hamilton St., J. Feinberg, proprietor—machinery and equipment for apron factory.

Pa., Ambridge—National Metal Moulding Co.—machinery and equipment for addition to metal moulding products plant.

Pa., Annville—J. H. Lloyd—machinery and equipment for the manufacture of turnbuckles and similar products.

Pa., Bethlehem—Kurtz Furniture Co.—machinery for furniture factory to replace that which was destroyed by fire.

Pa., Blawnox—Blawnox Co. (fabricated steel, etc.)—one 10 ton crane.

Pa., Bradford—E. R. Avery, Box 263—complete well drilling rig and outfit.

Pa., Franklin — Mercer Refining Co.—transmission and conveying machinery for oil refinery.

Pa., Fullerton—Fuller-Lehigh Co.— foundry equipment to replace that which was destroyed by fire.

Pa., Kane—Pennsylvania Silverware Co., F. C. Westfall, Genl. Mgr.—machinery and equipment for proposed addition to plant for the manufacture of metal and silverware specialties.

Pa., Phila.—Chilton Publishing Co., 49th and Market Sts.—stitchers, folders, presses and cutting machines.

Pa., Phila. — Duffy Bros., 3255 North Front St. (meat packers), J. M. Duffy, Purch. Agt.—conveyors, steam cooking vats and refrigerator plant for new factory.

Pa., Phila.—J. M. Melloys Sons Co., 1419 Spring Garden St., (manufacturer of tin ware), G. Melloy, Purch. Agt.—stamping machines, cutters, etc.

Pa., Phila.—L. A. Prouty Co., 1029 Ridge Ave. (manufacturer of soda water fixtures)—woodworking machinery, including 16 in. jointer, single spindle shaper, 30 in. band saw, circular saw and boring mill.

Pa., Phila. — J. H. Shriner, 36 North Delaware Ave. (fish dealer)—refrigerating plant and conveyors for new plant on Front St.

Pa., Phila. — United Gas Improvement Co., Broad and Arch Sts.—producers, boilers and conveying systems for loading and unloading at new plant.

Pa., Pittsburgh—Cutler Steel Co., Bowman Bldg. (steel fabricating)—10 ton crane for plant at New Cumberland, W. Va.

Pa., Pittsburgh—Pittsburgh Screw & Bolt Co., Preble Ave. near Island Ave., N. S.—one 3 ton crane and one 5 ton crane.

Pa., Scranton—Gaylord & Butler Pipe Co. (manufacturer of heating equipment), Pine Brook—machinery to replace that which was destroyed by fire.

Pa., Williamsport—H. Baier, 1529 West 4th St.—tinshop equipment.

Pa., Williamsport — Lycoming Motors Corp., foot of Park St.—additional machinery and equipment for plant for the manufacture of automobile motors.

Pa., Williamsport—West Branch Lime Co., Montoursville Rd.—one air compressor, 65 cu. ft. per minute at 80 lb. pressure.

Tenn., Chattanooga — Pipe & Foundry Co., Westside Ave. and 32nd St.—foundry equipment.

Vt., Rutland—P. R. Eaton—additional machinery for lumber mill.

Va., Richmond—W. C. Thurston, 1542 East Cary St. (wagon and automobile body builder)—rip saw.

W. Va., Huntington—Bd. Educ., Library Bldg.—manual training equipment for new schools.

W. Va., Huntington — Huntington Iron Wks., Adams Ave.—traveling crane and fabricating machinery.

W. Va., Huntington—Nightrack Mfg. Co., T. Harvey, Pres.—woodworking machinery and endless belts.

W. Va., Nitro—Charleston Paper Mfg. Co., R. C. Stewart, Secy.—belt conveyor.

W. Va., Wheeling—The Wheeling Steel Corp., Wheeling Steel Bldg.—locomotive crane.

Wis., Antigo—The Langlade Creamery Co.—machinery for proposed bottling plant.

Wis., Ashland—Northland Co-operative Creamery, c/o O. Regelein, R. R. 3—creamery machinery, including power churns, separators, etc.

Wis., Jackson—Jackson Canning Co.—graders for proposed canning factory.

Wis., Mayville—Bd. Educ., A. Droeger, Secy.—machinery and equipment for manual training department of proposed high school.

Wis., Milwaukee—J. L. Austin Mfg. Co., 419 Van Buren St. (manufacturer of grinders, etc.)—shafting, electric motor and later, additional machine tools for plant at Menomonee Falls.

Wis., Milwaukee—The Cedarburg Dairy Co., c/o H. Berns, 1586 Prospect Ave.—dairy and refrigeration machinery, belting and shafting for proposed dairy on 11th St.

Wis., Milwaukee—O. A. Clark Box Co., 1295 33rd St. (manufacturer of paper boxes)—special machinery, including corner cutters, scorers and glueing machines.

Wis., Milwaukee—Harley-Davidson Motor Co., 3732 Chestnut St., (manufacturer of motor cycles), W. Davidson, Purch. Agt.—small crane.

Wis., Milwaukee—Harsh-Chapline Shoe Co., 694 Hanover St.—shoe working machinery for proposed factory.

Wis., Milwaukee — Pfister & Vogel Leather Co., 443 Virginia St.—tanning machinery and shafting for proposed addition to tannery at South Milwaukee.

Wis., Milwaukee—Rose Candy Co., 355 East Water St., C. L. Burg, Purch. Agt.—candy making machinery.

Wis., Milwaukee—Royal Fixture Co., 85 35th St., D. C. Lappin, Purch. Agt.—special machinery and tools for the manufacture of lighting fixtures.

Wis., Oshkosh—Fluor Bros. Constr. Co., 52 State St.—band saw for proposed carpenter shop.

Wis., Platteville—Mound City Mfg. Co.—machinery and small tools for the manufacture of garden tools, etc.

Wis., Port Washington—J. C. Kohl, Grand Ave.—oil storage tanks and pumps for proposed filling station.

Wis., Racine — Lockwood Oil Co., 1421 Racine St., A. L. Flegel, Purch. Agt.—storage tanks and pumps for two filling stations.

Wis., Racine—Western Screw & Specialty Co., Ham Ave.—special machinery for the manufacture of screws and specialties on Clark St.

Wis., Sun Prairie—Standard & Specialty Porcelain Wks., c/o B. J. Chase—machinery and foundry equipment for the manufacture of porcelain products.

Ont., Acton—Thomson Motor Supplies, Ltd., c/o A. Harrison—machinery and equipment for proposed plant for the manufacture of motor supplies.

Ont., Arnprior—Arnprior Creamery, E. McKinny, Purch. Agt.—cold storage plant, boiler and manufacturing equipment.

Ont., London—Silverwoods, Ltd., A. E. Silverwood, Mgr.—equipment for proposed cold storage, ice cream and artificial ice plant at Chatham.

Ont., Newmarket—Russell Bell Flour Mills—equipment for additional mill.

Ont., North Bay—Red Wing Quarry Co., Ltd., H. Stockdale, Genl. Mgr.—stone crushing machinery and equipment.

Ont., Thorold—Ontario Harper Co.—additional paper making equipment.

Ont., Wallaceburg—Sydenham Brick & Tile Co.—drying and conveying machinery.

Que., Quebec—La Compagnie de Construction de Quebec, Limoilu Ward, c/o Standard Steel Construction Co., Welland, Ont.—complete equipment for steel mill.

Metal Working Shops

Ala., Birmingham — The Consolidated Coal Iron Co. awarded the contract for the construction of a 35 x 110 ft. collier, capacity 200 ton per hour. Estimated cost $50,000.

Ark., Stamps—The Louisiana & Arkansas Ry. Co., Texarkana, awarded the contract for the construction of a 1 story, 160 x 288 ft. locomotive repair shop, here. Estimated cost $150,000.

Calif., Corcoran — The Corcoran Union High School District, C. C. Wilson, Clk., will soon award the contract for the construction of a shop building for manual training department. Cost will exceed $5,000.

Calif., Fresno—The W. M. Murphy Motors Co., 1919 Calaveras St., will build a 30 x 75 ft. show room, a 20 x 80 ft. stock room, a 20 x 40 ft. machine shop and a 42 x 88 ft. mechanical shop on Van Ness Ave.

Calif., Oakland—The United States Light & Heat Corp., 5432 East 14th St., awarded the contract for the construction of a manufacturing plant. Estimated cost $50,000. Noted Nov. 16.

Calif., San Francisco—J. Cassaretto, 347 Berry St., will build a 1 story machine shop on Folsom and Dore Sts. Estimated cost $25,000. Noted Nov. 9.

Calif., San Francisco — The city and county of San Francisco, Bd. of Park Comrs., Park Lodge, Golden Gate Park, awarded the contract for the construction of repair shops, etc. Estimated cost $18,200. Noted Nov. 2.

Conn., Bridgeport—Jenkins Bros., 510 Main St., are having plans prepared for the construction of a factory for the manufacture of valves. Estimated cost $250,000. Lockwood, Green & Co., 101 Park Ave., New York City, Engrs. and Archts.

Conn., New Haven—The Holmes Special Tool Co., 38 Canal St., awarded the contract for the construction of a 1 story, 35 x 65 ft. addition to its factory. Estimated cost $10,000.

Conn., New Haven—A. Krah, 122 Mansfield St., awarded the contract for the construction of a 1 story, 50 x 125 ft. garage and service station on Derby Ave. Estimated cost $40,000.

Ill., Chicago—The Chicago Steel & Wire Co., 10257 Torrence Ave., awarded the contract for the construction of a factory on 103rd St. and Hoyne Ave. Estimated cost $15,000. Noted Nov. 2.

Ill., Chicago—The Goldsmith Bros. Smelting & Refining Co., 29 East Madison St., awarded the contract for the construction of a 1 story, 124 x 173 ft. factory at 5800-5814 Throop St. Estimated cost $55,000. Noted Nov. 2.

Ill., Chicago—C. C. Henderson, Archt., 105 South La Salle St., is receiving bids for the construction of a 3 and 4 story addition to factory for the Golden Rule Cutlery Co., Ogden Ave. and Sheldon St. Estimated cost $20,000.

Ill., Chicago—Huguelet Bros., 908 Gary St., awarded the contract for the construction of a 1 story, 68 x 100 ft. addition to garage. Estimated cost $50,000. Noted Nov. 2.

Kan., Wichita — Crouse Clear Vision Gasoline Pump Wks., 822 East Harry St., plans to build a 2 story, 60 x 70 ft. foundry for the manufacture of castings. Estimated cost $20,000. E. Crouse, Pres. Architect not selected.

Mass., Charlestown (Boston P. O.)—Stanley-[illegible], Inc., Main St., awarded the contract for the construction of a 1 story, [illegible] x 1[illegible] ft. garage, service station and repair shop on [illegible] and Main Sts. Estimated cost [illegible].

Mass., New Bedford—F. W. Greene, 555 [illegible] St., awarded the contract for the construction of a 1 story, 50 x 110 ft. garage and service station on Kempton St. Estimated cost $40,000.

Mass., Weymouth — The Brooks-Skinner Co. will build a 2 story, 40 x 130 ft. factory for the manufacture of metal garages. Estimated cost $40,000.

Mich., Detroit — The C. B. Rehn Fdry. Co., 3631 Hart Ave., is having plans prepared for the construction of an addition to its foundry consisting of 1 and 2 story buildings, 37 x 100 ft., 170 x 220 ft., 48 x [illegible] ft. and 38 x 140 ft., also a 50 x 100 ft. sand bin. Cost will exceed $[illegible]. C. W. Brandt, 1114 Kresge Bldg., Archt.

Mo., Fulton—N. O. Brown will build a 1 story garage on 4th and Nichols St. Estimated cost $10,000. Architect not announced.

Mo., St. Louis—The Ford Automobile Co., Highland Park, Mich., plans to build a 1 story, [illegible] x 1,500 ft. assembly plant for automobiles, tractors, etc., on east or west bank of the Mississippi River, here. Estimated cost, including equipment, $5,000,000.

Mo., St. Louis—The Haynes—Langenberg Mfg. Co., 4045-47 Forest Park Blvd., will soon receive bids for the construction of a 3 story, 150 x 200 ft. furnace factory and office building on Euclid Ave near Kings Highway. C. M. Morton, c/o owner, Engr. G. R. Langenberg, 4045 Forest Park Blvd., Archt.

N. Y., Buffalo—The Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, awarded the contract for the construction of a 1 and 2 story, 335 x 900 ft. factory and loading platform on East Delevan Ave., here. Noted Oct. 26.

N. Y., Rochester—M. D. Knowlton, 29 Elizabeth St., manufacturer of paper box machinery, awarded the contract for the construction of a factory at 19 Elizabeth St. Estimated cost $45,000.

O., Mansfield—The Ideal Electric & Mfg. Co., [illegible] East 5th St., awarded the contract for the construction of a 1 story, 100 x 150 ft. manufacturing plant.

Okla., Tulsa — The Dodge Bros. Motor Co., 716 South Boston St., awarded the contract for the construction of a 2 story garage. Estimated cost $50,000.

Pa., Fullerton—The Fuller-Lehigh Co. plans to rebuild the portion of its core foundry, which was destroyed by fire. Cost between $[illegible] and $35,000. Architect not announced.

Pa., New Castle — The Standard Wire Wks., plans to rebuild portion of its wire works which was destroyed by fire. Estimated cost $10,000. Architect not announced.

Pa., Phila.—Hoffman Henon Co., Archts., Finance Bldg., is receiving bids for the construction of a 1 story, 100 x 120 ft. garage on 11th and Walnut Sts., for W. E. [illegible], 1545 Chestnut St. Estimated cost $50,000.

Pa., Pittsburgh—Hubbard & Co., Granite Bldg., awarded the contract for the construction of a 1 story, 50 x 95 ft. addition to shovel factory at 6301 Butler St. Estimated cost $15,000. Noted Oct. 12.

Pa., Pittsburgh—The Metal & Thermite Corp., 1201 Bway, New York City, is receiving bids for the construction of a 2 story, 60 x 100 ft. thermite welding factory on Fayette St., here. Private plans.

Pa., Pittsburgh—The Simmons Co., 824 East Pennsylvania Ave., manufacturer of [illegible] beds, brass wire mattresses and cribs, will receive bids until Dec. 9 for the construction of a 2 story, 179 x 194 ft. warehouse and assembly plant on East River Ave. Estimated cost $150,000. Contractor will select own plans.

Pa., Scranton—The Gaylord & Butler [illegible] Co., Pike Brook, manufacturer of [illegible], plans to rebuild the portion of its factory which was destroyed by fire. Estimated cost $[illegible].

R. I., Providence—J. T. Avila, 31½ Governor St., plans to build a 1 story garage and repair shop [illegible] Sts. Estimated cost $[illegible]. Private plans.

R. I., Providence—W. F. and F. Hussey, 235 Williams St., plan to build a 2 story garage, service station and repair shop, [illegible] 7,240 sq.ft. of floor space. Estimated cost $40,000. Private plans.

Tenn., Memphis—Memphis Machine Wks., [illegible] Ave., plans to build an addition to its plant.

W. Va., Huntington—The Motor Sales Co., 1611 6th Ave., is receiving bids for the construction of a 2 story, 90 x 100 ft. garage on 6th Ave. and 13th St. Estimated cost $40,000. Meanor & Handloser, Robson-Pritchard Bldg., Archts.

W. Va., Logan—R. E. Matticks awarded the contract for the construction of a 2 story, 52 x 120 ft. garage. Estimated cost $40,000. Noted Sept. 7.

Wis., Appleton—Manthey & Puth, Washington and Morrison Sts., awarded the contract for the construction of a 1 story, 70 x 85 ft. garage on College St. Estimated cost $40,000.

Wis., Green Bay—J. A. Piaskowski, 445 South Jackson St., awarded the contract for the construction of a 1 story, 62 x 165 ft. garage on West Main St. Estimated cost $40,000.

Wis., Menomonie — E. V. Johnson will build a 1 story, 58 x 176 ft. garage and repair shop on Main St. Estimated cost $40,000. Noted Nov. 16.

Wis., Nichols—The All-American Steel Casket Corp., c/o J. A. Burrichter, Church and St. Peters Sts., St. Paul, Minn., awarded the contract for the construction of a 1 story, 60 x 160 ft. factory, here. Estimated cost $30,000.

Wis., Racine—The Racine Mfg. Co., 6th and Mead Sts., manufacturer of automobile bodies and accessories, awarded the contract for the construction of a 2 story, 50 x 120 ft. factory. Estimated cost $50,000.

Wis., Racine—The Western Screw & Specialty Co., Ham Ave., awarded the contract for the construction of a 2 story, 50 x 160 ft. factory for the manufacture of screws and specialties, on Clark St. Estimated cost $40,000.

B. C., Vancouver — The Burrard Iron Wks., 144 Alexander St., awarded the contract for the construction of a machine shop. Estimated cost $10,000.

Ont., Acton—The Thomson Motor Supplies, Ltd., c/o A. Harrison, plans to build a plant for the manufacture of motor supplies. Bylaw will be voted on Dec. 4. Estimated cost $40,000.

Ont., Tilsonburg — The Windsor Tool & Machine Co., Windsor, plans to build a 1 story machine shop, here. Estimated cost $40,000. Architect not selected.

General Manufacturing

Calif., Dinuba—The Dinuba Planing Mill has purchased a site on West Tulare St., and plans to build a mill. Estimated cost, including equipment, $60,000.

Calif., Fresno—The Fresno Consumers' Ice Co., Mono and P Sts., plans to build a 2 story, 90 x 98 ft. addition to ice storage plant.

Calif., North San Diego—The Vitrified Products Co., Spreckels Bldg., San Diego, plans to build a plant for the manufacture of brick, tile and clay pipe near the Santa Fe tracks, here. Estimated cost $250,000, including equipment.

Calif., San Francisco—Richard Hellman, Inc., 602 Jackson Ave., Long Island City, N. Y., manufacturer of mayonnaise dressing, is having plans prepared for the construction of a 5 story factory on a 75 x 245 ft. site on 20th and Harrison Sts., here. Estimated cost, including site, $250,000. A. Toriggino, Mills Bldg., Engr.

Conn., Bridgeport — The Massachusetts Baking Co., Housatonic Ave. and Wells St., awarded the contract for the construction of a 1 and 2 story, 100 x 115 ft. addition to its bakery, including more ovens, a portion for garage and shipping room. Estimated cost $75,000.

Conn., Hartford—The Hartford Courant, 64 State St., is having plans prepared for the construction of a 2 story addition to its newspaper plant. Estimated cost $50,000. I. A. Allen, Jr., Inc., 100 Farmington Ave., Archt.

Conn., Waterbury—The Gulf Refining Co., 21 State St., New York City, awarded the contract for the construction of a 1 story, 40 x 100 ft. plant, a 1 story, 50 x 78 ft. garage, 6 oil tanks and other smaller structures on Riverside St., here. Estimated cost $40,000.

Fla., McIntosh—The McIntosh Utilities Inc. plans to build a cold storage and refrigeration plant. Estimated cost $60,000. N. A. Russell, Treas. Architect not announced.

Ill., Chicago—The Star Wood Turning Co., 2267 Clybourn Ave., is receiving bids for the construction of a 2 story, 40 x 50 ft. addition to factory. Estimated cost $[illegible]. Koenigsberg & Weisfeld, 5 North La Salle St., Archts.

Pa., Phila.—Ballinger Co., Archts., 12th and Chestnut Sts., is receiving bids for the construction of an 8 story, 60 x 85 ft. printing plant, for the Ketterlinus Lithographic Mfg. Co., 4th and Arch Sts. Estimated cost $250,000.

Pa., Phila.—Cold Blast Feather Co., 169 West Berks St. will soon receive bids for the construction of a 2 story 100 x 153 ft. factory on Tiago and Janney Sts. Estimated cost $70,000. H. R. Stackhouse, 129 South 5th St., Archt.

Pa., Phila.—Duffy Bros., 3255 North Front St., are receiving bids for the construction of a 1 and 2 story, 64 x 68 x 140 x 180 ft. meat packing plant on Front and Venango Sts. Estimated cost $75,000. P. Kuhn Eng. Co., 3058 North 8th St., Engrs.

Pa., Pittsburgh—The Dusenberry Baking Co., 2138 Tustin St., is having plans prepared for the construction of a 3 story, 50 x 100 ft. bakery at 3201-15 Forbes St. Estimated cost $100,000. Rubin & Veshancey, Union Arcade, Archts.

S. C., Greenville—The Mills Mill awarded the contract for the construction of a 4 story, 50 x 100 ft. addition to its cotton mill. Estimated cost $35,000.

Tenn., Memphis—The Crown Rice Mill & Feed Co. is building a 4 story rice mill on Nichols St. and Union Belt R.R. Estimated cost $75,000.

Tenn., Nashville—The Baptist Sunday School Bd., 8th Ave., awarded the contract for the construction of a 2 story printing and publishing plant on 10th and Bayne Aves. Estimated cost $158,000.

Tenn., Nashville—The Warren Paint & Color Co., Wedgewood Ave., will build a 2 story paint factory, including oil tanks. Estimated cost $10,000.

Va., Richmond—The Wheeling Corrugating Co., 801 McDonough St., plans to build a 2 story addition to its factory for the manufacture of corrugated products. Estimated cost $17,000. Architect not announced.

Wash., Chelan—The Great Northern Ry. Co., Havermale Island, Spokane, is having plans prepared for the construction of an ice manufacturing and cold storage plant, here. Cost between $400,000 and $500,000. W. A. Wells, 601 Hyde Bldg., Spokane, Engr. and Archt.

W. Va., Huntington—The Nightrack Mfg. Co. is receiving bids for the construction of a 2 story, 40 x 120 ft. woodworking factory. Estimated cost $25,000. T. Harvey, Pres. W. F. Diehl, R. & P. Bldg., Archt.

W. Va., Parkersburg—The Ideal Corrugated Box Co. awarded the contract for the construction of a 2 story, 72 x 150 ft. addition to its box factory on Jeannette St. Estimated cost $25,000.

Wis., Crandon—The Vulcan Last Co. will build a 2 story, 60 x 120 ft. shoe factory. Noted Oct. 5.

Wis., Fond du Lac—B. E. Mehner, Archt., Main St., is receiving bids for the construction of a 3 story, 42 x 180 ft. factory and warehouse on Military St., for the Combination Door & Screen Co., 180 Ruggles St. Estimated cost $50,000.

Wis., Milwaukee—C. J. Keller & Son, Archts., 432 Bway., are receiving bids for the construction of a 2 story, 50 x 60 ft. addition to factory for the Federal Rug Cleaning Co., 914 Winnebago St. Estimated cost $20,000.

Wis., Rhinelander—The Northern Grain Co. will build a 1 story, 50 x 120 ft. feed mill, etc. Estimated cost $40,000. O. C. Nelson, Mgr. Private plans.

Alta., Calgary—The Imperial Oil Co. Ltd., 56 Church St., Toronto, Ont., awarded the contract for the construction of an oil refinery, here. Estimated cost $2,500,000.

B. C., Vancouver—The False Creek Lumber Co., 6th Ave., W., is having plans prepared for the construction of a lumber mill. Estimated cost $150,000. Private plans.

Ont., Elmira — The Elmira Co-operative Creamery awarded the contract for the construction of a 2 story, 40 x 50 ft. addition to its creamery. Estimated cost $18,000.

Ont., Paris—Penmans Ltd., manufacturer of woolen underwear, awarded the contract for the construction of a 3 story addition to plant No. 2 and a 1 story addition to plant No. 1. Estimated cost $100,000. Noted Oct. 12.

Ont., Welland—The St. Thomas Packing Co., St. Thomas, Ont., awarded the contract for the construction of a cold storage plant, here. Estimated cost $100,000. Noted June 29.

Que., Valleyfield—The Montreal Cottons, Ltd., are building a 4 story, 102 x 120 ft. waste plant.

American Machinist

Volume 57 NEW YORK, NOVEMBER 30, 1922 Number 22

Repair Work in a Tennessee Railroad Shop

Arc Welding—Driving Box Work—Machining Shoes and Wedges—Utilizing Old Asbestos Insulation—Inserting New Pieces in Broken Frames

BY S. ASHTON HAND
Associate Editor, *American Machinist*

ARC WELDING both for repairing broken parts and building up worn surfaces is a great boon to the railroad shop. Some examples of work done by the electric arc at the Coster shops of the Southern Railway System, Knoxville, Tenn., are shown in Figs. 1, 2 and 3. The slipper-type crosshead, Fig. 1, was cracked along the line *A* so the metal was cut out between the lines *B* and *C* and new metal fused or welded in by the electric torch, rendering the crosshead as serviceable as if a whole new casting had been made.

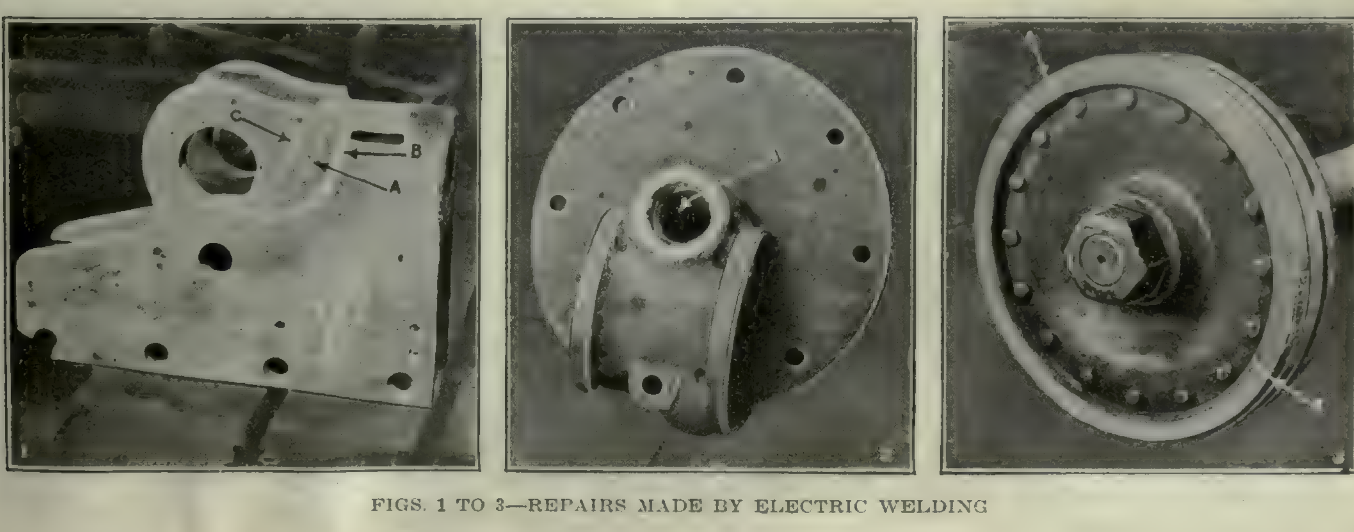
The cylinder head at the steam end of an air pump, Fig. 2, needed building up in the hole *A* and on the face of the boss to provide metal for truing while undergoing repairs. As building up with iron leaves a surface difficult to machine satisfactorily, the building up was done with brass. Another place where brass was used was on the outside of the piston shown in Fig. 3. Nearly all the wear on a piston is at the bottom where it bears on the lower part of the cylinder wall. When such wear reduces the piston so that the depth of the groove is insufficient to properly support the rings, the piston will have to be scrapped unless some method is at hand to restore metal in place of that worn away.

In the piston referred to, brass has been fused on that part of the periphery next to the first groove, and between the points *A* and *B*. The job has only been started and the other parts of the periphery between *A* and *B* will be likewise built up. After enough metal has been put on, the piston will be trued up in the lathe and the sides of the grooves faced. It has been the experience in this shop that pistons so repaired run longer between repairs than do new ones and that, as brass and iron make excellent bearing surfaces, there is less wear on the lower walls of the cylinders.

The repair of driving boxes constitutes a large item in the work of railroad shops and boxes for the heavier types of engines are so large as to tax the capacity of some of the machines used for certain parts of the work. One of the driving boxes of a Santa Fé type engine is shown undergoing the boring operation in Fig. 4. As this box carries a crown brass 22 in. long, some idea may be had of its size and the difficulty of handling it on machines installed before this type of engine was in use. It was stated above that the crown brass for this box was 22 in. long. Originally, the crown brass was that length, but the Southern System has found that brasses of such length wear bell mouthed on the ends next to the driver hubs, leaving about 14 in. for actual bearing on the axle. As the other 8 in. does no good, it was decided, when making repairs, to put in brasses only 14 in. in length, thus saving a considerable amount of costly material.

A few driving boxes of the ordinary type in the shop for repairs are shown in Fig. 5. Some must be replaned where the shoes and wedges fit, others must have new hub liners put on, and nearly all must be fitted with new crown brasses. In pressing crown brasses in or out of the boxes, the hydraulic press, Fig. 6, is used. Here all the boxes belonging to one engine are put on the truck shown in the illustration. This truck passes freely through the opening between the ram and anvil of the press, so that the boxes are brought consecutively into position by merely pushing the truck along the rails. This method of handling keeps the boxes for each engine by themselves.

Machining crown brasses to fit driving boxes may be done in several ways, such as shaping, slotting, or turning on the boring mill or lathe. Figure 7 shows the



FIGS. 1 TO 3—REPAIRS MADE BY ELECTRIC WELDING

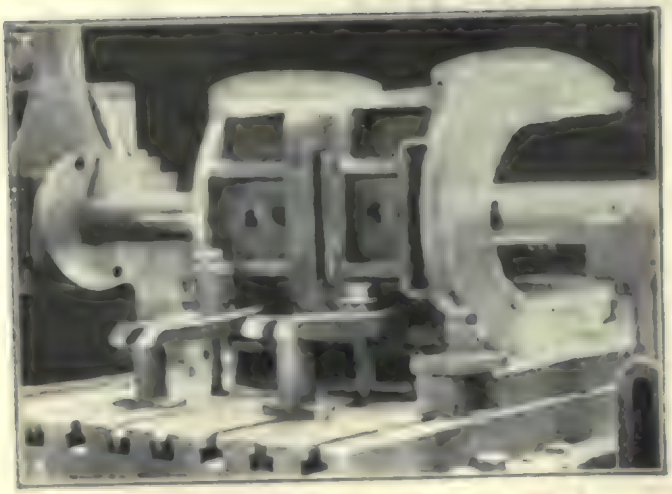


FIG. 4—BORING A SANTA FÉ DRIVING BOX

FIG. 5—DRIVING BOXES TO BE REPAIRED

operation on the lathe where the brass is mounted on a special mandrel and confined between collars at each end. Cup pointed setscrews in the collars bite into the ends of the brass and hold it securely. In planing driving boxes, they are strung out on the planer table, each box being held down by its individual pair of clamps, as shown in Fig. 8. End stops, to prevent shifting under the pressure of the cut, are, of course, set in place.

Shoes and wedges are also strung out on the planer table, shoes on one side and wedges on the other, as shown in Fig. 9. Both planer heads are in use and carry special tools, the one at *A* planing both the inside edges of the shoe simultaneously. The straddle tool for planing the outside edges, to be seen on top of the shoes at *B*, is a forging fitted with clamps for holding toolbits at *C* and *D*. To the right of the straddle tool at *E* is one of the clamps used between the ends of the shoes to hold them in place during the planing operation.

The tools and clamps described are used alike on both shoes and wedges. Shoes and wedges for engines of the Santa Fé type are generally planed singly as there

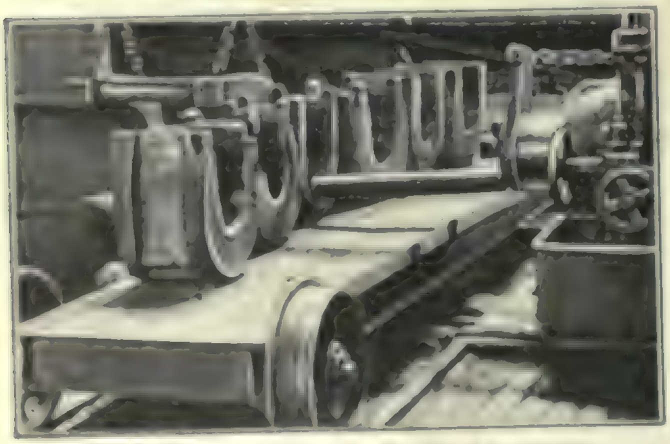


FIG. 6—PRESSING OUT CROWN BRASSES

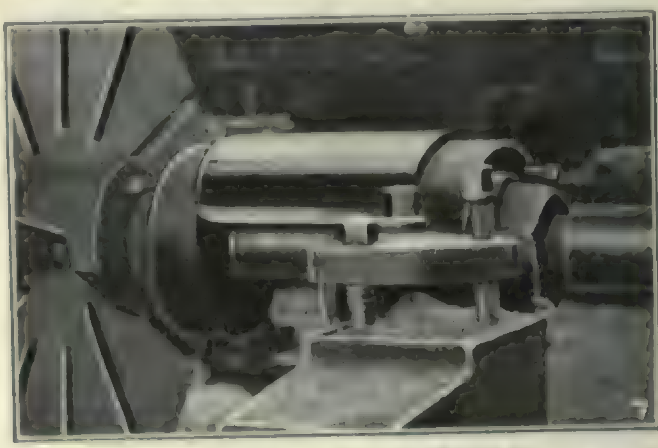


FIG. 7—TURNING A CROWN BRASS

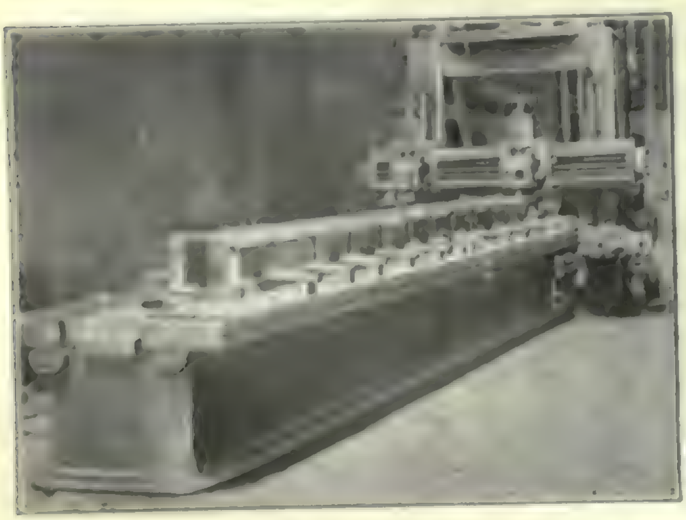


FIG. 8—PLANING DRIVING BOXES

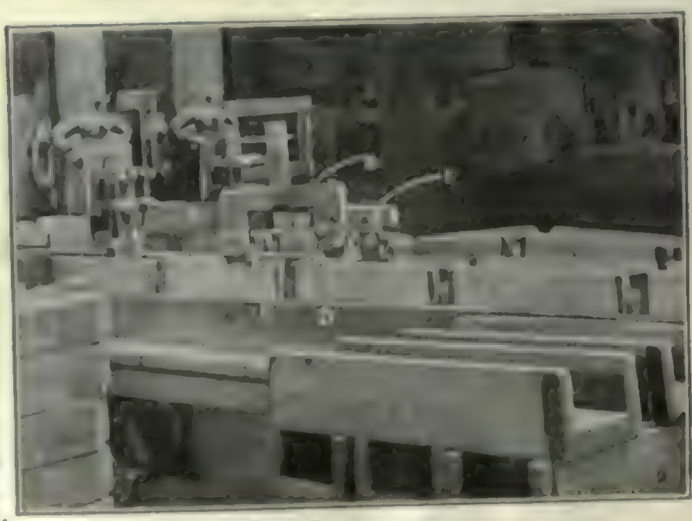


FIG. 9—PLANING SHOES AND WEDGES

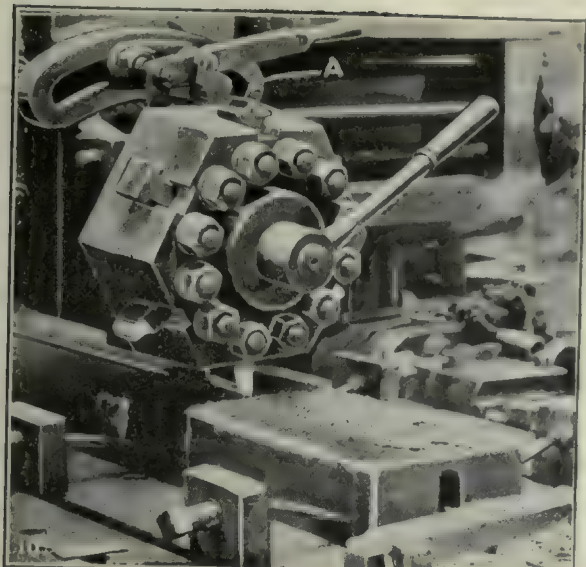


FIG. 10—TURRET MOUNTED ON PLANER HEAD.

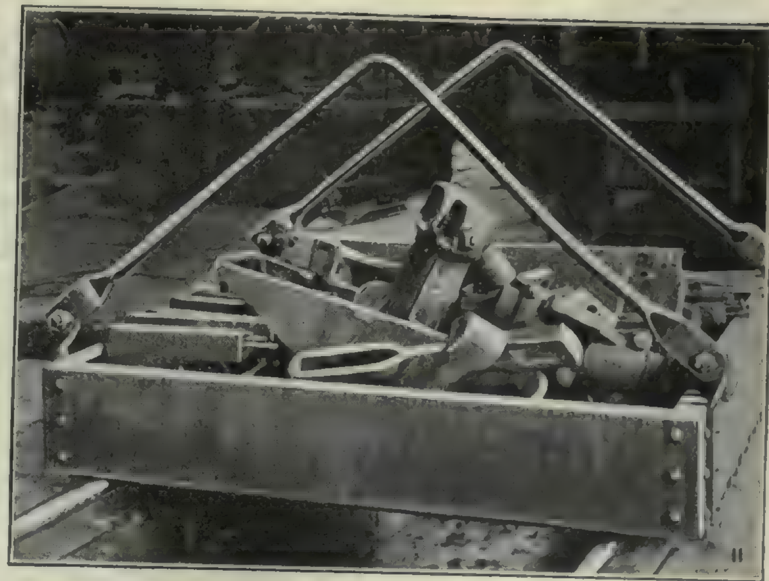


FIG. 11—BOX FOR TRANSPORTING SMALL PARTS

are not enough of them to be planed at any one time to warrant fitting up for stringing them out. Even where this is done, it would only apply to work on the outside as they are closed at one end which would prevent the inside tool from passing through. Fig. 10 shows the planing of a Santa Fé type shoe on a planer provided with a turret in which all the necessary tools are held. At the top at *A* is the combined right and left hand tool for forming the rounded corners on each side of the shoe.

When locomotives are stripped for repairs, all smaller parts are put in shallow boxes or trays permanently equipped with slings so as to be readily handled by the crane. One of these boxes is shown in Fig. 11. By

FIG. 12—MILL FOR GRINDING ASBESTOS

FIG. 13—NEW PARTS OF FRAMES

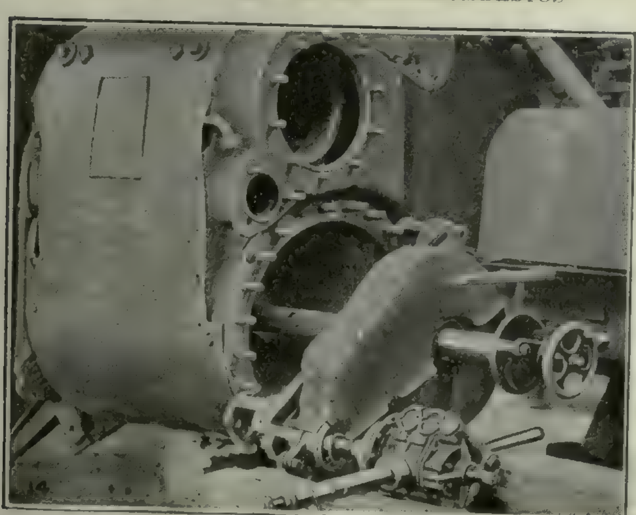


FIG. 14—RE-BORING A CYLINDER

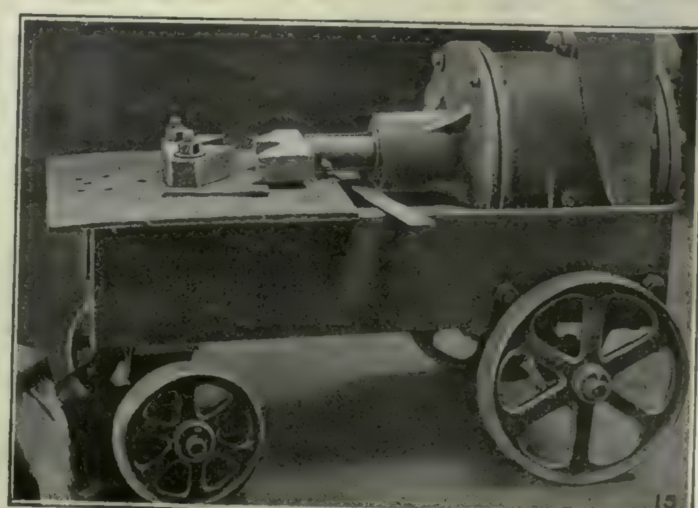


FIG. 15—A PORTABLE BULLDOZER

this method the smaller parts of an engine can be transported to any part of the shop and kept by themselves.

In stripping the jacket from the boiler, many of the asbestos blocks or slabs used for insulation are more or less damaged so as to be unfit for use. In some shops these damaged blocks are scrapped, but here a grinding mill has been installed in an old freight car as at *A*, Fig. 12, where the blocks are ground up. The pulverized material is made into plaster and used for filling in between blocks and covering irregular surfaces when reinsulating the boiler and answers the purpose as well as new plaster.

Cracked frames are generally repaired by welding, using the thermit process. It sometimes happens, however, that frames are so badly damaged that a considerable part of one or both have to be cut out and new parts welded in place.

New parts for a pair of frames are shown in Fig. 13 and will be welded onto the frames of the engine blocked up behind them. The rear ends of the damaged frames have been cut off at *A* and *B* and, when the new parts are welded on, the welds will be over the centers of the jaw openings. Before the advent of thermit welding, these frames would have been removed and taken to the blacksmith shop where the damaged parts would be cut out and the new parts welded in their places in the old fashioned way.

The universal use of compressed air has simplified many of the repair jobs. The ease by which power can be supplied to portable tools such as the cylinder boring machine is shown in Fig. 14. The blacksmith shop too has been the gainer by the introduction of compressed air, as portable tools, such as the bulldozer or bender, shown in Fig. 15, can be used at any fire that may be convenient.

It may be mentioned in passing that the Southern valve gear was originated in this shop.

Employment and Labor Turnover

A careful selection of employees and the development of a better understanding and closer co-operation betwen the employment department and department heads are among the big employment problems of today. Before the fall of 1920, when the demand for help was greater than the supply, we welcomed with open arms anybody who applied for a position. Scant attention was paid to careful selection. It was vital to fill vacancies rather than to choose the applicant whose qualifications were most suitable for the job.

The time has arrived when the employment manager must shoulder the entire responsibility for selecting the right person. The outgrowth of this will be a better understanding and a closer co-operation between the employment department and the department heads, as well as the building up of a better personnel. Until he accepts this responsibility the employment manager can not command the confidence of the operating man on the job.

Turnover as a Health Indicator

A high labor turnover indicates an industrial disease. A very low labor turnover may similarly indicate an unhealthy condition due to failure to eliminate the unfit. Turnover is an index of the health of the company from the point of view of good employer-employee relations. Every effort is expended in time and money to obtain the good will of customers and when obtained to hold it. No organization can be successful without this policy. Why should it not be just as important, if not more so, to obtain the good will of employees? Someone has very aptly called labor turnover the "yardstick" by which we may measure the mutual understanding between employer and employee.

It is impossible to figure the cost of labor turnover except in a very general sort of way. Too many variables enter into it. Some of the costs can be figured, but it is impossible for example to determine the cost of training an employee. Some are more intelligent than others with the result that it takes less time and is therefore less expensive to train them. It is possible, however, to show an employer that turnover reduces his profits, and frequently it is easy to do so.

The importance of a group of employees who have had long service with a company can not be overestimated. No matter how well the employee is instructed in company policy, he does not really understand the policies of that company until he has learned them through experience. The employee who sticks is the real backbone of the company. The one who stays only a short time can not be expected to have the best interests of the company at heart. The real spirit of partnership between the employer and employee is not established.

Cost of Training

High turnover means high cost of training, with the result that training activities for those already employed must necessarily be curtailed on account of the time and effort expended in training new employees. Organizations which have no regular training departments may feel that they are under no training expense, but they are selling themselves a "gold brick," for there is no line of endeavor where training of some kind or other is not required. The expense of training a machinist, for instance, results from high cost of spoiled material, injured machines, and loss of time. As the purpose of all labor turnover figures is to correct conditions which cause people to leave the employ of a company, it is necessary to obtain the true reason for leaving. These, at best, are difficult to obtain. Following the line of least resistance, an employee will say that he is moving out of town, or is going to remain at home, rather than to state frankly that his real reason for leaving is bad working conditions, improper supervision, etc. Many others will leave without giving the real reason or without any notice whatever. If this happens to any great extent it means that the employment department is not functioning properly. This difficulty can be overcome to some extent by arranging that the payroll department can not give an employee his final pay without the authorization of the employment department. This plan allows some representative of the employment department to interview all people who leave, and thus cuts down to a minimum the number of those who give no cause whatever for leaving. In interviewing an employee who is leaving, it is necessary to approach him sympathetically if the real cause for his exit is to be learned. If he is antagonized, the investigator has had his trouble for nothing.

Abstract of a committee report presented at the first annual [illegible] of the National [illegible] Association, Pittsburgh, Pa., [illegible] 9-10, 1922.

Industrial Cost Accounting for Executives

Third Article Deals with the Elements of Manufacturing Costs—Direct Material, Labor and Charges—Burden—Three Groups of Manufacturing Functions

BY PAUL M. ATKINS

BEFORE WE can start in making records and setting up accounts, we must have some idea of what we are going to account for and record. In the case of cost accounting, that means we must have some comprehension of what the elements of manufacturing costs really are. Perhaps the reader may think to himself—Why that's easy; material, labor and overhead—everyone who knows anything at all about manufacturing records is quite familiar with that. The rub comes, however, when you try to explain just what you mean by material, labor and overhead from the cost accounting point of view. The general statement sounds easy and is fundamentally correct but, as soon as the elements are analyzed a little, certain difficulties are met with and it becomes evident that the whole question is not quite so simple as it appears at first glance.

Let us take up the various elements in order and study them a little to see what they involve. No product can be turned out without material, so it is quite appropriate to start with that cost factor. At first, it seems as though it should be quite simple to determine the cost of the material which goes into the product. If an adequate system of production control is established, no material should be issued to the factory without a written order for it. In the joobing or intermittent type of industry, written requisitions or issues should be prepared on which may be recorded the quantity of material sent out.

In the case of a continuous process plant, a standing order to issue so much of certain kinds of material each day and a notation of the quantity sent out should be sufficient record. In either case, it appears as though it should not be difficult to ascertain the cost of the "direct" material, as the material going into the product is called. So many pounds of flour, of bar steel, so many yards of sheeting, such a number of screws, bolts, castings, parts, etc., are issued for use in making the product. With the quantity known and the price fixed or findable, it should not be hard to determine the cost of direct material.

Some Materials Cannot Be Measured

It sometimes happens that there are certain practical difficulties in the way of keeping track of all the many details, difficulties which are due to the number of records which must be handled when large quantities and a wide variety of materials are issued. There are other kinds of material, however, which enter directly into the makeup of the product and yet which cannot be measured against it.

Let us take as an example the enamel which goes on the box covers of an electric switch. The enamel is certainly direct material because it forms a part of the saleable product. But how much of it actually goes on any one box cover or on any order for box covers? The engineering department or the laboratory can quite possibly tell how much *should* go on, but the cost records must show not what ought to happen but what has actually happened. The box covers are first dipped in the tank of enamel and come up dripping. They are hung over a board to catch this drip until the enamel ceases to run off and are then pushed into an oven to be baked.

It is practically impossible to measure and record the amount of this enamel against the order and so from the cost-accounting point of view it cannot be treated as direct material, although essentially that is what it is. It must, therefore, be handled in some other way. In defining direct material costs, it will be necessary to say that they are such costs of material going into and forming a part of the product as can be ascertained with a reasonable degree of accuracy at a reasonable cost.

Direct Labor That Cannot Be Charged

When we consider the matter of labor we find that a similar condition exists. In most cases it is possible to measure and record the value of the labor which is engaged directly in turning the material into the product. Whether that labor is paid by a piece rate or by some system of wage payment in which the time taken is the prime element in the measurement of the charge, is immaterial. We can measure the output or the time taken for work on a particular product or order and, knowing the rate of payment, we can calculate the direct labor cost for making the product.

On the other hand, just as in the case of material, we will find there are occasions when it is not practical to measure the time taken and so ascertain the direct labor cost. A battery of automatic lathes or screw machines is operated by one man. He goes from one to another, spends a little time adjusting one, starts some material in another, sits and looks at the whole group a few moments, doing nothing but necessarily there to take care of any need which may arise.

If all the machines are working on one order, his time might, of course, be charged to that order, but if they are working on different orders, how is his time going to be split up among them? He changes from one to another so frequently that he would spend almost as much time recording as working if he tried to allocate each moment of his time. It certainly would not pay to keep some one there to record the changes for him, and hence we find that, although he is working directly on the product, his wages cannot be treated as a direct labor cost. The expense must be handled in some other way, just as in the case of the enamel above described. Our definition of direct labor cost from the cost accounting point is that it is the cost of that labor engaged in working directly on the finished product which can be measured with reasonable accuracy at a reasonable cost.

Here we have then direct material costs and direct labor costs and are apparently ready for an investigation of what is commonly called "overhead" or "burden." Before going on to this topic, however, we must pause for a moment to consider an element of cost

For the author's forthcoming book.

which has not yet been mentioned, which appears only infrequently, but which we cannot, nevertheless, leave out. It belongs at this point in our discussion for it is essentially one of the direct costs.

Perhaps the best way to make clear what the element is which we may call "direct charges" is to take an example. A machine shop turning out machines to order may have some part which is just too large for the equipment which it has to handle. The bed of the machine may be a bit too big to be planed on its planer and so the company sends it out to some nearby concern to have the work done for them. When the work is completed, the first company will receive a bill for it. It is evident that this bill is not for material, neither is it for labor alone, but is rather for the service rendered which is made not only of the labor but also of the cost of operating the machine on which the work was done and the profit which the second company makes on the job. At the same time from the point of view of the first company, the bill is not an element of expense, as will be obvious after the next few following paragraphs have been read, but is properly a direct charge against the order for the production of the machine on which the bed is to be used.

Hence we see that our study of the elements of manufacturing costs has revealed so far that there are ordinarily two and some times three direct costs:

(a) Direct material,

(b) Direct labor,

(c) Direct charges.

It has also shown us that the inclusive idea of direct material and direct labor needs to be modified when approached from the cost-accounting viewpoint in order to limit them to such materials and such labor as can be satisfactorily measured against the order for the product.

We are now ready to turn our attention to the question of overhead or burden as it is called by preference in these articles and try to see what it is and how it plays a part in making up the cost of the product. To my mind, burden is simply the cost of the operation of the business as a whole. A certain portion of this cost which measures the value of the services rendered by the business in the manufacture of the goods should be called earned burden and is chargeable to the orders for making the product as a proper part of the cost of production.

The other portion is a load which the business as a whole must carry and may be called "unearned burden" because it is a load which represents either excessive cost of operation or unused plant capacity or both. It is not chargeable to the product but directly to profit and loss. Space will not permit a thorough discussion of this subject here, so I must ask my readers to be patient until a later article—"Burden Earned and Unearned"—is reached. In that article the topic is vigorously investigated.

The task now before us is to see what the subelements of burden are. It has been stated that the burden was the total cost of the operation of the business, or, in other words, is the total of the expenses, which may be conveniently defined as the cost of carrying on the various departments of the business into which its functions are subdivided.

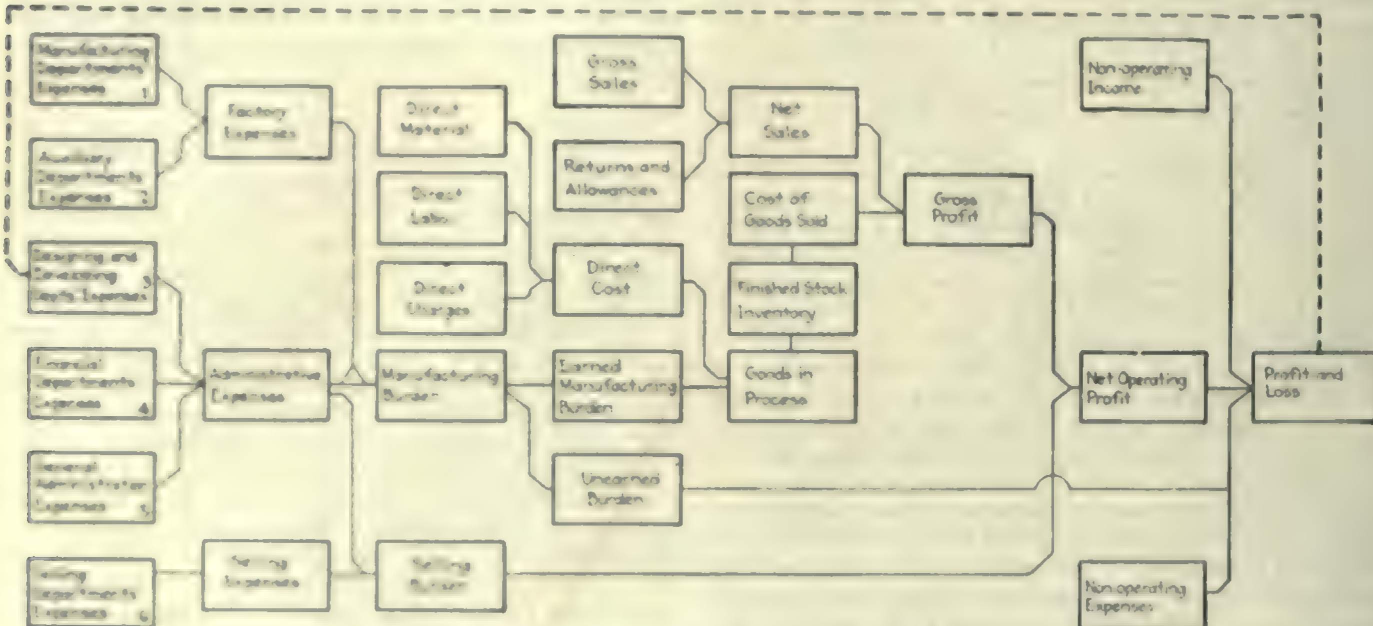


FIG. 1—A TYPICAL COST ACCOUNTING SYSTEM

The first step to be taken in studying expenses and burden, as the two phases of overhead are called, is to investigate the subdivision of the business into its functions or departments. Not more than a word or two can be said about this topic, but a later article will be devoted entirely to it. A few general suggestions, however, are necessary here. A business is nothing more nor less than a collection, sometimes a systematic, well organized collection and sometimes a heterogeneous collection of activities called functions. These are grouped into what we call departments and should be so put together as to promote harmonious cooperation in what may be termed an organization.

It is perfectly evident that the activities are going to vary greatly from industry to industry and even from company to company within an industry. Hence they cannot be discussed in detail unless a particular case is in hand. A few general points can be made, however, and these will apply to almost all manufacturing concerns no matter what their product may be.

There is hardly any manufacturing business in which the functions are not properly divided into three prin-

cipal groups. There are those which are principally concerned with the production of the finished goods; those which are occupied with selling the goods; and finally, those functions whose part is to guide, direct, supervise, and aid both selling and production. The first group may well be called the "manufacturing" functions; the second group, the "selling" functions; and the third group, the "administrative" functions.

Whether the product is steel rails or flour, cotton cloth or machinery or any other manufactured product, it must be produced, sold, and the business as a whole, administered. The three groups ordinarily should be divided in turn into departments which are the units most commonly employed as the basis for the organization and operation of the business. Of course, the number and kind of departments will vary according to the business. For our present purpose, however, it does not make any difference what they are.

Importance of Groups in Cost Accounting

It is of considerable importance that the distribution between the three groups be kept clearly in mind. The expenses of the business, it will be remembered, should be divided up according to the various departments for whose benefit they are incurred. Hence they will fall quite naturally under the three headings given above. It should be perfectly clear that all of the manufacturing expenses go to help make up the manufacturing burden but that none of them form any part of the cost of selling.

In the same way, the selling expenses are in no sense a part of the manufacturing burden but help only to make up the cost of selling. The expenses of administration are properly divided between the two since the administrative departments exist expressly for the benefit of the two other groups of functions.

Theoretically, then, the total burden of the business is divided into two parts, one of which represents the cost of operations involved in making the goods and the other, the cost of selling them. The manufacturing burden, as was pointed out, is properly divided into earned and unearned burden. Practically, there are certain difficulties involved in applying these theories to actual cases, though it is surprising how closely the theory can be followed in practice if correct methods are used. All such details as are commonly called 'indirect" or "non-productive" material, labor and expense are all included under the head of expenses together with insurance, depreciation and such items.

Elements of Manufacturing Costs

The elements which go to make up the cost of producing any goods are therefore:

(A) Direct costs
  1. Direct material
  2. Direct labor
  3. Direct charges

(B) Burden (Earned)
  1. Depreciation and other fixed charges
  2. Indirect labor
  3. Indirect material
  4. Other expenses

From this point on the course of the costs should be easily grasped from a study of the accompanying charts which show how the cost system interlocks with the general accounting system to form one comprehensive and consistent set of accounts and records. In the next article will be given a summary of the various accounts and journals which are necessary for a satisfactory recording of the various cost elements.

Explanation of Figure 1

Definition.—Expense consists of the expenditures necessary for the operation and maintenance of the various departments and includes such charges as taxes, insurance, depreciation and maintenance of all property occupied or used by the departments and a fair share of such charges for property used by several or all in common, wages and salaries of those whose time cannot be readily allocated to some production or improvement order; material used in the operation of the department, such as stationery, oil, waste, coal, etc.; outside services such as telephone, telegraph, water rates, etc.—in short, all expenditures incurred by the several departments which are needed to enable them to give the service they are expected to render. The kinds of expenses involved vary according to the departments.

1. *Manufacturing Department's Expense.* Made up of the expense incurred directly in the operation of the departments engaged directly in the manufacture of the product by changing the form or condition of the raw material.
2. *Auxiliary Department's Expense.* Made up of the expense of such departments as Purchasing. Cost, Manufacturing Standards, Finished Stock and Shipping, Heat, Light, Power, Inspection, Tool Cribs, Maintenance, Planning, Receiving, Stores, Safety and Sanitation, Training, Tool Manufacturing, Internal Transportation, Watchman and Pattern — departments whose services are rendered directly and primarily to the manufacturing departments and only incidentally to any others.
3. *Designing and Developing Department's Expense.* Made up of the expense of such departments as Blue Print and Photographs, Chemical Laboratory, Drafting, Engineering, Filing (Blue Prints and Drawings), Physical Laboratory, Experimental—departments whose chief service is that of designing and developing new products.
4. *Financial Department's Expense.* Made up of the expense of such departments as Accounting, Billing, Credits and Collections, Insurance (Property), Paymaster and Cashier—departments whose chief service is the handling and recording of financial transactions.
5. *General Administration Department's Expense.* Made up of the expense of such departments as Executive, Filing (General Office), Legal, Stenographic, Traffic—departments whose services are rendered to the business as a whole rather than to any one particular section of it.
6. *Selling Department's Expense.* Made up of the expense of such departments as Publicity, Sales, Branch Offices, Customers' Service—departments whose services consist of selling the goods of the concern and of keeping them sold.

Repairing an Engine Under Difficulties

By Hiram Hicks

Some years ago the writer was called upon to make repairs on a steam engine that furnished power for a small manufacturing establishment in a remote village.

The engine had been built by one of the old-time "backwoods" machinists from ideas and patterns of his own, and was like nothing else that ever existed. It was of the vertical type with the crankshaft at the apex of a pair of A-frames; it had two cylinders connected in the usual way to crank disks at opposite ends of the shaft, and it developed probably from 15 to 20 horsepower. The two sides of the engine were quite independent and either was capable of keeping the shop wheels turning if care was taken to regulate the power requirements to avoid "peak" loads.

There was nothing the matter with the engine except general debility; having been worn by long continued service until it was blowing away more steam than it used and making more noise than a freight train. The machine shop where it was built had long been out of business and no other was available. The shop must not be closed and there was no other power.

The only machine-tool equipment was an engine lathe of about 18-in. swing, built by the same machinist that had built the engine, and located in the attic of the shop. There was plenty of junk—the accumulated odds and ends of thirty years—from which to draw raw material, and I was fortunate enough to find in the pile all that was necessary to "make" new parts for all that had to be replaced except the pin brasses, castings for which I obtained by express from a far-away city brass foundry.

Having everything in readiness at 12 o'clock one day, one side of the engine was disconnected, the crank disk drawn off, steam and exhaust outlets plugged and a pair of improvised half-boxes fitted to that end of the shaft—all in the short space of one hour. At 1 o'clock the remaining side was started up, and it clattered gaily away for nearly two weeks while its mate was being rebuilt.

Reboring the cylinder was the first job. The casting was blocked up on the carriage of the lathe from which the cross-slide had been temporarily removed, a boring bar was placed on centers, the cylinder lined up by tramming, and two cuts were run through the bore. This was a good afternoon's work.

How the Lathe Was Rigged

Without disturbing the setting of the job the compound slide of the lathe was bolted to an angle plate that had previously been prepared to be bolted to the back of the lathe bed, and the lathe had become a shaper with a vertical slide but no cross adjustment. A splining tool of the kind commonly used for cutting keyways in the bores of wheels, gears, etc., adapted itself very nicely to the job of resurfacing the valve seat. No change was necessary in this tool except in the manner of using it; the "top rake" had become the "clearance" and the "clearance" the "top rake."

The traversing movement, equivalent to the movement of a shaper ram, was supplied by running the lathe carriage back and forth along the shears by means of the handwheel, elbow grease being the fuel consumed to supply the power. As the "shaper" had no cross movement (the casting being still bolted to the wings of the carriage) tool adjustment for successive cuts was made by putting sheet metal shims of the required thickness under the tool.

The next shaper job was the replaning of the crosshead guides. These, fortunately, were separate pieces bolted to the face of the A-frames and, being of generous proportions, needed little more than resurfacing. The crosshead was fitted with bronze shoes so that the amount of material removed from the guide (and also from the shoe) was compensated for by putting sheet metal shims of the proper thickness between the shoes and the crosshead.

The making of new pistons from chunks of iron several sizes too large, of piston rings, rods, wristpins and crankpins, etc., as well as the making of new eccentrics and reboring the straps to fit, was ordinary lathe work. The machining of the new pin brasses was, however, beyond the limitations of my "shaper" and the lathe had to become a milling machine. Several milling cutters were accordingly made, with tapered shanks to fit the spindle hole, and fluted by laying a suitable cutting tool on its side in the toolpost and again applying hand power to traverse the carriage back and forth.

To space the teeth somewhere near evenly a locking pin was rigged up to enter the tooth spaces of the main spindle gear. (I would not advise the use of this sort of a plate for accurate indexing.)

A milling machine requires movement in three planes (so, also, does a shaper for that matter) besides the rotative one of the cutter, and here the old backwoods machinist had unwittingly come to my aid when he built that lathe, for he had supplied an extra toolblock to go in place of the compound slide that could be adjusted vertically. By tapping two entirely unpremeditated holes in the front of that toolblock and making a small angle plate I was able to mount the brasses below the cutter in position to take advantage of all three adjustments.

Milling the channels in those brasses to fit the connecting-rod straps was child's play compared to the labor of getting ready to do it. With the milled brasses fitted to the straps and secured with the regular keys and a dummy rod end, the lathe once more became a lathe for the boring and facing operations.

One piece that puzzled me for quite a while was the valve, a plain D-slide, the surface of which constituted by far the largest part of it. It was so small and of such peculiar shape, besides having no place to get a strap on it without covering the surface to be machined, that I could not invent a way to hold it. I finally compromised by filing it flat and scraping it to match the valve seat on the cylinder casting.

The crankshaft ran in babbitt-filled bearings the bronze shells of which showed no wear as there was nothing in frictional contact with them. The main journals also showed so little wear when they were examined at the time of taking down the engine that it was not considered necessary to do anything to them, especially as any work upon the shaft would put the engine out of service. New babbitt in the shells put the main bearings in shape to go back.

Again at 12 o'clock, with every part tested to make sure that all would go together without delay, the engine was stopped and the new parts assembled. The opposite side was disconnected at crank and eccentric and the crosshead blocked against movement, but no part was dismounted as we wanted to make sure that the new engine was going to run. Upon starting at 1 o'clock no trouble was experienced by anybody but the engineer, who was depressed by the absence of noise, a depression no doubt eradicated by time.

Repairing the Second Engine

The new engine ran quietly and steadily all that afternoon and all the next morning until, at noon, the other side was dismounted to receive the same course of treatment. With all the special tools ready, many of the new parts nearly done (for when I had to make a new part for the first engine I had roughed out a duplicate for the other one) and with the advantage gained by the experience in knowing just what I was going to do, the second engine was put in shape in a few days. Not one minute of running time was lost by the shop and except for the three noon hours there was no overtime work done.

I saw that little engine last summer. It was clattering away as noisily and blowing away steam as recklessly as before I made that repair, but except for minor adjustments there had been no work expended upon it since that far-off March in 1897 when the engineer blamed me for "spoiling" his engine because "he couldn't tell whether it was running or not without looking at it."

The Law of the Involute Curve

Principles Developed in Preceding Article Applied to Generating Gear Teeth—Adapting the Milling Machine to Cutting Gear Teeth with the True Involute

By O. G. SIMMONS
Vice-President and General Manager,
Simmons Method-Hob Company

FROM THE theory of the involute curve developed in the preceding installment published on page 801 of *American Machinist,* it is apparent that involute curves may be generated in a lathe or a milling machine. In the case of the lathe, a piece of cardboard or metal plate is attached to the faceplate and a scriber or cutting point is placed in the toolpost so that the point is high enough above the center to coincide with the tangent line in our proposition of Fig. 1 in the preceding article. The proper change gears are placed in position to give the required lead to the cutting point. If the faceplate is rotated, the cutting point will generate an involute curve, which we now see is identical with the method which Fig. 1 demonstrates.

If, instead of a cutting point, we were to substitute an end mill, we could generate a right- and a left-hand involute curve and also the clearance space between these curves by one pass of the end mill across the blank being operated upon. Evidently, these curves can be generated according to the proposition illustrated in the previous article in Fig. 2, where two points could be used, one to generate the curve of one hand on approaching the blank, and the other the curve of the other hand on leaving the blank.

It is evident also, that the principle of Fig. 3, in the previous article could be used as that underlying the generation of involute curves, with the use of an end mill or a reciprocating planer tool as the cutter in a milling machine. This method is illustrated in Fig. 4 in which are clearly shown the end mill and the gear being operated upon, as well as the change gears necessary to obtain the lead of the involute curve. The position of the end mill can also be seen. The end mill rotates about a vertical axis, while the gear blank being operated upon has not only its rotary movement, but also a lineal movement, which is identical with the method Fig. 3 describes.

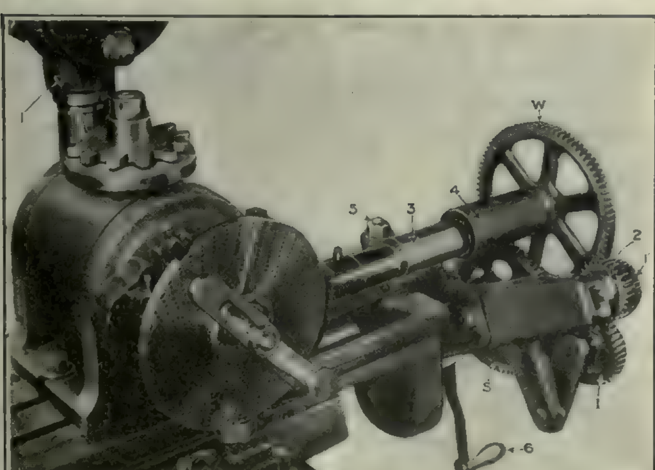


FIG. 4—MILLING MACHINE ADAPTED TO CUTTING AN INVOLUTE CURVE ON GEAR TEETH

Instead of a single marking point, however, which was shown in Fig. 3, we have an end mill provided with a series of cutting points rotating about a fixed axis. The fixed axis, of course, is the axis of the spindle of the vertical milling attachment indicated by the numeral *1* in Fig. 4. The end mill and the involute curves of the gear teeth are also visible. The axis of the gear shown is parallel to the axis of the spindle of the vertical milling attachment. This is accomplished by simply setting the spindle of the index head in a vertical position, by means of the degree graduations provided on all index heads.

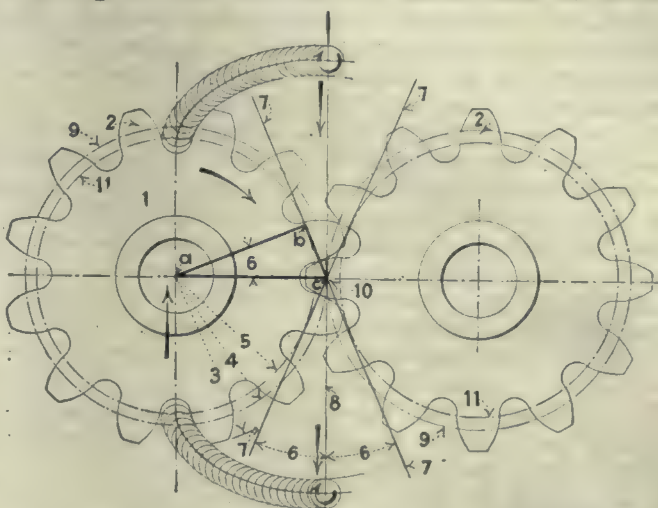


FIG. 5—DIAGRAM OF GEARS SHOWING BASE CIRCLE AND PRESSURE ANGLE

The writer believes that we should not leave this subject until the generation of the involute curve by mechanical means in an actual machine is described, as such a matter will, undoubtedly, result in a clear and precise understanding of the curve and its underlying law. Let us take, therefore, one concrete embodiment of the idea, as illustrated in Fig. 4, and generate the involute curves on the teeth of the gear shown.

Let us assume the gear is to have 12 teeth, 2.5 diametral pitch and a pressure angle of 22½ deg. Such a gear is illustrated in Fig. 5 in which the numeral *1* indicates the gear provided with the teeth *2*. The numeral *3* indicates the radius of the circle which forms the periphery of the gear, while the numeral *4* indicates the radius of the pitch circle, and the numeral *5* the radius of the base circle.

The base circle of the gear *1*, Fig. 5, is the evolute of the involute curves forming the faces of the teeth *2*. In order to determine the lead of the involute curve forming these faces, it will first be necessary to determine the diameter of the base circle. This measure of the diameter of the base circle is easily determined from the pitch circle diameter and the angle of pressure, both of which are known or determined from the data given

previously. The pitch circle diameter is found by dividing the number of teeth in the gear by the diametral pitch, giving the formula:

$$D = \frac{N}{P}$$

D = pitch circle diameter
P = diametral pitch
N = number of teeth

Substituting the values for the letters, we have:

$$D = \frac{12}{2.5} = 4.8 \text{ in.}$$

Thus, the diameter of the pitch circle is found to equal 4.8 in., and the measurement of the radius *4* of the pitch circle will equal 2.4 in. Having established this measurement, the measurement of the radius *5* of the base circle is easily determined by means of the right angle triangle *abc* with the right angle at *b*. The pressure angle is equal to 22½ deg. so that the pressure lines, indicated by the numeral *7*, have been constructed with an angle *6* equal to 22½ degrees.

It is to be noted that the pressure lines become such only when they intersect each other at the common point of tangency *10*, of the line *8* and the pitch circle *9*. It is evident that angle *bac* is equal to 22½ deg. and that the side *ab* is equal to the measurement of the radius *5* of the base circle. Further, the side *ac* is equal to the measurement of the radius *4* of the pitch circle *9*. The known elements of the triangle *abc* having thus been established the following equation is evident:

Side ab = side $ac \times \cos bac$

Substituting values for the letters, we have the following covering the special case under consideration:

ab = radius *5*
$ab = 2.4 \text{ in.} \times \cos 22\tfrac{1}{2} \text{ deg.}$
Radius $5 = 2.4 \text{ in.} \times 0.92388$
Radius $5 = 2.217312 \text{ in.}$

From these formulas, the diameter of the base circle which is the evolute being considered, equals twice the measurement of the radius *5*, or 4.434624 inches.

Direct Method of Finding Involute Lead

The foregoing details have been given in the interest of simplicity and to make clear all the steps covered in arriving at the measurement of the diameter of the base circle. A more direct and general method to arrive at this measurement now presents itself. Advantage is taken of the two given factors controlling the diameters of all base circles. As the pitch circle diameter is always known or quickly ascertained, and the pressure angle is always known, no further information is necessary. The diameter of any evolute or base circle may be expressed as follows:

$D'' = D \cos \alpha$
D'' = diameter of evolute
D = diameter of pitch circle
α = pressure angle

According to the law of the involute, stated in the previous article, the lead of any involute curve is equal to the perimeter of the evolute. Now our evolute is the base circle which we have under consideration, and its diameter equals 4.434624 in. To obtain the perimeter measurement, we have only to multiply the diameter measurement by 3.1415926535 which results in a lead of 13.9317821794247840 in. for the involute.

Ordinarily, the constant 3.1416 is close enough for machine construction purposes. It is usually found necessary to drop some of the decimals as we shall find in our present case. We may write our involute lead as equal to 13.9317 in. which will still be away inside any accuracy required or possible with the commercial manufacturing machines at our disposal.

It now becomes necessary for us to determine the change gears to produce the desired lead as just determined. The methods and rules for determining such change gears are given in several publications on milling machine practice and in many handbooks. These may be referred to by the reader, who, without doubt, is already thoroughly familiar with the subject. We have, therefore, only to look up the chart furnished with milling machines and, under the table of "leads," we find that the nearest lead to the one we desire is 13.933. This lead is near enough as it gives an error of only 0.0013 in. in over 13 in. The change gears to produce this lead, taken from the table, are:—

$$\frac{\text{Driven}}{\text{Driver}} \quad \frac{86 \times 56}{48 \times 72}$$

We now place these gears as indicated: The 86 gear on the worm indicated by the letter *W* in Fig. 4; the 56 gear on the stud indicated by the numeral *2*; the 48 gear on the stud indicated by the numeral *1'*; and the 72 gear on the screw which the letter *S* indicates.

We must now determine whether or not the rotary movement of the index head and the linear movement of the table are according to the proposition of Fig. 3 in the previous article. The evolute, we know, must roll on the line tangent to it. As becomes evident upon inspection, an idler gear must be introduced into our train of gears to give us the relative movements desired. We, therefore, place the idler gear, indicated by the letter *I* in Fig. 4, in our train of gears so that it engages the gears indicated by letter *S* and numeral *2*.

Milling machines have not been designed for these methods of generating involute curves. It is necessary, therefore, in order to generate right- and left-hand involute curves with a single pass across the end mill, to introduce an extension shaft secured to the worm shaft of the dividing head and to journal the extension shaft in a bracket secured to the table. The shaft referred to is indicated by the numeral *3* and is journaled as shown, in the bracket *4*. This bracket is secured to the table of the machine by means of the bolts *5*, one of which Fig. 4 clearly shows.

The index plate is arranged for twelve divisions, as

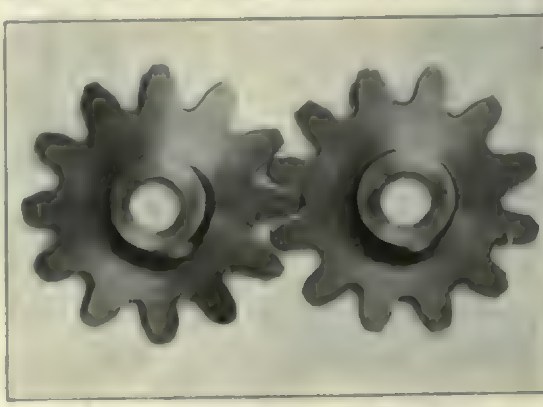


FIG. 6—PAIR OF PINIONS CUT ON A MILLING MACHINE

twelve is the number of teeth in our gear. We are now ready to generate involute curves according to the method illustrated in Fig. 3 of the previous article, using the mechanical means just described.

With reference to Fig. 5, it is noted that our evolute

or base circle is imaginary only, although it is represented by means of the circle *11*, and is well within the diameter of the blank which has the radius *3*. Mechanics will understand generally that the material to be removed between the teeth will require several cuts. Let us assume that the depth of the tooth, in order to have the center of the end mill coincide with the line tangent to the evolute at the proper depth, will equal 0.7885 inches. The center of the end mill may be well inside the tangent line without materially affecting the involute curve being generated or the thickness of the teeth of the gear.

Having decided the depth of the tooth, we can see that by removing 0.110 in. we can make seven cuts and a final cut of 0.0185 in. to finish the gear complete, or eight cuts in all. A left-hand two-lipped slotting end mill, of the high speed steel type, will accomplish nicely the first seven cuts, and a left-hand spiral end mill, shown in Fig. 4, will complete the last or finishing cut.

How Material Between Gear Teeth Is Removed

Proceeding on this theory we move in the table until the mill just touches the blank. To accomplish this, it is necessary to move the table longitudinally by means of the crank handle *6*, in Fig. 4. This will cause the blank to roll past the end mill. When the mill just touches, the graduated dial on the transverse screw should be set at the zero mark. If a left-hand end mill is used, the blank should be moved to the right of the mill to clear the mill, and the table should be moved in the 0.110 in. for the first cut. The feed is then thrown in so that the table moves to the left rolling the blank over the left-hand end mill.

When the mill leaves the blank, the machine should be stopped and the blank should be returned to its original position to the right of the mill and then indexed. The machine should be started and the cut taken for the second tooth, and so on until the first cut on all teeth has been completed, whereupon the table is moved in for the second cut and the cycle repeated until the gear is finished.

It is now obvious that we have, by positive mechanical means, generated true involute curves, the truth of which are dependent only upon the accuracy of the apparatus used. In other words, the inaccuracies of our apparatus are unquestionably reflected in the involute curves generated in the blank but to a smaller degree. A pair of twelve tooth pinions cut as previously described is shown in Fig. 6. The involute curves are clearly distinguishable as well as the circular curve lying below the base circle, which the line drawing of Fig. 5 shows.

Method Practical for Large Gears

The foregoing method is not a commercial possibility on the ordinary run of gears. It is practical, however, for large gears where the cutter cost becomes a factor. This method is used in the plant of the Simmons Method-Hob Co. to generate the curves on circular gear cutters by means of metal cutting tools before the cutters are hardened, and by means of abrasion or grinding after hardening. In this latter event, a disk emery wheel is substituted for the end mill.

We know now what an involute curve is and we are able to define it. We know the law underlying all involute curves and we can generate such a curve by a positive mechanical means admitting only of infinitesimal mechanical errors in which the human equation does not enter. We are now able to refer to an involute curve in terms of its lead. When one says an involute curve has a lead of 15 in., what is meant is immediately pictured in our minds just as though one were to say a circle is 15 in. in diameter.

A circle is referred to in terms of its diameter. We can, therefore, refer to an involute curve in terms of its lead and have an equal and complete understanding of what is meant. Many things are thus immediately given light, so that we are now prepared to apply this curve intelligently to the teeth of gear wheels.

Brief Reports Save Time

By Frank V. Faulhaber

In making out reports in the machine shop some foremen become vexed because of the extra time involved in the work. On close study it has been found that in some plants the reports that are sent in are entirely too long. Some foremen will take longer to get over their reports and this naturally points to another inefficient system. Too, when foremen are irked because of this problem, they naturally will cut themselves away from the pencil wherever possible and this means they will not take notes for their own benefit. They will thus neglect many important memorandums, such as the requirement of new stocks, etc.

In one progressive plant the superintendent has passed around the advice that reports be made brief as possible, thus to economize time. This executive observed: "It is laughable when you read some of the reports sent. We require reports from our assistant foremen, too, and it seems some of the fellows make large reports simply to have something to send in.

"On the other hand there are executives who will undervalue the importance of these reports. We find it necessary to remind them that they should send in all possible reports that in any way will help us in getting out better work, more of it, and to enable us to keep accurate tab on results. By educating each of our executives on sending in regular reports, brief, yet not overlooking anything important, we are getting more cooperation from them. A few hints have helped us materially in getting terse reports, thus saving time of the one who writes them and those who read them."

Firing Without Sufficient Cause

By A. W. Forbes

I have noted a number of articles in your paper in which it is stated that men are fired from industries with but little cause. And now the leading editorial states that it is still quite common to fire a man because "There is temporarily something wrong with his headstock."

I wonder if this can be true. Of course most persons that are fired have a long record of unsatisfactory work which culminates in a single act, and they often think that it is the single act for which they were fired. But did you ever know of a case where you knew the side of the management where anyone was fired for anything of a temporary nature? I have known of one such case. In a neighboring shop a new man set the building on fire through carelessness before he had been working long enough for the management to find out whether he was a good man or not. They did not keep him long enough to see. This is the only case I have known of.

Germany—Exports and Imports of Metal Working Machinery—("Maschinen zur Bearbeitung von Metallen")

Exports

Country	1909 Quantity 100 Kgs.	1909 Value 1000 Marks	1910 Quantity 100 Kgs.	1910 Value 1000 Marks	1911 Quantity 100 Kgs.	1911 Value 1000 Marks	1912 Quantity 100 Kgs.	1912 Value 1000 Marks	1913 Quantity 100 Kgs.	1913 Value 1000 Marks
Belgium	20,060	3,144	39,832	4,532	41,209	4,749	39,926	4,063	66,745	6,660
Bulgaria	1,606	104	1,701	344	2,402	245	2,348	247	936	104
Denmark	6,880	1,132	6,903	1,194	7,496	726	8,477	874	10,707	1,362
France	51,491	5,497	68,794	8,062	82,575	8,356	91,945	10,036	119,065	12,776
Greece	472	78	489	72	550	59	672	79	756	81
Great Britain	12,455	1,716	23,805	2,744	19,623	2,630	26,162	3,037	55,137	5,900
Italy	63,552	8,324	62,754	8,025	101,580	7,370	58,093	6,159	57,525	5,906
Netherlands	13,650	1,955	16,286	2,370	19,030	1,951	19,357	2,110	36,412	3,282
Norway	3,756	592	3,932	629	6,275	661	8,617	909	7,161	842
Austria-Hungary	71,700	10,294	85,510	11,415	97,648	10,461	107,631	11,609	113,089	12,460
Portugal	1,360	221	1,366	218	1,722	252	1,511	254	2,290	322
Roumania	3,289	487	3,601	366	6,253	577	8,291	811	5,124	561
European Russia	50,916	4,767	42,238	6,779	65,500	7,071	81,624	8,975	130,770	15,096
Asiatic Russia	354	63	527	116	876	89				
Finland	3,040	597	2,904	477	2,562	275	2,708	325	3,203	356
Sweden	9,134	1,474	8,684	1,348	10,321	1,127	12,402	1,500	17,170	2,095
Switzerland	23,916	3,641	23,684	3,678	26,869	3,096	25,612	3,266	25,905	3,062
Serbia	516	74	800	142	790	74	614	76	259	30
Spain	6,752	952	5,083	780	6,883	775	9,789	1,225	15,060	1,825
Turkey in Europe	621	122	609	110	2,866	343	3,164	417	1,392	160
Turkey in Asia	222	40	530	89	485	48				
Egypt	503	78	180	39	586	60	310	39	790	70
British South Africa	405	43	662	86	253	32	449	54	560	69
German Southwest Africa	443	48	900	120	646	61	507	57	590	64
German East Africa		..	..				960	106	825	93
Tunis	...	...	...		...	...	58	8	501	58
British India	434	79	4,534	407	1,132	122	567	74	1,300	136
China	1,298	153	2,397	241	2,704	423	650	95	2,257	240
Japan	1,104	173	2,455	283	4,286	518	7,657	959	13,536	1,106
Dutch East Indies	1,597	218	1,810	272	2,279	241	3,028	328	4,237	405
Siam	1,446	120	303	48	95	15				
Argentina	9,937	1,616	12,249	2,000	16,245	1,835	15,235	1,777	14,465	1,672
Brazil	3,448	599	5,233	834	5,473	624	10,718	1,480	12,776	1,719
Canada	207	23	350	43	715	86	626	82	785	91
Chile	1,177	230	1,160	215	1,634	212	3,286	342	2,819	329
Mexico	566	96	625	93	576	67	466	83	523	84
Uruguay	488	120	1,264	224	1,394	151	1,408	177	1,194	135
United States of America	6,501	720	8,729	1,091	6,662	944	9,819	1,171	12,591	1,709
Australia	629	98	1,364	164	1,992	263	2,368	276	2,042	244
Total	365,102	50,320	447,037	60,991	553,153	57,271	570,808	64,306	743,358	81,837

Note.—No statistics are available for the period 1914 to 1919 inclusive. Returns for 1920 and 1921 do not show this classification in the figures showing exports.

Imports

Country	1909 Quantity 100 Kgs.	1909 Value 1000 Marks	1910 Quantity 100 Kgs.	1910 Value 1000 Marks	1911 Quantity 100 Kgs.	1911 Value 1000 Marks	1912 Quantity 100 Kgs.	1912 Value 1000 Marks	1913 Quantity 100 Kgs.	1913 Value 1000 Marks	1920 Quantity 100 Kgs.	1920 Value 1000 Marks	***1921 Quantity 100 Kgs.	***1921 Value 1000 Marks
Belgium	1,759	214	1,134	156	2,044	260	2,588	323	2,356	340	......	......	......	......
Denmark	651	61	422	47	332	38	483	58	391	49	......	......	......	......
France	1,768	292	1,561	218	2,722	383	3,034	486	2,207	363	......	......	......	......
Great Britain	10,066	896	6,150	683	9,430	853	7,104	816	9,694	1,015	......	......	......	......
Italy	445	65	198	37	620	72	701	92	222	36	......	......	......	......
Netherlands	149	28	128	26	574	80	378	69	690	83	4,011	......	206	......
Norway	759	65	1,666	141	1,270	117	112	21	63	10	......	......	......	......
Austria-Hungary	2,259	328	6,213	573	1,745	258	2,161	325	1,596	332	*1,999	......	1,086	......
Sweden	522	80	939	108	483	86	293	66	497	89	1,101	......	......	......
Switzerland	1,447	272	1,545	308	2,945	491	3,913	731	4,120	718	741	......	1,294	......
United States of America	25,485	3,661	32,199	4,594	41,938	5,172	53,994	7,126	41,995	5,804	......	......	......	......
Other Countries	......	......	......	......	......	......	......	......	......	......	2,253	......	2,210	......
Total	45,478	5,988	52,349	6,917	64,328	7,848	75,036	10,161	64,270	8,911	10,105	**	5,121	14,206

*Austria only. **No value given for 1920. ***Statistics are for period May to December inclusive for 1921.

S. A. E. Production Meeting Papers

Abstracts of Eight of the Principal Papers Presented at the Production Meeting of the Society of Automotive Engineers, Detroit, October 26-27

Some Causes of Gear-Tooth Errors and Their Detection

By K. L. Herrmann
Engineer, Studebaker Corporation of America

IT IS THE purpose of this paper to show that production variables have a much greater influence on gear sounds than changing pressure-angles, steel or tooth-form details; also, by showing the errors present, to obtain definite help from the gear-cutting tool and the machine designer. We will confine this discussion, for the time being to the transmission, which is the simplest type of gearing used in the motor car.

It is not sufficient to check gears for spacing error from tooth to tooth. It is very desirable to check the accumulated error of a number of teeth, because a gear may vary 0.001 in. from tooth to tooth. With eight successive teeth each gaining 0.001 in. on the side of the gear and a similar number of teeth that may be losing 0.001 in., a total error of 0.016 in. might be imparted to the driven gears.

Figure 1 illustrates a very simple device that has been used for checking tooth spacing. The gears are mounted on a bushing and one tooth comes against a stop. A dial indicator is arranged so as to be in contact with some tooth one-fourth, one-third or one-half way around the gear. When the dial indicator is set at zero, with the tooth against the stop at any one point, the distance between the two points can be measured and, if the gear be correct for indexing, placing any of the two teeth in the gear in similar positions should not cause the dial indicator to vary, especially if the gear runs true.

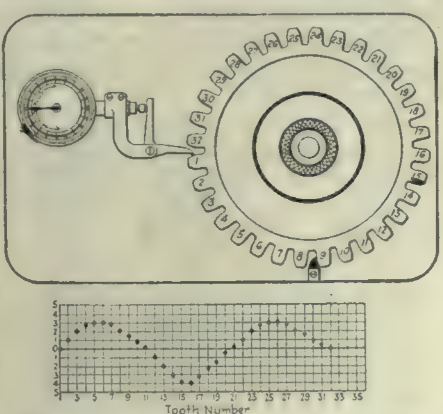


FIG. 1—CHECKING TOOTH SPACING

When the gear is first put on the indicating apparatus, the dial indicator is set at zero. We then put a mark at zero on the chart in Fig. 1 for tooth No. 1. The next step is to index the gear around one tooth. Any reading obtained is marked above the tooth number in the vertical line. We next index the gear around to tooth No. 3 and again mark the dial-indicator reading opposite the number of thousandths of an inch that it may show. The gear is then indexed to teeth Nos. 5, 6, etc., until all the teeth on the gear have been indexed.

For the purpose of record, we now have a chart showing the accumulated variables. It will be seen from Fig. 1 that at no point is the spacing variable as great as 0.001 in. between any two teeth, but it can be in error a total of 0.008 in. or more when the error between the several teeth has accumulated.

Hum or sing is not nearly so difficult to analyze as the matter of rattle in a transmission gear. If the teeth are not correct in shape and the gears are under a slight load, there may be 250 blows per sec. under certain conditions, which we are told corresponds to the tone of middle C on the piano. Should fewer teeth go into and out of mesh, and this may be caused by a slower speed, a much lower pitch can be produced.

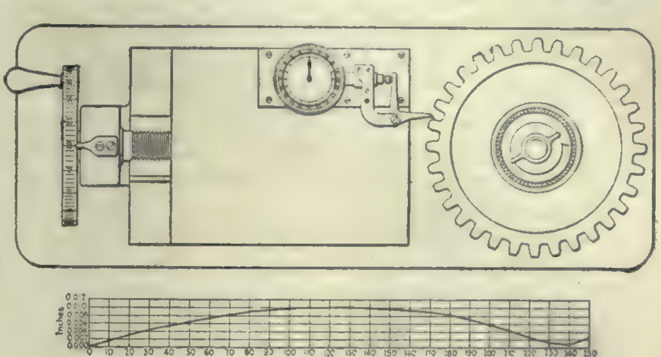


FIG. 2—ANALYZING TOOTH FORMS

In a similar way, because of the speed reduction that occurs in the usual type of transmission between the drive pinion and its countershaft, the tone produced by the reverse idler is very low and, instead of producing a hum or sing, it will produce what we usually call a growl. Errors in the sliding gears, because of their higher speeds, will produce higher pitch growls and approach a hum.

A great many instruments have been developed for the purpose of analyzing tooth-forms producing these sounds. The one that we have worked out and have

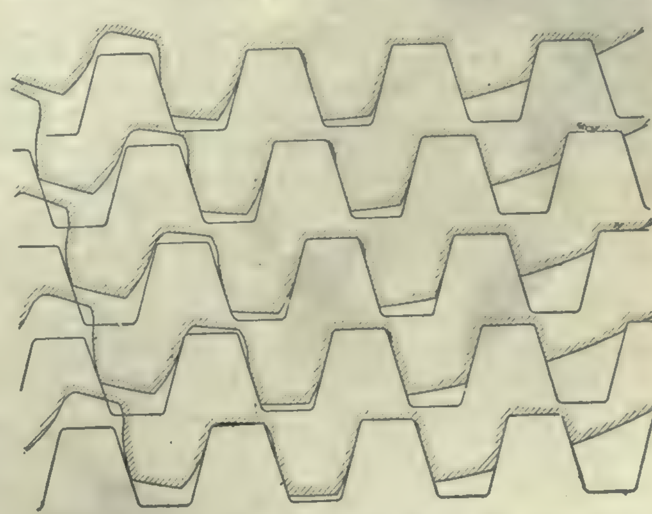


FIG. 3—OUTLINE OF TOOTH FORM PRODUCED BY HOBBING

chosen to use is shown in Fig. 2. It consists of a dial indicator mounted on a guided slide. We place the gear in a definite positon with respect to the indicator, start at the point of the tooth and set the indicator at zero.

The slide is then moved toward the gear 0.010 in. and the indicator-reading marked on the chart shown in the lower portion of Fig. 2. The slide is then moved 0.010 in. more, the reading is marked again, and this is continued until the bottom of the tooth is reached. By taking the gear that has just been charted off the bushing and placing another gear in its place, other tooth-forms will be compared with the first.

The causes of the errors referred to are various. Some of them occur in hardening, some in the cutting machines and some in the cutters. We have found these errors in all of the types of machine that we have used. For the purpose of this discussion we are selecting a hobbing machine.

The hob is a generating tool that produces a gear such as is shown in Fig. 3. It will be seen readily that if all tooth-heights of the hob are the same, each hob-tooth

FIG. 4—LAYOUT TO DETERMINE TOOTH LENGTH

generates, roughly, a flat in the tooth-form. If any one of the teeth in the hob is high, a wider flat will be produced. Should the tooth-heights be correct and the hob be mounted in the machine with a run-out, a leaning tooth can be produced, depending on the sideways setting of the hob with the ge r. Also, should the hob be correct and the end-thrust collar in the hob spindle be out of parallel, giving the hob a slightly reciprocating motion with each revolution, an error can be produced that may compensate for the hob run-out or may add to it.

Should the thrust collar at the rear end of the spindle be adjusted loosely so that the spindle may have end-play, the hob, as it cuts on one side, will be forced over and then back with each tooth of the gear and produce corresponding errors in the tooth-form. Again, if the

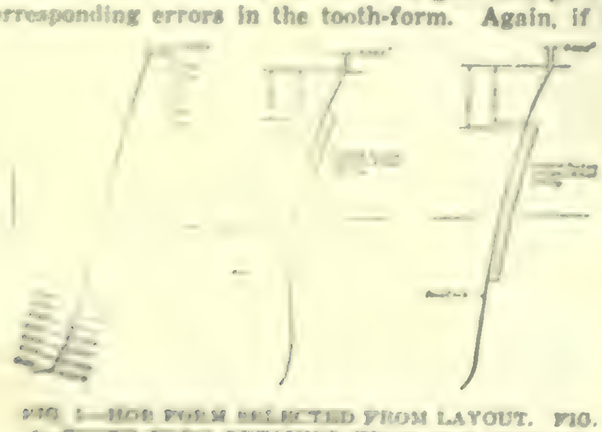


FIG. 5—HOB FORM SELECTED FROM LAYOUT. FIG. 6—TOOTH FORM OBTAINED FROM HOB OUTLINE

gears in the hob-grinding spindle have inherent index-errors in them, or should the gears driving this gear be concentric or improperly spaced, their errors will be transfered to the different teeth of the gear being cut.

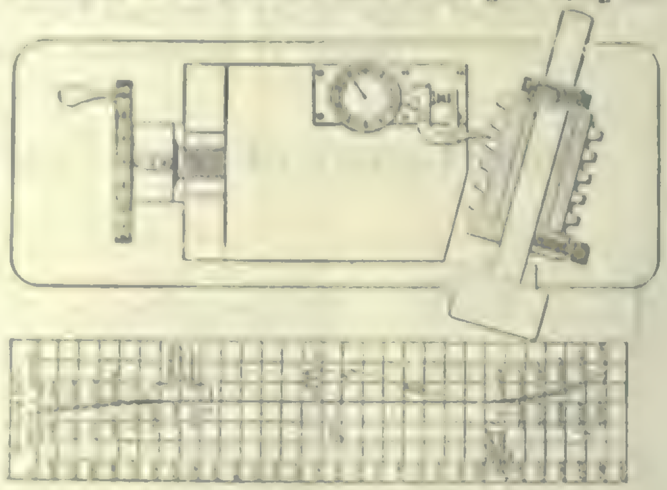


FIG. 7—HOB CHECKING DEVICE

Another important element in connection with the hob is the fit of the hob spindle.

We will all agree that, should the hob spindle be tight for a certain portion of the revolution and loose for a certain other portion of the revolution, a sagging will occur in the driving-gear train which will be very detrimental to the tooth-form. Some hobbing machines are built so that the bevel gears in the hob drive-spindle give a thrust in the opposite direction to that given by a spiral pinion driving a hob-spindle gear. This permits a back-and-forth movement of a hob-spindle drive-shaft and sometimes leaves its impression on the tooth-form.

Without going into the details concerning the other gears in the hob-spindle train, we might consider the influence of the thrust collar on the fits of the work spindle. In most hobbing-machines the bearings are kept fairly tight, and a great many operators insist that the hob spindle be kept warm. This also applies to the worm-shaft driving the wormwheel and, to a certain extent, to the work spindle.

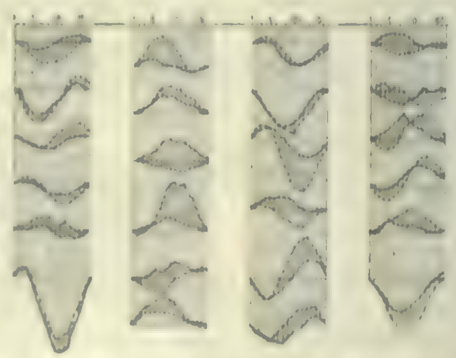


FIG. 8—VARIATIONS IN 24 GEARS

Unless the machines are extremely well adjusted, the thrust collars on the spindles so fitted score very easily and cause the spindles to be tight or loose at various portions of their revolutions. This causes a corresponding sag in the gears driving the index wormwheel and seems to be the main cause of the index errors already referred to. Another source of error is looseness in the gibs of the hob saddle.

It is very difficult to move the hob slide across the face of the tooth without having some play between the gibs. This amounts, in a very similar manner, to the error that is obtained by having end-play in the hob spindle. Another contributing error to tooth-form is depth of cut. There will be considerable error in the

tooth-form if the hob is sunk several thousandths of an inch too deep.

Should the hob be straight-sided, the pressure-angle will increase with the depth of the cut and decrease as it is raised above the pitch-diameter. Another factor having considerable influence is the outside support for the hob spindle. We have had considerable difficulty in placing this outboard support of the hob spindle back in exactly the same place, giving us exactly the same condition of hob spindle as before.

When the work spindle is caused to rotate ahead of or behind its proper position, we necessarily have certain tooth-form errors in addition to index errors, and also in addition to those produced by the hob, its spindle and driving mechanism. There are conditions under which some of the errors referred to are counterbalanced by other errors. There are conditions, however, in which these errors accumulate. Considering the number of gears in a hobbing machine and the number of possibilities for errors outside of these gears, it is largely a matter of chance whether suitable combinations can be obtained to produce proper tooth-forms.

Details of Tooth-form

The details of tooth-form are of some importance. Continuing with transmission gears, Fig. 4 shows the first layout which we make. This is with a view to determining the amount of tooth length necessary to give a 100-per cent arc of contact. With this information in hand, we select a hob form such as is shown in Fig. 5 and, using this on paper, we roll out two tooth-forms as shown in Fig. 6, one for each of the gears that are intended to be in contact with each other. The next step is to roll these gears on each other to determine the interferences, if any, and the amount that they are topped-off; then, if necessary, the hob form is modified and the same procedure carried through. When the hob form is established on paper in this manner, it is charted as shown in Fig. 7 and the hob supplier is asked to conform to this shape. Definite tolerances are given for the amount of variation from this form. On receipt of the hob, we inspect this form on a hob-checking apparatus very similar to that which we use for checking gear-tooth forms, a drawing of which is shown in Fig. 7. If these conform to our standard requirement, it is expected that the hob will be satisfactory.

Hardening of Gears

Relative to the errors produced by hardening, we have prepared a number of charts showing the condition of the gear in the green and the condition of the gear in the hard. The question as to whether oil-treated steel is better than carburized is still unanswered as regards warpage. We have hardened more than 5,000 gears of different brands of steel and carefully checked them. We find that there is very little difference in the warpage under the same hardening conditions.

The necessity for grinding gear-tooth forms depends largely on our ability to cut and harden gears, maintaining definite shapes. However, there is a large difference in the number of rejections that we have from gears ground by different processes. Our reports at this time show that out of 5,000 gears ground by one method we have had a 14-per cent rejection. This is slightly greater than that which we have had from the hob gear without grinding. By another method of grinding of a similar number of gears, we have had less than a 0.5-per cent rejection, as well as more satisfactory gears. In the first case, four gears of the transmission were ground, and in the second case only two gears of the transmission were ground. All transmissions were passed by the same inspector and inspected to the same standards. We, of course, are looking forward with great interest to the continuation of our experiment on gear-grinding.

Some Unique Features of Automobile Production

By William Dunk
Production Manager, H. H. Franklin Mfg. Co., Syracuse, N. Y.

ALL engineers realize that there are a large number of problems to be met in the production of automobiles, and that the majority of these problems are much the same with the H. H. Franklin Mfg. Co. as with any other. I will endeavor, therefore, to confine this discussion to the following topics that are somewhat unique in Franklin automobile designs; namely, (*a*) the production of air-cooled cylinders, (*b*) the making of case-hardened crankshafts, (*c*) the machining of duralumin connecting-rods and (*d*) experiments with hot-swaged rear-axle drive-shafts.

Production of the Air-Cooled Cylinder

The design of the Franklin engine necessitates the use of unit-cylinder construction rather than the regular block-cylinder design. This fact makes the production of the cylinder a somewhat different problem from that of machining a block casting. In the Franklin cylinder, the head is cast integrally with the body of the casting and steel cooling fins are cast in the outer surface of the cylinder-wall.

The foundry practice in connection with the production of these castings is of interest. The mold is composed of three distinct sections, the lower section being an assembly of dry-sand cores for making the head of the cylinder and the valve ports. Next above this section is a green-sand section containing the cooling fins, and the upper section of the mold is a green-sand section for the neck of the cylinder between the cooling fins and the bottom flange, the cylinder of course being cast in an inverted position. The core assembly for the head of the cylinder is made up of five unit-cores, made separately and assembled by pasting-in an accurate pasting jig so that the valve port cores are held accurately in position while drying. The valve-port cores are provided with prints to locate the upper end of the main cylinder-barrel core. For this reason it is necessary to be very accurate in the location of the port cores.

The cylinder pattern is milled longitudinally with the proper number of gooves to receive the vertical cooling-fins. These grooves are $\frac{1}{16}$ in. in depth, which corresponds to the amount that the fin is imbedded in the cylinder-wall. The green-sand section of the mold containing the cooling fins is made on an air-operated jar ramming-machine provided with a sand hopper directly above the mold. A very small amount of sand is used in this section of the mold, not over 2 in. of sand being provided outside of the diameter of the

cooling fins. The fins are held in place in the cylinder pattern by simply wrapping a piece of soft iron wire around them and twisting the ends tight. This wire remains in the mold until the casting has been made, and serves to keep the section of green sand that lies within the cooling fins from sagging below the rest of the mold. The upper section of the mold is also made in green sand and is located on the center section by taper dowels. The last operation in making the mold is the placing of the cylinder-barrel core and the strainer-gate core through which the metal is poured. The cooling fins are made of ordinary cold-rolled strip-steel which has been tinned and folded to a right angle about [illegible] in. from one edge. These cooling fins, when placed radially about the cylinder pattern, form a completely enclosed air-jacket.

The greatest source of casting loss that we experience in making this piece is caused by loose flanges. Unless the flanges extend at least [illegible] in. below the surface of the cast iron, they will not be properly held in place.

The analysis of iron used in making the Franklin cylinder is approximately as stated in Table I.

TABLE I—ANALYSIS OF IRON USED IN THE FRANKLIN CYLINDER

Constituents	Per Cent
Silicon,	2.00
Phosphorus,	0.50
Manganese,	0.50
Sulphur,	0.10
Carbon,	3.25

The machining operations are as follows: The cylinder casting is first mounted in a chucking fixture on the table of a small vertical boring-mill, and the bottom flange is faced and counterbored. This counterbore is used for locating the cylinder while drilling the four hold-down holes on the second operation. These hold-down holes are used for locating the cylinder for the boring operation, which is performed next. Our present method of boring the cylinder consists of making four separate cuts in the cylinder under a single-spindle Baker boring-machine. The necessity of making this number of cuts is caused by the fact that the cylinder-wall has no support to prevent its being split, if a heavy cut were attempted. The thickness of the metal of the finished cylinder between the cooling fins and the cylinder bore is only [illegible] inch.

A new cylinder-boring machine has just been completed and tested which makes five separate cuts in the cylinder, operating on five separate cylinders simultaneously. The first spindle of the machine rough-bores, and removes about [illegible] in. of metal from the cylinder-wall. The second spindle rough-bottoms the cylinder to within [illegible] in. of the finished depth. The third spindle semi-finish bores, and leaves 0.035 in. of metal for finish-boring. The fourth spindle finishes the bottom of the cylinder to depth, and the fifth finish-bores to grinding size. We are leaving about 0.007 to 0.010 in. of metal for grinding at present, and we may find it possible to reduce this to a maximum of 0.005 in. The fact that we are dealing with unit cylinders allows us to center each cylinder very accurately for the grinding operation. The complete boring operation as performed by the new cylinder-boring machine occupies about 1½ min. per cylinder.

The cylinder is ground on the standard type of Heald cylinder-grinding machine equipped with a special small table for unit-cylinder work. It is held against an ordinary angle-plate grinding-fixture, and is located with a plug through a master bushing inserted in the grinding fixture. Cooling water is flowed on the outside of the cylinder during the grinding operation. The valve ports in the cylinder are reamed holes about 2½ in. in diameter and 1 in. in depth. They are held to a limit of 0.001 in. to provide a sufficiently tight joint with the extension pieces that attach them to the suction and exhaust manifolds. A special double-head machine was built to bore and ream the port holes with accuracy required.

Briefly this machine consists of two three-spindle movable-heads operating toward a central holding-fixture on which four cylinders are mounted. There are three working positions and one loading position. The central fixture is arranged so that it can be indexed at the end of each stroke of the machine. The first pair of working spindles rough-bores the port holes to within 0.035 in. of the finished size. The second spindle does not remove any metal from the diameter of the hole but simply performs the bottoming operation. The third pair of spindles finish-reams the holes to size. By arranging the machine to operate on both ports at once, the thrust of the cutters has been neutralized almost exactly, because the ports lie nearly opposite each other across the cylinder casting. The cutters used in this machine for all operations are a standard type of shell-end mill, and they seem to give very satisfactory results. It is not necessary to change cutters oftener than one set to each 350 cylinders. The capacity of this machine is one complete cylinder every 40 sec. A particularly rapid means of loading and unloading the cylinder is necessary, to allow the operator to perform these operations during the cycle of the machine.

The valve-stem guides are separate castings machined complete and pressed into place in the cylinder casting, the final reaming operation being performed in the valve-stem holes after the guides are pressed-in. The seating and other minor operations on the cylinder are performed in the usual manner and do not require any special mention.

THE CASE-HARDENED CRANKSHAFT

Another interesting manufacturing detail is the Franklin case-hardened crankshaft, which we have been producing for the past two years. The primary object in incorporating this type of shaft is naturally to prolong the life, so far as possible, of the bearing surfaces. Preliminary experiments developed the fact that if a crankshaft can be hardened to a scleroscope hardness of between 80 and 100, the life of both the main bearings and the crankpin bearings can be prolonged considerably. In some of our test cars as much as 50,000 miles was covered without any adjustment of bearings being necessary.

In putting a proposition of this kind into production, a number of problems had to be met concerning which very few data were obtainable. The crankshaft forging has a carbon content of from 0.15 to 0.25 per cent and the required depth of carburization is specified at [illegible] inch.

In the manufacture of this shaft, the forging is first machined to within 0.040 or 0.045 in. of its finished diameter, with the exception of the flange and threaded ends which are left in the rough. The forging is then ready for the copper-plating operation, which is applied to prevent carburization of all parts of the shaft except the bearing surfaces. Several ideas were tried out in connection with preventing the copper-plating of these surfaces during the process, and we finally adopted the method of wrapping all bearings with pure gum rubber

held in place with clips. The rubber bands are easily removed and can be used again and again.

In carburizing the shafts they are packed, three in a box, in nickel-alloy carburizing-boxes, using either Q alloy or thermalloy. The approximate size of the carburizing boxes required is 12x44 in., and about 18 in. deep. A liberal amount of carburizing material is provided around each shaft. The boxes are sealed with the regulation cement and are loaded into the carburizing furnaces by a specially constructed charging truck, each furnace-chamber having a capacity of six boxes and each box having a total weight, loaded, of about 800 lb. The carburizing period necessary to get the required depth of penetration is between 22 and 24 hr. The use of nickel-alloy boxes seems to have a decided tendency to reduce the number of hours required to get this penetration.

Machining After Carburizing

At the end of the carburizing process, the shaft is returned to the crankshaft-machining department, where the flange end and the threaded end are machined, roughly, to the finished dimensions, this operation having the result of removing all of the carburized surface. This allows for the machining of these parts after the shaft has been hardened.

The shaft is then returned to the heat-treating department and reheated in a gas-fired furnace to a temperature of 1,420 deg. F. To keep the shaft as nearly straight as possible during the quenching operation, a hinged type of quenching die was devised that permits rapid loading of the shaft as soon as possible after removing it from the furnace. This die is of very heavy construction, and is handled by an air hoist. The shaft is quenched in water at main temperature, and comes from the quenching operation usually not over $\frac{1}{16}$ in. out of straight. It is necessary to straighten the shaft carefully at this point, before proceeding with the semi-finish and finish-grinding operations.

We have found it necessary to divide the finish-grinding operations into semi- and finish-grinding so as to use a rather coarse soft grinding-wheel for the semi-finish grinding in bringing the shaft to the finish-grinding size. The last 0.005 in. of metal is removed from the shaft with a very fine soft wheel to get the required smoothness of finish.

One somewhat uncertain feature that we always meet in the production of this shaft is the amount of shrinkage that will take place in the hardening operation. It is necessary to anticipate this, and to provide for it in machining the soft shaft. Our experience has shown that this shrinkage varies to a considerable degree. Our normal allowance in the overall length of the shaft and the spacing of the bearings is about 0.035 in. for a $5\frac{1}{2}$-in. center-distance between cylinders. We find that this allows us to finish the shaft within the limits required for length, in the majority of cases.

Our scleroscope-hardness requirements of 80 to 100 give us a shaft that has exceptionally long life. I neglected to state, however, that the point of contact of the quenching die with the shaft produces very small soft spots; but they do not seem, as a rule, to interfere with the general durability of the bearing surfaces in any way.

The Franklin connecting-rod is an aluminum-alloy forging, either of duralumin as furnished by the Baush Machine Tool Co. or of 17-S alloy furnished by the Aluminum Co. of America. This aluminum alloy contains the elements given in Table II.

TABLE II—ANALYSIS OF ALUMINUM ALLOY IN THE FRANKLIN CONNECTING-ROD

Constituents	Per Cent
Copper,	3.50
Manganese,	0.20
Magnesium,	0.25
Iron, not more than,	0.75
Silicon, not more than,	0.75

The elastic limit of the forging is between 30,000 and 35,000 lb. per sq.in.; the ultimate-strength is between 50,000 and 55,000 lb per sq.in.; and the elongation is from 15 to 25 per cent.

The forging is heat-treated by heating it to 920 or 940 deg. F., and is quenched in boiling water. It is then allowed to age about one week to bring it to a scleroscope hardness of 90 to 100.

We use about the following procedure in machining the duralumin forged connecting-rod. The forging is first coined under a heavy toggle-press, bringing the length of the wristpin and crankpin ends to within 0.025 in. of the finished size. It is then loaded onto a special fixture on a Blanchard grinding machine that has alternate roughing and finishing stations. It is ground first on one side, then removed from the roughing station, moved to the next adjacent station and finish-ground on the other side. A special multiple-spindle boring and reaming machine having an indexing table is used for boring and reaming the wristpin and crankpin holes. The operations which this machine performs are to rough-drill, rough-ream and semi-finish ream.

The action of the forging in these machining operations is similar to that of mild steel. The power required to drive the drills and reamers is approximately the same as the power we employed formerly with our steel connecting-rod, and the cutting speed does not exceed that for steel by more than 25 per cent. In machining this forging, it surprised us to find that it machined so nearly like a steel rod. We had anticipated being able to machine this rod at a much greater speed than we found possible. The extreme toughness and wire-like quality of the chips are convincing proof that the metal with which we are dealing is something more than ordinary aluminum.

Other Machining Operations

The forging is next drilled for the rod bolts and is then put over a multiple fixture for parting the cap from the rod and facing the seats for the bolts and nuts. A broaching operation follows for providing slots in which the lower-end babbitt blocks are locked. These babbitt blocks are forced into place and broached to their semi-finished size in an ordinary two-spindle broaching-machine. The finishing of the wristpin end of the rod has been rather difficult, because it is impossible to ream a sufficiently good wristpin hole in the bearing end. Our present method of handling this operation is to semi-finish ream this hole, removing about 0.025 to 0.030 in. of the diameter, then to use a final reaming operation that removes about 0.005 in. and a final burnishing operation that is done with a high-speed burnishing-tool under a copious flow of regular medium automobile motor-oil. We find that by leaving a uniform amount of about 0.005 in. on the diameter we can produce a highly burnished surface in the wristpin hole and maintain very uniform size.

However, to obtain the fits required by our engineering department between the wristpin and the connecting-rod, it is necessary to do a certain amount of wristpin selection. When it is finally finished, the alignment of this rod is held to a limit of ±0.005 in., measured between the ends of arbors 12 in. long.

The finishing to size of the lower end of the rod is left until it is ready for assembly with the crankshaft. This operation is performed on a special type of boring machine in which we use boring bars of five separate diameters, increasing their diameters in steps of 0.00025 in. from the minimum size required up to the maximum; this allows us to cover the entire range in the crank-pin bearings with the proper amount of oil clearance. At this time we use an oil clearance of about 0.001 in. for this bearing.

The weights of the finished connecting-rods run very uniform, it being necessary to maintain but two standards of weight to keep within the limits specified by our engineers, which are a variation in weight of any two connecting-rods on an engine of not more than 0.2 ounce.

Hot-Swaged Rear-Axle Driveshaft

We have been experimenting for the past 18 months with the production of driveshafts by the hot-swaging process but, up to the present, we have not felt justified in following this method of manufacture in large production quantities. The saving in the amount of material used to make a rear-axle driveshaft, together with the reduction in the amount of labor required by this method, make it a very attractive proposition, and we are not at the present time inclined to give up the idea without a struggle.

Troubles have developed in the source of our experiments. We have been unable to obtain a swaging machine heavy enough to withstand the load put upon it by an operation of this kind. We had experienced continued breakdowns of our original machine, and we have practically rebuilt it. The problem of producing a swaged shaft, without having the finished product show any twisting effect whatever from the swaging, has been difficult.

In performing the second swaging operation, which consists of necking the shaft below the diameter of the splined end, we have not been able to reheat for this operation without excessive scaling, which mars the appearance and reduces the strength of the finished shaft. The procedure that we are following at this time requires three separate swaging operations and three separate heats for making them. If it were possible to take the shaft directly from the first swaging operation and bring it up to swaging temperature again, which is about 2,000 deg. F. in our case, and to perform the second or necking operation immediately, we believe we could reduce the amount of twisting and the amount of scaling that we experience at present. The third swaging operation, that of producing the taper and the threaded end, is comparatively simple and gives us no trouble.

We are now considering the installation of a much heavier swaging machine. We find it can be built to order for us. We are considering also the installation of a second furnace to be used as a booster between swaging operations Nos. 1 and 2. With this proposed new equipment, we should be able to produce a very satisfactory product. We would be very glad, however, to learn of the experiences of some of the other automobile companies in producing a hot-swaged rear-axle driveshaft.

Experience Notes from a Production Notebook

By H. J. Crain and J. Brodie
Production Department, Packard Motor Car Co., Detroit

THE experiences recorded in this paper have not been selected in accordance with a specific plan. No attempt has been made to cover any particular subject fully or to arrange the different descriptions with regard to a related sequence.

The increasing congestion on city streets and the seriousness of the automobile accident and collision situation should be convincing evidence of the need of proper adjustment of motor-car brakes. It would seem important that cars should be shipped from the factories with the brakes seated and adjusted to overcome the rapid wear that usually occurs in driving the first few hundred miles. This rapid wear is caused by the ironing or smoothing of the brake-lining surface until the high spots have been worn down to the level of the rest of the lining face. It may be due also to slight imperfections in the contour of the brake-band. Two motor-driven machines were designed and built by the Packard company for the purpose of running-in brake-bands, one for the internal or expanding brake and the other for the external or contracting brake. The brake-drums rotate at a speed of approximately 1,000 r.p.m. in both cases. The drums are cooled by water, circulated about the peripheries so that the temperatures are never excessive. Pressure is exerted on the brake-bands by a weighted lever, the weight being adjusted so that the pressure is only great enough to assure a full bearing of the band on the drum. Each band is run for about 1 minute. It will be found that the bands acquire a polished surface on these machines, and that the irregularities sometimes existing around the rivet-holes and throughout the lining surface are smoothed-out. By taking this precaution at the factory the maximum brake efficiency is attained at the beginning of operation of the car, and the adjustments usually required in a new car after a few days of service are unnecessary.

FIG. 1—THE MANDREL THAT CAUSED TROUBLE

The importance of accuracy in grinding a piston skirt is recognized by all production men. The center, shown in Fig. 1, was originally used in the Packard shops for centering and driving the pistons during the external grinding operation. Excessive wear of the surface *A* necessitated the frequent replacement of this center and demanded constant supervision by the foreman in order that the work should not be spoiled by

continuing the use of a center that had passed the permissible stage of wear. The study given to this small puzzling problem resulted in the adoption of the mandrel shown in Fig. 2. The thrust and driving load are taken by a taper-roller bearing of heavy load-capacity, the wear is distributed over a very large surface, lubrication is easily maintained and the life of the center is greatly prolonged. The block *A* drives the piston by

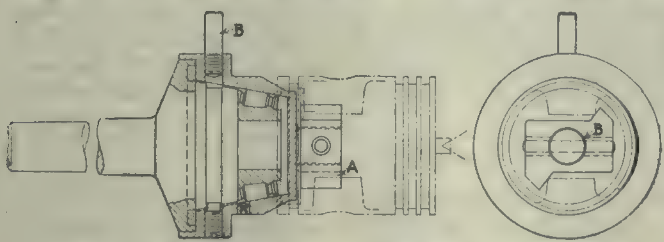


FIG. 2—A ROLLER BEARING PISTON MANDREL

the pin bosses, the block being part of the outer sleeve which is driven by the stud *B*. This design has proved very successful, and, no doubt, other tool designers could apply it to advantage.

All production and inspection departments have had the displeasure of running down peculiar engine knocks. A few years ago when a new model was started through the Packard shops the engines of the first run received at the test-stands were all found to have a perceptible piston slap or knock. Numerous remedies were tried but eventually the real cause of the noise was found largely through accident.

The click came only at the time of the explosion. Investigation revealed the fact that the valves were not centering properly in the conical surface in the cylinder. The condition is shown in exaggerated form in Fig. 3. It was found that the tool used to form the valve-seat was centered by a spindle inserted in the valve-stem guide. This spindle was too much undersize and allowed the tool to float just enough to throw the conical seat out of alignment with the valve-stem guide. As a result, the valve-spring would not bring the valve fully into the seat and the valve would hang on one side of the valve-seat until the explosion snapped the valve into the seat with a very noticeable click. Of course this part of the noise was obviated without difficulty. But this correction did not stop all the noise. A more annoying knock was eventually found to come from the piston-rings, which were of the diagonal-cut type with a slight clearance between the ends. As the explosion-pressure reached the rings they were compressed and their ends snapped. A ring that snaps in the manner described generally shows bright polished ends. When the proper end-clearance had been determined by experiment, the noise ceased. The rings in general use today have overlapping joints, but as the end clearance can be very large this trouble is not encountered.

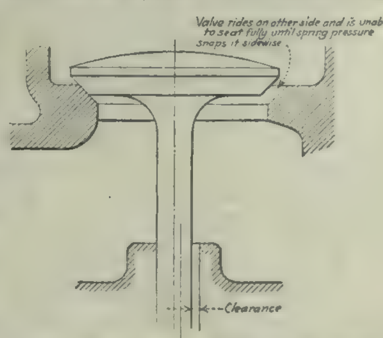


FIG. 3—AN IMPROPERLY CENTERED VALVE THAT WAS NOISY

Oil is circulated in Packard engines by a gear-pump similar to that illustrated in Fig. 4. When this particular design was first adopted it was found to produce a very irritating noise, which sounded like the blades of a fan striking a sheet of paper. Naturally this noise was attributed to imperfections in the gears. In the experiments made to abate this nuisance tooth-forms and pressure-angles were varied, and helical and herringbone gears were fitted, but the clatter persisted. All degrees of backlash were tried but without avail. It was noticed that a certain run of pumps were more quiet than the others. These were inspected carefully to ascertain what variation was responsible for the lessening of the noise. The only difference found was a slight relief on the lower face of the idler gear. At *A* is shown a feeder channel cut in the base of the pump for the purpose of carrying oil to the idler bearing through the cross channel *B*. Note that this channel is open to the pressure side of the pump but ends at the point where tooth contact ceases on the suction side. It was found that when the tooth corners were beveled, as shown at *C*, the noise was reduced. The possible effect of these changes was the basis of a careful study, which resulted in the discovery of the real source of the noise. Both these schemes eliminated the sharp cutting off of the oil stream that would naturally attempt to escape at *D* from the pressure side to the suction side of the pump. By relieving the pressure in the groove *A* the oil was not able to spurt against the tooth faces and rattle the unloaded idler gear in the backlash space in the driving gear. When, as an experiment, the groove *A* was filled with solder, the altered pump became quiet. The design of the pump was changed, the groove *A* was omitted, and no further trouble was experienced. This case is cited as an example because it indicates that gear noises are not always attributable to the gear-teeth themselves.

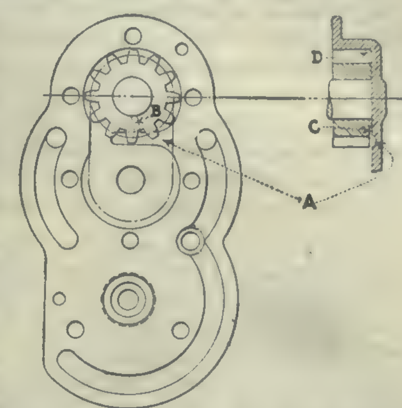


FIG. 4—THE PUMP FOR CIRCULATING LUBRICANT

The production and engineering staffs of the Packard Motor Car Co. have been studying the matter of gear noises for many years. This work is still being carried on but no panacea has been definitely discovered for gear troubles. A large number of investigations made over a period of years have led us to believe that gear noise does not always originate in variations of the gears themselves. Such variations undoubtedly contribute to the gear growl

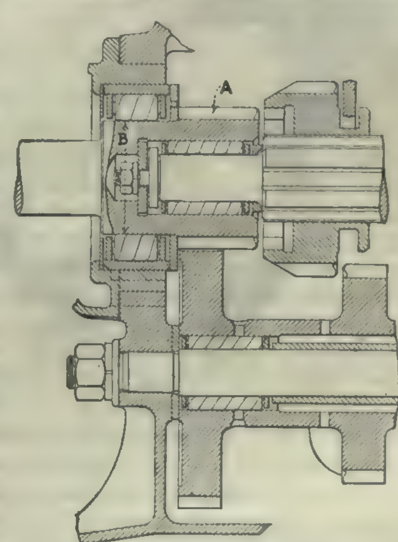


FIG. 5—FRONT END OF TYPICAL TRANSMISSION

or chatter but the noise can often be cured or dampened by an alteration of another part. We have concluded that the proper mounting of the gears on rigid shafts is a paramount requirement if noise is to be avoided. The most perfect tooth-forms, ground, shaped or milled, will not run quietly if they are carried on shafts that spring or are not in alignment.

The front end of a typical transmission is shown in Fig. 5. Particular attention is directed to the mounting of the main drive-gear *A* in which it will be seen that this is carried on a roller bearing, the inner race of which is formed by the shaft itself and the outer race is mounted in the transmission case. In the final inspection of a certain model at the Packard factory it was noticed that the degree of gear noise varied from very quiet to objectionably loud. Attention, naturally, was centered on the noisy gears. These were returned to the transmission department and torn down for careful inspection, adjustment and reassembling. Invariably the inspection revealed gears, bearings and shafts that were as near perfection as it seemed possible to approach. This led to the assembling of special gears in which perfection was carried to the utmost degree, a state far beyond that possible under even unreasonable inspection practice. But the noise, if anything, was worse.

Locating the Trouble

It remained for us to tear down and inspect several transmissions that were passed in the final car-test as being quiet. When this was done it was found that the roller race on the shafts had been ground to low-limit diameter, while the roller race in the shells had invariably been ground to the largest or extreme high limit specified for these holes. For purposes of comparison, six noisy transmissions were then torn down, the bearing diameter *B* was ground approximately 0.001 in. under the former low limit and the transmissions were reassembled and tested. This change caused the noise practically to disappear.

Experiments were made repeatedly with noisy transmissions and, in every case, when this alteration was made and the bearing clearance was increased, the noise was either entirely eliminated or reduced to a degree that was not objectionable. We concluded that this result was produced by providing sufficient space for an adequate oil-film. Further experiments along similar lines have substantiated this conclusion.

Providing the Remedy

The remedy seemed a simple one to apply but we were quite concerned about mounting a bearing under conditions that simulated those it would assume after several months' wear. We had always supposed that bearings of the anti-friction type must be mounted snugly. Before definitely adopting the new practice, wisdom demanded that we check the effect of the greater diametral clearance on the wear of the bearing. Transmissions were run under similar conditions with the standard or snug bearing and with the increased clearance. We found that the snug bearing wore rapidly during the early stages of the test and eventually reached the state of looseness with which the other bearings started. The loose bearing, on the contrary, practically retained its original clearance. We concluded that the wear of the snug bearing was accelerated because of the absence of an oil-film sufficient for complete lubrication. The loose bearing apparently accumulated an adequate oil-film and the wear was normal. The test was continued for some time and frequent examinations showed that the snug or full-fitting bearing continued to wear faster than the loose one. This, we believe, is due to the heavy initial wear that breaks or distorts the ground surface instead of glazing it as seems to be the case when the bearing is assembled with a proper clearance at the start.

After the transmissions using the roller bearings had been changed to conform to the practice just described, it became apparent that the same gear-noise existed in the transmission used in one of the other Packard models which had the transmission gears mounted on

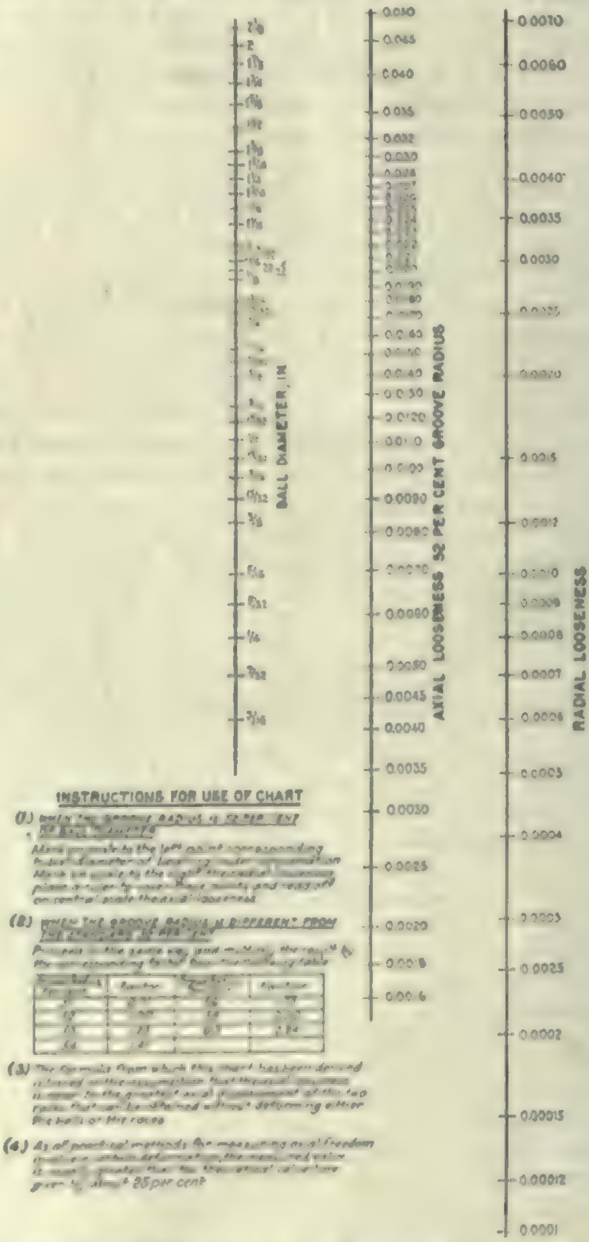


FIG. 6—CHART FOR BALL BEARING CLEARANCE

ball bearings. We altered a few experimental ball-bearings by deepening the grooves in the races to allow a minute clearance for the balls, instead of assembling them to a good rolling-fit or to the fit of the standard stock. This was done to provide oil clearance, as had been done with the roller bearings. When the loose ball-bearings were substituted for the tight ones in noisy transmissions, our previous experience was repeated and the noise decreased.

It was a comparatively easy matter to determine the

clearance needed in the case of the roller bearings since diametral clearances could readily be measured. It was found to be difficult, however, to measure radial clearance in the ball-bearing races and we were forced temporarily to determine the degree of clearance by the end-play or axial looseness. A maker of ball bearings prepared the chart, reproduced in Fig. 6, for the purpose of converting a desired radial clearance into the equivalent axial play. This enabled us to order bearings with a selected radial clearance, which could be held uniform without demanding a finer tolerance from the bearing maker, and cured the gear noise most effectively.

Backlash and Noise

From the two cases cited we judged that the same reasoning might apply in determining the proper allowable backlash in gear-teeth. Here, again, there is a possibility of not providing sufficient room for a film of lubricant, of squeezing all the oil out of the meshing space, and of causing increased noise. Experiments with gears identical in every respect, except in the amount of backlash showed, that a very evident drop in the noise of the gears was produced when the backlash was increased to a certain point.

It has been our experience that whenever you silence one noise in a car, another becomes evident that never caused complaint before. The eventual attainment of silence is the result of a persistent noise-curing campaign which starts with the noise that is most noticeable and works down the line. This method has resulted in finding that the rear-axle noise still persists in most cars though in a much less disagreeable degree.

The spiral bevel-gear, originally introduced by the Packard company, was a big step in the direction of reducing rear-axle gear-noise. Until other units of the automobile had been perfected to their present state of quietness, we were satisfied that rear axles were about as quiet as they could be made commercially. We are now endeavoring to perfect the assembling of the gear units, so that the noise caused by their operation shall be reduced to the smallest possible degree.

Selection of Machine Tools

By A. J. Baker
Production Department, Willys-Overland Co., Toledo, Ohio

A PRIMARY consideration that an executive must give to any purchase, be it design, material or equipment, must of course be its suitability for the purpose intended; another is the availability of a source of supply.

The machine-tool builder, who looks toward a full utilization of his plant, will use all his engineering ability to develop some new machine, the output of which shall be so great that it will relegate to the discard all the machines previously made by him, even though they may have been so well constructed and so well used that their productive life is still a matter of several years. He will do this on the theory that you cannot afford to be without the newer machine because of the marked increase in production of the newer tool.

Those of us who select the machinery must bear in mind the type of help that will operate it. Machines that call for adjusting by hand during their operation, for accurate reading of dials or indicators, for careful setting up of the work in the machine, for a complex cycle of operations involving a developed mentality; all are to be decried; for not only do such machines limit the number of operators available, but under the stress of production, the amount of scrap that the machines will produce is always entirely out of proportion to that produced by simpler equipment.

The Special Machine

A natural development of the above line of thought leads us to the special machine. By this I do not mean the single-purpose machine, or, better still, the single-piece machine. There is a marked difference here which must not be lost sight of and our failure as an industry to keep this difference clearly before us has led to the adoption and use of some machines that cannot be regarded as wholly satisfactory from an economic standpoint.

Between the single-piece machine and the standard machine tool is the safe position. Some machine-tool builders already have recognized, and there is no doubt that others will recognize, the special needs of the automobile business. They have produced machine tools in which the feeds and speeds cannot be changed at the will of the operator, but can be changed at the will of the executive by the transposition of gears. These machines permit adjustments but only by the set-up man. They are constructed liberally along the lines of spindles, slides, gearing pulleys, and the like, and preferably are over designed for the power that they will consume. They are lubricated fully and automatically and do not require the use of the oil can. In the hands of the operator they are only single-piece machines and as such may be designed with a reserve of power and a rigidity much in excess of the more universal type of machine, because their application is not so constrained, and they can be regarded as a perpetual asset even though the model, or some detail of a model were discarded and another took its place.

Why New Machines Are Bought

We now come to the reasons for purchasing new equipment or new machines. The one most frequently encountered is that the new machine will save money. It is not always expressed that way. It is sometimes argued that the new machine will reduce the labor cost or will turn out a piece more quickly than under the old method; but these are not the real things to be considered. The only satisfactory reason is to reduce the cost and not to reduce the labor charge or increase the production per man, and in this cost reduction appears the consideration of the items that I have already touched on. The second reason is to increase production; in other words, to turn out more parts per year or per season. In this case the consideration will be whether to put in more machines of the type already in use, or to purchase some machine that was an improvement but of the same general type, or to get an entirely new kind of machine.

There is much to be said for maintenance standards. If the records show that the tool you have been using is up to the average in productivity, it would be foolish to change to another make, even if a somewhat greater

output could be shown. Unfortunately many machine tools of the same general classification differ so much in detail that the equipment of one cannot be transferred to another. The T-slots in tables, the taper hole in spindles, the thread on spindles, the form of tool-holder, the method of clamping the tools, the arrangement of the control levers all differ very widely. You are therefore forced to make up special fixtures, which differ in some details from those you have been using on other machines. This means that if a breakdown occurs, and if you have planned for it and have extra tools available, you will have had to carry just twice as many fixtures in excess of actual requirements. If you have more than one make of machine you will not have the facility of immediate interchangeability. You will not with any degree of certainty, be able to transfer the operators. The foremen will spend much more time in the instruction of the men. The time-study department will have to make changes in the times, because the speeds and feeds may differ somewhat, and it may mean that the rates set on the job and used successfully will have to be readjusted.

In summarizing, I want to make these points:

1—There is a surplus of machine-tool equipment of the standard types both actual and potential.

2—Machine-tool makers are devoting their thought to high-production single-purpose machines of standard types.

3—The craze for special machinery is passing.

4—Special machinery will not always stand a financial comparison with standard machinery.

5—We are not, as an industry, facing our responsibilities in the matter of training operative help for tool and die work.

6—When considering new equipment we cannot disregard the inventory value of existing equipment and the loss that would be shown on our balance sheet if the existing equipment were converted from productive machinery into excess machinery for sale.

7—The only good reason for installing new machinery, old machinery or any machinery, apart from those cases where a better quality is demanded, is to reduce the cost of production.

Processing Spline Shafts by a New Method

By James A. Ford
Production Department, Studebaker Corporation of America

THE general practice among manufacturers of transmissions requiring a spline shaft has been, for many years, to finish the spline and body portions of the shaft by grinding with a formed wheel after hardening; but it has been found that this process necessitates frequent dressings of the grinding wheel and demands extreme care in the obtaining and maintaining of the desired form.

Since it was desirable that these difficulties be eliminated, it was decided by the corporation of which I am a representative that the best method would be to omit the grinding operation and substitute a process that would not include these grinding troubles. Experiments along this line consequently were carried through by the methods and standardization department of our corporation, and the results of its investigation are presented briefly as follows:

The accuracy of the finished shaft is the primary thought that was borne in mind during the investigation, and the other important points considered were that the

(1) Splines must be straight, in line with the axis of the shaft, uniform in width, properly spaced and smooth on the wearing portion

(2) Body of the shaft between the splines must be round and parallel with the axis of the shaft; the diameters must be held within prescribed limits at any given portion and the surface must be smooth.

(3) Entire shaft must be true in relation to its axis, of the proper degree of hardness and made of the best obtainable material for the purpose without regard to any difficulties that this requirement may introduce into machining operations.

It was evident that other troubles would appear after departure from the grinding troubles that were experienced in the finishing of the shaft by the old process. The troubles that were anticipated were as follows:

(1) Difficulty in hobbing to exact dimensions, obtaining a smooth, even surface and maintaining a true form

(2) Liability of warpage in shafts during the process of hardening

(3) Variation in diameter due to hardening

(4) Variation in the width of the splines because of hardening

It was believed that a given allowance could be made

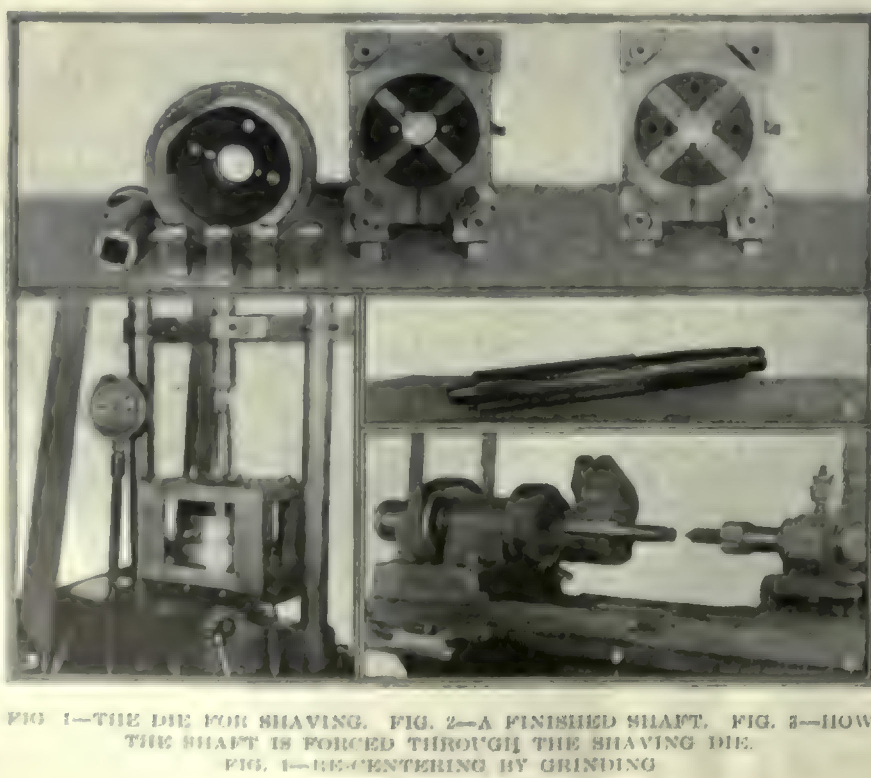


FIG. 1—THE DIE FOR SHAVING. FIG. 2—A FINISHED SHAFT. FIG. 3—HOW THE SHAFT IS FORCED THROUGH THE SHAVING DIE. FIG. 4—RE-CENTERING BY GRINDING

for shrinkage during the hardening process and that a uniform shape and size could be determined in advance. Therefore, to overcome difficulty (1), the decision was made to draw the shaft through a die after the shaft had been carbonized. It was found possible to do this by using the methods and tools that will now be described and illustrated.

The die shown in Fig. 1 is constructed according to the same principles that apply to the automatic threading-dies now in general usage, the cutters being in the position that the die chasers ordinarily would occupy. At the right cutters are shown installed in the die. The cam ring is practically of the same construction as that used on a threading die, except that the ring is made stronger. The opening feature is necessary on account of having to pass the shaft back through the die, because the body of the shaft beyond the splines is larger than the body-portion between the splines and the shaft will not pass completely through the die. This is illustrated clearly by the view of the shaft shown in Fig. 2.

The shaft is entered into a bushing that is lined-up with the die. Then the shaft is pressed through the die to a stop that has been set at a sufficient distance to permit the shaft to pass through to the shaft-neck at the end of the splines, as illustrated by Fig. 3. The cutters in the die are then released and the shaft is removed.

During the experiments with this die, it was ascertained that a clearance angle on the cutter of 30 min. was about correct, and it was decided that one pass of the shaft through the die gave the best result.

Up to this point we had a shaft that was carbonized, and its body and splines were finished to the dimensions desired. After hardening a number of shafts, we were able to determine just what change took place in them, and an allowance was made for this in the adjustment of the die. The change was uniform to a reasonable degree in all shafts, and the existence of this uniformity enabled us to determine very closely what the standard allowance should be.

The next problem was that of overcoming the warpage in a shaft after it had been hardened. Fortunately, we found that this warpage was outside of the splined portion of the shaft.

Straightening the Shaft

It was very difficult to revolve the shaft on its centers and straighten it to the degree of exactness required, and the operation required too much time. However, we found it possible to straighten the shafts easily to within 0.005 in. per ft. of being out of parallel with the true axis of the shaft. Therefore, we straightened the shafts to within the 0.005-in. per ft. limit.

After having been hardened and straightened to within the 0.005-in. per ft. limit, the shaft is gripped in a fixture mounted on the spindle of an internal-grinding machine as illustrated in Fig. 4. It is then revolved true with the splines while it is being re-centered by grinding against the pencil-shaped grinding-tool shown also in Fig. 4.

After the new centers have been established true with the spline portion of the shaft, the remainder of the operations follow ordinary shop practice.

The Group-Bonus Wage-Incentive Plan

By E. Karl Wennerlund
Production Department, General Motors Corporation, Detroit

The subject of wage incentive is an important one to factory executives. During the past few years it has received considerable study. Nearly all factories now have their own specialists who make time-studies of operations and recommend or set production rates. Even where outside industrial engineers are employed for this purpose their services are regarded as temporary, with the idea of developing a local staff as rapidly as possible to handle the regular routine. The question of the particular form of wage incentive, therefore, becomes important. No single plan can be recommended for all factories. Local conditions and the character of product will have to govern in each case.

Until recently, the plan followed has been generally of the type known as the individual-effort plan, with either straight piece-rates or some form of premium or bonus based on time measurements. Grouping of employes was not often resorted to, except for such operations as made it impracticable to keep track of the output from individuals.

Simplifying Factory Routine

It was the desire to simplify the factory routine, and to escape from this mass of detail management without sacrificing the principles of quantity checks, that prompted the development of the group-bonus plan.

Under the group plan it would not make much difference in theory whether a fixed group-price were established or some form of bonus or premium payment were used. On the other hand, a fixed group-price in money value would offer some very definite objections if adopted as a general plan.

To obtain a clear idea of the application of group standard-time and its use as a basis for a wage-incentive plan, let us consider a single production line manufacturing and assembling pistons in an automobile-engine plant. This unit has its operations arranged in sequence, in what is known as a progressive line of manufacture. It starts with the rough-machining of the casting and ends with the finished product with piston-rings inserted. The production line includes both machine and bench-assembly operations. Parts move without a break from one operation to the next in a steady flow. Some operations may be done by a single workman, while others may have several workers in parallel, depending on the volume of production and with what detail it is practicable to subdivide operations.

It is proposed to keep no check on quantities passing intermediate operations or on those completed by individual workers on operations in parallel, but to give credit for finished pistons passing final inspection. This particular production line may be located in a department also producing connecting-rods or any other line of manufacture. Such a line embraces a production unit of the factory, and is technically known under the group plan as a *division*. Its workers are primarily interested in the production of pistons but they know little or nothing about conditions on the connecting-rod line and should not be grouped with it.

Each member of a group receives the same percentage

of bonus at the end of the pay period, but it is computed on his wage earned while assigned to the group and the total amount earned by each worker will, therefore, depend on his hourly base-rate and number of hour worked. No job tickets are used. A shop timekeeper will handle from 300 to as high as 600 group workers. A list of employes is tabulated daily for each group, and elapsed time is taken at the end of the day from the entrance time-clock. If a worker is transferred out of or into a group, a transfer slip noting the time is recorded by the timekeeper and the elapsed hours are charged accordingly. Standard-hours credit is obtained from the finished inspection reports of quantities, multiplied by the group standard-time.

A group may produce various parts having different time-standards, and therefore different direct-labor costs and, since we use no individual elapsed-time job-tickets, labor costs are computed from the group cost per standard-hour. For given base-rates, the labor cost will be constant per standard-hour and per piece for all efficiencies above 100 per cent. If the average efficiency falls to 90 per cent, the labor cost will increase less than 2 per cent.

Grouping Indirect Labor

Indirect labor has been grouped extensively wherever a "community of interest" can be maintained between workers. They must have a common interest in the results of their own efforts. Storeroom labor, unloading materials from car, boxing and loading automobiles, for shipment and similar classes of work where the effort is measurable, have been grouped with very good results.

In summarizing our experience during the past four years with the group-bonus plan, it should be borne in mind that the particular feature involved is the principle of grouping employes and not the wage-incentive table that happened to be selected. Very likely any one of several incentive plans could have been used in connection with grouping and have produced satisfactory results. This one was selected because we thought it would be more adaptable to changing factory conditions than a system of fixed-group piece-rates having their value in dollars rather than in time. It also offers the same incentive to high production as could be obtained from piece rates.

Advantages of Grouping in Operation

Although the primary purpose of grouping was to simplify the factory system and to reduce the amount of clerical detail, it developed that there were many advantages from an operating standpoint. Much less material is tied-up in process, and full advantage can be taken of the mechanical arrangement of progressive lines whereby parts are made to flow from one operation to the next in a steady stream through single or parallel operations. Under the continuous-flow method of production, the checking of quantities after individual operations becomes difficult, if not impracticable; so, the logical method seems to be to count from the end of the line and credit groups of workers. Nearly every such production line has its "neck of the bottle" or several of them. If these can be speeded up, the whole line benefits.

One of the early advantages noted was the speeding-up, or elimination, of slow workers. Hence, it has been our experience that more production per man-hour has been obtained under grouping than under a previous individual-incentive plan. From the viewpoint of factory operation it has meant the elimination of job tickets and elapsed-time records for group operations. This has meant saving in clerical detail. It has added to productive time, because there are always some delays if employes are required to keep count on quantities, obtain job tickets or furnish information to shop checkers.

Standard Versus Special Machine-Tools for Automotive Production

By R. K. Mitchell
Maxwell Motor Co., Inc., Detroit

THIS PAPER is not an attempt to dictate a set rule or policy for the tool engineer or tool designer to follow in every problem that presents itself. Rather, it is a general criticism in disfavor of the present prevailing policy of making large expenditures for special equipment when standard equipment might well serve the purpose, and also a plea for the reduction of the altogether too large investment carried under fixtures and permanent tools.

There was a time when the automotive manufacturer found it necessary to build special machines for [illegible] operations and making special parts. When an operation or a part of that description was required, the policy was to design special fixtures and machine tools to meet the special conditions. But often when the original intention is only to design a special fixture, the ultimate result is a fixture or machine tool that requires special driving and feed mechanisms. Then comes the question of whether or not to design special drives and feeds for some machine that is already in the plant, and this is the critical point in the argument between special tools and standard equipment. In many instances the only machine tool that will accommodate the special heads is a machine tool designed and built purposely to meet this one particular difficulty; so, we arrive, perhaps unintentionally, at the stage we have so much desired to avoid, which is the design and fabrication of special machine-tools.

In the ordinary routine followed when building special machine-tools, we are confronted with numerous obstacles. The first is the fact that the average draftsman found in the general run of tool-designing departments has had neither the engineering nor the production experience essential to the proper designing of special machine-tools, and his lack of knowledge as to proper stresses, correct bearings, loads and the details to be employed, together with lack of foresight in considering the interchangeability of parts, ease of replacement and the use, so far as possible, of standard parts, is reflected in the enormous first cost of the majority of special machine-tools that are built under private supervision. The actual construction usually is performed in the tool room by high-priced labor, working an excessive amount of overtime, and the machine, finally completed,

has yet to meet its first test. It will be acknowledged that very few special machines have ever been devised and built that did not demand much undue expense and delay in production, not to mention the many changes made before they began to function as originally intended.

A special machine-tool for turning both sides of the flange and the face of a flywheel at one operation was designed and constructed recently at an expense of $18,000 to $20,000. Three days after the machines were installed, they were abandoned; but, fortunately for the manufacturer, the old set-up was still available. This was not because the old set-up was more efficient; but because, although there was every opportunity to devolop a machine that would give greater production, lack of foresight and poor design ruined the whole project. The worst blunder was that no provision had been made or could be made for the escape of chips. Chips from the upper cutters worked down and packed against the bottom face, impeding the two lower cutters and necessitating their removal with a chisel about every 10 min. The final outcome of this case was that the manufacturer had to go out in the market and buy standard machine-tools. If the outlay wasted in design and construction on the special equipment had been applied to the purchase of standard equipment, it would have more than covered the standard machine-tools that were afterward purchased. The result of the whole incident was that $35,000 to $40,000 was expended, where $15,000 would have served the purpose.

Disadvantages of Special Machines

A special machine-tool in production requires the services of a skilled or special operator, at least until those interested have become familiar with its care and operation. If the operator should be absent for any reason, loss of time and production must result before another man can be broken in.

Repair parts for special machine-tools are costly items. It develops not infrequently that patterns are broken, mislaid or left at the foundry and, when the casting is finally secured, it means day-and-night work in the tool room with additional expense and delay.

The most forceful argument against special machine-tools at present is the unstable design and development of automotive parts. When a designer produces a special machine-tool to accommodate a certain part, he has no guarantee as to the life of that part and, I venture to say, the average life of the majority of automotive parts, without change in design is less than 6 months.

Let us consider now some of the advantages of using standard equipment and machine tools. To-day, machine-tool bnilders have stocked the market with a large variety of simplified, standard machinery that can be adapted to special operations and parts with slight extra expense. In the first place, the standard machine-tool is very much cheaper than a special machine. It is built on a quantity-production basis, and designing and engineering charges are distributed over a greater number of units. The standard machine-tool is available for prompt delivery. It has had a thorough trial in practical work before being placed on the market, and is out of the experimental stage. Reputable manufacturers of standard machinery build their machine tools so that the parts are interchangeable and, in case of service requirements, they are prepared to furnish any part promptly from stock. Consider for a moment the money that is tied up in special machinery patterns, extra castings and the like. With a standard machine-tool in production in any large shop. if an operator is called from his machine, other men just as familiar with the operation of the machine are always available.

I believe there is ample room for improvement in the design of special fixtures. Too little attention is paid to the needs of manufacturers of standard parts whose product, if properly investigated, will be found to contain unlimited possibilities for incorporation in the design of special jigs and fixtures. In a recent issue of a popular weekly periodical. there was a full page spread. advertising the merits and possibilities of standard bushings. This advertisement alone probably meant an expenditure of $8,000 or $10,000 for that manufacturer. With dozens of companies just like this that place their engineering staffs and experience in their particular line at our disposal, still we do not pay enough attention to their claims and the merits of their products to consider them when designing our own pet tools and equipment.

So far as possible, when designing fixtures and tools, we should take advantage of all that the trade offers, and attempt to simplify our creations. The frequent use of the three fundamentals of jig and fixture work, the clamp, the V-block and the angle plate, is to be recommended.

As a recent instance, a large drum-type fixture was designed, built and installed on a machine. The cost was about $2,500, including special drive gears and the like that were constantly breaking, delaying production and running up a continuous repair bill on this job. The annoyance and continuous expense demanded immediate action and the whole fixture was replaced by two small angle-plate fixtures on which V-blocks to oppose each other were fastened. One side was loaded while the part on the other side of the fixture was being milled. These two fixtures cost about $70 and actually increased production beyond that of the more elaborate and expensive fixture. This is only one of similar instances that occur every day. I believe that the tool designer is so prone to become interested and intent on the design and construction of the fixture that he temporarily loses sight of the fact that the fixture or tool is not the ultimate issue, but only the means to an end.

The Control of Operating Tool and Supply Costs

By F. A. Mance
Production Department, Studebaker Corporation of America

A CONTROL OVER expenditures for perishable tools and operating supplies has been successfully established by rating or allotting the amounts to be used by each department for every operation. By this allotment we are able to regulate the amounts of tools and supplies used throughout the factories in accordance with the number of cars built. Each item is priced and extended, and the aggregate is totaled. The total represents the amount of money allotted to the department to produce a definite number of cars in a given period of time. In figuring departmental percentages of efficiency this amount is included with labor and production.

This system has been in operation for nearly four years and during this time the cost of renewals of perishable tools has decreased approximately 71 per cent,

though some of this reduction was due to a decrease in the cost of the tools.

To anyone interested in adopting this method we would suggest the following procedure: Start with the selection of a competent and aggressive tool-trouble man for making the survey. Provide work sheets on which to list the department, the part number, the operation, the description of both tools and supplies and the amounts allotted for any given number of cars per month. These work-sheets are afterward to be used in making up a standard form in quadruplicate. The standard form should contain additional information as to price, the extensions and the total, as previously explained. The standard allotment-sheets when completed are distributed to the foremen interested, the tool or supply stores, the superintendent of the plant and the supervisor of tools or the methods and standardization department.

Deliveries from stores are made upon approved requisitions, provided the article wanted has been previously allotted and appears on the allotment sheets. Departmental operating tool and supply reports are made up for every 10-day period by the supervisor of stores and show the amounts withdrawn during that period. They are then forwarded to the accounting department for pricing. From copies of these sheets each foreman is checked as to the amount he is running over or under his allotment and he is allowed to see these copies during each period in order to acquaint himself with the cost of the article that he uses.

Salvaged or restored tools are carried in stock and are given out on requisiton in the same manner as new tools, with the exception that the requisition is stamped with the word "salvage" in red ink. This signifies that there is to be no charge against the department drawing out this material. When a drill has become too short for use in one department it is turned in as "salvage" and reconditioned for use in another department. This is also done with cutters, reamers and grinding wheels. The allotment sheets show where the salvage should be used and each item so salvaged is listed "no charge."

The tool-salvage department keeps in touch daily with the various department foremen, advising them of available salvage tools especially when these are in addition to the tools specified on the allotment sheets. The use of salvage tools so far this year has amounted to $1 per car. This sum represents what the cost would have been had we purchased new tools. The amount of money spent to recondition the tools amounted to 30 per cent of the original cost. This 30 per cent is charged off as expense, and is pro-rated over the entire portion of the plant that is benefited by the use of the tools.

One important factor that has a direct bearing on tool cost is the listing of sources of supply. This list is made up by the methods and standardization department and contains the names of the firms whose tools have given us the best results in actual use over a period of from one to four years.

Selling Machine Tools

By Entropy

Taking the machine tool business of the country as a whole it does not seem likely that the amount of the total domestic sales is at all affected by advertising, salesmen's trips, or any kind of selling campaigns. What does happen is that of the total business available, more goes to the firms that advertise continuously and follow up their inquiries by personal interviews than to the firms that trust to luck that their share of the business will fall into their laps.

However, the purchaser pays for all this. He pays for the privilege of being solicited by a dozen representatives of different machine shops and it all comes in the bill for whatever he does buy. The point of this is that if customers make it expensive for firms to sell them their equipment, they simply add to a burden something which does no one any good. The customer who writes to every firm that advertises engine lathes, saying that he is in the market for one 18 in. x 8 ft. lathe and that he desires full information regarding it, and then asks that a representative be sent to see him, or what is the same thing, strings along the firm so that they think he is a likely prospect, adds to a total that is already bad enough.

There are a few points on which a customer needs information, he needs to know about the design, the workmanship, the materials, and price and delivery. Most advertisements are unenlightening on all these points. They tell us that the design is superior, the workmanship is workmanlike, the materials are the best in the market, and they suggest we write and ask the price, and whether deliveries are being made now or next year. In the old days of advertising when an ad was a permanent thing not changed from year to year, to say nothing of issue to issue, this was all right, but in these days it is possible to say how superior the design is, not merely that the main bearings have now been made a thirty-second of an inch larger than they were in 1910, but tell why the machine is an improvement on all other, or "garden varieties" of machines. Then workmanship can really be described.

For some purposes a lathe made interchangeable by means of fairly liberal tolerances in the sizes of the parts is good enough, but for our shop of course nothing will do but the finest of all hand-fitted work. Interchangability is all very well if we break a part, but we do not intend to break any parts, and we know that a truly high-grade machine must be hand fitted, part by part. Of course we are glad to know that the legs are drilled in jigs so that if the railroad in its anxiety to make quick delivery breaks one we can get another, but we want all the running parts to fit alike so that we can oil up with a fairly liquid oil and not have any shake in the fits. We want to know what the builder thinks are the finest possible materials. Is the main bearing made of cast iron, babbitt, or, if bronze, of what composition? Are the lead and cross-feed screws made of something in particular or of any stock the boy happened to find on the floor?

Of course it is entirely heretical to suggest any one marking the price of a machine tool in plain figures. To be sure the lathe builder travels to and from work in a machine the price of which, f.o.b. Detroit, is $298.00, which price is as well known as the name of the car itself, but if he should mark one of his lathes $984.50, the chances are he would be read out of the Machine Tool Builders' Association. Of course it would be still worse for him to advertise a line of 24-inch lathes and say, "We are now booked up to April. If you want May delivery order now." It might pay, and anything that makes the machine tool business a paying business should be frowned on.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

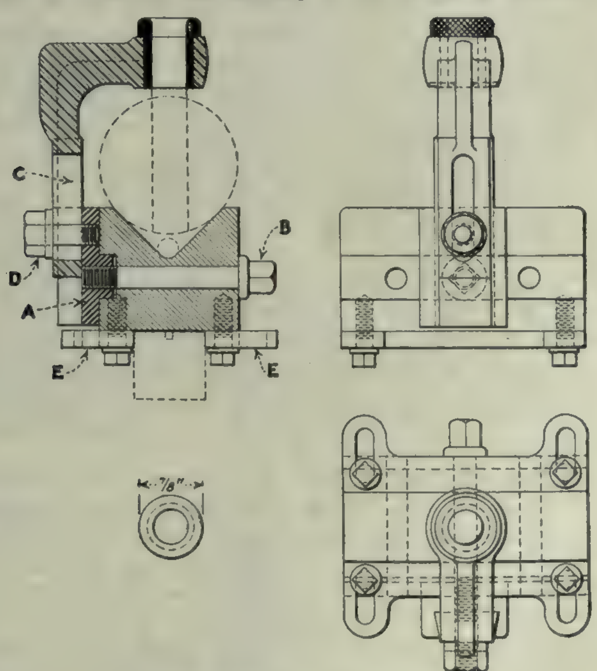
An Adjustable Drill Jig for Round Stock

By B. R. Wickes

The accompanying drawing shows an adjustable drill jig that is very serviceable in the shop where there is much drilling to be done upon round pieces. By reason of its adjustability it is adaptable to any size of round stock within its range. It will also hold half-rounds, squares or tapers.

The body consists of a V-block, in the side of which is milled a shallow rectangular shaped groove parallel to the V on the upper surface. Part *A* is tongued to fit this groove and is held in position by the long bolt *B*, passing clear through the block. Three (or more if desired) holes through the block permit the bushing bracket to be set at different positions with respect to the length of the block.

At a right angle to the tongue and on the opposite side of part *A* is an open dovetailed slot, fitted to receive the corresponding portion of the bushing bracket *C*, which is clamped to it by means of the shorter bolt *D*. A slot in *C* allows the setting of the bushing bracket at



ADJUSTABLE DRILLING JIG

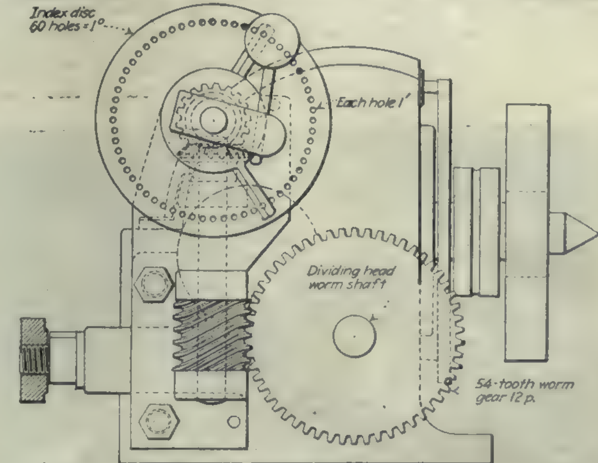
varying heights to accommodate different sizes of work. The bracket may also be turned end for end and the device used the other side up, the work in this case being held by the jaws *E*, which are adjustably attached to the under surface of the block by the small collar head screws. The tops of these screws should be ground off after they are in position and set up tight, as they act as feet upon which the device rests in normal position.

Attachment for Indexing Degrees and Minutes

By Edward J. Rantsch

The accompanying drawing shows an attachment for universal dividing heads, the purpose of which is to make possible the indexing of degrees and minutes.

Referring to the blueprint, it will be noted that a wormgear has been substituted for the usual index plate



ATTACHMENT TO DIVIDING HEAD FOR INDEXING TO ONE MINUTE OF ARC

and securely fastened to the regular worm shaft. Meshing into this worm gear is a sextuple threaded worm assembled on a bracket and driven by a pair of miter gears. The special index plate contains 60 holes, and is securely fastened to the bracket. The usual index crank handle is used as before, provision having been made to receive it. The complete bracket is held in position by two hex-head capscrews and two dowel pins.

In indexing, one turn of the crank handle equals one degree, and one hole equals one minute. It is necessary to turn the crank handle 360 times to make one revolution of the work. This means that the spindle moves one-ninth as fast as with the original gearing.

Let us say we wish to index the work through an arc of 39 min. As one hole on the plate equals 1 min., we index 39 holes for 39 min. Now take 25 deg. 19 min. As one turn equals 1 deg., we index 25 turns, and add the nineteen holes for the 19 minutes.

One of the jobs that this attachment is useful for is work requiring unequal indexings, such as the graduating of master gages used in checking and inspecting the time-fuse rings of shells. The graduations on the rings all vary, or in other words, are not equally spaced, and the writer well remembers the difficulty experienced in trying to get two master gages to agree.

The attachment can also be used on any tool, jig or fixture work where boring holes to angular measurements is required, as the indexings are so fine that it is possible to get within very close limits.

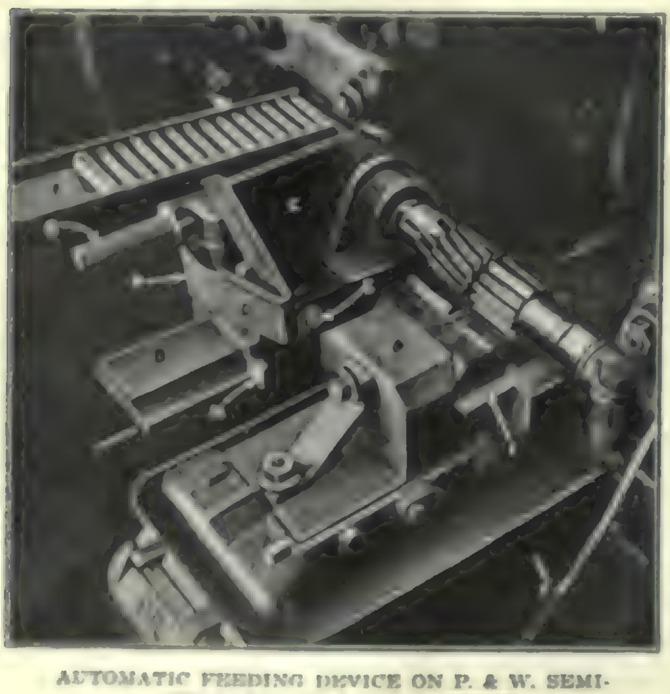
P. & W. Semi-Automatic Milling Machine Becomes Full Automatic

By Ellsworth Sheldon

By an ingenious attachment, a Pratt & Whitney semi-automatic milling machine in the shops of the Lovejoy Tool Co., Springfield, Vt., has been converted into a full-automatic machine, requiring no attention from the operator other than to fill up the hopper occasionally—and no harm done if he should happen to forget it. Mr. Lovejoy himself is sponsor for the device.

The work done by the machine is the flatting off and serrating of one side of round pieces of high-speed steel that are to become the cutting points of the Lovejoy company's inserted-tooth products. The machine is well known to all who have much to do with production work. The attachments that make it full automatic are the hopper and feeding device, and the self-opening and closing vise.

The feeding device, shown at *A* in the accompanying illustration, is fitted to slide freely upon the dovetailed guide-way *B*, lying beside and parallel to the main table of the machine. This guide way is bolted to the frame



AUTOMATIC FEEDING DEVICE ON P. & W. SEMI-AUTOMATIC MILLING MACHINE

of the milling machine and has no movement. The device is normally held against a positive stop in the position shown in the cut by a stiff coil spring; but at certain times in each cycle it moves outward to the end of the guide-way.

The hopper is in two parts. The triangular shaped casting *C* was first devised to hold a number of the pieces to be milled and the cavity was intended to be filled with the work. In the casting *D* there is a cradle just large enough to accommodate one of the pieces which, when lying in the cradle, will be in line with a bushed hole through which it may be pushed endwise out of the device. At *E* may be seen one of the pieces protruding slightly from the bushing; this piece, however, is not in normal position but was pushed part way out to show its location in the photograph.

Because of the tendency of the work pieces to jam and "hang up" in the triangular cavity of the original hopper, the sheet metal part *F* was added, the leg of which extends down into the cavity and closes off a portion of it so that now there is but a single stack of work pieces within the original hopper. The upper part of *F* is sufficiently inclined to cause the round pieces to roll forward against a stop, where the last piece in line rests on top of the vertical stack, ready to follow down as the pieces are successively pushed out from the bottom.

The transverse hole in part *D* passes clear through, the cradle, of course, forming the central portion of it. A round plunger, or pusher, slightly smaller in diameter than the work pieces, fills this hole when the device is at rest; but during the feeding movement it is withdrawn by a rack and pinion to allow the lowest piece of work in the stack (that up to this time has been resting upon the pusher) to fall into the cradle. As the device returns to its normal position the pusher advances, driving the work piece before it entirely out of the device and into the jaws of the work holding vise.

The pinion that operates the pusher is inclosed within the device and cannot be seen in the picture. The operating rack may be seen at *G* extending some distance from its guide, through which it is free to slide. The pusher also has rack teeth cut along one side and these two racks cross at a right angle, one slightly above the other. The pinion is long enough so that it is at all times in engagement with both racks.

Rack Has No Movement

The rack *G* is pinned at its inner end to the main frame of the milling machine and has no movement; it is the feeding device that moves. As the machine table is moved back by its cam, a permanent stop attached to one side of the table contacts with the lug *H* on the feeding device. At this instant the transverse hole in part *D* is in exact alignment with the vise jaws, which are open. As the table continues its rearward movement the feeding device must, perforce, go along with it against the tension of the spring.

The rearward movement of the device causes the inclosed pinion to roll along the stationary rack *G* and, as the pinion is also in mesh with the rack teeth of the pusher, the latter is withdrawn far enough to allow a work piece to drop in front of it into the cradle. The table now reverses and moves forward, the device following by virtue of the spring tension. The enclosed pinion rolls in the opposite direction and advances the pusher, driving the piece of work before it into the jaws of the vise which, during all of the back and forward movement, has remained in line.

During the actual feeding movement the table and feeding device are moving together as a unit, the former actuated by its cam and the latter by the spring. It will thus be seen that the feeding movement is brought about by spring tension only, and if for any reason a piece should jam and refuse to go out, the result would be only to stop the advance of the feeding device and allow the table to run away from it.

The vise jaws are opened and closed by the stationary cam *I*, attached to the machine bed at the opposite side of the table. At the rear of the vise there is an eccentric shaft that actuates the movable jaw, and to the end of this shaft is keyed a lever having at its outer end a roll that passes under the inclined surface of the cam *I*. At about the time when the table in its rearward movement has brought the stop into contact with the lug on the feeding device, the roller of the vise-operating lever passes out from under the cam and the jaws are open,

being opened and held so by springs. The table completes its return and again comes forward to this point, during which movement the feeding has been accomplished. Continued movement of the table then closes the vise jaws and carries the work to the cutters.

It is at about this point also that the table changes from slow to fast movement and *vice-versa;* but this has no bearing upon the operation of the device.

As the table continues forward the roll of the vise operating lever passes under the cam *I* and the jaws close. When closed, the pressure comes upon the high point of the eccentric (the position of which is adjustable) which thus acts as a toggle and relieves the cam and lever of the duty of maintaining the grip.

The milling operation is a double one; the two cutters nearest the main bearing of the machine flatting off a side of the round piece in the first position, while the remaining cutter mills the serrations upon a portion of the flatted surface in the second position.

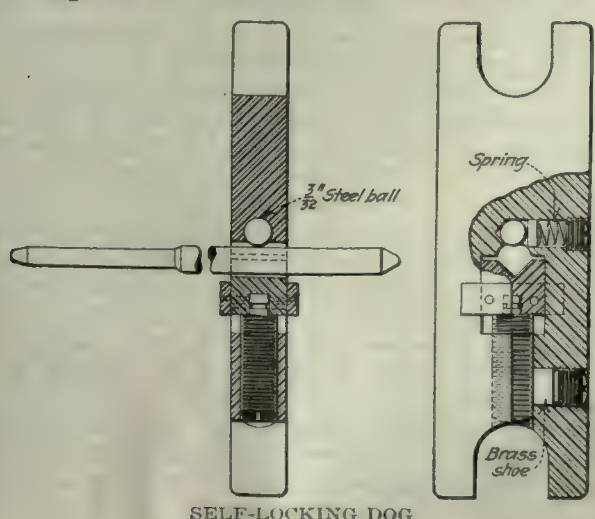
The piece as fed in by the pusher is round; having been previously finished to diameter and length. As the machine goes through its cycle the piece in first position is flatted. At the beginning of the second cycle the incoming piece pushes the already flatted one from first to second position. At the beginning of the third cycle the new piece again pushes the flatted piece forward, and this one in turn ejects the serrated piece from the vise. The machine thus completes one piece at each cycle after the second.

Adjustable Self-Locking Dog for Small Work

By George J. Fallow

Having a large quantity of small pins and piercing punches of different sizes to grind and noting the time lost in dogging them I designed the dog as per sketch and have found it to be a time saver of no small proportion, and well worth the time spent on its construction. The sketch shows the lock to be a $\frac{3}{32}$ in. steel ball with a spring and set screw back of it to hold it in place.

By giving the piece to be ground a slight turn in direction of the spring, it will slide into the dog quite easily, but reverse the motion and it will lock. The more pressure applied the tighter it holds. The V-block is adjusted by the screw in the center and when once set to size is locked by a screw on the side. A brass shoe under the locking screw prevents it from marring the adjusting screw.



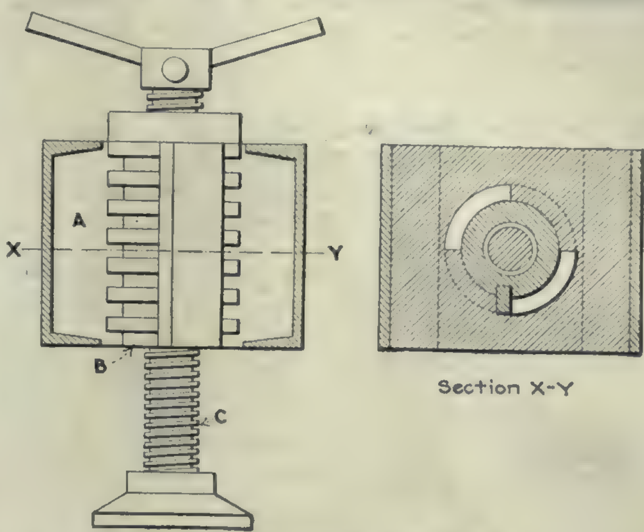
SELF-LOCKING DOG

A Quick Acting Screw Jack

By John S. Watts

At the Wabana Iron Ore Mine, electric shovels are used to load the ore into the mine cars underground. The pile of ore to be loaded is somewhat scattered and requires the moving ahead of the shovel quite frequently. The shovel is mounted on a wheeled truck traveling on rails and there are four jacks, one at each corner, which are screwed down to hold the truck from moving while the shovel is being forced into the pile.

To move the shovel forward involved the screwing up of the jacks some four inches or more to clear the ties,



QUICK ACTING SCREW JACK

and after moving, the four jacks had to be screwed down a similar distance. To shorten the time required to perform this operation, the jack shown in the accompanying sketch was designed. The nut is made in two parts, *A* and *B*, the part *B* having rings turned on its outer surface which fit into corresponding grooves in the hole in *A*. These rings and grooves are rectangular in form, and equally spaced. The rings on part *B* and the lands in part *A* are machined off for ninety degrees around the circumference on two opposite sides, and a key fitted on one side as shown in the sketch.

In use, after slacking the screw *C* enough to just release the load on it, the part *B* is revolved by means of the handles shown through ninety degrees in a counter-clockwise direction. In this position the rings on part *B* are out of mesh with the lands on part *A*, and *B* can now be lifted up the four inches or so required to lift the jack screw clear of the ties, and then revolved back again ninety degrees into mesh where it will stay until the shovel is moved forward into its new position.

After the shovel has been moved, part *B* is revolved again until the rings are clear of the grooves when it will drop until the screw *C* strikes the ground. Another movement of *B* back to its original position and it is locked again ready for the screw *C* to be tightened up. This arrangement eliminates all movement of the screw *C* except that required to merely take up the weight. The function of the key in part *B* is to prevent excess travel in either direction, and also to stop any tendency for part *B* to revolve with part *C*.

To insure that the rings on part *B* will enter the grooves in part *A*, in any position that *B* may take vertically, the rings and lands are beveled off on the entering edges.

Editorial

NO ONE need hesitate for a moment and try to remember statistics about this and that auditorium or ball room in imperial palaces. The largest room in the world is—the room for improvement. It offers an ever lengthening vista, the further we advance therein. It is immeasurable.

The Production Meeting of the Society of Automotive Engineers

THE FIRST exclusively production meeting of the Society of Automotive Engineers, held recently in Detroit, brought out papers of interest not only to automotive engineers but to production men everywhere. In this issue we are publishing abstracts from eight of the papers presented.

Machine tool builders, particularly, should be interested in the point of view of the automobile factory man on the selection, use and maintenance of machine tools, for some of the highest developments in the application of such equipment have occurred in our automobile shops.

A feature of this gathering, and one which might well be adopted by other branches of the machinery industry, was the free interchange of information on problems common to the whole automobile industry. Automobile manufacturing is a young business, run mostly by young men, and apparently free, to a large extent, from the diseases of knowing all there is to know about your own specialty and guarding that knowledge carefully from the rest of the world. As a result of the progressive spirit manifested in opening up their shops and their minds to new ideas, the automobile men have been successful beyond many other manufacturing fields in putting their business on a scientific and economically sound basis.

As an experiment, this meeting was a huge success and will undoubtedly be followed by others like it. We should like to see every branch of the metal trades attempt something of the sort.

Thanksgiving in 1922— A Real Feast

THERE IS a sound basis for a real Thanksgiving all along the line this year. As a consequence we feel moved to comment on the one holiday on which we always bring out an issue of the *American Machinist.*

Looking backward is an interesting procedure if one does not indulge in it too often. At this time we wish only to go back over five Thanksgiving Days. What a world of change has taken place in that short space of time!

In 1918 we celebrated the national feast only a fortnight after the signing of the armistice which brought the World War to an end. A great feeling of relief from anxiety was everywhere but the wiser ones among us were beginning to think of the hard reconstruction days ahead.

A year later we were not far from the crest of the wild wave of inflation that followed the deprivation and self-denial of four years of war. Money was rolling into the pockets of the laborer and the treasury of the company at an unprecedented rate and but few saw the precipice in front of us.

Before the next Thanksgiving Day the bottom dropped out of the market and times were very bad indeed. A glance at the files of the *American Machinist* shows that our editorial page for the Thanksgiving issue was devoted to a denunciation of contract cancellation and other evidences of business demoralization.

By November, 1921, the worst was over and business men were beginning to congratulate themselves that they were still solvent and looking hopefully to the future. The business tide was still at a very low ebb, however, and unemployment was so serious a menace that a conference was called at Washington to consider ways and means of meeting the situation.

And now we have reached another Thanksgiving Day. Some industries have been booming along for months, others are just reaching the stage of prosperity, while even the machinery industry is getting orders that seem almost like those of the proverbial good old days. We may have to skimp a little on coal this winter but unemployment is a thing of the past and wage increases are being dictated by the excess of demand for labor over the available supply.

A labor shortage is a pleasant thing for the worker to contemplate as it means the laying of the unemployment specter which is almost always lurking before his subconscious mind. But it should be even pleasanter for the machinery manufacturer as it means inevitably a quickened interest in labor saving devices of all kinds and a ready market for his products.

Truly this is a better Thanksgiving than we have had in years, with business on a sound basis and the tide of prosperity on the flow, employment for everybody and new markets constantly opening ahead.

May we make the most of our opportunities!

Just Suppose

JUST suppose two men try to sell you a machine for heavy work, that is to say each one tries to sell his own make. And suppose one of them points out that his driving pulley is of larger diameter and will take a wider belt than the other one. You would probably be inclined toward that machine, provided, of course, that they were equal in other points.

Now suppose you need a new furnace for your home and one maker points out that his machine can assimilate much more coal than any other, would you buy that furnace, or would you say: "What I want is a furnace which burns little coal, and gives much heat, especially this coming winter." Wouldn't you say that or something similar?

Oh, yes, a salesman would not call your attention to the fact that a great deal is required to run the thing—at least not when he tries to sell a furnace. Well, but—

Just suppose.

Shop Equipment News

Niles-Bement-Pond 60-Inch Heavy-Duty Engine Lathe

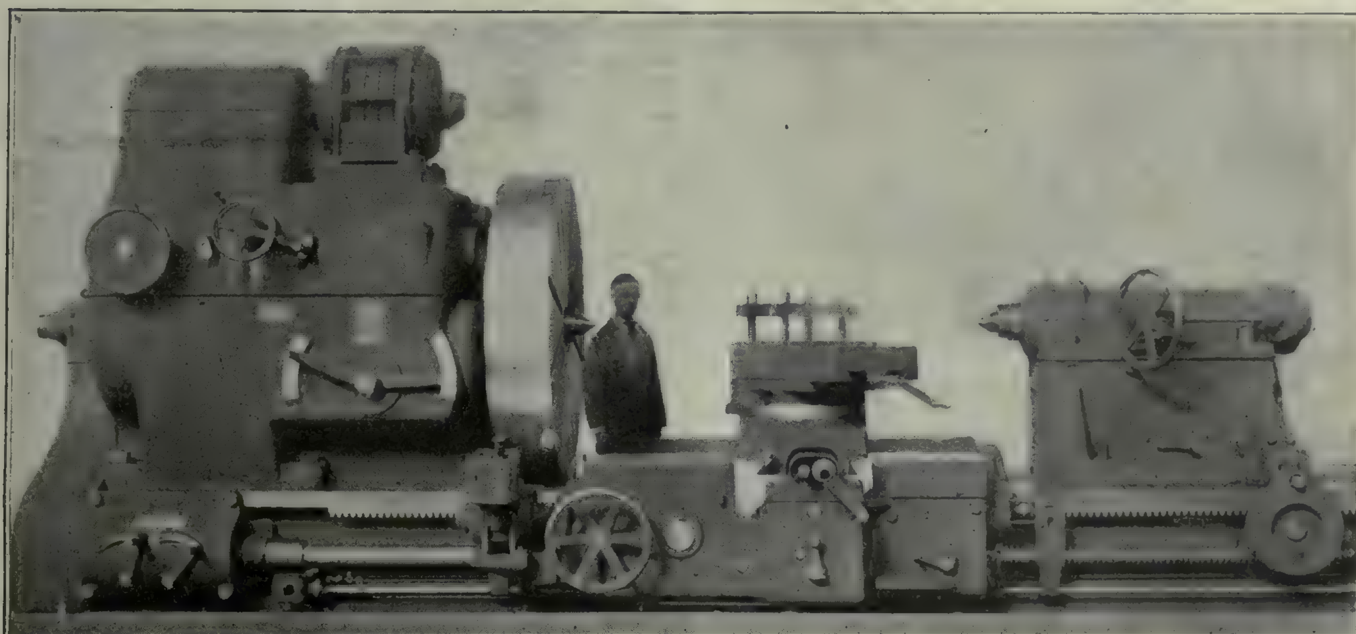
An engine lathe of 60-in. swing and for heavy duty that has recently been developed by the Niles-Bement-Pond Co., 111 Broadway, New York, N. Y., and built at its Pond Works, Plainfield, N. J., is shown in the accompanying illustration. The machine is fitted with a constant-speed motor of 40 hp., and it has twenty-four faceplate speeds obtained by change gears operated by levers located on the headstock.

When an adjustable-speed direct-current motor is used for driving, the geared speed changes in the head above the joint line are eliminated without reducing the speed range of the faceplate. The motor is then mounted on the head near the faceplate and the drive taken from it at the outer end of the machine. The motor may be started and stopped by a handle mounted on the carriage. When direct-current drive is employed, any faceplate speed within the range of the motor may be obtained by the use of the same handle. A pushbutton on the headstock may be used for "jogging" the driving motor to give quick and easy shifting of the speed-change gears.

The headstock is heavily constructed and is entirely inclosed, to prevent injury to both the operator and the gearing. All bearings and gears are continuously oiled by means of a pump supplying filtered oil to a reservoir in the upper part of the head, from which it is distributed by pipes. The surplus oil drains into a settling tank in the base of the head, from which it is pumped through a filter back to the reservoir.

The spindle bearings are very large, and on account of the slow speed of rotation, are fitted with oil distributing rings and large oil wells, in addition to the continuous oil supply. The faceplate has four pairs of parallel slots at right angles to permit attachment of faceplate jaws. The tool-steel centers are hardened and ground and fitted with large spanner nuts to aid extraction.

Adjustment of the tail spindle is accomplished through gearing by means of a handwheel located on the side of the tailstock in a position convenient for the operator when placing work between the centers. The upper portion of the tailstock has a cross adjustment operated by a screw for use in turning small tapers. It is clamped to the lower section by heavy bolts independent of those which clamp the tailstock to the bed. The adjustment of the tail spindle is not changed when moving the tailstock on the bed.



NILES-BEMENT-POND 60-INCH HEAVY-DUTY ENGINE LAT

In addition to the bolts which clamp the tailstock to the bed, there is a pawl engaging a ratchet so as to brace the tailstock and prevent slipping under very heavy end thrust. The pawl may be lifted out of the ratchet by a handle on the front of the tailstock. The ratchet is made in sections and is easily removable to allow cleaning out chips that may accumulate in the bed.

The tool carriage has lateral, cross and angular power and hand feeds, and also a rapid traverse along the bed operated by a 5-hp. motor. This motor is connected with a drum switch having a spring return to the off position and mounted on the carriage. The control of the driving motor also is obtained through a handle on the carriage. The tool slide is the full width of the bridge and has clamping bolts and straps for securing the cutting tools. Large micrometer collars are fitted on the crossfeed screws.

The apron is of the one-piece type. All shafts have bearings at each end and the gears and bearings are oiled from one reservoir, which is filled from the top of

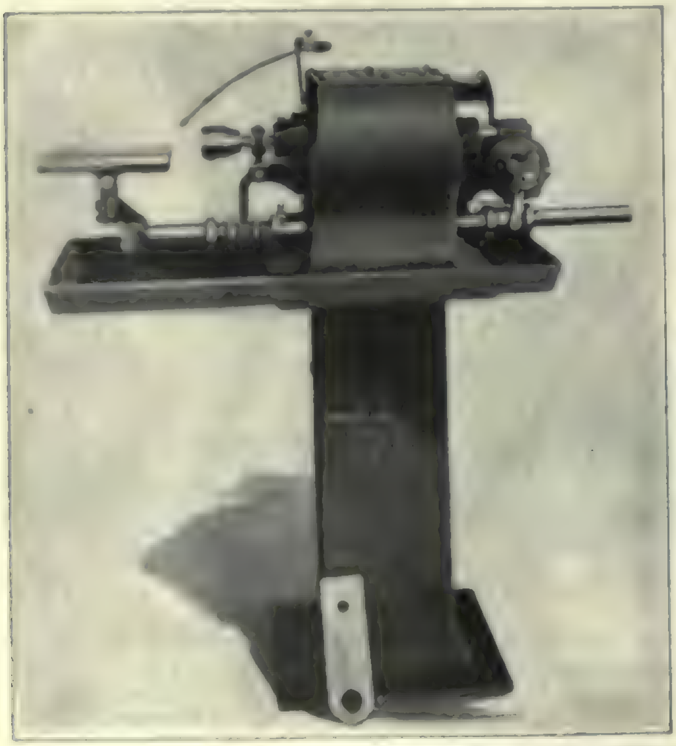
the carriage. The direction of any feed may be changed and started and stopped at the carriage. The levers are conveniently located and are so interlocked that no two feeds can be engaged at the same time.

The thread of the leadscrew is used only for thread cutting, feeds being obtained from a spline in the screw. A quick-change gear box gives four feeds without the necessity of removing gears. Removable change gears can be provided for obtaining any other feeds or threads that are desired. All gears and bearings in the feed box are oiled from a tank providing an ample supply of lubricant.

On lathes with long beds, the lead screw and controller shaft are supported at intervals by bearings which are automatically spaced by the carriage. A steady rest having five jaws with screw adjustment and large wearing surfaces is included in the equipment.

Burke No. 10 Automatic Tapping Machine

The Burke Machine Tool Co., Conneaut, Ohio, has recently put on the market the horizontal-spindle automatic tapping machine that is illustrated herewith. The machine has a capacity from $\frac{1}{8}$ to $\frac{5}{8}$ in. in steel, and can be run at very high speed, so that production is limited only by the stamina of the tap. The use of relieved



BURKE NO. 10 AUTOMATIC TAPPING MACHINE

taps is recommended. It is stated that the production does not depend on the experience of the operator, as the automatic features of the machine give rapid production even with unskilled operators.

The machine is driven by a constant-speed belt, and may be run directly from the lineshaft. If several different sizes of taps are to be used in it, a countershaft giving three speeds can be provided.

The chief feature of the machine is that it is equipped with a power feed and an automatic reverse. It is not necessary to depend on the pressure on the tap to make the machine drive and reverse, such as with hand-operated machines. Since the tap runs perfectly free, the tendency to cut oversize is eliminated, and an accurate thread can be cut.

It is only necessary for the operator to place the work on the machine and push it against the tap until the latter has entered the hole. The power feed then engages and drives the tap until the thread is completed. At this point, the spindle automatically reverses and backs the tap out at twice the forward speed. Since the operator does not need to press the work against the tap during its forward motion and to pull it outward during the reverse motion, his hands are free to select another piece for the next cut. The mechanical feed gives a more uniform and rapid production than hand feed.

The machine drives through a friction mechanism governed by the automatic feed, which is in turn controlled by another friction device. By this arrangement, the machine may be set for very sensitive operation, so that it will slip before breaking taps of small size. It can also be adjusted to pull large coarse-thread taps. The machine is driven through the frictions on both the forward and the reverse motions. These frictions are of taper cone design and the ring keyed on the spindle fits both the driving and the reversing cones.

The working parts run in oil, and the thrust of the spindle in both directions is taken on ball bearings. A Skinner positive-drive tap chuck is regularly furnished, as well as a pump and tank for supplying lubricant to the taps.

The table is fully universal and fitted with a T-slot for attaching jigs, so that holes can be tapped at any angle desired in the work. The table is fed toward the tap by positive power feed. A faceplate also is furnished to fit on the drawbar in place of the table. The side of the plate opposite the front of the machine is planed so that jigs or fixtures may be attached to it, the tap entering the work after passing through a hole in the plate. In this way, parts can be tapped that are larger than can be handled on the universal table.

Baker Ball-Bearing Air Compressors

The Baker-Hansen Manufacturing Co., 1900 Park St., Alameda, Calif., has recently added to its line of ball-bearing air compressors. Larger sizes in both duplex and two-stage machines are now made, and compressors can be furnished with capacities from 5 to 50 cu ft. of air per minute.

In Fig. 1 is shown a duplex compressor fitted with a glass cover on the crankcase so that the arrangement of the ball bearings can be seen. The machine is constructed similarly to the two-stage type, except that both cylinders are of the same diameter. Both pistons are made integral with a bar that passes from one cylinder to the other. A small connecting link is pivoted at one end on one piston, and run on the ball-bearing crank at the other end. Thus all rotating movement is carried on ball bearings, so that friction is greatly reduced. The bearings are easily accessible for replacement when they have become badly worn.

A ring valve with an automatically operated diaphragm is employed. This valve requires a smaller space than a poppet valve, and thus reduces the amount of piston clearance. An unloader is provided so that the machine can be started without load, and the load gradually put on. A pressure switch of the two-pole type having a one-piece diaphragm is used. This switch

can be sealed so that it operates at any desired pressure to stop the compressor automatically when the pressure has been built up to the predetermined point.

The cylinders are cooled by water circulated from the hoppers by means of the thermo-siphon system. Each cylinder has a strainer to prevent dust from entering.

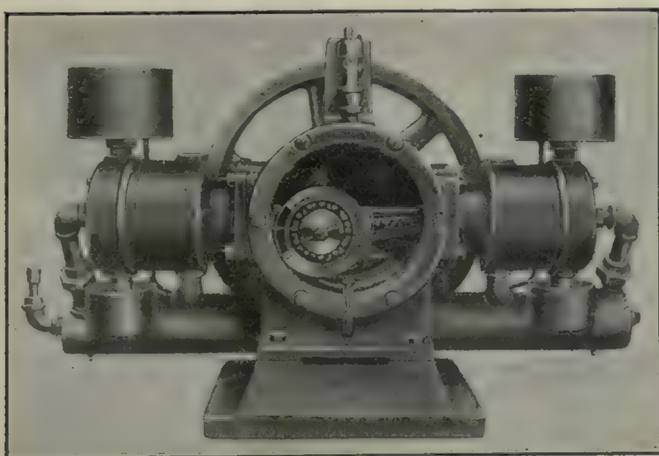


FIG. 1—BAKER DUPLEX BALL-BEARING AIR COMPRESSOR

The receivers are of welded and riveted steel. The compressor and the motor are mounted on cast-iron bases bolted to channel iron and placed on top of the tank, as shown in Fig. 2. Belt drive is employed. The arrangement is such that a minimum floor space is required for the installation.

The latter illustration shows a two-stage compressor having a capacity of 25 cu.ft. of air per minute and working at pressures between 140 and 175 lb. The air is first compressed in the large cylinder, then passed to the copper inter-cooler, and finally compressed in the small high-pressure cylinder. Machines of this type can be furnished for operation by either 1 or 5 hp. motors,

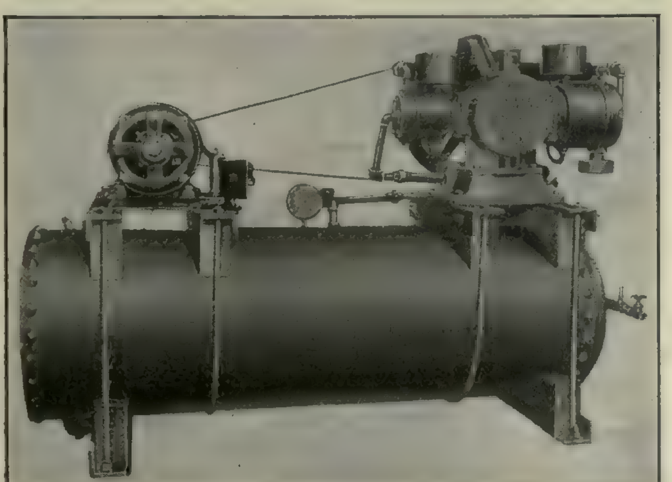


FIG. 2—BAKER TWO-STAGE BALL-BEARING AIR COMPRESSOR

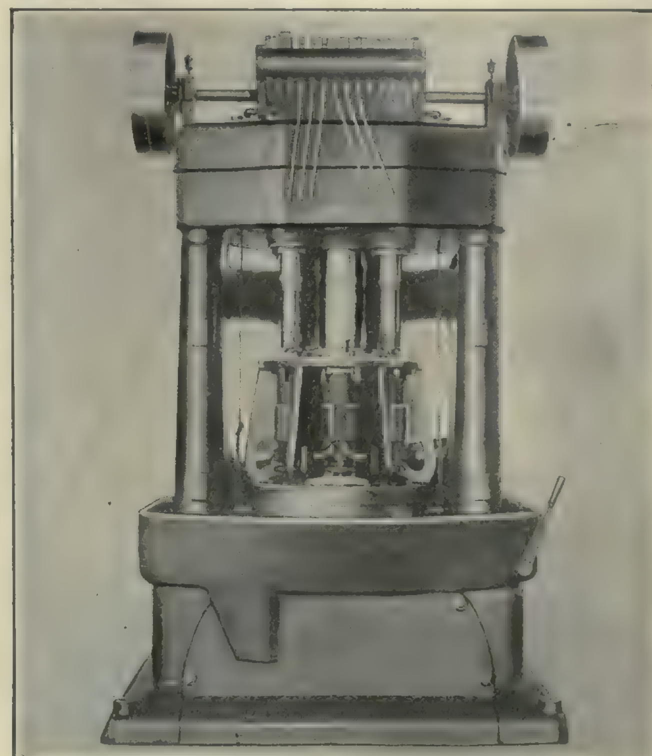
and tanks of different sizes can be provided, according to the nature of the work.

The duplex machine is provided for working pressure of 120 to 150 lb. per square inch for motors of 3, 5, 7½, 10 and 15 hp., depending upon the output required. A variety of sizes of tanks and motors can be coupled to three standard sizes of compressor proper to suit the equipment to varying conditions.

Manufacturers' Consulting Engineers Multiple-Spindle Cylinder Boring Machine

A multiple-spindle machine for boring gas-engine cylinders and finishing the head at one end of the bore has recently been developed by the Manufacturers' Consulting Engineers, McCarthy Building, Syracuse, N. Y. The machine is shown in the accompanying illustration equipped for boring air-cooled automotive-engine cylinders, although it can also be employed for boring cylinders cast *en bloc.*

There are five spindles in the machine; they do not move axially, but have only rotary motion. The work is mounted in a rotating fixture having six positions, five working positions and one for loading. The loading and unloading are done while the cuts are being taken,



MULTIPLE-SPINDLE CYLINDER BORING MACHINE

so that the only lost time is that required for indexing the fixture. Three separate cuts are taken for boring, and two for finishing the head of the cylinder, all being performed simultaneously.

The work holder and work are fed upward to the cutting tools by a cam which makes it possible to obtain a quick return, a quick approach, a uniform boring speed, a reduction in feed for machining the head of the cylinder, and a dwell for the final finishing of the head. It is stated that the time required for the complete cycle of the machine when boring a cylinder 3¼ in. in diameter and 9$\frac{5}{32}$ in. long is 1½ min. Where cylinders are machined in blocks having removable heads, the machining time is reduced.

Unusual rigidity is claimed for the machine, which feature gives accuracy of workmanship. This rigidity is obtained through the use of a large diameter pilot that is integral with the head of the machine and passes through the ram on which the rotating fixture is mounted. The parts are heavily constructed throughout.

The machine is semi-automatic, the only duties of the operator being loading and unloading the work while

the machine is in operation, indexing the fixture when the machine comes to rest automatically at the end of its quick return, and engaging the clutch after the fixture has been indexed.

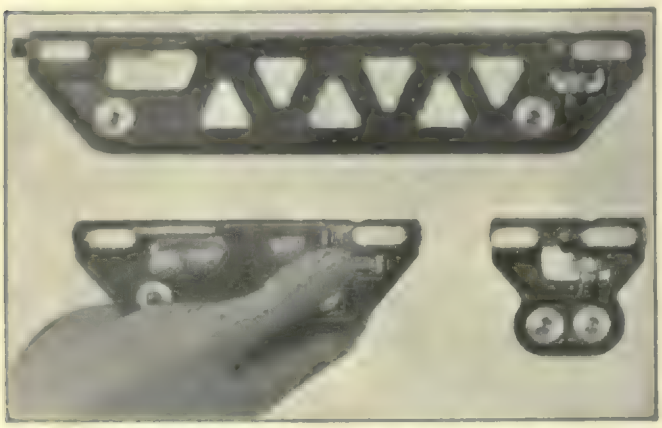
Coolant is employed to keep the cylinder at an approximately constant temperature throughout the cut, so that no distortion due to heating occurs. The coolant is pumped through the spindles and discharged adjacent to the cutting tools on the surface to be machined. It serves to wash away the chips as soon as they are formed. Passing the coolant through the spindles keeps them and the bearings at a constant temperature.

The machine is of considerable size. Its height from the floor to the top of the pulley is 8 ft. 2 in., and the base is about 5 ft. square. The machine is belt driven, with the driving pulley on top of the spindle head. A central oiling reservoir is mounted at the top of the machine and connected to the bearings by tubing.

Pratt & Whitney Adjustable Limit Pin Gage

The Pratt & Whitney Co., 111 Broadway, New York, N. Y., has recently added to its line of precision gages, a pin gage for making internal measurements. By means of its adjustable limits it combines a Go and No-Go gage in one unit. Two spherical-ended hardened steel pins are carried in a cast-iron frame, similar in construction to the "Trusform" gage described on page 1,144, Vol. 54 of *American Machinist*. The frame is built similarly to a bridge truss to combine lightness and strength. The accompanying illustration shows the construction of gages of different lengths.

One pin can be adjusted to any size within the range of the device by means of opposed setscrews which lock the pin firmly in position when tightened. The opposite pin works between two stops, one of which is adjustable to give limits from 0.001 to 0.025 in. The pin can be quickly moved by the thumb and finger of the hand in which the gage is held, the position being shown by the view on the left at the bottom of the illustration. The fingers can be turned in one direction to bring the pin to the Go position, and in the other direction to bring the pin to the adjustable stop for the No-Go size.



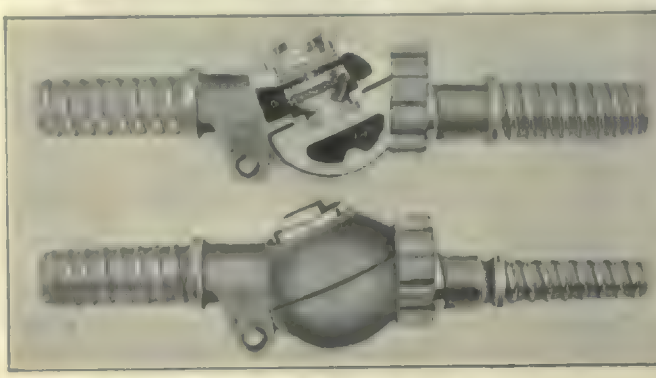
PRATT & WHITNEY ADJUSTABLE LIMIT PIN GAGES

The adjustment may be sealed to prevent tampering with the measurements. The setting can be tested at any time and change made to compensate for wear. Four removable brass disks provide space for marking sizes and other necessary information.

Robinson Automatic Air-Hose Coupling

An air-hose coupling recently placed on the market by the Robinson Machine Co., 39 Eighth St., Muskegon, Mich., is shown in both exterior and sectional views in the accompanying illustration. The purpose of the coupling is to prevent loss of air in the supply line when adding or removing lengths of hose.

The half of the coupling that is connected to the supply line is provided with an automatically operated check valve, which operates as soon as the coupling is parted so as to retain the air pressure. In this way lengths of hose can be either added or removed from the supply line without loss of air, a feature which prevents kinking of the hose. Neither is it necessary for the operator to go continually to the pipe line to turn the air on and off when it is desired to change tools or uncouple the hose. Tools may be changed by simply uncoupling and coupling at the work, so that the time of the operator is saved.



ROBINSON AUTOMATIC AIR-HOSE COUPLING

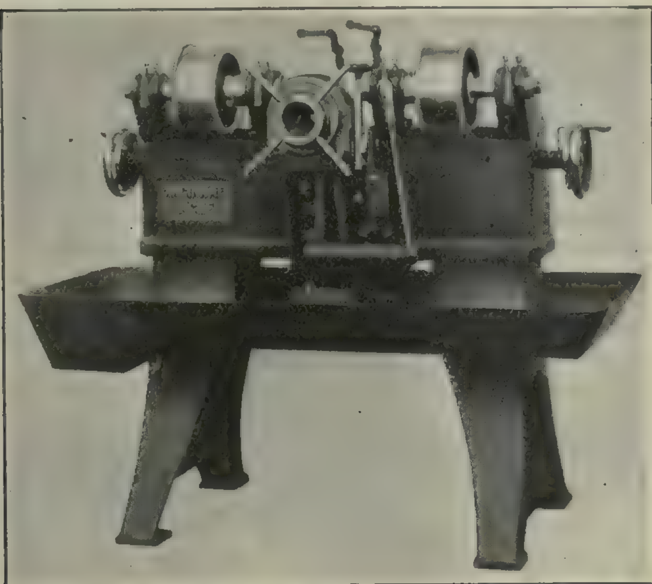
The check valve consists of a brass stem having a leather disk valve facing that can be easily replaced. The valve stem is centered in a reamed hole in the valve cap. Two projections with a crossbar extend beyond the face of the valve seat, and serve to protect the seat when the valve is being dragged along the floor at the end of the hose. This crossbar forms a pivot for the hook on the hose half when making the connection of the two members.

The half of the coupling to which the hose leading to the work is connected has two small projections beyond the valve face, which serve to push the check valve open when the connection is being made, thus admitting pressure to the new section of the line. This half carries a gasket to give a tight connection. When making a connection the hook on the hose half of the coupling is placed under the pin on the line half. The coupling is then pushed together and clamped by means of an eccentric ring that can be turned either way from the center. No air escapes while the connection is being made, and but little force is required to clamp the parts together. Unclamping can be performed just as readily. The air that escapes during this operation is from the hose on the work side, not from the supply line.

The hose shank halves are furnished with "Positive Grip" hose clamps for holding the hose tightly to the coupling. When desired for pipe lines, the line half of the coupling can be equipped with a threaded nipple. The coupling is made interchangeable in ½ and ¾ in. pipe and hose sizes. The body is of malleable iron, and is not subject to corrosion under ordinary conditions. Oil has no effect on the coupling, as the gasket maintains a tight connection even when oil is present.

Cincinnati Acme Duplex Valve Milling Machine

The Acme Machine Tool Co., Cincinnati, Ohio, has recently developed the hand milling machine shown in the accompanying illustration. The machine is equipped with two opposed spindles and is especially adapted for milling straight and tapered squares or flats, such as are



CINCINNATI ACME DUPLEX VALVE MILLING MACHINE

necessary to give the grip for the wrench on the bodies of valves. Either steel or brass can be cut, and the production is limited only by the speed at which the milling cutters can remove the stock, since changing the work can be accomplished very rapidly.

The two spindles are high-carbon steel forgings, and run in bronze bearings. They are independently driven from a plain countershaft, and when necessary, two speeds can be provided. The ends of the spindles have No. 9 B.&S. tapered holes to receive the milling cutters, and they are also provided with slots in the faces to receive the driving tangs of the cutters. The heads are arranged to swivel, so that either straight or tapered surfaces can be machined. They are mounted on slides which have longitudinal adjustment along the bed by means of the handwheels at each end. Micrometer dials aid in setting the slides, so that accurate adjustment can be obtained.

The bed upon which the heads are mounted carries at the front a vertical slide for the work-holding fixture. Adjustable gibs are provided to compensate for wear. The work-holding fixture is opened and closed by the four-pronged handle. It is similar to an automatic spring collet chuck, and the work is inserted from the front. A slight rotating motion of the handle to the right clamps the work, while a partial turn to the left opens the chuck. After the work has been clamped, the entire chuck is free to revolve. The chuck is arranged for indexing to four positions, and it can be clamped in each by a hardened and ground locking bolt.

The work-holding slide is given its vertical movement by means of the long lever connected to it by links. Motion of the lever causes the work to pass between the milling cutters, thus milling two sides of it simultaneously. As the slide moves downward after the cut is finished, the locking bolt is withdrawn from the work-holding fixture automatically, so that the operator may revolve the chuck with his left hand. In his right hand, the operator constantly holds the operating lever, so that the work can be very quickly fed again between the cutters. The vertical slide is counterbalanced to move freely in either direction.

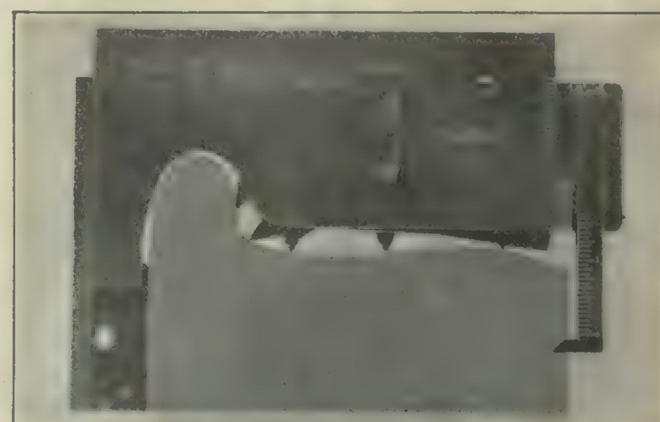
On the back of the bed between the heads there is a small horizontal slide on which is mounted an adjustable stop. The work is brought against this stop, so that all pieces are held alike and the square is machined to the same length on each. A pump to supply coolant to the cutters is also located on the rear of the machine. A large drip pan having a sump collects the coolant after it has passed over the work.

Pratt & Whitney A.R.A. Wheel-Tread Gage

A gage for measuring steel railway wheels when about to restore the proper contour to the tread has recently been placed on the market by the Pratt & Whitney Co., 111 Broadway, New York, N. Y. The gage, which is shown in the illustration herewith, is designated as the A.R.A., since it conforms to the standards and practice recommended by the American Railway Association. It serves to give a direct reading of the amount of service metal still available on used steel or steel-tired wheels, so that this amount may be taken as a basis for billing foreign roads for wheel replacements according to the interchange rules.

The gage indicates the amount of metal that will remain after turning, so that it can be determined in advance whether a worn wheel is worth re-turning to obtain the standard contour. The measurement can be obtained both before and after turning.

In the illustration, the gage is shown applied to a worn tread. The face on the left is held in contact with the wheel, the central pointer is put in contact with the



P. & W. A.R.A. WHEEL-TREAD GAGE

tread, and the hook on the bar at the right is placed in the groove provided in the wheel to indicate the limit of wear. The four sliding pointers are next brought in contact with the wheel and flange. The gage can then be removed for reading.

The sliding front plate is moved downward until its lower edge coincides with the lowest point of the four sliding pointers. The scale on the right of the body of the instrument indicates the amount of metal that must be removed in order to restore the standard contour. The scale on the small bar projecting at the right shows the amount of service metal that will remain after the contour has been restored. The contour may be observed at several points on the circumference of a wheel, so that the maximum wear may be ascertained.

Colburn Special Gang Drilling Machine

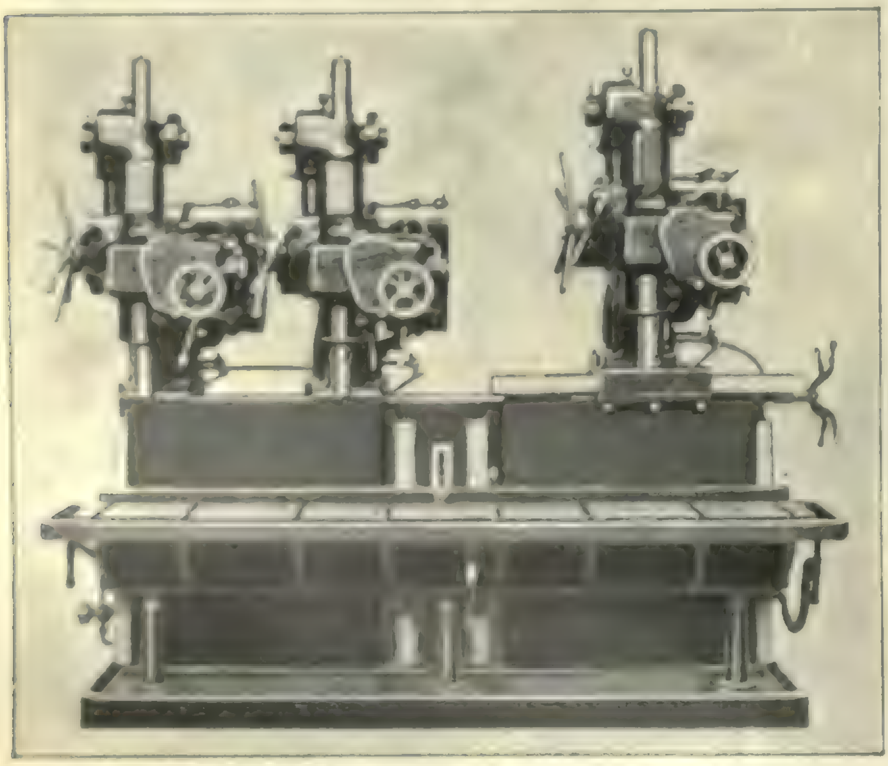
A special gang drilling machine having longitudinal movement for one of the heads has recently been placed on the market by the Consolidated Machine Tool Corporation of America, 17 East 42nd St., New York, N. Y., the machine being built at the Colburn Machine Tool Plant, Cleveland, Ohio. The general arrangement of the parts of the machine, as regards the four-spindle column and table, is similar to that in the Colburn gang drilling machine described on page 1,051, Vol. 46 of *American Machinist*. The difference is in fact that there are only two heads permanently mounted on the left side of the column with a fixed center distance between them. The third head is mounted on the right side of the machine on a plate attached to the column and having finished ways.

The movable head has an adjustment of 27 in., and is moved by means of a screw and capstan handle. Provision is made for clamping the head securely in the desired position. The minimum center distance between the adjustable spindle and the nearest fixed spindle is 27 in., and the maximum distance 54 in. The total range that can be obtained by the machine between spindle centers is 27 to 81 inches.

A machine having the same column and table, but with only two heads, can be arranged in the same manner. One head is fixed at the left end of the column, and the other head is movable from the right end over to the first head.

It is easily possible to convert the machine into the regular four-spindle machine with 27 in. fixed center distances between the spindles. The movable head is moved to the left end of its travel, and a fourth head secured to the plate on the right-hand end of the column. By removing the right-hand head, adjustment of the center distance can again be obtained by means of the third head in combination with either the first or the second head on the left.

The heads illustrated are those of the regular No. 4 drilling machine, having a capacity in steel of 2 in., although either the smaller size No. 2 or the larger size No. 6 machine, such as described on page 899, Vol. 55 of *American Machinist*, can be arranged with this mounting. The distance between the center of the spindle and the base of the column is 12½ in., and the machine is rated at 24-in. swing. Supporting screws are provided under the center and ends of the table, and both the table and column are heavily ribbed. The table has a 3-point bearing on the column. It can be raised and lowered by means of a single crank operating the three screws simultaneously.



COLBURN SPECIAL GANG DRILLING MACHINE

Each head can be operated independently of the others. The drive is ordinarily by belt to a constant-speed pulley on each head, although a countershaft may be employed and attached to the rear of the machine. For motor drive, a ball-bearing countershaft near the floor is geared directly to the motor. Two mechanical speed changes are provided, although removable change gears located on the left side of each head may be used to furnish fifty spindle speeds from 40 to 500 r.p.m. The two mechanical feed changes can be supplemented by transposing gears so that thirty-two feeds from 0.006 to 0.109 in. per revolution of the spindle are available.

The driving and feed gears are mounted inside each head and run in oil. They are made of heat-treated chrome-nickel steel. The shafts are of large diameter and mounted on ball bearings. The spindles are equipped with double splines. Automatic tripping devices are provided to control the depth of hole. A pump for coolant can be furnished, with piping to bring the coolant directly to the point of the drill.

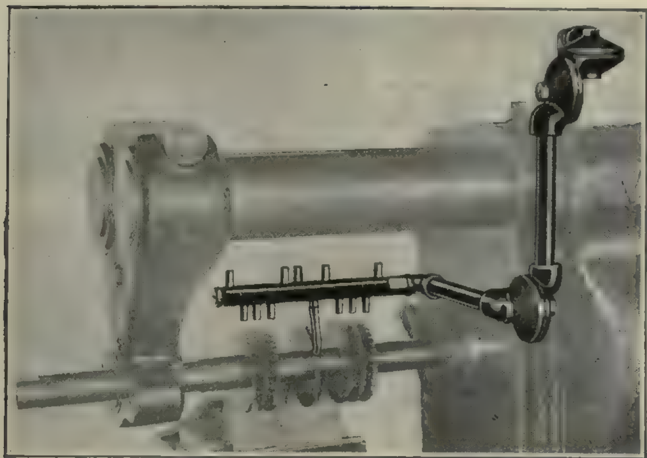
Borgeson "Multi-Production" Lubricator

The "Multi-Production" lubricator shown in the accompanying illustration is a recent product of the Borgeson Tool & Machine Co., Inc., 501 East Water St., Syracuse, N. Y. The lubricator is an attachment for lathes, milling machines and other machine tools, and it serves for directing and distributing the cooling compound to the tools and work. It is equipped with a number of nozzles, so that a flood of coolant can be brought to the position where it is needed to cool the tools and enable continuous production.

The nozzles are mounted on a slotted distributing tube, and are held in position by the tension of a spring. By turning a nozzle on the tube, the nozzle can be brought into position opposite the slot, or it can be turned away from the slot when it need not be used. Since the slots registering with the nozzles are elongated, a considerable range of adjustment is possible for each nozzle in its open position.

The attachment plug by which the coolant is brought to the distributing tube is threaded, and can be located at either the end or the middle of the distributing tube. Standard pipe sizes are employed for the threads, except that a special thread to fit Jones & Lamson machines can be provided.

The distributing tubes can be attached directly to the coolant piping



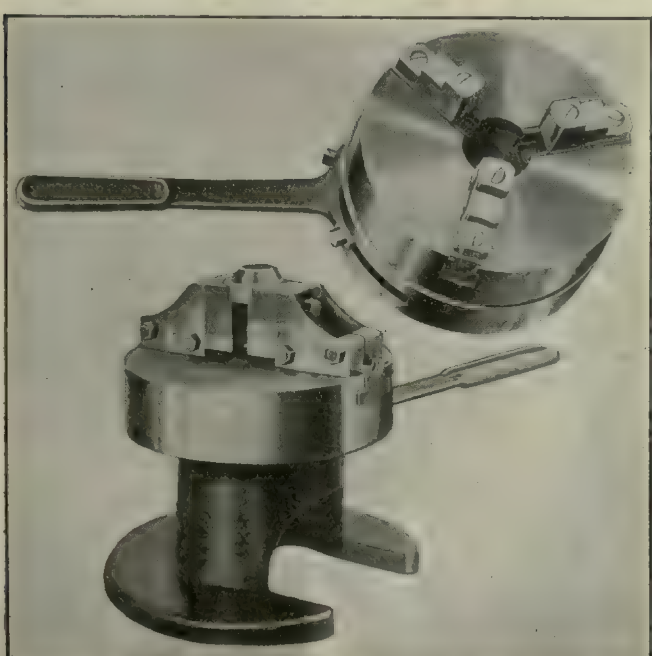
BORGESON "MULTI-PRODUCTION" LUBRICATOR ON MILLING MACHINE

that is furnished on the machine. Where swivel joints are required, an arrangement such as shown on the milling machine in the illustration can be employed. These swivel joints are made either single or double and allow the distributor to be swung into any position. The joints have large ground friction surfaces and do not leak or allow the nozzles to jar from position when the machine is in use.

From six to twenty nozzles can be furnished on the distributing tube, with a ½-in. pipe thread connection. Spouts 2½, 3½ and 4½ in. long for attachment to the nozzles can be furnished from stock, and special lengths and shapes can be supplied on order.

Changes in Barker Wrenchless Chuck

The Thomas Elevator Co., 22 S. Hoyne Ave., Chicago, Ill., manufacturer of the Barker wrenchless chuck and drilling machine vise, has recently made several changes in the design of the chuck, which was originally described on page 881, Vol. 42 of *American Machinist.* The cam mechanism has been redesigned so as to obtain greater strength and a greater travel of the jaws, which makes it possible to handle a wider range of irregular work than heretofore.



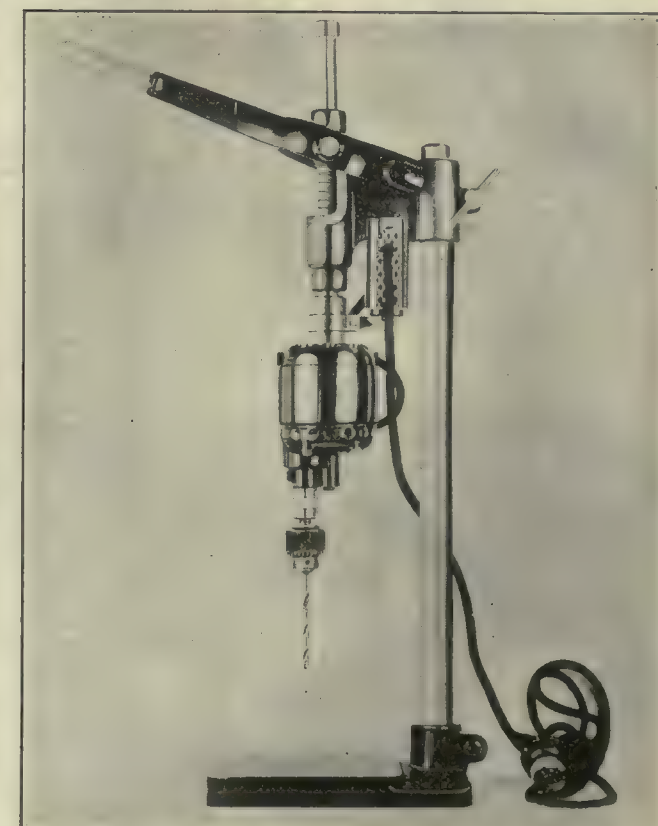
BARKER WRENCHLESS CHUCK AND DRILLING MACHINE VISE MADE BY THOMAS ELEVATOR CO.

In the smaller sizes of the chuck, a box cam eliminates the necessity for the use of trunnion arms, and in the larger sizes, the arms have been redesigned to obtain greater strength and a wider range of movement. These changes make it possible to apply a large leverage without injuring the chuck. At the top of the accompanying illustration is shown a three-jaw lathe chuck, while a two-jaw drilling machine vise is shown at the bottom.

Jones Automatic Sensitive Bench Drilling Machine

A small electric-driven sensitive drilling machine for use on a bench is shown in the accompanying illustration. The machine has a capacity for drilling holes up to ¼ in. in diameter in steel, and it has recently been placed on the market by Joseph W. Jones, 29 West 35th St., New York, N. Y.

The principal feature of the machine is that it is equipped with a device for automatically starting and stopping the motor as the handle is lowered and raised.



JONES AUTOMATIC SENSITIVE DRILLING MACHINE

The motor and the drill do not revolve when the handle is in the raised position and no work is being done. Electric current is saved in this way, and wear is reduced on the parts, since they do not run during the time in which the operator is changing the work underneath the spindle.

The motor drives the spindle through gears, and is operated on current taken from a convenient lighting circuit. The whole installation is very easily portable. The machine is particularly suitable for manufacturing purposes, where light drilling operations are required. The base is 7½ x 6 in. in size, and the column 20 in. high. The net weight is only 18 pounds.

News Section

National Founders Hold 26th Annual Convention

The responsibilities of employers to their employees, with particular emphasis upon the thought that an honest return from labor is predicated squarely upon the giving to labor of honest treatment, was the subject of the annual report of William H. Barr, president of the National Founders' Association, delivered last week at the twenty-sixth annual convention of the association at the Astor Hotel, New York City. Mr. Barr said, in part:

"We have passed through a year of industrial readjustment and conflict, the upward progress of which is complicated, not only by social chaos throughout the world, but also by two national utility calamities involving public deprivation, heavy financial losses and violent death.

"And while the establishment of open shop conditions on the railroads and in the coal mines were not wholly successful, nevertheless, substantial improvement in operating conditions was made. Great credit is due to many executives and mine operators for their fearlessness in refusing, under heavy pressure, to waver from the path of conscientious public duty.

"While it may be true that each branch of industry is more or less selfish, I believe that its attitude toward subjects of national concern no organization—industrial or otherwise—has ever been guided by stronger patriotic motives than the National Founders' Association.

An unbiased investigation of labor unions by Congress was suggested by Mr. Barr. He said the treatment of employees should be such as to inspire "that pride in the job which the labor unions have almost completely destroyed." He predicted that prosperity in the coming year would be checked by a shortage of unskilled labor because of the present immigration law.

The speakers at Wednesday's session were John E. Edgerton, President of the National Association of Manufacturers, who talked on the "open shop;" L. F. Loree, President of the Delaware & Hudson Railroad, who spoke on the railroad situation, and Dr. J. J. Moorehead, whose subject was "The Physician in Industry."

The feature of Thursday's session, Nov. 23, was the talk on "Improved Foundry Practice," by D. R. Wilson, vice-president of the Wilson Foundry and Machine Co., Pontiac, Mich. Mr. Wilson's paper was supplemented by a detailed lantern slide talk by H. M. Lane, foundry expert of the Wilson Co., describing in an instructive manner the operations, processes and methods employed in the Pontiac foundry in securing large scale production.

Colonel Samuel Harden Church, President of the Carnegie Institute, Pittsburgh, was the speaker at the annual dinner. At the final session William H. Barr was re-elected president of the association for the ensuing year and Chas. L. Taylor, of the Taylor & Fenn Co., Hartford, Conn., was elected vice-president.

The attendance upon the convention was one of the chief features, more than fifty per cent of the entire membership being present.

Annual Meeting of Taylor Society

The growing interest in scientific sales and production management was evident last week in the large attendance of keenly interested executives from many lines of industry upon the sessions of the annual meeting of the Taylor Society which held a three-day convention at the United Engineering Societies Building, Nov. 22, 23 and 24.

An excellent paper was that delivered by Percy S. Brown, Works Manager of the Corona Typewriter Co., Groton, N. Y. Its title was "The Organization and Management of a Medium-Sized Plant." The presentation covered all the phases of management, and the speaker was not sparing in detail. What he said aroused great enthusiasm among the members of the large audience and called forth considerable discussion. That the criticism was in no way destructive was evidence of the value of the paper and the belief of his hearers that Mr. Brown's company has formulated a highly efficient management system and is conducting its plant with little avoidable waste. The discussion was led by L. H. Ballou of the Lewis Mfg. Co., Walpole, Mass., and R. H. Landsburg, Horton School, University of Pennsylvania.

In the afternoon Harry B. Horwitz of the planning department of Harry A. Wembridge, statistical division and Herman J. Hutkin of the methods division of the Joseph and Feiss Co., Cleveland, read a paper on Statistical Compilation: Some of its Uses as a Function of Scientific Management.

The evening session was marked by the address of the managing director of the Society, Mr. H. S. Person. The subject of the paper was "Shaping Your Management to Meet Developing Industrial Conditions." The paper was an exhaustive study of present day economic changes with a critical estimate of the management methods which have obtained in industry in the past few years. Mr. Person pointed out the great value to industry to be gained by research and study of the economics of raw material and price movements. He concluded with a forecast that the successful sales or production manager of the next ten years will be one who is a keen annalist of markets and methods rather than the so-called "go-getter" type in evidence in recent years.

The sessions of Friday, Nov. 24 were given over to papers by W. W. Duncan of the Hood Rubber Co.; Ernest E. Brooks of the Dennison Co.; and Philip J. Reilly, associate director of the Retail Research Association.

Bethlehem Buys Midvale and Cambria

The board of directors of Bethlehem Steel Corporation at a special meeting held yesterday authorized contracts for the purchase of the plants and other assets of Midvale Steel and Ordnance Company and of Cambria Steel Company, accepting the ordnance plant and other business located at Nicetown, Pa., and assets appurtenant thereto.

In payment for the properties to be acquired, Bethlehem Steel Corporation, besides providing for the assumption of the bonds and other indebtedness of the Midvale and Cambria companies (excepting current liabilities appurtenant to the operation of the Nicetown plant), will issue about $97,650,000, par value, of the Bethlehem common stock, of which $95,000,000, par value, will go to the Midvale company for distribution on dissolution to its stockholders, and the balance to the holders of the stock of Cambria not held by Midvale.

Further Decline in Structural Sales

A marked seasonal decline in the sales of fabricated structural steel in October is announced by the Department of Commerce from reports made to the Bureau of the Census. October sales amounted to 54.9 per cent of shop capacity, compared with 61.6 per cent in September.

Reports received from 140 identical firms from April through October, with a shop capacity of 221,790 tons per month, show the following actual tonnages booked each month and the percentage of shop capacity represented by these bookings. A revision of these capacities in accordance with a uniform standard is now being undertaken by the Bureau of the Census.

	Tonnage Booked	Per Cent of Capacity
April	191,805	86.5
May	172,260	77.7
June	153,278	69.1
July	141,907	64.0
August	143,515	64.7
September	136,587	61.6
October	121,763	54.9

German Activity in Russia

The well-known Wolf concern of Cologne, one of the largest German concerns in the iron and steel industry, has just formed a new company for the sale of iron, steel, machinery, etc., in Russia. The new company has the right to import these products into Russia, independent of the Russian Foreign Trade Commission. The Wolf concern has placed the amount of 750,000 pounds sterling to the disposal of the Russian Government and promised the further payment of 500,000 pounds sterling. Both sums are to be used in connection with the business of the new company. Branch offices and depots will be opened in a number of the larger Russian cities.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

HERE are the more important items in the Farm Bloc program as announced by its titular leader, Senator Capper, as Congress convened:

"A complete rural credit organization.

"A reduction in freight rates.

"A re-establishment of state control over intra-state railway traffic.

"A better marketing system.

"The delivery of the Muscle Shoals project to Henry Ford.

"An income tax on corporate surpluses and stock dividends.

"A constitutional amendment prohibiting tax exempt securities."

Other congressmen within and without the Farm Bloc are demanding that a Bonus Bill which will cost no one knows how much shall be passed, and if necessary repassed over a possible veto, and in his speech urging a ship subsidy that will call for from 20 to 50 million dollars a year the President said that the Administration would lend a "willing ear" to any measures that will mitigate the distress of the farmer who is "the chief sufferer from the cruel readjustments which follow war's inflation."

In thus summarizing what is asked of Congress it is not intended to criticize or oppose any of the proposals made. They are all debatable. Each one has the backing of an important portion of the body politic and the demand for lower freight rates will certainly be very popular with every one but the railroads.

But it is also to be observed that in its entirety the program is avowedly agrarian and contemplates a heavy increase in the taxes that are directly paid by invested wealth. Therefore it is not surprising that stocks and bonds have declined. The railroad shares have been especially weak, upon the theory that there might be an early reduction in freight rates, but the stocks of the forty odd big corporations that have recently declared stock dividends have also dropped as the recipients of these dividends have been turning them into cash and buying tax exempt bonds in an effort to prepare for the deluge of new taxes that is anticipated.

But the depreciation that has taken place since Sept. 25, when I first called attention to the change of sentiment, is not primarily due to the selling of any particular group or individuals. Capital, which was growing cautious as the election approached, has been seriously alarmed by the size of the radical vote cast, and the epidemic of fear now prevalent will probably run its course. It is futile to point out that the old Congress now in session will expire by limitation on the 4th of March. That it is unlikely that it will pass any legislation of importance except the appropriation bills. That the newly elected Congress cannot meet before December, 1923, unless the President calls a special session, which is unlikely, and that we probably have a year of comparative political tranquility ahead of us.

All this is forgotten or ignored. But when the wave of pessimism and fear that is now sweeping the investment market has subsided it will probably be found that prices have been carried too low and that the time to buy is when, as at present, most people are eager to sell. This is why I am now disposed to suggest that those who have common sense and money should commence looking for bargains in the confident belief that the people of this country will, in the future, as in the past, find a way to avoid being ruined by fool legislation.

The commodity markets and business generally have not as yet felt the stock market depression, nor is it logical that they should, for most of the proposals by which investors have been scared are intended to benefit the farmer and the wage earner.

The scarcity of labor is becoming acute. In the country as well as in the cities there is a job at good pay for every one who wants to work. One result of this is sustained activity in the retail and jobbing trades, but there has been no speculation and the buying is still from hand to mouth.

The railroad congestion is somewhat relieved. The Federal Reserve statement shows a substantial contraction of credit, a gain of $15,000,000 in gold and a higher reserve ratio, but the money market is no lower.

The production of coal is now on a scale which assures an adequate though not a superabundant supply for the winter. Both iron and steel are somewhat lower as the demand for the latter is a little less eager. An excellent demand for copper is reported, but the market is held down to 14 cents by the selling of the large producers who seem to fear that a higher price would lead to the reopening of the smaller mines and a burdensome increase in the supply.

The "edge" appears to be temporarily off the cotton market as in the light of the ginning figures the crop looks a little larger than previously. But the demand for cotton goods is excellent and most of the mills are sold well ahead. Sugar is firmer on the strong statistical position. Wool and woolen goods are steady without appreciable change in price. Rubber is slightly higher. Silk is a shade easier. Hides and leather are steady, reflecting an excellent shoe business, although the upholstery demand is poor.

Our foreign trade figures for October show exports valued at $372,000,000 as against $343,000,000 last year. This is both surprising and encouraging. Imports are not yet reported, the delay being due to the rush caused by the tariff bill.

The news from Europe is still rather sombre. Germany continues to print paper marks at the rate of several billion daily in an effort to avert the inevitable deflation. Financial England seems somewhat heartened by the victory of the Conservatives, but industrial Lanchasire is rather less cheerful and some short time is reported. Sterling exchange has advanced sharply and francs followed but only to lose most of their advance. French business seems to be fairly prosperous despite the financial predicament of the government.

From Russia an amazing recovery is reported since the Soviet government permitted a partial resumption of capitalistic practices, but the news is almost too good to be entirely true and it is probably colored by the self interest of those in power.

Mexico seems to be still in a state of financial instability and irritability, but the outlook elsewhere in Latin America and especially in Cuba is satisfactory and encouraging. In Canada good crops and a dollar that is worth more than 100 American cents are creating a consciousness of prosperity.

Speaking generally it may be said that in the Western hemisphere Thanksgiving Day may be celebrated with real thankfulness for blessings already enjoyed, but in Europe it will be chiefly observed with the gratitude that has been defined as "a lively appreciation of favors yet to be received."

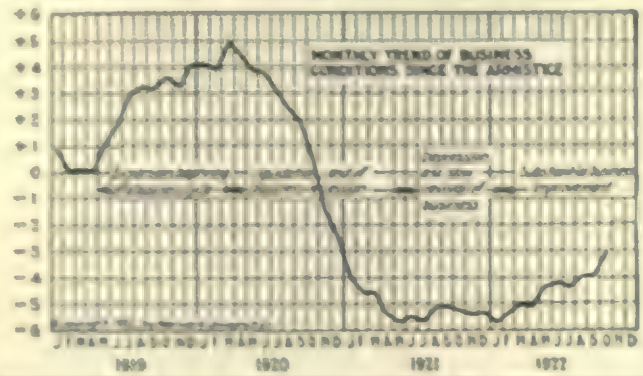
U. S. Leads in Railway Mileage

In the following table, prepared by the Bureau of Railway Economics, the railway mileage of the United States is compared with that of some of the other countries by indicating, through multiples, how many times the mileage of the United States exceeds that of the other countries.

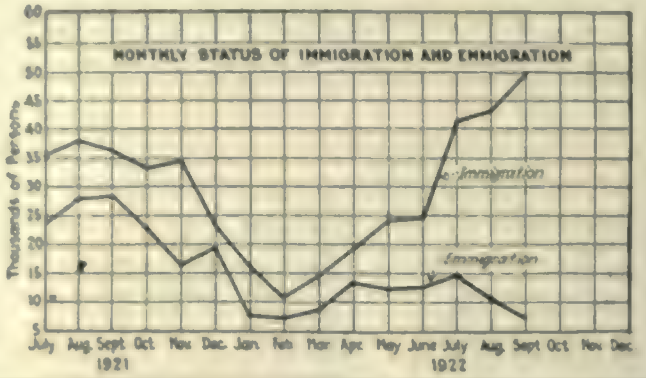
	Railway Mileage	Ratio of U. S Mileage to Mileage of Country Named
United States	264,373	....
Russia (incl. Asiatic)	51,646	5.1 times
Canada	38,888	6.8 times
British East Indies	36,325	7.3 times
Germany	36,131	7.3 times
France	35,145	7.5 times
United Kingdom	24,396	10.8 times
Argentina	23,156	11.4 times
Brazil	17,478	15.1 times
Mexico	15,841	16.7 times
Italy	12,501	21.7 times

"In other words," says the Bureau, in commenting on the comparison, "the railway mileage of the United States is five times as great as the mileage of Russia, which contains the next largest system of railways.

Monthly status of immigration and emigration in the United States based on returns collected and compiled by National Industrial Conference Board.



Trend of business conditions in the United States based on Bradstreet's price index and Bank Clearings outside of New York as computed by Harvard Economic Bureau.



BUSINESS conditions since the armistice as reflected in the statistics of the Harvard Economic Bureau show that the slow revival of business which set in about January of the current year is continuing steadily upward, with a substantial business improvement reflected in October. Bank clearings outside of New York and Bradstreets price index upon which the curve of business conditions is based show an improvement in October as compared with September of seven-tenths of one per cent.

Bond prices as reflected from the average of 40 representative issues in the New York market fell off slightly in October to $80.82 as compared with $82.14 in October. The decline was largely in sympathy with the share markets, but of no great significance. High grade bonds continue to be attractive and in demand and the average price of the 40 issues shows a progressive advance from $69.71 in January 1921 to the October average without any reaction in that time.

Production of manufactured goods in the United States continues to show the heavy volume which began in May of the current year. The total volume of manufacture reached 99.1 per cent in June, declining slightly in July to 95.2 per cent. Estimates for August and September point to a record volume of production of 104.6 per cent and 101.3 per cent respectively. The chief commodities showing increases of considerable proportions over the early months of the current year are lumber, petroleum, textiles and food.

Comparative Prices of Shop Supplies

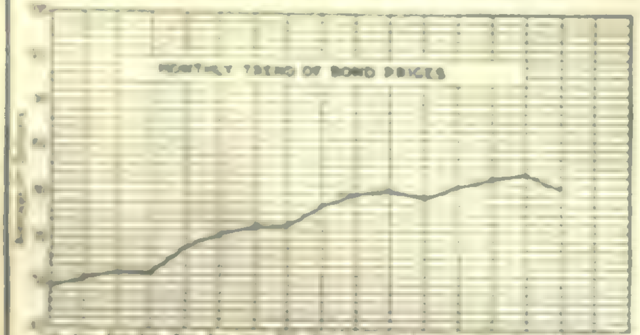
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0295	$0.0295	$0.0273
Cold finished shafting	per lb.	0.0378	0.0378	0.0373
Brass rods	per lb.	0.171	0.1700	0.15
Solder (½ and ½)	per lb.	0.24	0.23	0.20
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.59	0.575	....
Machine oil	per gal.	0.36	0.36	....
Belting, leather, medium	off list	30–10% @50%	40–5% @50%	–
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

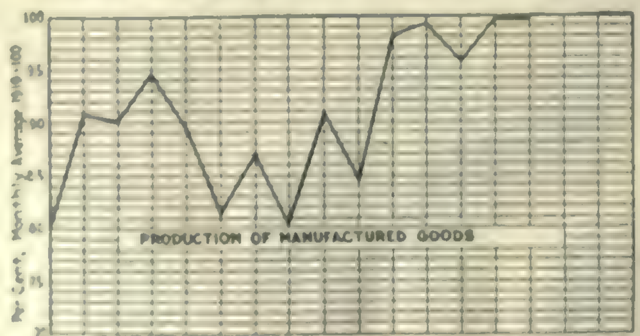
Serious labor shortage, both skilled and unskilled, continues to occupy the attention of the majority of essential industries. Manufacturers associations in convention assembled during the past few months have been unanimous in declaring themselves against the present immigration legislation and in many cases they have passed resolutions favoring amendments to the acts so as to permit the necessary labor to enter this country. Statistics compiled by the National Industrial Conference Board show that since January, 1921, up to date the net gain in immigration over emigration has averaged less than 18,000 persons per month. The result has been a great shortage of workers and a consequent bidding up of labor rates to draw men from one industry into another. One of the matters which will, without doubt, be brought before the next Congress, will be some measure of legislation calculated to relieve the serious situation which has developed, from which all industries suffer.

Loadings of revenue freight continue to be the heaviest in the history of American roads. For the week ending Nov. 11, a total of 953,909 cars were loaded, an increase of 198,132 cars as compared with the corresponding week of last year and an increase of 26,328 cars compared with the corresponding week in 1920. Car shortage continues serious, the total shortage on November 8 totaling 174,498 cars, a decrease of about 4,000 cars from week previous.

Monthly movement of bond averages based on weekly prices of 40 representative railroad and industrial issues compiled and furnished by Times Annalist.



Percentage of total manufacture of steel, lumber, paper, petroleum, textiles, leather, food and tobacco compiled by Federal Reserve Board.



Decrease in Bad Order Locomotives

The railroads of the country repaired and turned out of their shops during the period from Oct. 15 to Nov. 1 last the largest number of locomotives for any semi-monthly period in approximately the last two years, according to reports received today from the carriers by the Car Service Division of the American Railway Association.

During that semi-monthly period, 13,490 locomotives were repaired. This also exceeded by 2,086 the number turned out of the shops from Oct. 1 to Oct. 15 last.

Locomotives in need of repair on Nov. 1 totaled 18,366, or 28.5 per cent of the number on line. This was a decrease of 865 since Oct. 15, at which time 19,231, or 29.8 per cent were in need of repairs.

Of the total number on Nov. 1 last, 15,101 were in need of repairs requiring more than 24 hours. This was a decrease since Oct. 15 of 834 locomotives in the number needing heavy repairs. The remaining 3,265 represented locomotives in need of light repairs, which was a decrease of 31 within the same period.

Reports filed by the carriers show that on Nov. 1 the railroads had 46,096 serviceable locomotives.

Weirton Steel Co. Will Erect Big Sheet Mills

Eight sheet mills involving an outlay of $1,500,000 will be erected in Weirton, W. Va., within a year by the Weirton Steel Co., according to an announcement last week by D. M. Weir, vice-president of the company. Five hundred men will be afforded employment by the completion of the new unit. The output of the mills, Mr. Weir said, would be restricted to black and galvanized sheets and the new department would be conducted entirely separate from the tin unit of the plant.

The construction of the battery of sheet mills will bring the number of hands employed by the Weirton Co. close to the 16,000 mark.

Southern Metal Industry Expanding Trade with South America

Southern metal trades industries have been experiencing an unusual increase in export sales to Latin-American countries the past five or six weeks, according to William E. Dunn, Jr., secretary of the Southern Metal Trades Association, who advises that metal trades products made in the South are in greater demand now in all Latin-American countries than in the past two years. Central, South American and Cuban trade is especially good, with Brazil and Argentine trade in the lead. Porto Rican conditions are rapidly improving, and border trade with Mexico has increased rapidly during the past two months. The outlook, Mr. Dunn states, is for the largest export business with Latin-American in 1923 that the southern metal trades industries have yet experienced.

New Process Gear Plans Expansion

Definite plans for the expansion of the New Process Gear Corporation of Syracuse, recently purchased for $2,100,000 by T. W. Warner, of Toledo, vice-president of the Durant Motors, Inc., are being worked out. The plant has been working at full capacity producing gears for both the Durant and Star cars for several months, and it is understood that the plans being formulated call for a larger plant. C. R. Burt is managing the plant for Mr. Warner, and it is understood that he will remain at the head of it.

The Alliance Machine Co., Alliance, Ohio, according to reports, has booked orders for thirty-one cranes and hoists during the past month.

Supreme Court Denies Duesenberg Claim

The possibility of an armistice ending the world war was a factor influencing contracts for war supplies in which the contractor should share responsibility in certain classes of cases, according to a decision of the United States Supreme Court, rendered Nov. 13 in denying a claim of the Duesenberg Motors Corporation against the government for $152,808.93. The Court of Claims had dismissed the claim and the Supreme Court upholds this action.

The Duesenberg corporation entered into a contract to manufacture airplane motors, the contract being changed twice, first to enlarge an order for Liberty motors and later to change the type to Bugotti motors. Specifications were delayed and at the same time the plant was not fully ready, when the armistice ended the need for the motors. The corporation claimed the $152,808.93 to be due it in addition to the amounts which were paid it by the government.

Leather Belt Men Hold Educational Sessions

A three-day educational session of the Leather Belting Exchange was held at the Hotel Pennsylvania, New York, N. Y., November 16, 17, 18. As the purpose of the meeting was to interest the members in the finer points of leather belting manufacture, the main feature was a description of the experimental work carried on by the scientific research committee in its laboratory at Cornell University.

R. F. Jones, the research director, discussed "Research Work in Leather Belting," following his address with a demonstration of a miniature of the apparatus in use at the Cornell laboratory. Among the other subjects taken up were: How a Belt Transmits Power, by J. E. Rhoads, chairman research committee; The Belt vs. the Motor—the Costs of Belt Tensions, by R. C. Moore, chief engineer, Chas. A. Schieren Co.; The Chain Drive in Its Relation to Leather Belting, by C. O. Streeter, mechanical engineer, Graton & Knight Manufacturing Co. The same program was given Thursday and Friday with the substitution of Dr. R. R. Tatnall, chief engineer, J. E. Rhoads and Sons, in place of J. E. Rhoads in the discussion of How a Belt Transmits Power.

Locomotives for the Polish Railways

According to a report recently received, the Polish Railway Administration has placed orders for 25 locomotives in the United States and 20 locomotives in Switzerland, aggregating $900,000. Further orders have also been placed during the last few days with Austrian works. The latter are for locomotives of a lighter type and will be used on the Galician sections of the State Railways.

The Polish Government has also placed an order for 150 big tank cars with the French Arbel Works.

Business Items

The Manufacturers' Polishing and Platers' Supply Co., of Bridgeport, Conn., incorporated the past week, to manufacture polishing and platers' supplies, buffing tools, etc., has taken a lease on 6,000 square feet of floor space in a portion of the old Morris Metal Goods Co. plant on Union Ave., that city, and plan to begin operations Dec. 1.

The Perry Laundry Machinery Co., of Fairhaven, Mass., has incorporated under the laws of Massachusetts, to manufacture laundry and other machinery, etc., The capital stock is $100,000, and the incorporators are: Frank Vera, Emanuel J. Perry, 1352 Rockdale Ave., New Bedford, Mass., and M. V. Sequeria. Mr. Vera has been chosen president, and Mr. Perry is the treasurer of the company.

The Guy Steel Casting Co., Elmwood, a suburb of Hartford, Conn., has, during the past week, filed a certificate of dissolution with the Secretary of the State of Connecticut. The firm has decided to cease business, and claims may be sent to Mr. George B. Kinghorn, 776 New Britain Ave., Hartford, Conn. The company made steel castings, etc.

The Acme Shear Company, Bridgeport, Conn., large manufacturers of shears, cutters, etc., has recently increased the capital stock of the concern from $500,000 to $1,000,000. A certificate to that effect was filed during the present week with the Secretary of the State of Connecticut.

The Moore Drop Forging Co., Springfield, Mass., is about to build a new machine shop to be located close to the drop forging plant. It is to be 93 x 35, one story and will cost $20,000. McClintock & Craig of Springfield are the architects and L. S. Wood has the building contract.

The Dominion Wheel and Foundries Co., Toronto, has recently acquired the plant at Cobourg, Can., formerly occupied by the Crossen Car Co., in which it is making brake shoes and general castings.

The Alloy Steel Castings Co., the plant of which is located at Levittsburg, Pa., has been granted authority at Columbus, Ohio, to increase its capital stock in the amount of $300,000, making its total capitalization $450,000. O. R. Grimmesey, treasurer of the com-

pany, says that the increase will augment the company's output approximately 100 per cent.

The Hyken Manufacturing Co., Canton, Ohio, manufacturer of automobile and electrical tools, suffered a loss from fire during the the past week estimated at $[illegible].

The Premier Manufacturing Co., of Sandy Hook, Conn., manufacturer of electric, gas and water instruments, has during the past week, acquired the business of the W. & B. Douglas Co., Middletown, Conn., manufacturer of pumps and equipment since 1832. The same firm has also acquired the business of the Standard Metal Work Corporation, of Thompsonville, Conn., manufacturer of sheet metal parts, etc. Charles H. Cole, president of the Premier Co., states that the concern will probably have a capital stock of about $[illegible], and that the general office of the companies will be removed to Middletown, using the Douglas plant as main headquarters. The other plants will still be in operation and they will continue to make the various articles as heretofore.

The Locomobile Co. of America at Bridgeport, Conn., by order of Referee Keogh, has been formally transferred to the trustees of the new Locomobile Co. of America, a new York corporation, controlled by W. C. Durant.

The General Motors Corporation estimates that 1922 sales will aggregate [illegible] motor vehicles. In the first three-quarters of the year 316,136 cars and trucks were produced.

The Hayes Wheel Co. of Canada, Ltd., recently purchased the plant of the General Forgings and Stampings, Ltd., at Meriton, Can., and will equip it to produce automobile rims.

The Apex Tool and Stamping Co., [illegible] Southern Parkway, Louisville Ky., has been organized recently to manufacture tools and stamped metal goods.

The National Forge and Tool Co., Irvine, Pa., is planning to increase its manufacturing facilities by installation of additional equipment.

The Mid-City Railroad Co. has been incorporated at Haines City, Fla., with $[illegible] capital, and plans construction and operation of a line between Haines City and Polk City, fifteen miles, and a later forty mile extension to Clermont, Fla., thence to Dade City, thirty-five miles. Isaac Van Horn is named president of the company.

The Broadfoot Iron Works, of Wilmington, N. C., according to W. G. Broadfoot, president, has under construction additional units representing total investment of about $200,000. The company conducts a business in boiler and general machine and welding work.

The Anderson Tractor Co., manufacturer, has been organized at Anderson, S. C., with $200,000 capital, by William S. Anderson and associates.

The Street Bros. Machine Works and the Patten Manufacturing Co., both of Chattanooga, and among the South's largest manufacturers of hoisting machinery, have consolidated under the name of the Street Brothers Machine Works, Inc., according to J. H. Street, who continues as president of the enlarged company. J. W. Burrell, sales manager of the Patten company, continues as sales manager of the merged company.

The H. H. Chase Co., has been organized at Jamestown, N. Y. by H. H. Chase, formerly superintendent of the Salisbury Axle Co., of that city. The company will manufacture handle lock socket wrenches.

The Moon Motor Car Co. reports net profits of $326,478 for the quarter ended Sept. 30.

The Monitor Controller Co., Baltimore, Md., manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus has recently established in the South a branch office at Birmingham, Ala.

The Instant Heat Device Co. has been incorporated at Miami, Fla., with $300,000 capital, to establish a plant for the manufacture of a recently invented quick heater. W. A. Brown, of Miami, heads the company.

Olmstead, Kent & Co., has been organized at Orlando, Fla., with $25,000 capital it is announced by Lucien L. Olmstead, of Orlando, the new company to handle machinery, machinery supplies and engineering supplies at wholesale and retail. Mr. Olmstead is president, Roscoe Kent, vice-president and Robert E. Duckworth, secretary and treasurer.

Sugg Brothers, of Carthage, N. C., machine shop operators, announce plans for the immediate construction of a large shop, which, including new machinery to be installed, will represent an investment of several thousand dollars.

The Kalman Steel Co., at Youngstown, Ohio, operating a reinforcing bar plant, is installing machinery that will increase its capacity 50 per cent, says Supt. West. Next year the company will add a unit 76 x 376, giving the local plant about double its present capacity. Announcement is made that the Kalman Steel Co. has taken over the Foughner Steel Co. of New York.

The Studebaker Corporation, in its report for the third quarter shows a total production of 87,951 cars as against 56,168 in 1921. The total production for 1922 is expected to be about 110,000.

The Roller-Smith Co., 233 Broadway, New York City, announces the appointment of the Electric Material Co. as its agent in the State of Washington and parts of Oregon and Idaho. The Electric Material Co. has recently opened an office in the Hinckley Building, Seattle, and will handle the Roller-Smith Co.'s lines of electrical instruments, circuit breakers and radio apparatus in that territory. The Seattle office is in charge of R. F. Robinson, formerly connected with the Western Electric Co., and the Pacific Telephone and Telegraph Co. The Electric Material Co.'s main office is at 589 Howard St., San Francisco, Calif., and it also has a branch office in the Title Insurance Building, in Los Angeles. Roller-Smith apparatus is handled by both of these offices as well as the Seattle office which means that the Electric Material Co. represents the Roller-Smith Co. along the entire Pacific Coast.

The McClain Co. has been incorporated at Portland, Me., to manufacture wood and metal working machinery and tools. The directors are Frank H. McClain, treasurer; Clark B. Dunton and Henry L. Cheney.

The Somerset Machine Co. has been incorporated at Skowhegan, Me., to manufacture and repair tools and machines, with a capital of $10,000. The directors are: President, Oscar Thompson of Skowhegan; treasurer, Wallace S. Clark, Skowhegan, and Frank C. Fellows of Brookline, Mass.

The Victor Tool Co., Waynesboro, Pa., announces the appointment of the J. F. Buhr Machine Tool Co., 7762 Dubois Ave., Detroit, Mich., to represent the entire line of Victor products in Eastern Michigan.

Personals

WILLIAM T. RAYNER, treasurer of the Gilbert & Barker Manufacturing Co., Springfield, Mass., sailed recently on a pleasure trip through the South American countries. Mr. Rayner expects to be in the South for several weeks.

A. SKIDMORE, for many years associated with the Ayer-O'Connell Manufacturing Co., of Meriden, Conn., has been chosen superintendent of the Manufacturers' Polishing and Platers Supply Co., recently incorporated and organized to manufacture platers' supplies, buffing tools, etc., of Bridgeport, Conn.

FREDERICK G. HUGHES, vice-president of the New Departure Manufacturing Co., Bristol, Conn., has been elected president of the Bristol Chamber of Commerce, and will assume the duties of that office immediately.

MITCHELL S. LITTLE, president of the M. S. Little Manufacturing Co., of Hartford, Conn., and affiliated with several other industrial companies of Hartford, and vicinity, was, during the past week, elected a director of the Ætna Life Insurance Co., of Hartford, filling a vacancy caused by the recent death of the Hon. Morgan Gardner Bulkeley, former Governor of Connecticut, and Ex-United States Senator.

F. F. ROHRER, assistant to the manager of both the power and railway departments of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., has been appointed general contract manager of that company. In his new appointment, which is effective immediately, Mr. Rohrer will be a member of the staff of W. S. Rugg, general sales manager.

PAUL M. LINCOLN, past president of the American Institute of Electrical Engineers, and for many years associated with the Westinghouse Electric and Manufacturing Co., has been appointed director of the School of Electrical Engineering in the College of Engineering, Cornell University, to succeed the late Professor Alexander Gray.

D. K. HUTCHCRAFT, formerly vice-president of the Indiana Air Pump Co., Indianapolis, and one of the leading authorities on air lift pumping, has been appointed district manager of the Chicago Pneumatic Tool Co.'s branch office recently established at Tulsa, Okla.

EARLE M. HAYES, formerly general manager of and for the past five years with Hunter & Havens, steel, iron and mill supply merchants, Bridgeport, Conn., has just been appointed general manager of steel sales of the American Tube and Stamping Co., Bridgeport, Conn.

EDWARD T. OLIVER has been appointed to represent the Victor Tool Co., Waynesboro, Pa., manufacturer of taps, die heads, reamer holders, etc., in the Northern Ohio territory. He will make his headquarters at 2031 Lincoln Ave., Lakewood, Cleveland, Ohio.

THOMAS K. GLENN, head of the Atlantic Steel Co., of Atlanta, for many years, and one of the best known iron and steel manufacturers in the southern field, has been named to the presidency of a new banking corporation formed in Atlanta this month by the consolidation of the Lowry National Bank and the Trust Company of Georgia.

H. H. GILDNER, formerly with the S K F organization in New York, has become associated with the Timken Roller Bearing Co. as district manager of sales in the Chicago territory.

JOHN H. PECKHAM, for many years connected with the Norton Grinding Co., Worcester, Mass., has now joined the selling department of Henry Prentiss and Co., New York. Mr. Peckham will act as grinding machine specialist for the sales and service ends.

D. W. PITCOCK, former superintendent of the Massillon Rolling Mill Co., Massillon, Ohio, has become general superintendent of the Universal Steel Co., at Bridgeville, Pa.

CHARLES B. WILSON, vice-president and general manager of the Willys-Overland Co., Toledo, Ohio, has resigned to return to Pontiac, Mich., as active president of the Wilson Foundry and Machine Co., of which he was president and general manager until his active affiliation with the Willys organization late in 1920.

WILLIAM H. WARREN, former general manager of the Gary plant of the Illinois Steel Co., and of the Brier Hill Steel Co., has been appointed general superintendent of the Trumbull Steel Co., at Warren, Ohio.

H. B. NEWTON, purchasing agent for the Thew Shovel Co., Lorain, Ohio, has been named to do the purchasing also for the Universal Crane Co., an affiliated company, Elyria. All the buying will be done at Lorain.

STANLEY B. MATHEWSON, factory manager of the old Elwood-Meyers Co., Springfield, Ohio, has resigned to become director of personnel of Antioch College, Yellow Springs, Ohio, succeeding H. L. Gardner, who has been made assistant to the general manager of the Shelton Looms, Shelton, Conn.

A. W. IRVING, formerly with the Holden Co. of Canada, has joined the sales organization of the Canadian Machinery Corporation, Toronto.

WILLIAM GAMBLE, formerly with the Moline Plow Co. at Poughkeepsie, N. Y., has been appointed purchasing agent of the Rock Island Plow Co., Rock Island, Ill.

J. W. LEROUX, of Atlanta, for several years southeastern representative of the Virginia Bridge and Iron Co., of Roanoke, Va., has resigned, effective Jan. 1, 1923, and will thereafter devote his entire time to industrial development work in the southern field. E. S. Humphries, of Roanoke, has been named to succeed Mr. Leroux.

COLONEL WILLIAM L. SCOTT, of Atlanta, for the past eight years sales manager in the southern territory for the Ohlen-Bishop Co., of Columbus, Ohio, and one of the South's best known machinery and saw men, has tendered his resignation to this company and accepted a similar position with the American Saw and Manufacturing Co., of Springfield, Mass. He will make his headquarters in Atlanta at 42 West Alabama St.

Obituary

WALTER M. SPAULDING, chairman of the board of directors of the Graton & Knight Manufacturing Co., Worcester, Mass., and identified with that company for more than 50 years, of which 13 years were as president, died at his home in that city, Nov. 16, aged 76 years. He retired as president last March.

MYRON E. REAM, vice-president of Leffingwell-Ream Co., management engineers, died suddenly November 17, in Chicago.

WILLIAM MAURER, 63 years old, prominent South Bend, Ind., manufacturer and owner of the Maurer Machine Works, died recently in that city.

JAMES BUTTERWORTH, retired manufacturer of textile machinery, died November 14, at his home, No. 252 Pelham Road, Mt. Airy, Philadelphia, Pa., aged 82 years. Born in that city, he entered the service of his father, head of the H. W. Butterworth & Sons' Co., in 1857, and was admitted to the firm in 1889. He was its president when he retired 10 years ago.

Book Reviews

Foreign Commercial Credits. By George W. Edwards, Assistant Professor of Banking, School of Business, Columbia University, and Research Assistant, Federal Reserve Board. Two hundred thirty-eight 6 x 9 in. pages, cloth boards. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $2.50.

A welcome addition to our rather meager literature dealing with foreign trade. The United States, as a nation is probably less well founded in fundamentals of foreign trade than any other large nation, yet must realize that eventually she will engage extensively in that type of commerce. On that account this book, which takes up the letter of credit, the fundamental method of financing foreign trade for many years, should be of great value to those who wish to understand how to do business abroad. Practical and legal principles underlying the letter of credit are explained.

An introduction by H. Parker Willis is followed by chapters on the movement toward uniformity in commercial documents, present status of shipping documents meaning and classification of letters of credit, operation of letters of credit, travelers' letters of credit, the letter of credit in American law—principles, the letter of credit in American law—decisions, the authority to purchase, the trust receipt, British commercial credits, the letter of credit in British law, German commercal credits, commercial credit practice of Japanese banks, commercial credit practice of some continental banks.

There are appendices on commercial credit instruments, uniform commercial credit regulations of the commercial credit conference, the Hague rules, 1921, points of variance between the Hague rules and the Harter act, American foreign trade definitions, Diamond Alkali Export Corporation vs. Bourgeois.

Manchuria: Land of Opportunities. Published by the South Manchuria Railway, Dairen, Manchuria. Boards, 113 6 x 9 pages, 100 half tones, map and 10 charts.

This book tells the story of the amazing transformation that has taken place in Manchuria. The development of this country has been made possible by the South Manchuria Railway, with its American equipment, its coal and iron mines, steel works, electric plants and industrial works.

Known only a few years ago as "The Forbidden Provinces," this section of China has made almost unbelievable strides since the close of the Russo-Japanese War, when Russia's rights in the country were transferred to Japan. The traveler in Manchuria rides in a Pullman sleeping car, drawn by a Baldwin Locomotive over 100 lb. rails made in Pittsburgh.

Riding from the modern part of Dairen northward through cities lighted by electricity, with their fine railway stations, paved streets, hotels, schools, hospitals and scientific laboratories; past American equipped steel works, coal mines and factories, the transformation is so great that the traveller can hardly believe he is in a land which only a few years since was the home of the Manchu rulers of China and a forbidden land to world commerce.

The book is absorbingly interesting and gives one an insight into this almost unknown country that cannot be obtained from any history.

Fundamentals of Practical Mathematics. By George Wentworth, David Eugene Smith and Herbert Druery Harper. One hundred ninety-eight 5 x 7 in. pages, cloth boards. Illustrated. Published by Ginn & Co., 15 Ashburton Place, Boston 2, Mass. Price $1.20.

The authors divide the book into chapters on fundamental operations, ratio and proportion, mensuration, trigonometry, the slide rule, and general applications. From a consideration of those divisions it may be seen just what they include under "fundamentals."

There are two general points to be considered in any book, content and arrangement. Much praise may honestly be given to both in "Fundamentals of Practical Mathematics." Beginning with a review of addition, subtraction, multiplication and division of whole numbers, decimals and common fractions, the student is led by easy steps through elementary trigonometry, which is followed by a chapter on the slide rule.

Arrangement of the contents eliminates almost all inconvenience. Problems and the illustrations to which they refer are printed on facing pages. The first page after the table of contents contains an explanation of symbols. The last two pages of text consist of definitions of mechanical terms. Text dealing with trigonometry is followed by four-place tables of the natural functions. A feature of the book is that the line cuts are printed in blue, showing a white line on a blue background, in that way teaching the student how to read blue prints. As the problems refer to the cuts, the blue prints must be used constantly.

Problems of the type that the student will meet in his work have been selected. Mathematics is shown to be a practical subject, not merely one used to exercise the mind.

Motor Vehicle Engineering—The Chassis. By Ethelbert Favary, author of "Motor Vehicle Engineering—Engines." Four hundred sixty 6 x 9 in. pages, 515 illustrations, cloth boards. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y. Price $5.00.

The author has attempted, and to the reviewer he seems to have very satisfactorily accomplished, the embodiment of information that may be applied by students, and those engaged, or wishing to become engaged, in the automotive industry, to actual work. For clarity in presentation the contents of such a book naturally fall into several divisions. In this book they deal with chassis layout, mechanics of materials, frames, clutches, shafts and universal joints, transmission or change speed gears, rear axles, rear axles for trucks, rear axle loads and stresses, torque arms, thrust-, radius-, and truss rods, brakes, front axles, steering gears and other subjects.

There is little of a historical nature about the book and it is in no sense merely a compilation of information showing present day practice. Underlying principles have been stated and explained clearly. Only elementary mathematics has been used. To quote from the preface, "The method pursued in the treatment of the subject is largely a result of the author's work as consulting engineer, his experience with draftsmen and designers and his lectures on motor vehicle design at Cooper Union to men engaged in the industry."

Machine Shop Mathematics. By George Wentworth, David Eugene Smith and [illegible] Harper. [illegible] pages, cloth boards, [illegible]. Published by Ginn & Co., [illegible] Place, Boston [illegible], Mass. [illegible]

The second book of a series (the first is "Fundamentals of Practical Mathematics," reviewed in American Machinist, page 568c). The purpose of the book, the authors declare, is "to meet the needs of students who expect to become machinists, either in the special line of automobile construction or in the more general lines.

Measuring instruments is the title of the first chapter. It is followed by chapters on speeds and feeds, tapers and taper turning, screw threads, indexing and spiral cutting, gears, review problems. Reference tables include tables of measures, decimal equivalents, natural trigonometric functions, powers and roots, sizes of twist drills with decimal equivalents, speeds of drills, sizes of screw threads and tap drills, and others. The problems are thoroughly practical and well presented.

1922 Year Book of the Merchants Association of New York. Published by the Association. Paper cover; [illegible] pages with index.

The book is a complete record of the activities of the Association. It contains a list of the complete executive personnel, the make-up of its various departments, their functions and duties, reports of the various officers for the past year and the names of the members of the association.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machines for making cement blocks—Mexico. Purchase desired. Quotations, f.o.b. New York or New Orleans. Payment, cash. Reference No. 4296.

Clay working machinery suitable for making pottery, fancy tiles and particularly electric porcelains, and also glazing materials of various colors for the above articles—China. Purchase desired. Quotations, c.i.f. Chinese port. Reference No. [illegible]

Batteries and magnetos for motor cars, [illegible]—South Africa. Purchase and agency desired. Quotations, f.o.b. New York. Payment to be made in New York. Reference No. 4278.

Seamless solid drawn steel tubes from [illegible] to [illegible] inches in diameter—Scotland. Purchase desired. Quotations, c.i.f. Scottish port. Terms: Payment against documents. Reference No. [illegible]

Machines to make twisted-wire brushes of all kinds—Canada. Purchase desired. Payment, cash. Reference No. 4281.

A [illegible] metal sprayer for use in spraying [illegible], copper, nickel and other metals on cast iron, etc.—Norway. Purchase desired. Quotations, f.o.b. New York. Reference No. 4291.

[illegible] goods and equipment of every kind [illegible] hardware and [illegible]—[illegible]. Agency desired. Quotations, c.i.f. [illegible]. Reference No. [illegible]

A [illegible] or circular shearing machine—[illegible]. Purchase desired. Quotations, c.i.f. French port. Terms, cash with order. Correspondence, French. Reference No. [illegible]

Machinery for the manufacturing and [illegible] of all types of [illegible]—[illegible]. Quotations, c.i.f. [illegible] port. Terms, cash against documents. Reference No. [illegible]

[illegible] screws, [illegible], hinges, steel latches, sand-[illegible]—[illegible]. Purchase desired. Quotations, c.i.f. [illegible]. Payment, cash in advance. Reference No. [illegible]

[illegible] rods and steel plates—England. Purchase or agency desired. Quotations, [illegible] New York. Reference No. [illegible]

Machinery and tools for the equipment of a factory to turn out 300 clocks per day, and also machinery for the manufacture of [illegible] and wooden clock cases—India. [illegible] Purchase desired. Quotations c.i.f. port of India. Reference No. [illegible]

Agricultural machines, tractors, automobiles (lighter and cheaper cars), motor trucks (1½ to 3 tons), and motors of various descriptions—Baltic Provinces. Purchase and agency desired. Quotations, c.i.f. Baltic port. Correspondence, German. Reference No. 4350.

Motor cars, motor cycles and accessories, spares and tools of every description—India. Purchase and agency desired. Quotations, f.o.b. New York. Reference No. 4352.

One hundred copper steam tubings, each of 5 meters in length, diameter 70 millimeters, and thickness 2 millimeters—Greece. Purchase desired. Quotations, f.o.b. New York. Payment arranged by confirmed letter of credit in New York. Reference No. 4353.

All sorts of radio-telegraphic apparatus and precise measuring instruments for radio laboratories, such as amperemeters and voltmeters—Czecho-Slovakia. Catalogues and price lists are desired. Reference No. 4354.

Plant for the development of power facilities, or equipment for the extension of existing electric light plant through the agency of crude oil engines or water—Canada. Purchase desired. Quotations, literature and catalogues requested. Reference No. 4355.

Mechanical specialties and specialities of all kinds (excepting automobile accessories), and also general merchandise of all kinds—South Africa. Inquirer is in the United States for a short time for the purpose of securing agencies. Reference No. 4360.

Machinery for the equipment of a factory for the manufacture of cork products—Italy. Purchase desired. Quotations, c.i.f. Italian port. Payment: Cash against documents. Reference No. 4361.

Galvanized sheets, 1 by 2 meters, in two thicknesses, 0.55 and 0.65 millimeter—Switzerland. Purchase desired. Quotations, c.i.f. Antwerp. Terms: Cash. Reference No. 4363.

Solution for removing rust or for loosening rusted screws and bolts—Italy. Purchase desired. Quotations, c.i.f. Italian port. Payment: Cash. Reference No. 4368.

Agricultural implements and machinery—Japan. Purchase and agency desired. Quotations, c.i.f. Kobe or Yokohama. Terms: Payment against documents. Reference No. 4370.

Electrical goods of all kinds, labor-saving machinery, machine tools, rubber belting, rubber hose, metals, rails and novelties in the engineering line—Sweden. Agency desired. Quotations, f.o.b. New York. Reference No. 4371.

Electrical apparatus of all sorts and machinery in general—Spain. Agency desired. Terms: Payment upon receipt of merchandise. Correspondence, Spanish. Reference No. 4372.

Large machine for the reconditioning of worn and flattened electric car wheels—Spain. Purchase desired by railway company. Quotations, c.i.f. Spanish port. Terms: Cash on delivery of machinery. Correspondence, Spanish or French. Reference No. 4385.

Refractories—Italy. Purchase desired by manufacturer. Quotations, c.i.f. Italian port. Reference No. 4386.

Trade Catalogs

Gear Grinding. The Lees-Bradner Co., Cleveland, Ohio. This company has just issued a new publication of sixteen pages, with an attractive arrangement, on the subject of gear grinding. The publication features the Lees-Bradner product in the line of grinders for this work and contains eleven selected illustrations. It sets forth in detail a quantity of output process that finishes spur gears after hardening, maintaining standards of accuracy and quietness in the product. A feature of the publication is the discussion of the principles of the involute curve, the development of the involute tooth, proving the involute principle and the rack form and the process of generating gear teeth of this type on the Lees-Bradner machines. The illustrations show not only the general assembly of the grinders but give details of construction as well.

Flexible Shaft Applications. The S. S. White Dental Manufacturing Co., Philadelphia, Pa. A new sixteen-page publication just issued by this company is entitled "From Sheep Shears to Speedometers and Other Applications of the Flexible Shaft." It is a general review of the progress made in recent years of the development of flexible shafts by this company, tells how they are made and sets forth their many uses in numerous industries.

Brown Pyrometers. The Brown Instrument Co., Philadelphia, Pa. This company has just issued a new folder featuring the Brown method of automatic temperature control on furnaces in shops, etc., for hardening and tempering tools.

Portable Undercutting Equipment. The S. S. White Dental Manufacturing Co., Philadelphia, Pa. A new four-page folder just issued by this company illustrates and describes its portable undercutting equipment, handpieces and flexible shafts designed especially for cutting down the mica between commutation segments.

War Surplus. The U. S. War Department, Director of Sales, has just issued a small pamphlet describing, in a general way, the methods of sale resorted to by the Department in the disposal of its stocks of surplus property. The pamphlet tells what these stocks consist of and contains a loose-leaf insert listing the dates of the important sales scheduled for the near future.

General Electric Catalog for 1921. The General Electric Co., Schenectady, N. Y. The company has just issued its general catalog for 1921, of 1338 pages with a catalog number index and a subject index. The catalog gives a representative listing of the company's products obtainable through its sales offices and distributors, all of which are given. The information on supplies also includes identification for ordering and, in most cases, prices also. The catalog supersedes all previous publications.

Power Punching Presses. The Niagara Machine and Tool Workers, Buffalo, N. Y. The company has just issued Bulletin No. 61 of twenty-four pages on its line of power punching presses, series Nos. 30-40-110. The bulletin is fully illustrated with views of the various types of machines and contains cuts showing construction details as well as specifications on each style and size.

Commercial Rust Remover and Pickling Compound. Peter A. Frasse and Co., Inc., 417 Canal St., New York City. This company has just issued a folder describing a new compound for the removal of rust.

Forthcoming Meetings

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

American Institute of Weights and Measures, annual meeting December 8, 1922, United Engineering Societies' Building, 29 West 39th St., New York City. Chas. C. Stutz, 115 Broadway, New York City, is secretary.

National Exposition of Power and Mechanical Engineering, Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21, Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago — Monighan Machine Co., 2030 Carroll Ave.—slotting machine with 24 in. stroke and 36 in. clearance from center of table to housing.

Ill., Chicago—E. H. Stafford Mfg. Co., 218 South Wabash Ave. (manufacturer of furniture)—factory trucks, edge sanding machines and radial boring machines.

Ind., Newcastle—Goodwin Auto Co., J. Goodwin, Proprietor—machinery, tools and equipment for 2 story garage and service works on Race St.

Mass., Charlestown (Boston P. O.)—General Baking Co., Bunker Hill St.—equipment for proposed $100,000 garage on Ferrin St.

Mass., Roxbury (Boston P. O.) — B. White, 44 Holworthy St.—machinery and tools for garage.

Mo., St. Louis—J. Segal, 1231 Market St.—tools, motor and machinery for machine shop (used).

N. Y., Brooklyn—Metropolitan Mechanical Wks., 129 Boerum Pl.—one bench lathe.

N. Y., Buffalo—L. Feldstein, 2022 Seneca St.—machinery and equipment for garage and service station.

N. Y., Buffalo—Genesee Arcade, Inc., 1446 Genesee St.—mechanical equipment for $40,000 garage and service station.

N. Y., Buffalo—A. Korpalski, 1673 Bway.—two 1,000 gal. gas tanks and pumps, also other equipment for service station.

N. Y., Buffalo — M. & M. Oil Co., 20 Breckenridge St.—1,000 gal. gas tank and pump, also other equipment for service station on Huron and Oak Sts.

N. Y., Hamlin—H. E. Lewis—one power driven cutting machine.

N. Y., Rochester—Cullinan-Malcolm Co., Inc., 4322 Lake Ave.—equipment for gasoline and automobile service station.

Pa., Phila.—C. Crowley, Wildey St. and Montgomery Ave. (machinist)—additional machinery for new factory.

Pa., Phila.—Edward Wilkie Motor Co., 917 North Broad St.—machine shop equipment for sales and service station.

Wis., Kenosha—W. Russell, 603 Milwaukee Ave.—automobile repair machinery for proposed $40,000 garage.

Wis., Milwaukee—M. S. Mann., 1219 Holton St.—equipment, including gasoline tank and pump, for proposed $40,000 garage on 4th St.

Ont., Ford—Ford Motor Co. of Canada—equipment for machine shop additions.

Que., Montreal—Menard Garage, 223 St. Ambroise St., M. Menard, Purch. Agt.—lathe and other equipment for garage and repair shop.

Machinery Wanted

Ala., Alco (Brewton P. O.)—Alco Coal Co., F. Rice, Genl. Mgr.—electrical hoisting and mining machinery.

Ala., Wetumpka—J. F. Godard—planing mill, hardwood and veneer mill machinery.

Calif., San Francisco — San Francisco Chronicle, Chronicle Bldg., M. D. DeYoung, owner—equipment for proposed newspaper plant on 5th and Mission Sts.

Calif., San Francisco—Talbot Investment Co., c/o J. E. Kraft & Sons, Archts., Phelan Bldg.—traveling cranes, monorail system, spiral chutes, etc., for proposed warehouse on 8th and Natoma Sts.

Colo., Alamosa—Alamosa Journal—12 x 18 in. job printing press for power equipment.

Colo., Denver—Blaney-Murphy Co., Stock Yards, L. B. Hill, Purch. Agt.—machinery for proposed packing plant on 48th and Gilpin Sts.

Conn., Stafford Springs — Cyril Johnson Woolen Co.—machinery for addition to woolen mill.

Conn., Union City (Naugatuck P.O.)—J. Broderick, 117 Woodbine St. (woolen goods)—two 20 x 60 in. Garnett machines, one Kitson lapping machine, one baling press, one 36 in. jute picker (used).

D. C., Wash.—Bureau of Yards & Docks, Navy Dept., Spec. 4755—electric elevator cranes for Navy Yard, Puget Sound, Wash.

D. C., Wash.—C. R. Forbes, Dir. United States Veterans' Bureau, Arlington Bldg., will receive bids until Dec. 18 for laundry equipment and refrigerating machinery for U. S. Veterans' Hospital at Livermore, Calif.

Ill., Chicago—Chicago Metallic Mfg. Co., 542 West 35th St.—air compressors, hangers, shafting, pulleys and belting.

Ind., Bourbon—News-Minor—7 column newspaper press.

Ind., Warsaw—J. A. Dalton Co.—foundry equipment to replace that which was destroyed by fire.

Ia., Davenport—Linograph Co., Front and Scott Sts.—8 x 12 in. or 10 x 15 in. job press for power equipment.

Ky., Paducah—Paducah Ice Co.—refrigeration machinery and equipment for proposed addition to ice manufacturing plant.

Mass., Brockton—Lapworth Webbing Co., Sumner St.—machinery for addition to factory.

Mass., Clinton—Lancaster Mills, 1 Green St., (manufacturer of ginghams)—machinery for addition to mill.

Mass., Holyoke—J. Wisly, 18 Hitchcock St.—offset press and miscellaneous accessories for proposed addition to printing plant.

Mass., Roxbury (Boston P. O.)—E. Howard Clock Co., 206 Eustis St.—machinery for addition to plant.

Mich., Grand Rapids—Grand Rapids Wire Frame Co., 1719 Elizabeth Ave.—complete spot welder (used).

Minn., Minneapolis—Bd. Educ., 305 City Hall, F. S. Gram, Purch. Agt.—receiving bids until Dec. 4 for woodworking, refrigerating and sheet metal working machinery for Lincoln and Bryant Junior High Schools.

Mo., Bolivar—Stiles Mfg. Co., H. West, Pres.—steel lathe, drills, hack saws, cutoff saws, etc., for foundry and wood working factory, for the manufacture of gravel and coal loaders, etc.

Mo., Bowling Green—Printer, Box 42—complete equipment for job printing, including linotype, paper cutter, job press, hangers and pulleys (used).

Mo., Kansas City—B. & H. Auto Livery Co., 1026 Wyandotte St.—welding machinery and outfit, also power emery wheel, belting, hangers and pulleys.

Mo., Purdy—Review—job printing press, newspaper press and full equipment.

Mo., St. Louis—Haynes-Langenberg Mfg. Co., 4045-57 Forest Park Blvd. (manufacturer of furnaces)—one 20 hp. spot welder and two 20 hp. arc welders.

N. J., Hammonton—Littlefield Ice & Coal Co., A. Littlefield, Purch. Agt.—refrigerating machines, stills and conveyors for ice and cold storage plant.

N. J., Millville—Taubel, Scott & Kitzmiller Co., Millville and Riverside (manufacturer of textiles)—additional ribbers, loopers and latch needle machines for new mill.

N. Y., Buffalo—J. F. Endres—795 East Delevan Ave.—equipment for bakery at 407 Leroy Ave.

N. Y., Buffalo—K. Ostrowski, 19 Sunnyside Ave.—machinery and equipment for the manufacture of soft drinks.

N. Y., Buffalo—Williams Gold Refining Co., 2978 Main St.—equipment for proposed addition to factory.

N. Y., Jamestown—Clarke Baking Co., 809 North Main St.—bakeshop equipment to replace that which was destroyed by fire.

N. Y., Jamestown—New Ice & Coal Co., 925 Clinton St.—refrigeration machinery for proposed ice manufacturing plant.

N. Y., Philmont—Columbine Garment Co. (manufacturer of wearing apparel)—baling press, folding and measuring machine and cloth cutting machinery.

N. Y., Rochester—J. Lockhart, 979 Harvard St.—machinery and equipment for the manufacture of picture frames, for factory on Elwood Ave.

N. Y., Rochester—M. Michael, 71 North Water St.—bandsaw, swing saw, variety saw, jointer and pony planer.

N. Y., Rochester—Standard Oil Co. of New York, 312 Wilder Bldg.—tools and equipment for gasoline station on North Clinton Ave.

N. Y., South Dayton — Mohawk Condensed Milk Co.—machinery and equipment for the manufacture of evaporated milk.

N. Y., Wellsville—Andover Silk Weaving Corp., South Main St.—60 silk weaving looms and other equipment for silk mill.

N. Y., Westfield—Welch Grape Juice Co., Welch Bldg.—machinery and equipment for grape juice plant at Springdale, Ark.

O., Columbus — Columbus Sheet Metal Wks., Lynn and Ludlow Sts., O. C. Hearing, Proprietor—new sheet metal working equipment, including breaker, slotter, etc.

O., Columbus—Modern Woodworking Co., 476 South High St., C. F. Biederman, Purch. Agt.—one sticker, one double cutoff saw, one double spindle shaper and one tenon machine.

O., Greenville—Allied Belting Co.—looms and other equipment for weaving cotton duck into belting.

O., London—Williams Co. (manufacturer of steel wool)—machinery and equipment for addition to factory.

O., Springfield—Fairbanks Piano Plate Co., Kenton St.—equipment for factory to replace that which was destroyed by fire.

Pa., Bridesburg (Phila. P. O.)—Abrasive Co., Tacony and Fraley Sts. (emery and other products)—additional metal working machinery, cloth and paper coating machines, also machinery to work abrasives, etc.

Pa., Erie—The Northwestern Motors Co., 21st and State Sts.—machinery and equipment for factory to replace that which was recently destroyed by fire.

Pa., Glassmere—Allegheny Plate Glass Co.—machinery and equipment for $100,000 addition to glass factory.

Pa., Johnstown—Edward Hahn Packing Co., Hickory St. and Baltimore & Ohio R.R.—trolley conveying system and ice machines.

Pa., Johnstown—National Radiator Co., Central Ave. and Ohio St., S. Moore, Genl. Mgr.—one electric overhead crane.

Pa., Lebanon—J. Warren Light—machinery and equipment for the manufacture of machine screws and similar products.

Pa., Manyunk (Phila. P. O.)—R. Krook, Main St. (manufacturer of carpet yarns, rugs, etc.)—additional sets, mule spindles, etc.

Pa., Norristown—Ballard Knitting Co.—10 x 12 in. Wildman body machines with revolving cylinders.

Pa., Norristown—Bd. Educ.—vocational equipment for $250,000 junior high school.

Pa., Phila.—Commercial Truck Co., 27th and Brown St.—one No. 3 Nazel air hammer.

Pa., Phila.—M. Dam, 7205 Buist Ave. (electro plating)—rumbling barrels, plating dynamo, wood plating tank, steel tank, polishing machines, etc.

Pa., Phila.—H. J. O'Donnell, 6106 Vine St. (tinners and sheet metal works)—one set of 30 in. and one set of 36 in. rollers, one turning machine, one folder, tinners' tools, etc.

Pa., Phila.—Paper Mfg. Co., 562 Cherry St.—machinery for the manufacture of paper, also belting, pulleys, etc., for new factory.

Pa., Phila.—Pennsylvania R.R. Co., 17th and Filbert Sts., M. Smith, Purch. Agt.—1,500 lb. steam hammer.

Pa., Pittsburgh—Pittsburgh Stencil & Tool Co., 40 Water St.—metal cutting band saw.

Pa., Swarthmore—E. F. Woodhead—machinery and equipment for the manufacture of paper products.

Pa., Wayne—Bd. Educ., F. Seaggs, Secy.—vocational equipment for proposed high school.

R. I., Woonsocket — Fairmont Worsted Co., 18 Worrall St., J. F. Sweeney, Purch.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Steel bars quoted at $2.10 per 100 lb., f.o.b. Pittsburgh, for delivery in first quarter of 1923. Aluminum ingots, ton lots, advanced 2½c. per lb. during week; following rise of 2c. per lb. for the week preceding.

Declines—Although shapes, plates and bars are holding to the $2 level, some mills have shown willingness to cut under this price, to the extent of $1@$2 per ton, f.o.b. mill. Plates have been shaded to $1.85@$1.90 for special lots of 1,000 tons or more. Pig-iron market remains weak, with improvement in coke production and the car supply. Tin plate prices remain unchanged. This item represents the only steel product which did not advance in the general market rise, started last spring. Zinc quoted in New York warehouses at 7½c. as against 7¼c. per lb., last week. Lead, quiet; down ⅛c. per lb. in East St. Louis. Linseed oil, f.o.b. New York, 90c. as compared with 98c. per gal., one week ago. Lard oils quiet without change in price. No improvement in demand for lubricants.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.55
Northern Basic	31.27
Southern Ohio No. 2	31.71
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.27
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.14
Virginia No. 2	37.17
Basic	28.26
Grey Forge	29.64
CHICAGO	
No. 2 Foundry local	30.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.50
Basic	28.00
Bessemer	31.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill.

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]	4.19	3.70	4.00
No. 12	[illegible]	4.24	3.75	4.05
No. 14	[illegible]	4.29	3.80	4.10
No. 16	[illegible]	4.39	3.90	4.20
Black				
Nos. 17 and 21	[illegible]	4.70	4.20	4.70
Nos. 22 and 24	[illegible]	4.75	4.25	4.70
Nos. 25 and 26	[illegible]	4.80	4.30	4.75
No. 28	[illegible]	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	3.35@3.50	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.60	5.00	4.50	4.95
Nos. 17 and 21	3.75@3.90	5.30	4.80	....
Nos. 22 and 24	3.90@4.05	5.45	4.95	5.45
No. 26	4.05@4.20	5.60	5.10	5.55
No. 28	4.35@4.50	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	36.87½
Lead (up to carlots), St. Louis	6.85@6.90; New York, 7.50
Zinc (up to carlots), St. Louis	6.95@7.00; New York, 7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—*Shop Materials and Supplies*

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.75	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.75	7.00
Zinc	3 00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		\$6.75@7.25	
Coke, prompt foundry, Connellsville...per net ton		7.50@8.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	\$5.00	\$3.90	\$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.60	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

[illegible] narrow pattern loom, one jack [illegible] winder and one single spooling machine (used).

Tenn., Memphis — Stryker Nut-N-Wood Co., [illegible] Crosstown Ave.—machinery and equipment for [illegible] plant for the manufacture of bending specialties.

Tex., [illegible]—News—[illegible] column fast newspaper press.

W. Va., Wheeling—Wheeling Box Co., [illegible] Chapline St.—automatic cut saw, rip saw and jointing.

Wis., Beloit—T. H. Goodall, 433 Broad St.—oil storage tanks and pumps for proposed filling station.

Wis., Clinton—Robert Wock & Co., Inc., F. W. Herron, Vice Pres.—machinery and equipment for the manufacture of septic and storage tanks, chemical toilets and sanitation systems.

Wis., Fond du Lac—Gurney Refrigerator Co., 44 South Brook St., E. G. Vail, Pres.—machinery for the manufacture of refrigerators, also machinery for power plant.

Wis., Jackson—Jackson Canning Co., M. Gardner, Mgr.—electric power machinery for proposed canning factory.

Wis., Janesville—Janesville Caloric Co., F. M. Coyle, Genl. Supt.—machinery, tools and equipment for the manufacture of electric fireless cookers.

Wis., Milwaukee — Milwaukee - Western Fuel Co., 122 Wisconsin St.—chain hoist for proposed repair shop on Clinton St.

Wis., Milwaukee—J. M. Nash, 342 30th St.—woodworking machinery.

Wis., Milwaukee—Wisconsin Ice & Coal Co., 716 West Water St.—ice making machinery for proposed plant on 31st and Galena Sts.

Wis., New London—Wisconsin Cabinet & Panel Co., J. H. McLaughlin, Mgr.—power machinery for proposed box factory.

Wis., Port Washington—Hansen Canning Machine Co.—machinery for the manufacture of special vegetable canning machines for proposed factory at Cedarburg.

Wis., Prairie du Chien—Prairie du Chien Tool Co.—machinery and equipment for the manufacture of wrenches, tools and automotive specialties.

Wis., Sheboygan — Vollrath Co., West Michigan Ave., D. F. Ross, Secy.—special machinery for proposed enameling factory, including annealing and stamping room.

Wis., Waupun — Althouse-Wheeler Co., H. O. Thompson, Mgr.—machinery for the manufacture of wind mills, steel towers, tanks, etc.

Wis., Wisconsin Rapids—Prentiss-Wabers Co.—enameling and special machinery for the manufacture of heating devices.

Ont., Oshawa—Phillips Mfg. Co. (manufacturer of picture moldings, frames, etc.)—machinery and equipment for addition to plant.

Ont., Welland—Welland Packing Co., Ltd.—several thousand dollars worth of machinery for proposed plant at Niagara Falls.

Metal Working Shops

Calif., San Francisco—The Amalgamated Laundries, 6th and Harrison Sts., awarded the contract for the construction of a 1 story garage. Estimated cost $40,000.

Calif., San Francisco — A. S. Hughes, Archt., 34 Montgomery St., is receiving bids for the construction of a 2 story garage on Sacramento St. near Polk St., for L. R. [illegible], Mills Bldg. Estimated cost $54,000. Noted Nov. 16.

Calif., San Francisco—The Simmons Co., [illegible] St., manufacturer of metal furniture, beds, etc., awarded the contract for the construction of a 3 story factory and warehouse on Powell and Bay Sts. Estimated cost $250,000.

Calif., San Francisco—The Star Garage Co., 154 Turk St., is having plans prepared for the construction of a 2 story addition to its garage. Estimated cost $[illegible]. J. L. [illegible] Bldg., Archt.

Calif., Watsonville — Watsonville Union High School Dist. awarded the contract for the construction of a machine shop. Estimated cost $[illegible]. Noted Nov. 9.

Conn., Bridgeport—The Locomobile Co. of America, Inc., 2 Main St., manufacturer of automobiles and trucks, awarded the contract for alterations, and for the construction of a 1 story, 60 x 120 ft. and 40 x 150 ft. additions to its machine shop.

Conn., Hartford—Kaplan & Goldberg, 32 John St., will build a 1 story, 50 x 100 ft. garage and service station. Estimated cost $40,000.

Conn., Torrington—The Union Hardware Co., Migeon Ave., plans to build a 3 story addition to its plant. Estimated cost $50,000. Architect not announced.

Ill., Chicago—The Advance Fdry. & Pattern Co., 2734 West 38th St., awarded the contract for the construction of a 1 and 2 story, 55 x 142 ft. addition to its factory. Estimated cost $50,000. Noted Oct. 19.

Ill., Chicago — Voightmann & Co., 445 West Erie St., manufacturer of metal windows, awarded the contract for the construction of a 1 story, 280 x 300 ft. factory at 4158 Schubert Ave. Estimated cost $150,000.

Ind., Warsaw—The J. A. Dalton Co. plans to rebuild portion of its foundry which was destroyed by fire. Estimated cost $15,000. Architect not announced.

Ky., Louisville—The Mengel Body Co. is having plans prepared for the construction of an automobile body plant on a 30 acre site on 4th and G Sts. Joseph & Joseph, Francis Bldg., Archts.

Mass., Boston—The Boston Flower Exchange, Inc., 1 Winthrop Sq., awarded the contract for the construction of a 2 story, 115 x 200 ft. garage and mercantile building at 541 Tremont St. Estimated cost $50,000.

Mass., Charlestown (Boston P. O.)—The General Baking Co., Bunker Hill St., awarded the contract for the construction of a 2 story garage on Ferrin St. Estimated cost $100,000.

Mass., West Lynn (Lynn P. O.)—The General Electric Co. will build a 4 story 122 x 157 ft. addition to its factory. Estimated cost $200,000. Noted Sept. 14.

Mich., Holland—The Federal Mfg. Co. is building a plant for the manufacture of warm air furnace accessories (pressed steel). Cost between $60,000 and $100,000.

Mo., Bolivar—The Stiles Mfg. Co. is having plans prepared for the construction of a 46 x 106 ft. foundry and wood working factory, for the manufacture of gravel and coal loaders, etc. Estimated cost $5,000. H. West, Pres. E. Stiles, Aldrich, Engr.

Mo., Webster Groves—The Texas Oil Co., Houston, Tex., awarded the contract for the construction of a 1 story, 40 x 170 ft. garage on Forsythe Ave., here. Estimated cost $40,000.

General Manufacturing

Ind., Hartford City—The Fort Wayne Corrugated Paper Co., Murray and Barr Sts., Fort Wayne, is having plans prepared for the construction of a 1 to 2 story plant for the manufacture of paper, here. Estimated cost $70,000. Mills, Rhines, Bellman & Nordhoff, Ohio Bldg., Toledo, Ohio, Archts.

Ia., Davenport—The Linwood Stone & Cement Co., 712 Kohl Bldg., plans to build a cement plant, capacity 2,000 bbl per day. Estimated cost $1,500,000. Architect not selected.

Mass., Fitchburg—The Star Worsted Co., manufacturer of Bradford spun worsted yarns, will soon receive bids for the construction of a 5 story addition to its mill, to contain about 40,000 sq.ft. of floor space, to be used for combing, drawing and spinning. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

Mass., New Bedford — The Hathaway Mfg. Co., Front St., manufacturer of cotton goods, awarded the contract for the construction of a 1 story, 40 x 98 ft. addition to its mill and a 3 story, 25 x 40 ft. manufacturing building. Estimated cost $40,000.

Mich., Flat Rock—The Ford Motor Co., Highland Park, awarded the contract for the construction of a 1 and 2 story plate glass factory, here. Noted Nov. 2.

Mich., Muskegon—The Central Paper Co. awarded the contract for the construction of additions to its factory, consisting of a 3 story, 90 x 110 ft. warehouse, a 3 story, 55 x 200 ft. machine room and 3 story, 42 x 52 ft., 2 story, 45 x 150 ft. and 4 story, 45 x 50 ft. buildings. Estimated cost $200,000. Noted Nov. 9.

Neb., Fremont—The Fremont Mfg. Co. awarded the contract for the construction of 1 story, 60 x 64 ft., 112 x 140 ft., 66 x 140 ft., 40 x 144 ft. factory buildings for the manufacture of refrigerators, incubators, etc. Estimated cost $50,000.

N. Y., Binghamton — The Binghamton Gas Co., 40 Chenango St., plans to build a fuel oil and gas station, capacity 500,000 gal., on Court St. Estimated cost $10,000. C. Bennett, Genl. Mgr.

N. Y., Buffalo—The Island Warehouse Co., Ganson St. and Ship Canal, awarded the contract for the construction of a 10 story, 9 x 100 x 268 ft. flour mill. Estimated cost $600,000.

N. Y., New York—The Empire State Ice Co., 76 West Monroe St., Chicago, awarded the contract for the construction of a 3 story, 110 x 138 ft. ice making plant on 161st St. and Grant Ave., here. Estimated cost $135,000.

N. Y., Oswego—The Oswego Netherland Co. is having plans prepared for the construction of a 1 story, 100 x 365 ft. ice cream plant. Estimated cost $180,000. The McCormick Co., Inc., Century Bldg., Pittsburgh, Pa., Archts.

O., Ashland—The J. E. Matthews Produce Co. is having plans prepared for the construction of a 3 story, 60 x 75 ft. cold storage building with 15-ton ice making equipment. L. J. Goodrich, 207 East 4th St., Engr.

O., Columbus—The Doddington Co., 451 West Broad St., will build a 2 story, 60 x 100 ft. factory for mill work on Duerr Rd. Estimated cost $25,000.

Pa., Bethlehem—The Kurtz Furniture Co., plans to reconstruct its buildings 3, 4 and 5, which were recently destroyed by fire. Estimated cost $800,000. Architect not announced.

Pa., Clearfield—The Gingery Hardware Co. awarded the contract for the construction of a 3 story, 50 x 100 ft. store, warehouse and planing mill on 4th and Pine Sts. Estimated cost $40,000. D. Gingery, Pres.

Pa., Jeannette — The Amer. Window Glass Co., Farmers Bank Bldg., Pittsburgh, will soon award the contract for the construction of a 1 story, 40 x 828 ft. glass factory and cutting room, here. Estimated cost $175,000. L. J. Pierce, c/o owner, Engr. Private plans.

R. I., Woonsocket — The Rhode Island Knitting Co., Jeffers St., plans to build a 2 story addition to its knitting mill. Estimated cost $50,000. Private plans.

Va., Richmond — The Wortendyke Mfg. Co., foot of 13th St., manufacturer of paper products, has had sketches made for the construction of a 3 story factory. Estimated cost incl. machinery, $200,000. Carneal & Johnston, Chamber of Commerce Bldg., Archts.

W. Va., Fairmont—The Monongah Glass Co. awarded the contract for the construction of a 2 story, 36 x 103 ft. cooper shop and glass factory. Estimated cost $15,000.

W. Va., Huntington—The Carbocite Co., c/o S. J. Hyman, Day and Night Bank Bldg., plans to build a 1 story coal tar refining factory. Estimated cost $100,000. Architect not selected.

Wis., Antigo — The Langlade Creamery Co. will build a 2 story, 50 x 95 ft. bottling plant. Estimated cost $45,000.

Wis., Jackson—The Jackson Canning Co. awarded the contract for the construction of a 1 story, 24 x 30 ft. addition to its canning factory. Estimated cost $8,000.

Wis., La Crosse—The Weisse Mfg. Co., Caledonia and Gillett Sts., plans to build a 2 story, 50 x 100 ft. factory for the manufacture of millwork products. Estimated cost $50,000. J. Weisse, Pres. Architect not selected.

Wis., Madison — The J. Heilprin Fruit Co., West Mifflin St., plans to build a 2 story, 75 x 150 ft. cold storage warehouse on Bedford St. Estimated cost $90,000. J. Heilprin, Pres. Architect not selected.

Wis., Mayville — The Bd. Educ., A. Droeger, Secy., is having plans prepared for the construction of a 2 story, 112 x 274 ft. high school, including manual training plant. Estimated cost $260,000. Parkinson & Dockendorff, Linker Bldg., La Crosse, Archts.

Wis., Milwaukee—The Cedarburg Dairy Co., c/o H. Berns, 1586 Prospect Ave., is having plans prepared for the construction of a 1 story, 100 x 150 ft. dairy on 11th St. Estimated cost $75,000. H. J. Esser, 82 Wisconsin St., Archt.

Wis., Milwaukee—H. J. Esser, Engr. and Archt., 82 Wisconsin St., is receiving bids for the construction of a 4 story, 60 x 210 ft. and a 2 story, 60 x 210 ft. factory buildings for the Harsh-Chapline Shoe Co., 692 Hanover St.

Wis., South Milwaukee—The Pfister & Vogel Leather Co., 442 Virginia St., Milwaukee, awarded the contract for the construction of a 1 story, 63 x 66 ft. addition to its tannery, here. Estimated cost $25,000.

Ont., Chatham—Silverwoods, Ltd., London, is having plans prepared for the construction of a cold storage, ice cream and artificial ice plant. A. E. Silverwood, Mgr.

869

American Machinist

Volume 57 NEW YORK, DECEMBER 7, 1922 Number 23

Ordering and Storing Small Tools

Things to Do and to Avoid in Ordering Small Tools—Inspection and Storage Methods—Systems of Getting Tools to Workmen

BY W. J. SANSOM

THE principal points to be considered in ordering the purchase of small tools are:

(1) The reasonable quantity that should be kept in stock, sufficient to meet ordinary demands. Careful estimating by the director will determine this and if a record has been kept of previous purchases on perpetual inventory cards or on the form shown in Fig. 1, the matter of the quantity required for a given period will have been well established.

RECORD OF TOOLS PURCHASED

Date of Reqn	Manufactured by	Cost each	Quantity

FIG. 1—CARD FOR RECORDING TOOL PURCHASES

(2) What particular brand or make of tools has given the best satisfaction hitherto? The director should keep in touch with shop foremen on this point and keep notes for reference.

(3) Is the tool or appliance required of standard size, or is it special? If the tool is special, can changes be made on the part to be manufactured that will allow of stock sizes of tools being used? If the tool must be a special, then full details and, if necessary, a dimensioned sketch should accompany the order to the purchasing agent so that he may act with intelligence and the manufacturer may proceed without delay. Such sketches should be made with carbon duplicates as the retention of the duplicates may save a great deal of annoyance and expense.

(4) What will be the approximate cost of the tools? The superintendent is interested in costs and before he approves the requisition he should by all means know about the cost of the order.

The writer remembers a case where a tool director ordered a quantity of chasers for pipe threading machines and the order was sent to the manufacturer who discovered that it amounted to almost $1,000. This quantity being unusually large for the purchaser's needs, in the estimation of the manufacturer, an inquiry was sent to the purchaser regarding the order and, upon investigation, it was found that a $250 order would fill all requirements. If the purchaser had followed the plan of having the tool director state the approximate value of the order, the large amount of the order would have resulted in an investigation of the requirements before the requisition left the superintendent's hands.

(5) If the tools requisitioned are to replace others, can the old tools be repaired economically and returned to service? This feature of tool upkeep will require expert knowledge of costs and ability to discriminate between tools that are beyond repair and those that may be salvaged.

(6) If the required tools are to be used only occasionally, can the tool be borrowed from some other department within the works?

The card shown in Fig. 1 is useful for keeping track of tools purchased and the form to be used by the tool director in requisitioning through the purchasing department is shown in Fig. 2. So that there shall be no duplication of orders, no one should be authorized to requisition tools except the tool director. Foremen of departments should be required to send all requests for tools to the tool director as he would perhaps be able to furnish the required tools from stock or would at any time be able to offer suggestions that would avoid the necessity of ordering them.

Upon receipt, purchased tools should be subjected

CHECK DEPARTMENT REQUISITION. Date______ ______191_

Material on this order should be delivered by______ ______191_

Quantity	Name of Article	Description	Sold by	Value
			Total	

Approved______ Superintendent ______ Tool Director.

FIG. 2—TOOL REQUISITION FORM

to a careful examination for defects in material, and, if necessary, be measured for accuracy of sizes. If hardened tools have been ordered to a stated degree of hardness they should be given a hardness test. The manufacturers of products requiring a high degree of interchangeability of parts often specify that taps be furnished with limits on variations from the stated pitch diameter. Milling cutters must be checked in many cases for sizes and shape.

The matter of tool inspection is one which must be left to the intelligence of the director of the department and can very easily be carried to extremes, but it is time profitably spent and the writer has found from experience that the manufacturers of small tools are more than willing to rectify an error and are pleased to have the trouble brought to their attention. This brings to mind a case where a manufacturer furnished a large hob costing about $140 for cutting gear teeth. Upon inspection this hob was found to be cracked almost its entire length due to improper heat treatment.

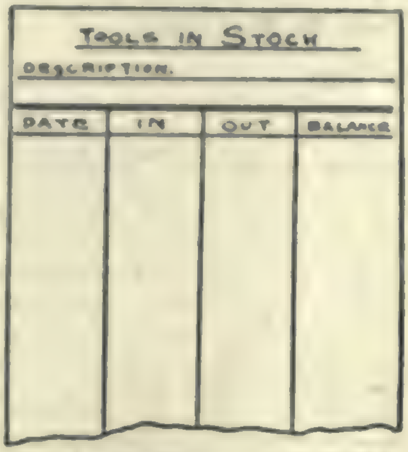


FIG. 3—PERPETUAL INVENTORY CARD

The manufacturers were notified of the defect and agreed to replace the hob should it break down. It proved necessary for them to fulfill their promise very shortly afterwards. This instance shows the importance of inspection, for had the tool been used before the defect was noticed it would not have been so easy to make a complaint. The director should be very sure that his complaint is justified before taking any action. Failure to prove his statement upon investigation by the manufacturer would result in nullifying any future complaint that he might make and would mark him as unreliable.

After the inspection of new small tools, they should be locked up either in a special room provided for that purpose or in cupboards. None but the director and one other responsible check room employee should have access to these stores. A card record, conveniently located, should be kept of all material stored and as the stock is replenished or removed, an accounting should be made directly on the record thus keeping a perpetual inventory, see Fig. 3. Only such tools as are necessary for the shop should be in circulation and no tools should be withdrawn from the stock room until the old tools they are intended to replace are beyond repair.

Micrometers may be kept in a case having a glass door and should be so arranged as to hang in plain sight. A red background of the same outline as the micrometer will indicate any tool that is in service, the tool covering the outline when hanging in the case. Hooks should also be provided in the case for checks and the case locked up after working hours. It is sometimes preferable to have special boxes made for micrometers, each box containing an adjusting wrench and standard reference disk, the whole outfit being checked to the workman as a unit.

In some shops it is customary to obtain a written order from the shop foreman to get micrometers from the check room but this should really be unnecessary except that perhaps it will prevent workmen using such tools on work that can be done with ordinary calipers and so release the micrometer for other more important work. Verniers and other fine measuring tools, such as gage blocks that are used only for standard reference, may also be stored in the same way and the director should see that they are returned to their respective places at the close of the working day.

A rack containing a large number of bins, preferably of steel, should be erected for storing drills, reamers, mandrels, and kindred tools. A separate bin should be provided for each size of tool. Racks should be designed that will allow increase of the size of any bin to suit the quantity of tools to be stored and so economize on space. If the racks are of wood, the expansion feature may be provided for by having $\frac{1}{16}$-in. saw cuts at half-inch intervals directly opposite on the top and bottom of the shelf and using number twelve gage sheet iron for the sides of the bin.

Machine screw taps and number drills may best be taken care of by using a cabinet containing shallow drawers with partitions for each size of tool. Another good plan is to use small hardwood blocks drilled to receive the tap, tap drill and body size drill and check the outfit to the workman as a unit. The blocks can be incased in a collar made of standard iron pipe slightly tapered in the bore to permit of the block being driven in and so avoid splitting of the wood. The smaller sizes of pipe taps can be handled in the same way but the larger sizes will necessarily have to be handled separately on account of their bulk. Tap wrenches will occupy the least space if a small hole is drilled close to the end of the handle so that they may hang on nails driven into a board.

Toolholders should be separated as to size and kind in individual bins. Forged tools should be kept in an open cabinet with shallow shelves and separated according to shape, size and whether carbon or high-speed

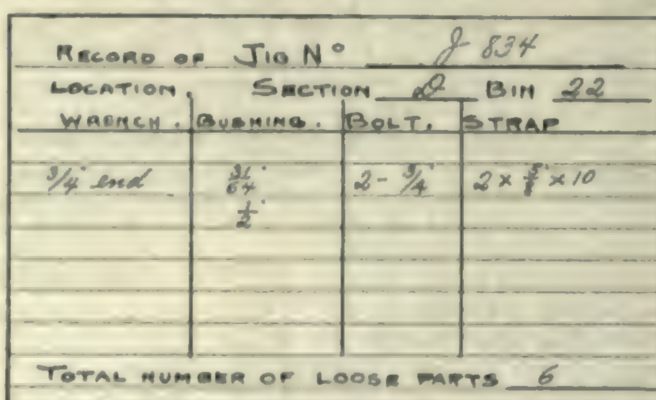


FIG. 4—JIG RECORD CARD

steel. A symbol letter should be stamped on the tool indicating the brand of steel of which it is made and figures should be used to indicate its shape. A copy of these symbols should be furnished for the use of the tool dresser so that he will give the proper heat treatment. Die stocks may be economically disposed of in the same manner as tap wrenches. For the sizes in common use around the shop it is better to furnish full stocked dies, leaving the dies set permanently. This will save the workman's time in setting the die

and offset the small additional expense of the die stock.

Pipe and U. S. standard hand dies can be stored in shallow drawers partitioned off and labeled for each die, the same segments of the die always being kept together. Chasers for bolt and pipe threaders should be stored in separate shallow bins and kept in sets as received from the manufacturer and this is especially important where it is the custom to use chasers that have been recut. While these chasers are generally supposed to be interchangeable it will be found that it is preferable to keep the sets intact as only by so doing can the best results be obtained and spoiled work be reduced to a minimum.

Spring dies and hollow mills, when not kept on their permanent arbors, may be stored in trays in which wooden pegs, smaller in diameter than the holes in the cutters, are fastened vertically to the bottom board by means of screws. The cutters may then be arranged in groups according to type and size. Milling cutters can be kept in an orderly manner by hinging wooden leaves around a post or a stand built for that purpose, hanging the cutters on nails and labeling each space according to the cutter to be placed thereon. Extra large and heavy cutters will of necessity have to be kept on shelves properly partitioned for them.

Gear cutters may be stored in the same way as milling cutters and a convenient plan of the board is to arrange by pitch vertically and by the number of the cutter horizontally. A good supply of standard sizes of bolts of various lengths should always be on hand and kept in such condition that the nuts may be run down the full length of the thread with the fingers. A bolt on which it is necessary to turn the nut with a wrench is an abomination. Straps of different sizes and kinds with bolt holes drilled every two inches of length should also be on hand in liberal quantities.

Storage of Blueprints

Provision is made in many factory systems for furnishing a drawing of the part to be made with the shop order but as a general rule it is necessary for the workman to get his blueprints from the check room. In order to protect them they should be mounted on stiff cardboard or on sheet iron and then be shellacked to allow for the removal of grease. Blueprints so mounted may be stored by filing vertically in deep drawers in the same way as office records are filed. The prints may be separated by index sheets also of iron with the blueprint number thereon and provided with a receptacle or clip for receiving the workman's check.

An accurate record of all prints in the shop should be kept by the tool director so that if a change on the print is necessary, it will be possible to know exactly how many prints at a given time are in service and to see that all are returned to the drafting room when changes are made, thus avoiding the possibility of an old print being used in the shop and a quantity of work spoiled through the change not being noted thereon.

Welding torches and all appliances, wrenches, etc., should be stored in a box provided with lock and key and charged to the workman as a unit, a card record of the contents which should comprise a standard equipment being kept in the check room. Tool cabinets may be designed of square or hexagon shape mounted on a ball bearing base to permit of being revolved. Such an arrangement is very convenient and economical in the amount of floor space occupied.

Jigs and fixtures are usually of such a bulky nature as to cause considerable trouble in providing for their proper storage and accessibility. If a large number of such tools are in frequent use it is well to have a separate room devoted exclusively to their storage. Substantial bins should be erected, each section being small enough, about six feet in length, to allow for removal without interference with the arrangement in general should the occasion arise and each section should be partitioned to suit each individual jig in so far as is practical. A card record should be kept of all jigs in storage indicating the section and the number of the bin and the quantity and size of straps, nuts, bolts and loose parts such as removable bushings, special wrenches, etc. See Fig. 4.

Systems for Checking the Tools

Sections may be distinguished by letters and the bins by numbers. For instance, the tool attendant knowing the number of a jig, would find on his card record that it is stored in section D, Bin 22, and would note the quantity of loose parts that must be used with the jig. Each section of bins may be easily lettered by nailing a piece of sheet iron to the top and painting the letters thereon very prominently. The bins may also be numbered either directly on the shelves or by a square piece of sheet iron on which the number is painted. If the bins are painted black and the numbers in chrome yellow a good contrast is obtained, making the figures easily discernible at a distance.

A large machine-tool factory in the middle west employed a number of messenger boys whose duties consisted of taking workmen's checks and getting tools for them from the check room. These messengers were stationed at certain points in the shop and were at the beck and call of the workmen. The system was not an unqualified success principally because the boys revolted from such menial duties in a very short time. As no boy with ambition would accept such a position, it took considerable energy to keep up a force of trained messengers and after a fair trial the plan was dropped.

Another concern manufacturing farm tractors has a shop telephone system operating directly between groups of machines and the check room. The telephones are numerous and conveniently placed. The floor inspector upon observing that a machine is nearing the end of a job will notify the time-keeper and routing clerk to that effect. The routing clerk then notifies the check room of the job next in order for that machine. The check room, having a card record of all tools used on the job, will deliver the tools required to the machine and at the same time bring back the tools not needed from the previous job.

If the tools require sharpening, the workman telephones the check department to that effect and either another tool is sent out or the dull tool is called for, sharpened and returned. This method is a good one and the messenger boy is not necessarily kept on the same job every day as it can be arranged to alternate the duties so that a boy may spend one day delivering tools and the next day be kept busy on work within the check room such as sorting, sharpening and repairing tools.

If it is thought preferable to give written rather than verbal orders to the check department the routing clerk could easily send this order by means of a pneumatic tube if compressed air is available in the shop. Where there are several check rooms in one factory, a telephone system is a great convenience to the tool

director enabling him to reach distant points easily and to keep on the trail of his men far better than if it were necessary for him to walk around the plant.

A common fault with most check room windows is the lack of space provided for the workmen to receive their tools, usually only one or two men being accommodated at the same time. To avoid this condition, the windows should be at least six feet in length and of a generous height with ample shelf space.

A Plan for Unit Storing

A highly commendable plan, where sufficient tools are in stock to permit of such an arrangement, is to assemble all tools used on a particular piece of work in a box, not allowing them to be used on any other work than the piece specified. The box would be given a number or symbol and be identified by it. A printed card should be fastened on the box preferably in a label holder to permit of the card being changed and stating exactly the tools that should be therein. Upon the tools being returned to the check room, they should be ground and put in first-class condition ready for the next order of these particular pieces. This method wherever possible, will prove to be very efficient, and a big time saver, inasmuch as the tools are always ready and exactly suitable for the next job.

Engineering Sales Methods

By C. J. Morrison

Engineering sales methods instead of ordinary salesmanship will save the day for the machine-tool builders if applied in an energetic, constructive manner. The field at present for installations in new or enlarged shops is not large, but the field for replacing old, worn out and obsolete machines is very large and is the one in which engineering methods are particularly needed and where these methods will bring in results satisfactory to both the customer and the builder.

It is not sufficient simply to tell a machine-tool user that he should replace his old machines with new ones, but he must be shown in a concrete way what profit will be made on the investment. A study should be made of the manufacturing methods, the present costs of operations determined, and a report submitted showing the economies to be effected by purchasing new equipment and the returns which this will give on the investment. It is too much to expect the average shop manager to do this for himself and, besides, he may not know the times that are required for operations on the new machines, or he may not realize the hand work that may be eliminated by the use of machines which will produce more accurate work than the ones he is using.

The Policy of One User of Machine Tools

There is one very large user of machine tools who has a fixed policy that any machine replacing an old one must pay for itself in five years. This company has very accurate costs, is always willing to be shown, and places all the necessary information at the disposal of any reputable concern which wishes to submit a proposition. However, it is a pure waste of time simply to state that the proposed machine will meet the requirements and pay for itself in five years. A detailed report with blueprints showing the set-ups and times must be submitted, but if this report proves the case, a sale is almost certain.

Probably the biggest field for replacements is in the railroad shops, most of which are loaded up with machines that outlived their usefulness many years ago. Also the railroad shops have a large number of home-made machines, many of which are quite efficient, but others of which are expensive jokes. These conditions are due largely to the fact that the shops are side issues with the railroads and are simply tolerated as an unavoidable expense. Appropriations for machines are hard to get and are often so curtailed that a compromise has to be made and machines purchased that are not all they should be, but which are cheap. This condition also accounts for many of the home-made machines because they can be manufactured without a special appropriation.

An educational campaign conducted by engineer salesmen will develop this field. These men should work with the superintendents of motive power and prepare reports for the officials who control the appropriations showing exactly what economies the proposed machines will effect and particularly the reductions that will be made in the time lost by locomotives and cars undergoing repairs. These men thoroughly understand charts and figures and if the facts are properly presented to them, sales can be made. Once the purchase of specific machines is authorized, the purchasing agent will buy them and nothing else.

There has been too much effort made to sell the railroads merely lathes, planers, boring mills, and machines of a similar class, and too little to show specifically what certain machines would accomplish. The railroad officials have been prone to authorize the purchase of a certain number of each kind of machine and the purchasing agents naturally bought the cheapest they could get. Under those conditions the men in charge of the shops have become discouraged and have taken what they could get and not what they wanted. The machine-tool builders can change these conditions and, as a result, sell many machines.

Railroad Shops Have Little Use for "Repetitive" Machines

A mistake that has frequently been made in the past should be carefully guarded against, that is, of trying to sell the railroads machines that are particularly efficient only for repetitive manufacturing. The railroads have little use for such machines and, outside of a few in the main shops of the larger roads, they are more of a hindrance than a help.

The textile plants and the companies manufacturing textile machinery afford another good field for engineering salesmanship, but these concerns will have to be shown in very much the same way that the railroads must be shown. In this field considerable engineering ability may have to be used because the textile industry is filled with the traditions of how grandfather did things and probably it has taken less advantage of modern metals and practices than has any other industry. In order to make sales, the engineer may have to go so far as to redesign some of the textile machines, but the field is so full of opportunity that the effort can scarcely fail to obtain the desired reward.

Other fields can be developed in the same way, but the two mentioned are the most promising at the present time. Of course the work involved in carrying out the suggestions made is a species of "free service" but the results will certainly be far more profitable than allowing shops to run on part time and of offering to sell machines at cost for the one and only purpose of keeping the plant running.

Maintenance of Small Portable Power Tools

First of Several Articles — Periodical Inspection of Prime Importance —Schemes to Insure Thorough and Regular Lubrication

By R. P. Walsh

TOOLS WHICH are used for fabricating or measuring to exact dimensions and commonly known as "Precision Tools," have been so well covered in trade periodicals that their construction and uses are generally known. There is, however, a large class of important tools common to steel fabrication trades that has not received the attention it deserves.

Pneumatic drilling machines, riveting and chipping hammers, holder-on machines, rivet sets, countersinks, twist drills and bridge reamers are examples of tools included in this class. It is proposed in what follows to deal with some representative tools of the "Non-precision" class so that users of such tools may, it is hoped, be given information which will result in their more economical use. The necessity of keeping accurate and detailed records of tools, so that such records may be consulted when considering the purchase of new equipment, is generally recognized, but in a large percentage of cases ignored. The pneumatic drilling machine is a case in point. This is a portable power tool of complicated mechanical construction which is in a class by itself in the amount of abuse it is called upon to withstand in service.

TYPE CAPACITY M'FGR. PLACED IN SERVICE			PURCHASED COST M'FGR.NO. SHOP NO.			
RETURNED FOR REPAIRS	REPAIRS COMPLETED	NATURE OF REPAIRS	PARTS REPLACED	COST OF MATERIAL	COST OF LABOR	COST TOTAL

FIG. 1—GENERAL INFORMATION RECORD CARD

Operated by compressed air, its pistons and valves are subjected to the abrasive action of water of condensation containing particles of iron oxide or other matter from the walls of the compressed air piping. This is particularly true where the machine is used outdoors in cold weather.

The speed of a pneumatic drilling machine is never constant, fluctuating according to the hardness of the material being drilled and to the irregularity of feed, the latter depending upon the skill of the operator. In addition, and with few exceptions, the machine is moved for every hole. When the operator is working on a piece work basis, hundreds of holes are drilled or reamed during the day, necessitating rapid shifting of the machine, and increasing the liability of damage. Great care must also be exercised by the operator in manipulating the machine when the drill is breaking through the work.

A proper record on this type of machine, see Fig. 1, should contain the following information: Type, capacity, name of manufacturer, date of purchase, cost, manufacturer's serial number, shop identification number, date when placed in service, a complete record of all dates when the machine was returned to shop for repairs, when machine was again placed in service together with details as to the nature of the repairs, parts replaced, their cost and the labor involved. If, in addition to the foregoing, the rule be followed of turning in all machines at the end of the working period for lubrication, a close approximation can be made of the actual number of hours a machine has been in operation and thus its suitability may be determined.

It is of prime importance to have all portable power tools turned in at regular periods for examination as it frequently happens that such an examination discloses defects which might do serious damage to a tool if not discovered in time. Because of the extent to which pneumatic drilling machines are employed, their high cost and their liability to damage due to the severe conditions under which they are used, it is considered desirable to describe how such tools are handled in a large ship yard with satisfactory results.

The purchase of the machine is based solely on merit as determined by its performance under tests governed by actual service conditions. Weight is also given to all pertinent data such as previous experience with the type being tested, economy of operation, cost of spare parts, ease of repair, ease of operation, etc. The price of the machine is, of course, important but is not considered more so than performance.

MACHINE				YARD NO.
MUSTER NUMBER	TOOL CHECK NO	ISSUED	RETURNED	JOB

FIG. 2—TOOL ISSUE RECORD CARD

After the purchase of the tool, it is drawn from stock on a standard form of requisition and delivered to the main toolroom where it is card indexed, given a shop identification number, lubricated, operated for a few moments without load and then assigned to a place on the issuing rack. A second index card, Fig. 2, is used when the machine is issued to record the name of the mechanic requiring it, as well as the date of

issuance and job he is on. The date of return to the toolroom is also noted. This procedure is repeated each time the machine is issued.

Upon each return of the tool to the toolroom it is tested to determine its condition and, if found in proper working order, it is then lubricated and placed upon the issuing rack. Machines found defective are tagged and set aside for repair. Lack of periodic and proper lubrication is without doubt responsible in a greater degree than any other factor for shortening the life of a pneumatic tool. In the ship yard referred to, it is required that each drilling machine be turned in to a greasing rack upon the completion of the work period for oiling and greasing. This rack is of convenient form and boxed in so that it can be locked; moreover it is so located as to make it convenient for the men to turn in or obtain their machines. Wherever it is necessary two or more of these racks are used.

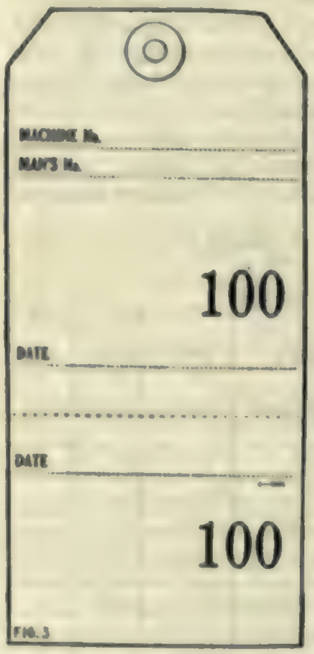
When the operator reports for work at the morning muster, the supervisor at the muster check board hands him a linen tag with stub attached. Both tag and stub are numbered and bear the date issued. Before turning in his machine upon completion of the day's work, it is required that the mechanic tie the large section of the tag to the feed screw spindle, retaining the stub. Upon presentation of the stub the following day at the morning or noon muster, the machine is returned except when the stub is presented two days later than the date indicated by stamp on the stub.

Checking up on Lubrication

In order to enable the "greaser" to spot at once any machine that has previously been oiled and greased and to avoid duplication of work, and also pick out machines that have remained on the rack for three successive days, the machine tags as shown in Fig. 3 are used in three colors, red, white and blue. A red tag is issued one day, a white tag the next day and the blue tag on the third day. The "greaser" working on a blue tag day knows that any machine having a red or white tag attached has already been oiled and greased and also knows that any machine with a blue tag of a date other than that on which he is greasing has been on the rack at least three days. After a machine has remained on the rack for three days it is returned to the toolroom in order that the number of idle machines may be reduced to the minimum.

No driller is permitted to have more than two machines (they must be of different capacities) on tool checks at any one time. If some of the machines prove more satisfactory than others it is frequently the practice among the operators to hide away the live or dead handle of a machine preferred to the others thus to insure that no one else can use it. As this practice, if unchecked, means the loss of small parts and the existence of a class of "pet" machines, penalties should be inflicted in such cases where the parts were found missing and steps be taken to bring all machines to the same high rating. The machines appearing on the list of those oiled and greased during the night should be checked against the list of machines shown to be in service and operators having tool checks on machines not appearing on the list of machines greased are called upon for an explanation, which, if unsatisfactory, results in disciplinary action being taken. Usually the delinquent is warned on the first offense and on the second reduced in rating.

While the system of using the three colored linen tags has proved quite satisfactory for the yard in question it is considered that the duplicate brass check system is more generally satisfactory. In the latter system, the operator, when turning in his machine at the end of the work period, receives a numbered brass check from the man in charge of the greasing rack and the duplicate, suspended from a split brass ring, is forced on to a spoke of the feed screw handle. By this arrangement no time is lost in turning in the machine, and it is not necessary for each individual mechanic to carry a linen tag in an overalls pocket during the day and tie such a tag on the machine when turning it in to the greasing rack. Often the linen tag when handled by greasy hands becomes soiled, making it impossible to decipher the tag number and



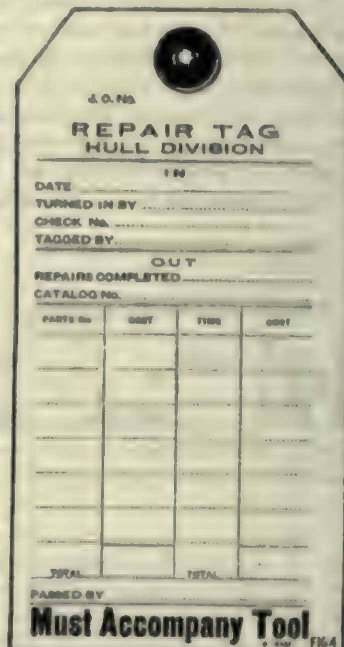


FIG. 3—COLORED TAG USED TO AVOID DUPLICATION OF GREASING. FIG. 4—REPAIR TAG

causing confusion in identifying the machine it covers. Such tags are also easily destroyed and it is necessary to carry a considerable supply in stock, whereas the brass checks may be used over and over again indefinitely. Under the duplicate brass check system, all machines, not claimed at the morning muster, are returned to the main toolroom and no machines are held on the racks. This means that a smaller number of machines may be carried in stock.

Inspection and Maintenance Suggestions

As previously stated, the periodic lubrication of pneumatic drilling machines is of the first importance, if they are to be kept in good working order. At the present time, there are on the market oils and greases specifically made for pneumatic tools and these may be purchased from the manufacturers of the tools. It is not well to experiment with unknown lubricants.

As a means of prolonging the life of his machine, a driller should up-end the tool for a short interval, for example, during the time it is laid down to change a reamer or twist drill, or for any other reason. This permits the oils and greases to run back over the crankshaft, pistons, etc. When the machine is in use the lubricants tend to gravitate away from the upper work-

ing parts. In the smaller, faster running machines this precaution cannot be ignored and if followed will do much to cut down the cost of repairs.

At the periodic examination a careful scrutiny should be made of the condition of the internal wall and the slot of the spindle taking the Morse taper shank of the tools driven by the machine. For this purpose a small electric light bulb, such as is used on a pocket flashlight may be employed in combination with a dry cell. The light bulb connected to wire leads from the battery, of sufficient length to fully explore the length of the spindle, is lowered through the spindle hole and illuminates the interior surfaces so that their condition may be observed.

All abrasions of this interior surface should be removed either by reaming or scraping and all spindles whose slots are found to be worn too large should be replaced. If this practice is followed the number of drills, reamers, countersinks and other tools rendered unserviceable because of broken or twisted tangs will be very materially reduced. A single pneumatic drilling machine with a defective spindle can ruin more tools, without being suspected, than any other destructive agent known.

Morse taper shanks are ground to size so that they may intimately fit the sleeve, socket or spindle used as a medium in the drive and consequently any inequality of the internal surface of the sleeve, socket or spindle which does not permit the intimate contact serves to throw the torque of the drive on the tang of the Morse taper shanked tool, with the inevitable result of injuring the tang. Greasy or dirty tool shanks are also a prolific source of tang destruction. When a tool is turned in for repairs, the linen tag shown in Fig. 4 is attached to it and remains with it until the tool is repaired, tested and returned to the tool room, ready for re-issue.

Misapplied Machine Tools—Discussion

By S. R. Holmes

The writer wishes to add his "Amen" to the article with the above caption on page 736, but thinks the most glaring and expensive example was overlooked by Mr. Nevin.

Can a man who respects fine machine tools see a precision lathe used with a grinding attachment, without gnashing his teeth? Such jobs usually require accuracy and therefore the best tool-room lathe available is selected. How long can the shears, cross-slide and leadscrew be expected to retain their accuracy when a little abrasive dust is occasionally added to the necessary lubricating oil?

If a lathe is not built to stand milling operations, how much less will it stand the after effects of grinding? The writer has seen examples of the finest lathes practically ruined, so far as accurate tool-room work is concerned, in two years' time, by workmen who were otherwise careful but used their lathes occasionally for grinding. Similar lathes, after twenty years of service, were practically as good as new. The grinding must be done dry, and it is impossible to protect the working parts referred to. Bench lathes are of course used for grinding operations, but the compound rest and threading attachment are first removed and the plain surface of the bed is easily cleaned.

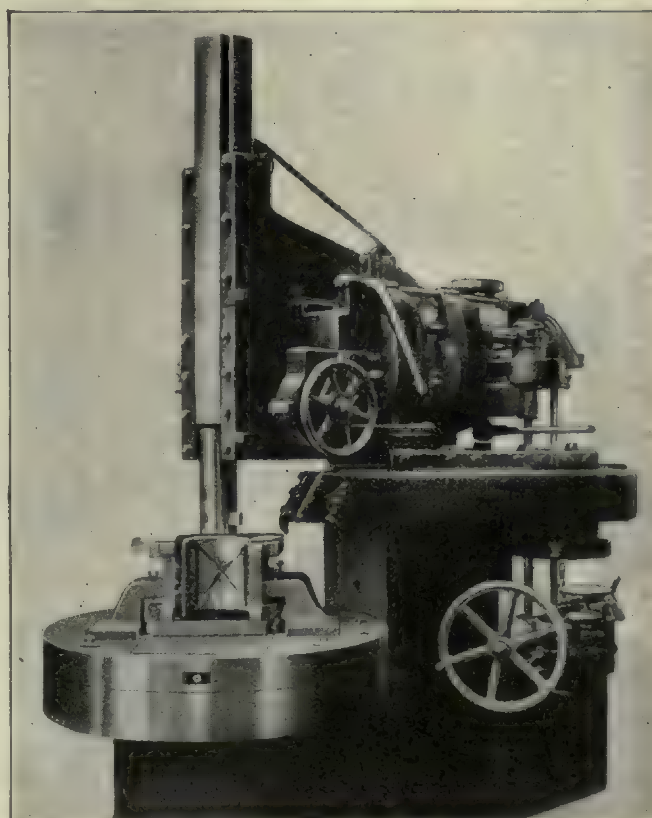
Modern grinding machines form a part of the equipment of any shop likely to have a precision lathe, but they are usually not equipped for grinding threads, and a lathe with some portable grinding attachment is "misapplied" to the job. The threads so produced, even if good, are expensive when the injury to the lathe is considered.

A Correction

Through an unfortunate mistake the article "Repair Work in a Tennessee Railroad Shop," which appeared in our last issue, was published before it had been approved and released by the Southern Railway System.

In releasing the article for publication, the Southern Railway System requested the following changes as here set forth:

The first illustration showing the repair on a slipper type crosshead, should have been omitted together with the description of how the repair was made. Repairing fractures by the method given is contrary to the approved practice of the Southern Railway System and is resorted to only in extreme emergencies that are, of course, of infrequent occurrence.



BORING AND FACING MILL FOR LOCOMOTIVE DRIVING BOXES

In explanation of Figs. 2 and 3 showing repairs on an air-pump head and a piston it was stated that brass is used. The material used to build up the worn surfaces is Tobin bronze which is an alloy giving much longer wearing life than brass.

Since the article was written, the practice of boring driving boxes has been changed so that the method shown in Fig. 4 is now obsolete. The vertical boring and facing mill, shown in the accompanying illustration, built by William Sellers & Co., Inc., especially for boring and facing driving boxes, has been installed and the work is now done in a much more efficient manner than was formerly the case.

Table VII

Sweden—Exports of Metal Working Machinery

"Maskiner for Bearbetning af Metaller"

Country	1909 Kg	1909 Kroner	1910 Kg	1910 Kroner	1911 Kg	1911 Kroner	1912 Kg	1912 Kroner	1913 Kg	1913 Kroner	Kg
Norway	33,110	23,764	19,063	33,543	81,495	73,585					18,069
Finland	33,307	47,144	31,869	23,133	90,866	93,276	37,760	32,765			95,649
Russia in Europe	110,617	102,057	73,780	130,046	95,997	107,157	191,121	231,361	92,215	132,595	368,699
Denmark	43,419	29,520	66,601	45,669	118,625	73,537	149,162	96,456	191,290	140,704	127,360
Germany	32,683	41,178	39,835	90,237	114,144	144,070	16,644	37,394	20,460	21,900	84,373
Netherlands	421	2,135	2,473	5,100							
Belgium	3,070	5,290	13,854	13,667	18,894	30,195					
Britain	12,664	13,709	19,416	20,296	23,653	23,158	13,573	14,330	19,848	26,280	17,037
France	2,679	4,745	9,841	18,135	33,020	50,559	32,812	33,610	59,518	69,587	8,100
Spain	1,396	2,073	1,250	1,250							
Portugal	735	700	1,035	2,060							
Italy	287	1,000	249	1,400							
Switzerland			5,894	8,750							
Austria	864	970	2,610	7,603	13,124	19,960					
Hungary	501	1,292	826	690							
Roumania											
Bulgaria	22	40									
Iceland											
Egypt			71	44							
British South Africa	933	1,750	636	520							
China											
Japan	545	295	3,272	2,306							
Other Asia	240	150									
Australia	3,510	3,213	13,584	13,856	17,436	17,771			10,710	11,150	11,228
British North America	920	850									
United States of America	993	2,000	712	4,100							
Brazil	1,588	555									
Argentina	1,260	2,292	2,041	1,970							
Other Countries	...	..	...	...	22,221	31,087	227,088	294,104	202,598	262,836	185,453
Total	310,456	489,002	329,512	448,275	648,313	753,485	688,529	771,840	598,339	669,854	915,866

Par value of Krona = 26.80c

Note.—Only monthly reports are available for 1920 and 1921—the figures do not show the countries of destination, and metal working machinery is included with woodworking and other industrial machinery.

Table VIII

Sweden—Imports of Metal Working Machinery

"Maskiner for Bearbetning af Metaller"

Country	1909 Kilograms	1909 Kroner	1910 Kilograms	1910 Kroner	1911 Kilograms	1911 Kroner	1912 Kilograms	1912 Kroner	1913 Kilograms	1913 Kroner	1914 Kilograms	1914 Kroner
Norway	40,488	20,573	44,756	46,514	62,059	66,589						
Finland	3,210	2,552	1,953	1,232	.....	.....						......
Russia	3	43										
Denmark	9,325	15,087	59,614	72,750	51,620	49,806			38,052	33,684	20,323	29,219
Germany	1,065,990	827,195	1,445,973	1,060,176	1,532,656	1,207,591	1,015,038	1,200,456	1,590,190	1,741,685	985,919	1,124,310
Netherlands	8,693	5,560	16,139	4,890					9,821	11,534		
Great Britain	235,109	249,108	324,344	345,335	336,557	341,213	178,163	210,199	213,848	334,356	214,261	304,442
France	9,513	9,549	2,701	3,387								
Switzerland	1,767	1,874	113	694	5,787	16,688						
Austria	118	679	51	556								
Belgium			2,001	5,727	48,482	12,114						
United States of America	152,054	241,698	249,165	356,055	223,095	389,119	257,998	448,934	612,211	1,054,671	310,738	571,745
Other Countries					21,435	11,354	148,920	208,491	99,867	142,514	95,519	128,763
Total	1,526,262	1,373,918	2,146,810	1,897,316	2,281,691	2,094,474	1,610,119	2,068,080	2,563,989	3,318,444	1,626,760	2,158,479

Sweden—Exports of Metal Working Machinery—*Continued*

Table VII

"Maskiner for Bearbetning af Metaller"

Country	1914 Kroner	1915 Kg.	1915 Kroner	1916 Kg.	1916 Kroner	1917 Kg.	1917 Kroner	1918 Kg.	1918 Kroner	1919 Kg.	1919 Kroner
Norway	10,071	58,915	65,619	505,524	747,978	425,480	1,066,200	610,698	1,926,194	392,486	1,087,723
Finland	169,693	508,214	936,566	513,421	1,115,237	220,325	707,815	31,742	91,024	52,770	240,598
Russia in Europe	739,626	1,992,561	4,539,405	2,259,053	5,914,629	1,323,747	4,193,567	12,477	40,949		
Denmark	89,889	386,581	516,898	375,990	533,566	142,638	226,860	267,174	763,871	238,445	435,262
Germany	75,150	433,023	870,148	382,757	1,385,768	1,589,615	6,010,000	5,117	32,525		
Netherlands				125,170	311,285	111, 08	319,869	505,456	1,739,126	78,922	297,989
Belgium										32,709	145,036
Britain	18,747	45,489	58,004	19,299	47,314	47,867	182,398	139,112	897,044	86,380	248,937
France	17,760	8,790	10,340	99,976	274,029	56,837	150,916			144,860	455,202
Spain										28,476	97,288
Portugal											
Italy				6,100	13,000					30,491	154,940
Switzerland								8,900	25,950		
Austria		228,922	508,505	86,083	248,833	219,763	760,050	19,084	69,635		
Hungary		35,798	93,150								
Roumania											
Bulgaria											
Iceland				1,947	2,[illegible]64						
Egypt											
British South Africa											
China											
Japan						5,416	29,500				
Other Asia											
Australia	11,095			5,739	10,305						
British North America											
United States of America				27,925	104,493			42,915	233,657		
Brazil											
Argentina											
Other Countries	219,702	210,828	261,009	136,699	231,303	259,982	553,497	146,605	472,309	292,373	890,833
Total	1,351,733	3,909,121	7,859,644	4,545,683	10,939,801	4,402,678	14,200,272	1,789,280	6,292,284	1,377,912	4,053,808

Par value of Krona 26.80

Note.—Only monthly reports are available for 1920 and 1921—the figures do not show the countries of destination, and metal working machinery is included with woodworking and other industrial machinery.

Sweden—Imports of Metal Working Machinery—*Continued*

Table VIII

"Maskiner for Bearbetning af Metaller"

Country	1915 Kilograms	1915 Kroner	1916 Kilograms	1916 Kroner	1917 Kilograms	1917 Kroner	1918 Kilograms	1918 Kroner	1919 Kilograms	1919 Kroner
Norway	7,277	15,877	34,445	143,646	104,873	370,412	45,613	214,148	35,623	78,504
Finland										
Russia										
Denmark	4,935	9,631	124,690	284,806	208,811	593,783	229,562	729,394	63,055	204,082
Germany	165,624	198,396	454,131	496,741	200,763	162,992	207,636	273,245	931,699	1,260,328
Netherlands										
Great Britain	78,071	100,409	6,925	15,027			2,108	4,397	12,008	17,503
France										
Switzerland			5,081	13,896			594	762		
Austria										
Belgium										
United States of America	391,365	725,112	523,298	1,078,372	274,028	802,586	236,307	929,079	920,046	3,121,620
Other Countries	100,868	138,853	72,983	106,130	107,936	255,794	71,027	207,099	116,568	286,210
Total	748,131	1,188,278	1,221,553	2,138,618	896,411	2,185,567	792,847	2,303,224	2,078,999	4,968,247

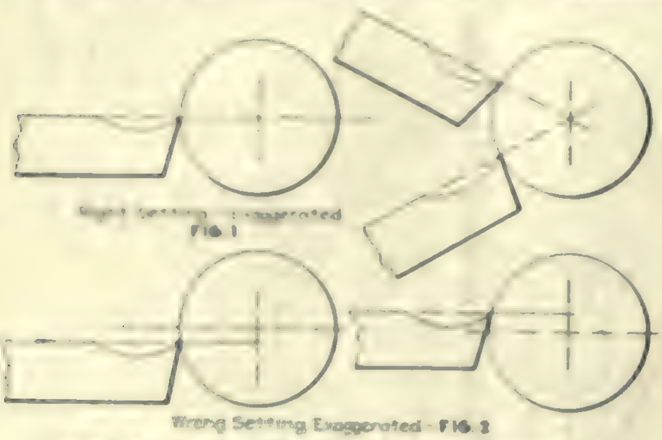
Par value of Krona is 26.80c.

Know Why You Do Things

By S. R. Hunter

Some of the articles published in *American Machinist* under the above title, during the early part of last year have brought out, in a very entertaining and instructive manner, some points which were under discussion when I first entered the shop as an apprentice. Doubtless the same subjects were argued over long before that time, but, as a charter member of the "Irememberwaybackwhen" Club, I would like to recall attention to those articles which contained discussions as to whether or not a lathe tool (I refer to the point of the tool) should be set above, upon, or below the center line of the work being turned.

It is evident that a great difference of opinion will be expressed, because of the application of the question to different jobs and conditions of work. I believe every practical lathe operator and machinist will admit that it is much easier to face a disk true and without chatter marks if the tool point is set slightly lower than the center of the disk to be faced, but on cylindrical work there will, doubtless, be room for argument.



FIGS. 1 AND 2—RIGHT AND WRONG SETTINGS OF LATHE TOOLS

Generally speaking, I am of the opinion that the best results can be obtained if the cutting edge of the tool is set on a radial line from the center of the work being turned (See Fig. 1) and I believe John Brent had this in mind in his article which appeared on page 565 in the March 31, 1921 issue of the *American Machinist*.

This setting may be obtained usually by tipping the tool either up or down at the point as the case may be. With the possible exception of a job of large diameter, I do not believe any benefit will be derived from having the point of the tool set below or above the center line (See Fig. 2) and not set at any angle corresponding to a radial line drawn from the center of the work. The radial line with this setting should be parallel to the top of the cutting tool.

I take exception to Mr. Brent's statement that "the machine for grinding tools is of no use to a real machinist," as I believe every machinist, real or otherwise, who has been privileged to use turning tools ground on a machine would never have any desire to go back to the old method. The saving in time, which results in having all turning tools ground on a machine, is a very big factor from the viewpoint of reduced cost of production, to say nothing of the inconvenience to which the machinist is put when he is obliged to shut down his machine, make a trip to the grinder, and perhaps stand in line, waiting his turn, in order to grind his own turning tools to meet his individual fancy.

Anyone who has worked in a shop where it is only necessary to turn in the dull tool at the crib or go to the board where wooden models of all standard tools are kept and to pick out the number of the one required in order to get a freshly ground one will, I believe, not suffer from homesickness for the old method. There are, however, some cases when special work is done in limited quantities and where it may still be necessary, or at least advisable, to have some tools ground in the shop where they are used. Generally speaking, however, the number of such jobs can be reduced to a very small minority by careful planning.

I do not agree with Mr. Brent in his definition of a machinist. Of course there are machinists, real machinists, and all around machinists and, as it is apparent, judging from the information we have available covering machinist apprenticeship training courses, that the aim of practically all manufacturers, who have courses of training in effect, is to produce all around machinists. My definition will apply only to this particular species.

The all around machinist, to my way of thinking, should be a man capable of handling any productive operation which may arise in a machine shop. This should include necessary experience which will enable him, in any case of necessity, to make a simple sketch, as well as to make the simple patterns or forgings required and to do any and all machine, bench, hand, floor and assembly work involved to put the mechanism into usable shape.

To do this the machinist should be able to figure gears, line up and set up any machine tool with its counter and line shaft and pulleys, lace and apply the required belting, as well as to forge, temper and grind the necessary tools. Any man who cannot function as outlined above to my mind should not be classified as an all around machinist. He had better be catalogued as a one-sided machinist or specialist. The millwright, bench hand, fitter, erector, machine operator and assembler come under this classification, while the title "all around machinist" should apply only to one who is an all around man or one who can "handle any job in the shop."

It is admitted that these men are mighty scarce and, as a general rule, they never have to look for a job. If, in addition to the above attainments, they possess a willingness to assume responsibility and some of that indefinable ingredient known as executive ability they usually become foremen at a comparatively early age and, perhaps later, superintendents and works managers.

The Foreman's Biggest Job

By Robert Grimshaw

The foreman's biggest job is not the understanding and handling of the machinery, the materials or the workers. Nor does it lie in understanding the methods by which these are utilized to the best advantage of all concerned—including the community. But his biggest job is the understanding and handling of his own personal equipment for his job. It is knowing his possibilities and his limitations and how to utilize the first to the fullest and how to counteract the latter. This he may learn by self-analysis and study, and sometimes by the help of "friend wife."

What's Wrong with the Railroad Shops?—III

Small Tool Situation—Lack of Co-operaton Between Mechanical and Purchasing Departments—Inadequacy of Tool-Sharpening Equipment

BROADLY SPEAKING, the tooling in the railroad shop is neglected. There are cutters and lathe tools and drills just like the ones you would find in any machine shop but they do not seem to have been selected by men who understood the requirements of the railroad shop. There seems to be little doubt that the difficulty arises from the relations existing between mechanical department and purchasing department.

The function of any mechanical department is to get out the best possible work at the least possible cost. To accomplish this end the men at the head of it are naturally anxious to get the tools and equipment best suited to the purpose, the cost of such equipment being less important than its capacity. The purchasing department on the other hand is expected to meet the requirements of the mechanical department in the way of tools and supplies at the least possible cost. Where the two departments work hand in hand, each sympathetic with the purpose of the other and willing to compromise for the good of the whole company, excellent results are possible. When the two departments are constantly at loggerheads the result is more than apt to be quite the reverse.

> WHAT WAS said in the previous article about machine tools and equipment applies with equal force to small tools. Our observations led us to believe that little betterment of the small-tool situation in the railroad repair shops is to be expected until some means are found to secure co-operation between the mechanical and purchasing departments. By the very nature of things their functions are diametrically opposed and the way to get them together is through the personal intervention of the man to whom they report. It is asking a good deal of a busy official to expect him to take the time to bring about such co-operation, but it is asking entirely too much to expect his subordinates to do it if he appears not to have the interest in the problem which could cause him to devote some time to it. Where he leads they will be glad to follow.

In the majority of railroad shops the co-operation of the purchasing department and the mechanical department leaves much to be desired and is undoubtedly responsible for many of the faults we are pointing out in these articles. We shall have more to say on this particular point, which is a management function, in a later article.

With very few exceptions the railroad shop employs no tool engineer. As a rule the work which would naturally be done by such a man is entrusted to the toolroom foreman. It is not fair to expect that a man whose experience has been entirely along the line of making things should also be a capable designer. We saw some instances where the toolroom foreman had made meritorious attempts to improve existing tools and make special tools for certain kinds of work, but in most cases these attempts showed very clearly that ambition and ingenuity were handicapped by the lack of detailed knowledge and engineering ability.

The average toolroom foreman has neither the time nor the opportunity to watch the various jobs in the shop to an extent that would enable him to form ideas as to the best method of performing a given operation or the best construction of the tool used. It is just as wrong to expect the toolroom foreman to design tools as it is to expect the master mechanic to design locomotives. Toolroom foremen have designed tools and master mechanics have designed locomotives. Perhaps that is why we have such a complete lack of standardization in both.

A visit to the largest repair shop of one important railroad system showed conditions that would be difficult to duplicate in anything but a railroad shop. At the carwheel boring machine 400 pairs of boring tools were neatly hung on pegs on two blackboards. At a slotter 460 tools were found ranging in composition from chilled cast iron to the latest high-speed steel, and in shape through all the known forms and far into the realm of the unknown. These two lots of tools had been collected gradually by the men then working on the machines and their predecessors and were conclusive proof that the practice in this particular shop had been developed entirely by the men themselves without any instructions or control from the outside.

If it is too much to expect of a toolroom foreman that he should be able to design tools, isn't it rather worse to expect the machine operator to develop his own tools and methods? Experience in production shops indicates that the development of tools and methods cannot be left in the hands of even the brightest and most energetic machine operator. Such a man is not in a position where he has the time or the facilities to do the necessary experimenting to decide on the best methods or tools, although if this same man were put at such experimental work he might perhaps prove to be exactly fitted for the task.

Stranger than the fact that many necessary tools are not made or supplied is the fact that some of the best talent in the shop is employed in making simple standard tools which can be bought in any hardware store at less than half the cost. It seems incredible that a modern shop superintendent would permit an expert blacksmith to spend his time forging cold chisels and heads for sledge hammers at a time when locomotive repairs were being delayed through lack of them, yet that was exactly what was being done in a number of shops. The blacksmith was not engaged in making a tool that was needed in a hurry, an emergency job, but was making a deliberate attempt to manufacture, for he was supplied with a good set of dies for making several sizes of chisels.

It may be that the cost record shows that the chisels can be made somewhat more cheaply at home. If so it

is almost sure that the cost record is at fault, but whether these cold chisels were actually cheaper than those one can buy in the hardware store is a point of minor importance. The main thing is that a skilled man engaged in a railroad shop should not be employed in making articles which can be bought in the open market.

If the purchasing department does not honor requisitions so that the shop is habitually short of the necessary tools the shop is practically justified in helping itself in making what it needs, but this is no excuse for the company as a whole. Another excuse may be the idea that here is a skillful man for whom there is not sufficient work at present but whom one wants to retain in the organization. This situation may partly justify the shop management but certainly not the company.

In the same shop we were told that there was a rule against making parts for stock. Had such a rule not been issued the shop management could have put this man to work making articles which at one time or another would be required for the repair of locomotives or cars.

Inadequate Tool Sharpening Equipment

In most of the shops the equipment for sharpening tools was inadequate. It must be said here in fairness to the railroad shops that the same remark might be made about most other machine shops, but it is no excuse for any man's neglect that other men are equally neglectful.

Cutter sharpening unquestionably was below par. Not only was there a lack of proper equipment but what equipment there was was generally not used to the best advantage. There seemed to be an absence of knowledge as to what was required in a tool and the means to obtain it. The fact that cutters intended for the same or similar work were ground with different clearances and with and without rake, all in the same shop, shows the truth of our contention. A further investigation showed that, even if this knowledge had not been lacking, there would not have been the proper equipment to get good and uniform results. Tool grinders, it is true, were found in most of the shops visited, but there was an utter lack of uniformity of angles though the tools were to be used for the same kind of work and in the same shop.

One story we ran across has nothing to do with tool sharpening but it does bear out the statement that knowledge of what is required of a tool is lacking. This happened in one of the best-equipped and best-managed railroad shops in the country during the early days of the war. The shop had been using high-speed drills wherever possible and the men in charge were rather pleased with the results they were getting. The war, however, soon drove the price of high-speed drills to a height beyond the reach of the railroad exchequer and it was reluctantly decided to go back to carbon drills.

The change was made and some time later a check was made on the speeds and feeds of the drilling machines throughout the shop. Considerable consternation arose when it was discovered that not a single change in speeds or feeds had been made and that apparently the carbon drills were standing up in an entirely satisfactory way. Just how many thousands of dollars had been wasted by driving the high-speed drills to a fraction of their capacity will never be known but the loss is typical of many similar ones brought out through like ignorance or lack of interest. Assigning a new Pacific type locomotive to hauling two day coaches and a combination regularly on a three-mile branch line would be a money-saving proposition compared to it.

Another evidence of the insufficient or inefficient sharpening equipment was the condition of the reamers, boring tools and similar precision tools. They were neither round nor sharp nor ground to any definite size. This condition we are glad to say was by no means universal. In some of the shops equipment of this nature was kept in excellent condition. While we are on the subject of reamers we might mention one odd fact about bridge reamers. Although it is well established that a ground bridge reamer lasts many times as long as one that is used in the rough, most shops seem to buy them unground.

Jigs and fixtures are conspicuous by their absence and those that are in use are pretty primitive. The lack of such essential parts of the equipment of manufacturing plants may be explained, at least partly, by the fact that railroad shops do not make parts in quantity. Jigs and fixtures, however, are not used merely for the purpose of reducing the cost of things but also to make them better and particularly to make them interchangeable. Though the cost of the piece itself might not have been lessened, interchangeability reduces the cost of its installing in the finished product.

We shall have more to say about the lack of standardization but it should be mentioned here that many things are done which could be done better if there were more uniformity of parts. Connecting rod brasses, for example, are laboriously shaped instead of being quickly milled because, so it is said, there are too many sizes to warrant the use of such costly tools as milling cutters. There is no question that many sizes are in use but that so many sizes are necessary is very doubtful.

There seems to be a general lack of appreciation of the necessity of studying operations and applying the best method available. There are a few operations which have been specialized and for which special machines or tools have been built, wheel and axle lathes for example, but on the whole little attention seems to be paid to the proper method of machining, the idea being that anything goes so long as the piece is ready when needed.

Few Jigs and Fixtures Used

An extreme example came to our notice in one of the shops, a shop by the way where the equipment was much above the average. The job was the boring of a cylindrical piece of steel which had been turned up. The hole was lengthwise with the piece which was about 5 in. in diameter and 10 in. long. The piece was clamped in an upright position against an angle plate fastened to the bed of a radial drill and a 2-in. drill did the roughing out. No jig was used although the hole was supposed to be central with the piece. A good boring bar was used for finishing but most of its accuracy was dissipated through the uncertain and wobbly connection between it and the spindle of the machine. It is difficult to imagine a worse method.

From what has gone before it may be guessed, what we found to be a fact, that instructions to the men were at most scanty, and generally missing altogether. Operations were performed according to traditional methods. Only in scattered cases had an operation been standardized and records made of it. Perhaps records existed in such cases but if so there was not sufficient contact

between the engineering department and the shop to put these records to work.

In one shop where most of the equipment was modern a large planer was out of action. The feed blocks had to be removed for repairs. After spending a good deal of time on false starts the man who had worked on it found that a large part of the driving mechanism, pulleys, pulley shaft, pulley shaft outboard bearing, some gears and other shafts had to be removed before he could remove the feed box. He had spent several days in fruitless efforts to handle it some other way and had just discovered the necessity of removing all the parts mentioned.

We asked him, "Didn't you have a blueprint of the machine or a foundation plan?"

The answer was, "No."

"Isn't there such a blueprint in the shop?"

Answer, "I don't know."

"Did you ask your foreman?"

"No."

"Didn't he tell you something about it?"

"No, he didn't."

Now it may very well be that such a blueprint existed in the engineering department. If so it would have given the necessary information and a lot of useless work would have been saved. Here was an utter lack of instruction and it seems likely also that the foreman was ignorant that such a blueprint could be had. Whether the blue print existed or not is immaterial because no attempt was made to ascertain the facts and no instructions were given to the workman except to "fix up" the machine.

This situation calls to mind the ancient army story about the flag pole. An instructor asked his class of cadets how they would proceed to erect a flag pole of given dimensions in a given spot. After much thought various more or less ingenious answers were evolved. The instructor listened to all of them and then said, "You are all wrong. You would simply say, 'Sergeant, put up that flag pole.'" This plan of operation is a very simple one for the army officer or the shop foreman, but it has its drawbacks from the point of view not only of the sergeant and the workman but as an efficient performance.

There are, of course, many men in the railroad shop who are good and faithful and willing to work but who are not exactly college professors or mechanical engineers and who are at their best only when properly instructed. There are other men, not so many perhaps, who have the mental equipment and initiative to strike out for themselves along new paths but who cannot possibly turn their gifts to the best advantage unless they are given the tools and equipment necessary to turn out a good job.

Here again the close contact between the management and the men necessary to produce results seems to be lacking. It is not that the management is standing aloof from the men but that the idea seems to prevail that the men should know what needs to be done and that they actually do know so that instructions would be superfluous and might possibly hurt the feelings of the man. It is needless to say that the feelings of a good man are never hurt when he is instructed in the proper way.

Sash Weights and Machine Tools

By Charles W. Lee

The *American Machinist* has recently, much to my gratification, published a mighty fine little booklet, "Machine Tools and the Machines They Build," which exposes a false idea that I have long been fighting, that of considering the value of machine tools in terms of weight.

I hope this booklet will accomplish more than I have; this "how much a pound" idea is so firmly established that my converts total only two among those who have been looking at the matter from the buyer's viewpoint.

One of the converts was the superintendent of a large plant making small low-priced steam engines who said that he had to figure his stuff by the pound and that there was no reason why machine tools shouldn't be so figured. Explanations that the more skilled labor put into a certain weight of material the harder and more undesirable it was to sell it by the pound were of no avail. He said:

"I keep my sizes just as close as any machine tool maker in the world. I admit it is not necessary to the working of the engines, but I more than make it up in economy of assembling" (a point which might well be considered in some places I know of). "Come with me; I'll show you something."

And I did and he did. What he showed was a first class measuring machine. "There," he said, "we can easily measure to the ten thousandth part of an inch on that machine." And he mentioned the cost, which ran into thousands of dollars.

"And how much does it weigh?" I softly asked. And that converted *him*!

The other convert was the president of a somewhat similar concern who did not make as much of a point of what his product cost per pound, as he did of the price per pound of a machine that was being offered him and alleged to be every bit as good as the one I was offering. At the end of a (perfect) day of periodical battles, he said:

"We will have a directors' meeting at 9 a.m. tomorrow. Come around."

At the meeting the battle raged until the president said, "What will you do if we absolutely refuse to pay your price?"

"Take the next train out of town; what time does it leave?"

"Eleven o'clock."

Looking at my watch, shaking it, holding it to my ear, and trying, evidently with success, to achieve an expression of chagrin and dismay, I said:

"What time is it anyhow?"

The president pulled out a very nice looking watch. "Nine-thirty."

"Are you *sure* your watch is right? Is it a *good* watch?"

The president began to get a little peeved: "Bet your life it's a good watch. I paid two hundred and fifty for it!"

"How much a pound was that?"

And so the directors gave the president the "ha, ha" and me the order. Yes, they really did, although I hate to mention it on account of confessing the harmless chicanery in the matter of my watch, which the astute reader knows was running merrily along all the time.

I've had two converts but I want more.

Learning the Trade Forty Years Ago

N. S. Davenport

(The last of four articles)

The means for spacing the carriage forward at the end of each cycle was peculiar. A smooth round shaft extended the whole length of the machine under the carriage, and this shaft was given an intermittent endwise movement by means of a suitable cam. The amplitude of the movement was adjustable to suit different pitches of the beam.

A fixed boss on the underside of the carriage, through which the shaft passed, was provided with a grip that could be closed upon the shaft or released to allow the shaft to slide freely through it, the grip being operated by a separate cam. When the log was carrying the work across the cutter the carriage was tightly gripped to the shaft, which was at this moment stationary; but when the oscillating movement had ceased the grip was released and the shaft moved back to its limit. The carriage grip would then close and the shaft would move forward, carrying with it the entire carriage with the work upon it. Other and later machines for the same purpose were provided with screw and ratchet mechanisms for indexing, but this old machine did excellent work.

"Sealing" the Scale Beams

All the beams were, however, subjected to a later operation known as "sealing," performed after the scales were assembled. To do this the sealer would first place the poise in the zero notch and adjust the scale to bring the beam into balance. He would then place a standard weight upon the platform of the scale and move the poise one notch forward. If the beam did not then balance he would file the notch forward or backward as the position of the beam indicated until it did. This operation would then be continued by adding weights to the platform and correcting each notch as required to the end of the beam.

Setting the pivots in these large scale beams was quite an exacting job. The pivots were of square-sectioned steel, necessitating a square hole and a nice fit in the beam. A hole, equal in diameter to the measurement across the flats of the pivots would first be drilled in the beam and then filed nearly to the required size and shape, after which a square broach was forced through it.

The pivots were hand-forged and finished to size by filing. They were also slightly tapered to insure a tight fit in the beam. A pivot would be driven part way through the hole and then tested for "squareness" and position and if any error was disclosed by this test the pivot would be forced out and the error corrected by filing. This was really fine work and was done by some of the most skilled men in the shop.

Grinding the Cutters

One of my jobs in the toolroom was to grind the cutters used for cutting the notches in the beams. These cutters were perhaps 5 in. in diameter by about ¼ in. thick at the center, tapering somewhat toward the periphery where the teeth were shaped to conform to the contour of the notches. The arbor holes were parallel and were not chambered in the middle as is now the common practice; nor were the holes ground after hardening.

In the cutter grinding machine the cutters were placed on a fixed bar and slid past the wheel by the operator's fingers. If the center hole was not round neither would the periphery be round; and, as I had received little instruction as to the manner of grinding and had not been impressed with the need for care and accuracy, I suspected that some of the cutters I ground were no better than they should have been. Also, with the grade of wheels we used in those days many of the teeth were softened by the heat of grinding, though I always took care to grind away the tell-tale blue that would have disclosed this condition.

The tool room was equipped with a good Pratt & Whitney lathe, but I was not allowed to use it much, although on occasions I would escape the vigilant eye of the boss and try my hand at it. It was with the help of this lathe that I built my first automatic machine.

My First Automatic Machine

One of the jobs that was delegated to the "kid" in the toolroom was the making of the little "fish-hooks" of iron wire with which the molders in the foundry suspended the pivots in the molds when castings were being made that required the pivots to be cast in. It was a tedious and monotonous job to bend hundreds of the little hooks, all alike, with no tools other than the bare fingers and a pair of round-nose pliers, so I devised a way to do it by machinery.

I took an 8-lb. scale weight, smoothed off one side flat for the base of my machine and fastened to it suitably shaped pieces of steel to form the hook. The movable part of the former was attached to a short lever that was fulcrumed on the base, so that by placing the short pieces of wire and pulling the lever I would get a completed hook in one movement.

This was good as far as it went and far better than the hand and plier method, but I would always rather turn a crank than pull a lever so later I added another part, made from a sewing machine balance-wheel with a pitman attached to the lever, so that I could turn the crank continuously with one hand while feeding in the short wires with the other.

Improvements Suggested

One of the men, Powers by name, who had previously worked in the toolroom and had special privileges there, became interested in my device and suggested further improvements. Together we worked out and built a crank and ratchet device by means of which the wire would be fed in from a coil and cut off automatically. When this had been accomplished, a round belt from the line shaft to the balance wheel added the final touch and I was an inventor, with my first automatic machine in actual operation.

I have designed and built many and complicated automatic machines since that day, but never one that gave me greater pride than I experienced when I first saw this crude little device performing so quickly and easily the work that had been so monotonous when done by hand. I suspect that a streak of laziness in my makeup has been responsible for my tendency toward automatic machinery, for I would far rather lean my elbows on a drawing board and plan out levers, gear trains, and mechanical movements than to work—even now.

And after all, has not the world advanced more because of this desire to save labor than from any other single cause? Chopping down trees may be good exercise for ex-Kaisers but a sawmill is of greater use to the world at large.

Commercial Standards

As Adopted by The Tap and Die Institute

(12 TABLES)

TABLE 1
Dimensions of Standard Hand Taps

Diam. of Tap Inches	Length, Inches		Diam. of Shank Inches	Size of Square Inches	Diam. of Tap Inches	Length, Inches		Diam. of Shank Inches	Size of Square Inches
	Thread	Overall				Thread	Overall		
1/4	1	2 1/2	.2530	.1897	1 1/4	2 9/16	5 3/4	1.0215	.7661
17/64	1	2 1/2	.2686	.2015	1 9/32	2 9/16	5 3/4	1.0527	.7895
9/32	1	2 1/2	.2843	.2132	1 5/16	2 9/16	5 3/4	1.0840	.8130
19/64	1	2 1/2	.2999	.2249	1 3/8	3	6 1/16	1.1083	.8312
5/16	1 1/8	2 23/32	.3155	.2366	1 13/32	3	6 1/16	1.1395	.8546
21/64	1 1/8	2 23/32	.3311	.2483	1 7/16	3	6 1/16	1.1708	.8781
11/32	1 1/8	2 23/32	.3468	.2601	1 1/2	3	6 3/8	1.2333	.9250
23/64	1 1/8	2 23/32	.3624	.2718	1 17/32	3	6 3/8	1.2645	.9484
3/8	1 1/4	2 15/16	.3785	.2839	1 5/8	3 3/16	6 11/16	1.3050	.9787
25/64	1 1/4	2 15/16	.3941	.2956	1 21/32	3 3/16	6 11/16	1.3362	1.0021
13/32	1 1/4	2 15/16	.4098	.3074	1 3/4	3 3/16	7	1.4300	1.0725
					1 25/32	3 3/16	7	1.4612	1.0959
3/8	1 1/4	2 15/16	.2750	.2062	1 7/8	3 9/16	7 5/16	1.5195	1.1396
25/64	1 1/4	2 15/16	.2906	.2179	1 29/32	3 9/16	7 5/16	1.5507	1.1630
13/32	1 1/4	2 15/16	.3062	.2296	2	3 9/16	7 5/8	1.6445	1.2334
27/64	1 1/4	2 15/16	.3218	.2414	2 1/32	3 9/16	7 5/8	1.6757	1.2568
7/16	1 7/16	3 5/32	.3232	.2124	2 1/8	3 9/16	8	1.7694	1.3271
29/64	1 7/16	3 5/32	.3388	.2541	2 5/32	3 9/16	8	1.8007	1.3505
15/32	1 7/16	3 5/32	.3544	.2658	2 1/4	3 9/16	8 1/4	1.8944	1.4208
31/64	1 7/16	3 5/32	.3700	.2775	2 9/32	3 9/16	8 1/4	1.9257	1.4443
1/2	1 21/32	3 3/8	.3667	.2750	2 3/8	4	8 1/2	2.0194	1.5146
33/64	1 21/32	3 3/8	.3823	.2867	2 13/32	4	8 1/2	2.0507	1.5380
17/32	1 21/32	3 3/8	.3979	.2984	2 1/2	4	8 3/4	2.1000	1.5750
35/64	1 21/32	3 3/8	.4135	.3101	2 17/32	4	8 3/4	2.1313	1.5984
9/16	1 21/32	3 19/32	.4292	.3219	2 5/8	4	8 3/4	2.2250	1.6687
37/64	1 21/32	3 19/32	.4448	.3336	2 21/32	4	8 3/4	2.2563	1.6922
19/32	1 21/32	3 19/32	.4604	.3453	2 3/4	4	9 1/4	2.3500	1.7625
39/64	1 21/32	3 19/32	.4760	.3570	2 25/32	4	9 1/4	2.3813	1.7859
5/8	1 13/16	3 13/16	.4796	.3597	2 7/8	4	9 1/4	2.4750	1.8562
41/64	1 13/16	3 13/16	.4952	.3714	2 29/32	4	9 1/4	2.5063	1.8797
21/32	1 13/16	3 13/16	.5108	.3831	3	4 9/16	9 3/4	2.5429	1.9072
11/16	1 13/16	4 1/32	.5421	.4066	3 1/32	4 9/16	9 3/4	2.5742	1.9306
23/32	1 13/16	4 1/32	.5733	.4300	3 1/8	4 9/16	9 3/4	2.6679	2.0009
3/4	2	4 1/4	.5900	.4425	3 5/32	4 9/16	9 3/4	2.6992	2.0244
25/32	2	4 1/4	.6212	.4659	3 1/4	4 9/16	10	2.7929	2.0946
13/16	2	4 15/32	.6525	.4894	3 9/32	4 9/16	10	2.8242	2.1181
27/32	2	4 15/32	.6837	.5128	3 3/8	4 9/16	10	2.8827	2.1620
7/8	2 7/32	4 11/16	.6973	.5230	3 13/32	4 9/16	10	2.9140	2.1855
29/32	2 7/32	4 11/16	.7285	.5464	3 1/2	4 15/16	10 1/4	3.0077	2.2557
15/16	2 7/32	4 29/32	.7598	.5698	3 17/32	4 15/16	10 1/4	3.0390	2.2792
31/32	2 7/32	4 29/32	.7910	.5932	3 5/8	4 15/16	10 1/4	3.1327	2.3495
1	2 1/2	5 1/8	.8000	.6000	3 21/32	4 15/16	10 1/4	3.1640	2.3730
1 1/32	2 1/2	5 1/8	.8312	.6234	3 3/4	5 5/16	10 1/2	3.2167	2.4125
1 1/16	2 1/2	5 1/8	.8625	.6469	3 25/32	5 5/16	10 1/2	3.2479	2.4359
1 1/8	2 9/16	5 7/16	.8965	.6724	3 7/8	5 5/16	10 1/2	3.3417	2.5062
1 5/32	2 9/16	5 7/16	.9277	.6958	3 29/32	5 5/16	10 1/2	3.3729	2.5297
1 3/16	2 9/16	5 7/16	.9590	.7192	4	5 5/16	10 3/4	3.4667	2.6000

NOTE — For Tolerances, see Table 3
For Fine Pitch Taps over 1½" see Table 2

TABLE 2
Dimensions of Special Hand Taps Over 1½" Diameter Having 10 or More Threads per Inch

Diameter of Tap Inches	Length, Inches		Diameter of Shank Inches	Size of Square Inches
	Thread	Overall		
1 5/8	2	5	1.3050	.9787
1 3/4	2	5	1.4300	1.0725
1 7/8	2	5	1.5195	1.1396
2	2	5	1.6445	1.2334
2 1/8	2	5 1/4	1.7695	1.3271
2 1/4	2	5 1/4	1.8944	1.4208
2 3/8	2	5 1/4	2.0194	1.5146
2 1/2	2	5 1/4	2.1000	1.5750
2 5/8	2	5 1/2	2.2250	1.6687
2 3/4	2	5 1/2	2.3500	1.7625
2 7/8	2	5 1/2	2.4750	1.8562
3	2	5 1/2	2.5429	1.9072
3 1/8	2	5 3/4	2.6679	2.0009
3 1/4	2	5 3/4	2.7929	2.0946
3 3/8	2	5 3/4	2.8827	2.1620
3 1/2	2	5 3/4	3.0077	2.2557
3 5/8	2	6	3.1327	2.3495
3 3/4	2	6	3.2167	2.4125
3 7/8	2	6	3.3417	2.5062
4	2	6	3.4667	2.6000

Diameter of Shank and size of square are same as for Standard Hand Taps. (See Table I.)

Tolerances for All Hand Taps

Length overall, ¼" to 1 1/32" incl.	plus or minus 1/32"
Length overall, 1 1/16" to 4" incl.	plus or minus 1/16"
Length of thread	plus or minus 3/64"
Diameter of shank to 1" incl.	size to size minus .005"
Diameter of shank 1 1/32" to 2" incl.	size to size minus .007"
Diameter of shank over 2"	size to size minus .009"
Size of square, ½" and smaller	size to size minus .004"
Size of square, 33/64" to 1" incl.	size to size minus .006"
Size of square, 1 1/32" to 2" incl.	size to size minus .008"
Size of square, 2 1/32" to 4" incl.	size to size minus .010"

Formulae

Diameter of shank = O. D. of tap — (Std. "V" Pitch × 1.6)

Size of square = Diameter of shank × .75

Several years ago The Tap and Die Institute realized that there was a definite demand among the users of taps and dies for a greater degree of uniformity in these tools. Work was commenced and as a result a number of standard tables have been prepared and adopted. A number of the more important ones are presented on this and the following pages. Many other standardized dimensions of taps and dies can be found

TABLE 3
Dimensions of Pipe Taps

Nominal Size Inches	Length, Inches: Thread	Length, Inches: Overall	Diam. of Shank Inches	Size of Square Inches	Dist. Small End of Briggs Std. Tap Projects through Gauge	Pitch Diam. of Straight Pipe Taps, Inches: Basic	Minimum	Maximum
1/8	3/4	2 1/8	.3125	.234	.312	.3748	.3733	.3763
			.4375	.328				
1/4	1 1/16	2 7/16	.4375	.328	.459	.4899	.4884	.4914
			.5625	.421				
3/8	1 1/16	2 9/16	.5625	.421	.454	.6270	.6253	.6288
			.7000	.531				
1/2	1 3/8	3 1/8	.6875	.515	.579	.7784	.7767	.7802
			.8650	.640				
5/8	1 3/8	3 1/4	.8125	.594	...	.....	.....	.....
			.9270	.687				
3/4	1 9/16	3 1/4	.9063	.679	.565	.9889	.9869	.9909
			1.0750	.812				
7/8	1 11/16	3 1/2	1.0937	.812	...	.....	.....	.....
1	1 3/4	3 3/4	1.1250	.843	.678	1.2386	1.2366	1.2406
1 1/4	1 3/4	4	1.3125	.984	.686	1.5834	1.5811	1.5856
1 1/2	1 3/4	4 1/4	1.5000	1.125	.699	1.8223	1.8201	1.8246
1 3/4	1 3/4	4 3/8	1.6250	1.218		.....	.....	.....
2	1 3/4	4 1/2	1.8750	1.406	.667	2.2963	2.2938	2.2988
2 1/4	2 1/8	5	2.0000	1.500	....	.....	.....	.....
2 1/2	2 9/16	5 1/2	2.2500	1.687	.925	2.7622	2.7594	2.7649
2 3/4	2 9/16	5 3/4	2.3750	1.781	....	.....	.....	.....
3	2 5/8	6	2.6250	1.968	.925	3.3855	3.3858	3.3913
3 1/4	2 5/8	6 1/8	2.7500	2.062	....	.....	.....	.....
3 1/2	2 11/16	6 1/2	2.8125	2.108	.938	3.8888	3.8861	3.8916
3 3/4	2 11/16	6 5/8	2.8750	2.156	....	.....	.....	.....
4	2 3/4	6 3/4	3.0000	2.250	.950	4.3871	4.3844	4.3899

Tolerances

Length overall, 1/8" to 3/4" incl.	plus or minus 1/32"
Length overall, 7/8" to 4" incl.	plus or minus 1/16"
Length of thread	plus or minus 1/16"
Diameter of shank to 1/2" incl.	size to size minus .007"
Diameter of shank over 1/2"	size to size minus .009"
Size of square to 1/2" incl.	size to size minus .006"
Size of square over 1/2"	size to size minus .010"
Distance projecting through gauge, 1/8" to 3/4" incl.	plus or minus 1/16"
Distance projecting through gauge, 1" to 3" incl.	plus or minus 3/32"
Distance projecting through gauge, 3 1/2" and over	plus or minus 1/8"

TABLE 4
Dimensions of Taps for Nos. 2 1/2 and 3 Beaman & Smith Holders

Diameter of Tap Inches	For No. 2 1/2 Holder: Length of Thread	Length Overall	Diam. of Shank	For No. 3 Holder: Length of Thread	Length Overall	Diam. of Shank
1	2 1/2"	6 3/4"	1 1/2"			
1 1/16	2 1/2"	6 3/4"	1 1/2"			
1 1/8	2 1/2"	6 3/4"	1 1/2"			
1 3/16	2 1/2"	6 3/4"	1 1/2"			
1 1/4	2 5/8"	7"	1 1/2"	2 5/8"	7 1/4"	1 5/8"
1 5/16	2 11/16"	7"	1 1/2"	2 5/8"	7 1/4"	1 5/8"
1 3/8	2 3/4"	7 1/4"	1 1/2"	2 3/4"	7 1/2"	1 5/8"
1 7/16	2 3/4"	7 1/4"	1 1/2"	2 3/4"	7 1/2"	1 5/8"
1 1/2	2 7/8"	7 1/2"	1 1/2"	2 7/8"	7 3/4"	1 5/8"
1 5/8	3"	7 3/4"	1 1/2"	3"	8"	1 5/8"
1 3/4	3 1/8"	8"	1 1/2"	3 1/8"	8 1/4"	1 5/8"
1 7/8	3 1/4"	8 1/4"	1 1/2"	3 1/4"	8 1/2"	1 5/8"
2	3 3/8"	8 1/2"	1 1/2"	3 3/8"	8 3/4"	2"
2 1/8				3 1/2"	9"	2"
2 1/4				3 5/8"	9 1/4"	3"
2 3/8				3 3/4"	9 1/2"	2"
2 1/2				3 7/8"	9 3/4"	2"

Dimensions of Pipe Taps for Beaman & Smith Holders

Size Pipe	Fitting Holder Number	Diameter Shank Inches	Length Thread Inches	Length Overall Inches
1/8"	1	1/2	3/4	2 1/8
1/4"	1	1/2	1 1/16	2 7/16
3/8"	2	3/4	1 1/16	3 1/16
1/2"	2	3/4	1 3/8	3 3/8
3/4"	2	3/4	1 3/8	3 3/8
1"	2 1/2	1 1/2	1 3/4	5
1 1/4"	2 1/2	1 1/2	1 3/4	5
1 1/2"	2 1/2	1 1/2	1 3/4	5
2"	3	2	1 3/4	6
2 1/2"	3	2	2 9/16	6 13/16
3"	3	2	2 5/8	6 7/8

in the trade catalogs of the members of the Institute. The work of standardization is continually going on and from time to time additional tables will doubtless be made available in published form by the Institute.

The Tap and Die Institute was formed several years ago with the primary object of bringing about a greater degree of physical uniformity in taps and dies and, in general, so to standardize the dimensions of taps and

TABLE 5

Commercial Tolerances for Hand Taps, Pulley Taps and Taps for B. & S. Holder United States Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Toler-ance	Min. = Basic Plus	Max. = Basic Plus	Toler-ance
¼–20	.2500	.2175	.0010	.0035	.0025	.0005	.0025	.0020
5/16–18	.3125	.2764	.0010	.0035	.0025	.0005	.0025	.0020
⅜–16	.3750	.3344	.0010	.0035	.0025	.0005	.0025	.0020
7/16–14	.4375	.3911	.0010	.0040	.0030	.0005	.0030	.0025
½–13	.5000	.4500	.0010	.0040	.0030	.0005	.0030	.0025
9/16–12	.5625	.5084	.0010	.0040	.0030	.0005	.0030	.0025
⅝–11	.6250	.5660	.0010	.0040	.0030	.0005	.0030	.0025
¾–10	.7500	.6851	.0010	.0050	.0040	.0005	.0035	.0030
⅞– 9	.8750	.8028	.0010	.0050	.0040	.0005	.0035	.0030
1 – 8	1.0000	.9188	.0010	.0050	.0040	.0005	.0035	.0030
1⅛– 7	1.1250	1.0322	.0015	.0060	.0045	.0005	.0040	.0035
1¼– 7	1.2500	1.1572	.0015	.0060	.0045	.0005	.0040	.0035
1⅜– 6	1.3750	1.2668	.0015	.0060	.0045	.0005	.0040	.0035
1½– 6	1.5000	1.3918	.0015	.0060	.0045	.0005	.0040	.0035
1⅝– 5½	1.6250	1.5069	.0015	.0070	.0055	.0010	.0050	.0040
1¾– 5	1.7500	1.6201	.0015	.0070	.0055	.0010	.0050	.0040
1⅞– 5	1.8750	1.7451	.0015	.0070	.0055	.0010	.0050	.0040
2 – 4½	2.0000	1.8557	.0015	.0070	.0055	.0010	.0050	.0040
2⅛– 4½	2.1250	1.9807	.0020	.0080	.0060	.0010	.0055	.0045
2¼– 4½	2.2500	2.1057	.0020	.0080	.0060	.0010	.0055	.0045
2⅜– 4	2.3750	2.2126	.0020	.0080	.0060	.0010	.0055	.0045
2½– 4	2.5000	2.3376	.0020	.0080	.0060	.0010	.0055	.0045
2⅝– 4	2.6250	2.4626	.0020	.0090	.0070	.0010	.0060	.0050
2¾– 4	2.7500	2.5876	.0020	.0090	.0070	.0010	.0060	.0050
2⅞– 3½	2.8750	2.6894	.0020	.0090	.0070	.0010	.0060	.0050
3 – 3½	3.0000	2.8144	.0020	.0090	.0070	.0010	.0060	.0050

LEAD TOLERANCE

A maximum lead error of plus or minus .003″ in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

TABLE 6

Commercial Tolerances for Hand Taps and Taps for B. & S. Holder S. A. E. Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Toler-ance	Min. = Basic Plus	Max. = Basic Plus	Toler-ance
¼–28	.2500	.2268	.0010	.0035	.0025	.0005	.0020	.0015
5/16–24	.3125	.2854	.0010	.0035	.0025	.0005	.0020	.0015
⅜–24	.3750	.3479	.0010	.0035	.0025	.0005	.0020	.0015
7/16–20	.4375	.4050	.0010	.0040	.0030	.0005	.0025	.0020
½–20	.5000	.4675	.0010	.0040	.0030	.0005	.0025	.0020
9/16–18	.5625	.5264	.0010	.0040	.0030	.0005	.0025	.0020
⅝–18	.6250	.5889	.0010	.0040	.0030	.0005	.0025	.0020
11/16–16	.6875	.6469	.0010	.0050	.0040	.0005	.0030	.0025
¾–16	.7500	.7094	.0010	.0050	.0040	.0005	0030	.0025
⅞–14	.8750	.8286	.0010	.0050	.0040	.0005	.0030	.0025
⅞–18	.8750	.8389	.0010	.0050	.0040	.0005	.0030	.0025
1 –14	1.0000	.9536	.0010	.0050	.0040	.0005	.0030	.0025
1⅛–12	1.1250	1.0709	.0015	.0060	.0045	.0005	.0035	.0030
1¼–12	1.2500	1.1959	.0015	.0060	.0045	.0005	.0035	.0030
1⅜–12	1.3750	1.3209	.0015	.0060	.0045	.0005	.0035	.0030
1½–12	1.5000	1.4459	.0015	.0060	.0045	.0005	.0035	.0030

*TAPS OVER 1½″ WITH 10 OR MORE THREADS PER INCH

Size	Tap Measurements					
	O. D.			P. D.		
	Min. = Basic Plus	Max. = Basic Plus	Toler-ance	Min. = Basic Plus	Max. = Basic Plus	Toler-ance
1⅝″ to 2″ incl.	.0015	.0060	.0045	.0005	.0035	.0030
2⅛″ to 3″ incl.	.0015	.0060	.0045	.0005	.0040	.0035
3⅛″ to 4″ incl.	.0015	.0070	.0055	.0005	.0050	.0045

*For taps over 1½″ with less than 10 threads per inch use tolerances for U. S. S. Taps.

LEAD TOLERANCE

A maximum lead error of plus or minus .003″ in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

dies as better to serve the interests of ultimate users, and bring these products into closer conformity to the standards adopted from time to time in many of the other branches of the iron and steel-working industry.

This work has been in constant progress under the direct supervision of a committee on standards whose work in turn is passed upon by the members of the Institute before it is adopted and cataloged as standard.

TABLE 7

Commercial Tolerances for Machine Screw Taps

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
0–80	.060	.0519	.0010	.0025	.0015	.0005	.0015	.0010
1–56	.073	.0614	.0010	.0025	.0015	.0005	.0015	.0010
64	.073	.0629	.0010	.0025	.0015	.0005	.0015	.0010
72	.073	.0640	.0010	.0025	.0015	.0005	.0015	.0010
2–56	.086	.0744	.0010	.0025	.0015	.0005	.0015	.0010
64	.086	.0759	.0010	.0025	.0015	.0005	.0015	.0010
3–48	.099	.0855	.0010	.0025	.0015	.0005	.0015	.0010
56	.099	.0874	.0010	.0025	.0015	.0005	.0015	.0010
4–32	.112	.0917	.0010	.0030	.0020	.0005	.0020	.0015
36	.112	.0940	.0010	.0030	.0020	.0005	.0020	.0015
40	.112	.0958	.0010	.0030	.0020	.0005	.0020	.0015
48	.112	.0985	.0010	.0030	.0020	.0005	.0020	.0015
5–36	.125	.1070	.0010	.0030	.0020	.0005	.0020	.0015
40	.125	.1088	.0010	.0030	.0020	.0005	.0020	.0015
44	.125	.1102	.0010	.0030	.0020	.0005	.0020	.0015
6–32	.138	.1177	.0010	.0030	.0020	.0005	.0020	.0015
36	.138	.1200	.0010	.0030	.0020	.0005	.0020	.0015
40	.138	.1218	.0010	.0030	.0020	.0005	.0020	.0015
7–30	.151	.1294	.0010	.0030	.0020	.0005	.0020	.0015
32	.151	.1307	.0010	.0030	.0020	.0005	.0020	.0015
36	.151	.1330	.0010	.0030	.0020	.0005	.0020	.0015
8–30	.164	.1423	.0010	.0030	.0020	.0005	.0020	.0015
32	.164	.1437	.0010	.0030	.0020	.0005	.0020	.0015
36	.164	.1460	.0010	.0030	.0020	.0005	.0020	.0015
40	.164	.1478	.0010	.0030	.0020	.0005	.0020	.0015
9–24	.177	.1499	.0010	.0030	.0020	.0005	.0020	.0015
30	.177	.1553	.0010	.0030	.0020	.0005	.0020	.0015
32	.177	.1567	.0010	.0030	.0020	.0005	.0020	.0015

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

TABLE 7
(CONCLUDED)

Commercial Tolerances for Machine Screw Taps

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
10–24	.190	.1629	.0010	.0030	.0020	.0005	.0020	.0015
28	.190	.1668	.0010	.0030	.0020	.0005	.0020	.0015
30	.190	.1684	.0010	.0030	.0020	.0005	.0020	.0015
32	.190	.1697	.0010	.0030	.0020	.0005	.0020	.0015
12–24	.216	.1889	.0010	.0030	.0020	.0005	.0020	.0015
28	.216	.1928	.0010	.0030	.0020	.0005	.0020	.0015
32	.216	.1957	.0010	.0030	.0020	.0005	.0020	.0015
14–20	.242	.2095	.0010	.0035	.0025	.0005	.0025	.0020
24	.242	.2149	.0010	.0035	.0025	.0005	.0025	.0020
16–18	.268	.2319	.0010	.0035	.0025	.0005	.0025	.0020
20	.268	.2355	.0010	.0035	.0025	.0005	.0025	.0020
22	.268	.2385	.0010	.0035	.0025	.0005	.0025	.0020
18–18	.294	.2579	.0010	.0035	.0025	.0005	.0025	.0020
20	.294	.2615	.0010	.0035	.0025	.0005	.0025	.0020
20–16	.320	.2794	.0010	.0035	.0025	.0005	.0025	.0020
18	.320	.2839	.0010	.0035	.0025	.0005	.0025	.0020
20	.320	.2875	.0010	.0035	.0025	.0005	.0025	.0020
22–16	.346	.3054	.0010	.0035	.0025	.0005	.0025	.0020
18	.346	.3099	.0010	.0035	.0025	.0005	.0025	.0020
24–16	.372	.3314	.0010	.0035	.0025	.0005	.0025	.0020
18	.372	.3359	.0010	.0035	.0025	.0005	.0025	.0020
26–14	.398	.3516	.0010	.0040	.0030	.0005	.0030	.0025
16	.398	.3574	.0010	.0040	.0030	.0005	.0030	.0025
28–14	.424	.3776	.0010	.0040	.0030	.0005	.0030	.0025
16	.424	.3834	.0010	.0040	.0030	.0005	.0030	.0025
30–14	.450	.4036	.0010	.0040	.0030	.0005	.0030	.0025
16	.450	.4094	.0010	.0040	.0030	.0005	.0030	.0025

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

It is interesting to know how and for what purposes an association of this kind was formed: Possibly the main objects can best be given by quoting from a general statement of purposes contained in its constitution:

"The purpose of the Institute shall be the improvement of the tap and die manufacturing business by striving toward the correction by all proper and legitimate means of unintelligences, faulty standardization

TABLE 8

Commercial Tolerances for Nut and Tapper Taps United States Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
1/4–20	.2500	.2175	.0020	.0050	.0030	.0015	.0040	.0025
5/16–18	.3125	.2764	.0020	.0050	.0030	.0015	.0040	.0025
3/8–16	.3750	.3311	.0020	.0050	.0030	.0015	.0040	.0025
7/16–14	.4375	.3911	.0020	.0060	.0040	.0015	.0045	.0030
1/2–13	.5000	.4500	.0020	.0060	.0040	.0015	.0045	.0030
9/16–12	.5625	.5081	.0025	.0065	.0040	.0020	.0050	.0030
5/8–11	.6250	.5660	.0025	.0065	.0040	.0020	.0050	.0030
3/4–10	.7500	.6851	.0025	.0070	.0045	.0020	.0055	.0035
7/8– 9	.8750	.8028	.0025	.0070	.0045	.0020	.0055	.0035
1 – 8	1.0000	.9188	.0025	.0070	.0045	.0020	.0055	.0035
1 1/8– 7	1.1250	1.0322	.0030	.0080	.0050	.0025	.0065	.0040
1 1/4– 7	1.2500	1.1572	.0030	.0080	.0050	.0025	.0065	.0040
1 3/8– 6	1.3750	1.2668	.0030	.0080	.0050	.0025	.0065	.0040
1 1/2– 6	1.5000	1.3918	.0030	.0080	.0050	.0025	.0065	.0040
1 5/8– 5 1/2	1.6250	1.5069	.0030	.0090	.0060	.0025	.0070	.0045
1 3/4– 5	1.7500	1.6201	.0030	.0090	.0060	.0025	.0070	.0045
1 7/8– 5	1.8750	1.7451	.0030	.0090	.0060	.0025	.0070	.0045
2 – 4 1/2	2.0000	1.8557	.0030	.0090	.0060	.0025	.0070	.0045
2 1/8– 4 1/2	2.1250	1.9807	.0040	.0110	.0070	.0030	.0080	.0050
2 1/4– 4 1/2	2.2500	2.1057	.0040	.0110	.0070	.0030	.0080	.0050
2 3/8– 4	2.3750	2.2126	.0040	.0110	.0070	.0030	.0080	.0050
2 1/2– 4	2.5000	2.3376	.0040	.0110	.0070	.0030	.0080	.0050
2 5/8– 4	2.6250	2.4626	.0040	.0120	.0080	.0030	.0085	.0055
2 3/4– 4	2.7500	2.5876	.0040	.0120	.0080	.0030	.0085	.0055
2 7/8– 3 1/2	2.8750	2.6894	.0040	.0120	.0080	.0030	.0085	.0055
3 – 3 1/2	3.0000	2.8144	.0040	.0120	.0080	.0030	.0085	.0055

LEAD TOLERANCE

A maximum lead error of plus or minus .003″ in once inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

TABLE 9

Commercial Tolerances for Nut and Tapper Taps S. A. E. Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
1/4–28	.2500	.2268	.0020	.0050	.0030	.0010	.0030	.0020
5/16–24	.3125	.2854	.0020	.0050	.0030	.0010	.0030	.0020
3/8–24	.3750	.3479	.0020	.0050	.0030	.0010	.0030	.0020
7/16–20	.4375	.4050	.0020	.0060	.0040	.0010	.0035	.0025
1/2–20	.5000	.4675	.0020	.0060	.0040	.0010	.0035	.0025
9/16–18	.5625	.5264	.0025	.0065	.0040	.0015	.0040	.0025
5/8–18	.6250	.5889	.0025	.0065	.0040	.0015	.0040	.0025
11/16–16	.6875	.6469	.0025	.0070	.0045	.0015	.0045	.0030
3/4–16	.7500	.7094	.0025	.0070	.0045	.0015	.0045	.0030
7/8–14	.8750	.8286	.0025	.0070	.0045	.0015	.0045	.0030
7/8–18	.8750	.8389	.0025	.0070	.0045	.0015	.0045	.0030
1 –14	1.0000	.9536	.0025	.0070	.0045	.0015	.0045	.0030
1 1/8–12	1.1250	1.0709	.0030	.0080	.0050	.0020	.0055	.0035
1 1/4–12	1.2500	1.1959	.0030	.0080	.0050	.0020	.0055	.0035
1 3/8–12	1.3750	1.3209	.0030	.0080	.0050	.0020	.0055	.0035
1 1/2–12	1.5000	1.4459	.0030	.0080	.0050	.0020	.0055	.0035

LEAD TOLERANCE

A maximum lead error of plus or minus .003″ in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

and abuses in the trade. To co-operate along the lines of metallurgical research in the securing of better steels for use in manufacturing taps and dies so that the result will be to raise the standard of quality to its highest point of efficiency, thereby making great savings to the consumer, and, further, to co-operate in the standardization of sizes, dimensions and tolerances of the product manufactured by the members of the Institute.

TABLE 10

Basic Thread Dimensions and Tap Drill Sizes

A. S. M. E. THREADS

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
0–80	.0600	.0519	.0438	3/64	.0469
1–56	.0730	.0614	.0498	54	.0550
64	.0730	.0629	.0527	53	.0595
72	.0730	.0640	.0550	53	.0595
2–56	.0860	.0744	.0628	50	.0700
64	.0860	.0759	.0657	50	.0700
3–48	.0990	.0855	.0719	47	.0785
56	.0990	.0871	.0758	45	.0820
4–32	.1120	.0917	.0714	45	.0820
36	.1120	.0940	.0759	44	.0860
40	.1120	.0958	.0795	43	.0890
48	.1120	.0985	.0849	42	.0935
5–36	.1250	.1078	.0889	40	.0980
40	.1250	.1088	.0925	38	.1015
44	.1250	.1102	.0955	37	.1040
6–32	.1380	.1177	.0974	36	.1065
36	.1380	.1200	.1019	34	.1110
40	.1380	.1218	.1055	33	.1130
7–30	.1510	.1294	.1077	31	.1200
32	.1510	.1307	.1104	31	.1200
36	.1510	.1330	.1149	1/8	.1250
8–30	.1640	.1423	.1207	30	.1285
32	.1640	.1437	.1234	29	.1360
36	.1640	.1460	.1279	29	.1360
40	.1640	.1478	.1315	28	.1405
9–24	.1770	.1499	.1229	29	.1360
30	.1770	.1553	.1337	27	.1440
32	.1770	.1567	.1364	26	.1470

TABLE 10
(CONCLUDED)

Basic Thread Dimensions and Tap Drill Sizes

A. S. M. E. THREADS

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
10–24	.1900	.1629	.1359	25	.1495
28	.1900	.1668	.1436	23	.1540
30	.1900	.1684	.1467	22	.1570
32	.1900	.1697	.1494	21	.1590
12–24	.2160	.1889	.1619	16	.1770
28	.2160	.1928	.1696	14	.1820
32	.2160	.1957	.1754	13	.1850
14–20	.2420	.2095	.1770	10	.1935
24	.2420	.2149	.1879	7	.2010
16–18	.2680	.2319	.1966	3	.2130
20	.2680	.2355	.2030	7/32	.2187
22	.2680	.2385	.2090	2	.2210
18–18	.2940	.2579	.2218	B	.2380
20	.2940	.2615	.2290	D	.2460
20–16	.3200	.2794	.2388	G	.2610
18	.3200	.2839	.2478	17/64	.2656
20	.3200	.2875	.2559	I	.2720
22–16	.3460	.3054	.2648	9/32	.2812
18	.3460	.3099	.2738	L	.2900
24–16	.3720	.3314	.2908	5/16	.3125
18	.3720	.3359	.2998	O	.3160
26–14	.3980	.3516	.3052	21/64	.3281
16	.3980	.3574	.3168	R	.3390
28–14	.4240	.3776	.3312	T	.3580
16	.4240	.3834	.3428	23/64	.3594
30–14	.4500	.4036	.3572	V	.3770
16	.4500	.4094	.3688	25/64	.3906

Additionally, it was designed that the Institute function as a central bureau or source of information with which other engineering and manufacturing organizations may consult, and obtain reliable information in co-operative efforts **for the benefit of the industry as a whole.**

The officers of the Institute are: President, **F. G.** Echols, Vice-President and General Manager, Green-

Table 11

Basic Thread Dimensions and Tap Drill Sizes

UNITED STATES THREAD

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
$\frac{1}{16}$–64	.0625	.0524	.0422	$\frac{3}{64}$	.0469
72	.0625	.0535	.0415	$\frac{3}{64}$	.0469
$\frac{5}{64}$–60	.0781	.0673	.0563	$\frac{1}{16}$	.0625
72	.0781	.0691	.0601	52	.0635
$\frac{3}{32}$–48	.0938	.0803	.0667	49	.0730
50	.0938	.0808	.0678	49	.0730
$\frac{7}{64}$–48	.1094	.0959	.0823	43	.0890
$\frac{1}{8}$–32	.1250	.1047	.0844	$\frac{3}{32}$	.0937
40	.1250	.1088	.0925	38	.1015
$\frac{9}{64}$–40	.1406	.1244	.1081	32	.1160
$\frac{5}{32}$–32	.1563	.1360	.1157	$\frac{1}{8}$	.1250
36	.1563	.1382	.1202	30	.1285
$\frac{11}{64}$–32	.1719	.1505	.1313	$\frac{9}{64}$	.1406
$\frac{3}{16}$–24	.1875	.1604	.1334	26	.1470
32	.1875	.1672	.1469	22	.1570
$\frac{13}{64}$–24	.2031	.1760	.1490	20	.1610
$\frac{7}{32}$–24	.2188	.1919	.1646	16	.1770
32	.2188	.1985	.1782	12	.1890
$\frac{15}{64}$–24	.2344	.2073	.1806	10	.1935
$\frac{1}{4}$–20	.2500	.2176	.1850	7	.2010
24	.2500	.2229	.1959	4	.2090
27	.2500	.2260	.2019	3	.2130
28	.2500	.2268	.2036	3	.2130
32	.2500	.2297	.2094	$\frac{7}{32}$	.2187
$\frac{5}{16}$–18	.3125	.2764	.2403	F	.2570
20	.3125	.2800	.2476	$\frac{17}{64}$	.2656
24	.3125	.2854	.2584	I	.2720
27	.3125	.2884	.2644	J	.2770
32	.3125	.2922	.2719	$\frac{9}{32}$	.2812

TABLE 11
(CONTINUED)

Basic Thread Dimensions and Tap Drill Sizes

UNITED STATES THREAD

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
$\frac{3}{8}$–16	.3750	.3344	.2938	$\frac{5}{16}$	.3125
20	.3750	.3425	.3100	$\frac{21}{64}$	.3281
24	.3750	.3479	.3209	Q	.3320
27	.3750	.3509	.3269	R	.3390
$\frac{7}{16}$–14	.4375	.3911	.3447	U	.3680
20	.4375	.4050	.3726	$\frac{25}{64}$	.3906
24	.4375	.4104	.3834	X	.3970
27	.4375	.4134	.3894	Y	.4040
$\frac{1}{2}$–12	.5000	.4459	.3918	$\frac{27}{64}$	.4219
13	.5000	.4501	.4001	$\frac{27}{64}$	.4219
20	.5000	.4675	.4351	$\frac{29}{64}$	.4531
24	.5000	.4729	.4459	$\frac{29}{64}$	.4531
27	.5000	.4759	.4519	$\frac{15}{32}$	.4687
$\frac{9}{16}$–12	.5625	.5084	.4542	$\frac{31}{64}$	.4844
18	.5625	.5264	.4903	$\frac{33}{64}$	.5156
27	.5625	.5384	.5144	$\frac{17}{32}$	.5312
$\frac{5}{8}$–11	.6250	.5660	.5069	$\frac{17}{32}$	.5312
12	.6250	.5709	.5168	$\frac{35}{64}$	.5469
18	.6250	.5889	.5528	$\frac{37}{64}$	.5781
27	.6250	.6009	.5769	$\frac{19}{32}$	.5937
$\frac{11}{16}$–11	.6875	.6285	.5694	$\frac{19}{32}$	.5937
16	.6875	.6469	.6063	$\frac{5}{8}$	.6250
$\frac{3}{4}$–10	.7500	.6851	.6201	$\frac{21}{32}$	.6562
12	.7500	.6959	.6418	$\frac{43}{64}$	.6719
16	.7500	.7094	.6688	$\frac{11}{16}$	.6875
27	.7500	.7259	.7019	$\frac{23}{32}$	.7187
$\frac{13}{16}$–10	.8125	.7476	.6826	$\frac{23}{32}$	.7187
$\frac{7}{8}$–9	.8750	.8029	.7307	$\frac{49}{64}$	.7656
12	.8750	.8209	.7668	$\frac{51}{64}$	.7969
14	.8750	.8286	.7822	$\frac{13}{16}$	.8125
18	.8750	.8389	.8028	$\frac{53}{64}$	.8281
27	.8750	.8509	.8269	$\frac{27}{32}$	.8437

field Tap and Die Corporation, Greenfield, Mass.; Vice-President, J. E. Winter, General Manager, Winter Brothers Co., Wrentham, Mass.; Chairman Committee on Standards, C. M. Pond, Assistant Manager, Small Tools Department, Pratt & Whitney Co., Hartford, Conn.; Secretary, Herbert S. Blake. The office of the Tap and Die Institute, headquarters of the secretary, is located at 116-120 West 32nd Street, New York City.

TABLE 11
(CONCLUDED)

Basic Thread Dimensions and Tap Drill Sizes

UNITED STATES THREAD

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
15/16 - 9	.9375	.8654	.7932	53/64	.8281
1 - 8	1.0000	.9188	.8376	7/8	.8750
12	1.0000	.9459	.8918	59/64	.9219
14	1.0000	.9536	.9072	15/16	.9375
27	1.0000	.9759	.9519	31/32	.9687
1 1/8 - 7	1.1250	1.0322	.9394	63/64	.9844
12	1.1250	1.0709	1.0168	1 3/64	1.0469
1 1/4 - 7	1.2500	1.1572	1.0644	1 7/64	1.1094
12	1.2500	1.1959	1.1418	1 11/64	1.1719
1 3/8 - 6	1.3750	1.2668	1.1585	1 7/32	1.2187
12	1.3750	1.3209	1.2668	1 19/64	1.2969
1 1/2 - 6	1.5000	1.3918	1.2835	1 11/32	1.3437
12	1.5000	1.4459	1.3918	1 27/64	1.4219
1 5/8 - 5 1/2	1.6250	1.5070	1.3888	1 29/64	1.4531
1 3/4 - 5	1.7500	1.6201	1.4902	1 9/16	1.5625
1 7/8 - 5	1.8750	1.7451	1.6152	1 11/16	1.6875
2 - 4 1/2	2.0000	1.8557	1.7113	1 25/32	1.7812
2 1/8 - 4 1/2	2.1250	1.9807	1.8363	1 29/32	1.9062
2 1/4 - 4 1/2	2.2500	2.1057	1.9613	2 1/32	2.0312
2 3/8 - 4	2.3750	2.2126	2.0502	2 1/8	2.1250
2 1/2 - 4	2.5000	2.3376	2.1752	2 1/4	2.2500
2 3/4 - 4	2.7500	2.5876	2.4252	2 1/2	2.5000
3 - 3 1/2	3.0000	2.8145	2.6288	2 23/32	2.7187
3 1/4 - 3 1/2	3.2500	3.0645	2.8788	2 31/32	2.9687
3 1/2 - 3 1/4	3.5000	3.3002	3.1003	3 3/16	3.1875
3 3/4 - 3	3.7500	3.5335	3.3170	3 7/16	3.4375
4 - 3	4.0000	3.7835	3.5670	3 11/16	3.6875

TABLE 12

Chamfer on Dies

All dies listed in our catalogue will be chamfered approximately as shown in the following table. When dies are specified with a chamfer varying from that shown in the table they will be considered special.

APPROXIMATE NUMBER OF THREADS CHAMFER

Type of Die	Front Face	Rear Face
Spring Screw Threading	2 1/2 to 3	
Solid Square Bolt	2 1/2 to 3	1 to 1 1/2
Solid Square Pipe	2 1/2 to 3	0
Adjustable Round Split, Straight Thread	2 1/2 to 3	1 to 1 1/2
Adjustable Round Split, Taper Thread	2 1/2 to 3	0
Gas Fixture	2 1/2 to 3	1 to 1 1/2
Hexagon Rethreading	1	1

Tables 5, 6, 7, 8 and 9 give commercial tolerances for taps. It should be clearly and distinctly understood that the figures given by these tables represent the measurements of the taps themselves and *not* the tapped hole.

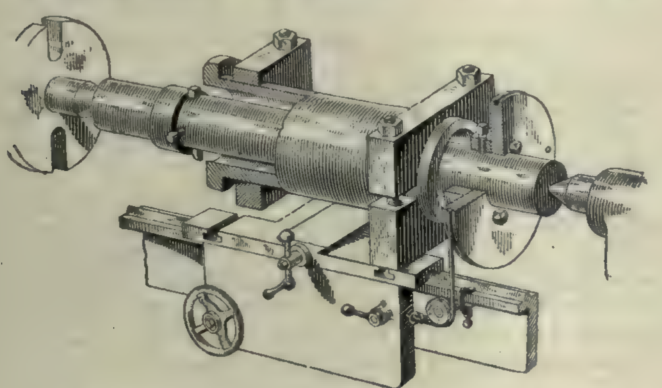
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Kink in a Mexican Mine Shop

By E. W. Heinrichs
Frenillo, Mexico

In out-of-the-way places, far removed from the regular sources of supply and yet where all sorts of emergency jobs of unusual and unforeseen nature are continually presenting themselves, it is necessary to have either a very complete and comprehensive equipment or to possess a fair amount of the ingenuity that



RIG FOR OIL GROOVING LARGE BEARING SLEEVES

enables the shop man to do all sorts of jobs by improvised methods—usually the latter.

The writer is foreman of the machine shop in a Mexican silver mine and it is his duty to see that repairs to mining machinery of all kinds are made promptly and the machines kept in service. Often there are jobs to be done that are beyond the scope of the equipment and the latter must be supplemented with homemade devices and contrivances for getting out the work. One such job that came along recently was the cutting of oil grooves in some large sleeves for turbine bearings.

These sleeves were of bronze, 8 in. in diameter inside and 9½ in. outside by 24 in. long, with a substantial head at one end, as the sketch will show. To cast and machine these sleeves up to the point of cutting the oil groove was ordinary work and need not be described to the machine shop man, but the cutting of the right and left hand helical grooves was quite another matter.

The work was all done in a McCabe lathe. The sleeves were mounted on blocks on the carriage and bored in the usual way with a bar between centers. To make the oil grooves we proceeded as follows:

We fitted a 16-in. diameter blind flange to the outer end of the boring bar and fastened it with setscrews. In the periphery of the flange we then cut a groove to accommodate a ¼-in. steel cable; so calculating the diameter at the bottom of the grooves as to make one-half its effective circumference equal to the length of a sleeve and thus determining the "lead" of our helix.

A small hole drilled at an angle from the groove through the side of the flange furnished a means of attaching the cable to the drum and the free end was then passed under a sheave, previously clamped to the front of the lathe bed, and carried forward to the carriage. With a suitable tool in the collar, or cutter head of the bar, we were ready to proceed with the work of cutting.

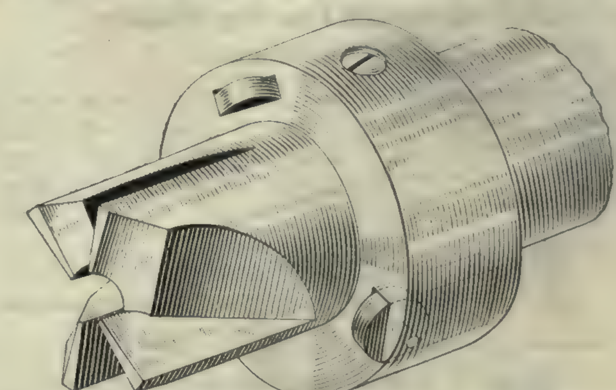
As the carriage is advanced it withdraws the cable from the drum and causes the latter to rotate one-half of a revolution in 24 in. of carriage movement. The tool was set out by hand after each successive cut. To cut the opposite helix all that was necessary was to transfer the sheave and cable to the back of the lathe, a procedure that caused the bar to rotate in the opposite direction.

The method did not require a great amount of rigging up and the job was quickly and satisfactorily done. The only objection raised was by the poor "Mex" whose duty it was to traverse the carriage by hand. He gets one peso per day of eight hours—equivalent to about 50 cents in American money—but we must not overlook the important fact that if he got more we would have to hire a new bunch of men every day.

Roller Stop for Counterbore

By C. E. Andrews

The sketch shows a roller stop that was designed for use in connection with some work having a highly finished surface that must not be marred and upon which the depth of the counterbored space must be held within very accurate limits. The ordinary form of counterbore stop would have left a blemish upon the



COUNTERBORE STOP WITH ROLLERS

surface, no matter how light the contact, and the nature of the work necessitated gaging the depth from this surface.

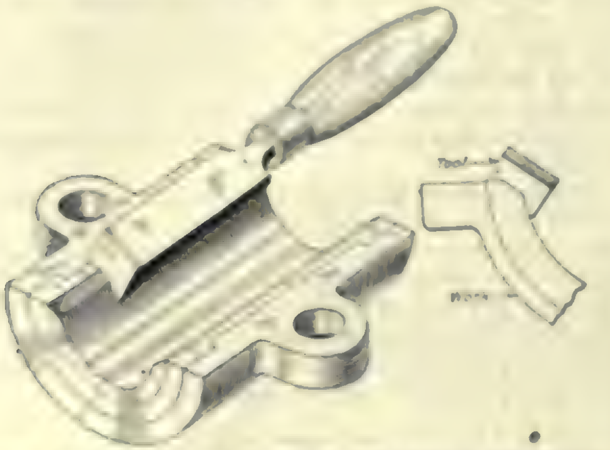
Though but one roller is shown in the sketch it is desirable to have three or more in order to balance the pressure upon the collar when the rollers contact with the gaging surface.

Chamfering the Edges of Bearing Caps

BY GEORGE A. LUERS

It is essential that the edges of bearing caps and bearings be beveled. A new bearing when first run will tend to flow and this space permits the metal to move out into the groove and so prevent the babbitt from burning out. Oil is distributed from the groove on the bearing surfaces, the groove serving as a reservoir.

A tool for the purpose of cutting a bevel on either the cap or the seat is illustrated in the sketch. This tool was devised to overcome some of the disadvantages encountered in making the bevel. To file the bevel is difficult because of the clogging of the file with the particles of babbitt. To chip the groove disturbs the metal in the seat, making it necessary to scrape it down afterwards. This bevel cutting tool has been found to do the work rapidly, cutting a clean smooth edge. The cutter may be sharpened with an oil stone on both faces, as cutting is done in both directions. The guiding surfaces are relieved by rounding the edges so that they will not cut on surfaces where cutting is not required.

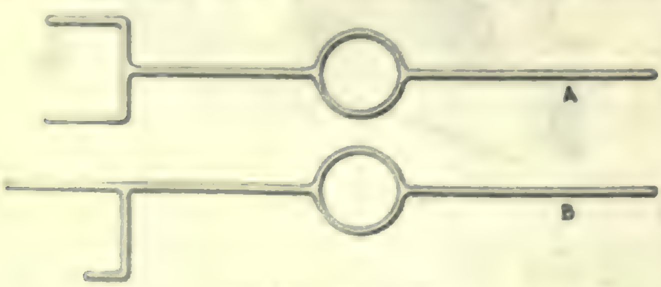


TOOL FOR BEVELING EDGES OF BABBITT BEARINGS

A Convenient Pouring Holder

BY WALTER KAUFMAN

The average pouring holder for crucibles is as shown in sketch *A* and is a rather hard holder from which to pour accurately, as it is difficult for the men to get up to the flasks except where they are set far apart or in a circular form. In our foundry we have stands which hold flasks in a long straight line, making it very awkward to pour with the usual holder. By simply making the center rod of holder straight and making the right handle the only one used in pouring, as in sketch *B*, we make it possible for the men pouring to get up very close to the flasks and pour accurately.



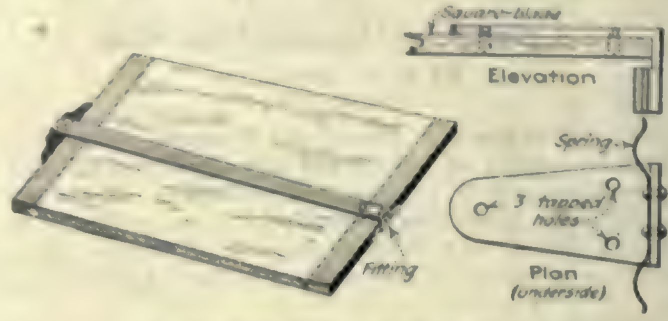
POURING HOLDERS

A Drafting-Room Kink

BY E. LYTTON BROOKS

The accompanying sketch shows a simple and useful little contrivance for assisting in the manipulation of large and unwieldly T-squares.

Three countersunk screws, sunk in the square blade from the underside serve to secure the fitting, which has three tapped holes ⅛ in. Whitworth or 4 B.A. The spring used is ½ in. wide by 0.020 in. thick with just enough tension to prevent the square sliding down the board from its own weight.



ATTACHMENT FOR LARGE T-SQUARE

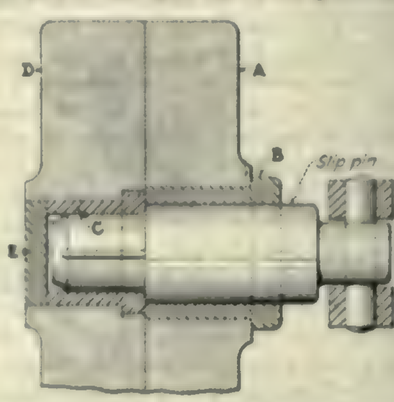
Rollers may be fitted to engage the board edge if desired, but are quite unnecessary. The square should slide up and down freely with the head kept square against the board when working properly. The fitting was made from ⅛ in. aluminum sheet, but brass will answer well enough. The spring tension is determined when mounting the fitting.

An Index Lock-Pin

BY C. H. VAN FOSSEN

The illustration shows a simple method of constructing a slip-pin device for locking an indexing jig in its several positions. The same scheme may, of course, be adapted to milling fixtures and to sliding members instead of rotating ones as described, and for that reason is adaptable to many varieties of work.

A hole is first drilled and reamed in the base plate *A* to receive the hardened and ground bushing *B*, the bore of which is ground to a close fit for a standard reamer. This bushing is pressed in place and then serves as a jig through which the hole for the bushing *C* may be drilled and reamed through plate *D*. It is only necessary then to line up the two members in the required positions and ream the holes in line. A counterbore to receive the head of the bushing *C* may be added afterward.



METHOD OF FITTING A LOCK PIN

The two diameters of the slip-pin are then ground to slip fits in the respective bushings. To protect the device from dirt and chips a soft plug *E* may be added, and, in that case, the small diameter of the slip-pin should be scored to permit the escape of air when the pin enters the bushing.

Two Simple Rigs for Grinding Cutters

By I. B. Rich

For grinding the tops of the teeth of slitting saws and cutters of a similar nature the device shown in Fig. 1 has proved very satisfactory. The base *A* carries an upright with a stud *B*, considerably smaller than the hole in the cutter. The base also has a slot cut at *C* which acts as a stop for the tooth at the bottom of the cutter. In use the operator merely slips the cutter over the stud *B*, locates a tooth against the stop at *C* and pushes the cutter toward the grinding wheel *D* until it stops against the stud *B*. Assuming the teeth to be evenly spaced this gives a uniform tooth length and the grinding can be done very rapidly.

A device for use in grinding the face of the teeth of similar cutters is shown in Fig. 2. Here the stud *B* is mounted vertically in the base *A*, a top view being shown. In order to have the cutter clear the wheel when being indexed the fixture is set on about the angle shown. The cutter is moved up against the side of the wheel *C* until it stops against the stud *B*. This device is used by the Pioneer Instrument Co., Brooklyn, N. Y.

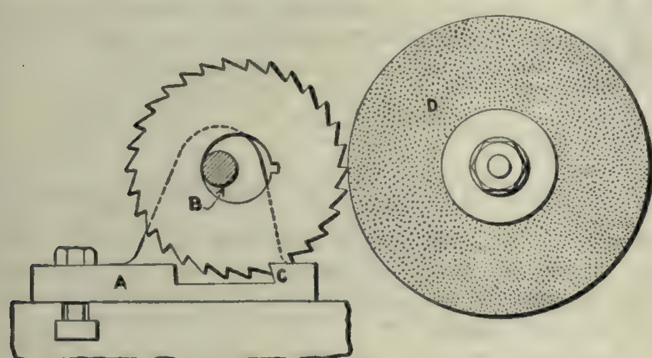


FIG.1

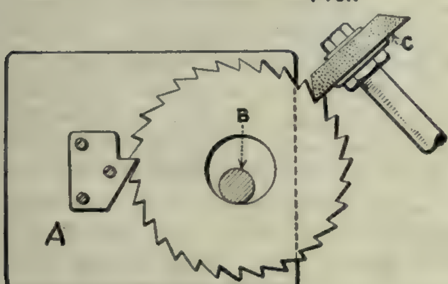


FIG.2

FIG. 1—FIXTURE FOR GRINDING CUTTER TEETH. FIG. 2—MODIFICATION FOR GRINDING FACE TEETH

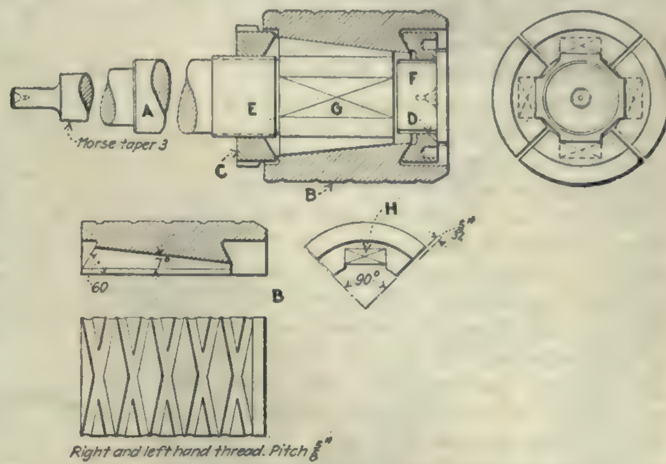
Automobile Cylinder Lap

By R. E. D. Delrue
Steyr, Austria

The accompanying illustration shows a typical design of an automobile-cylinder lap which has been used very successfully for lapping cylinders to size.

It is our practice not to grind our cylinders but to lap them to size after a series of careful boring operations. For some time we used the well-known split lap which is expanded by means of a tapered key or a wedge. Such a lap, however, has the disadvantage of expanding unevenly, the lower part increasing in size much more than the upper. This condition caused our laps to follow any unevenness in the cylinder-bore, leaving it in an imperfect condition and to avoid this trouble I constructed the lap illustrated which has the advantage of expanding evenly along its whole length, so that it needs in no case, to be turned after each resetting.

The lap consists of an arbor *A*, provided at one end with a shank to fit the lapping-machine spindle. At the other end four wedge-shaped splines are milled to receive the lapping segments *B*, which are held in position by means of the nuts *C* and *D*, engaging threads at *E* and *F*. The lapping segments are turned to shape out of a solid bar of copper after which they are sawed apart. A channel *H* is milled through their full length and is made to accurately fit the splines on arbor *A*.



LAP FOR AUTOMOBILE CYLINDERS

After the lap is assembled, it is turned to the correct diameter and a right and left hand thread about $\frac{1}{32}$ in. in depth cut over its surface, the thread serving to facilitate the introduction of the lubricant mixed with the lapping ingredients. To expand the lap, the nut *C* is loosened a trifle while the nut *D* is tightened. By the motion of nut *D* the lapping plates are moved towards the larger parts of the splines and expanded. The movement of the lapping plates being parallel to the axis of the arbor *A* it is possible at any time to adjust them for wear.

We have lately put in operation a somewhat different type of lap in which the lapping plates are made of steel and covered with copper to a thickness of about $\frac{5}{32}$ in., the advantage being that after the plates have been fully expanded to take up wear, the copper plates can be removed and new ones put on. The lap is then restored to its original diameter.

Utilizing Fixtures on Different Machines—Discussion

By Stanley W. Mills

The articles under the above title by Frank C. Hudson and C. L. Henry on pages 27 and 582, Vol. 57 of the *American Machinist*, remind me that in 1908 I established a system for fixture tongues practically the same as that used by the Lucas Machine Tool Co.

The reason for an off-set tongue with respect to the slot in base of fixture is not plain to me and in fact appears to be a distinct detriment rather than an advantage, for the reason that it is entirely possible for the fixture to be mis-located with respect to the slot in the platen.

From the point of view of accurately grinding the keys or tongues which should preferably be case-hard-

ened, it appears to me to be just as simple to locate the tongue centrally with the base as in the manner shown by Mr. Hudson, although there may be some advantage in his design as applied to an overhanging fixture. I venture to disagree with the plan adopted by Mr. Henry of locating the tongues against one side only of the T-slot in the machine platen and depending upon the clamps or bolts to hold the fixture in place.

It has been my experience, and this applies not only to fixtures but also in any instance where one piece must be held definitely with relation to another, that bolts are unreliable and that a dowel or key is imperative, the function of the bolts being merely to clamp and not to position the work. Mr. Henry's plan, however, would be more or less satisfactory, if in addition to the clamps, jack screws were used against the side of the fixture to force the tongues against one side of the slot and it is possible that this device is used by him.

I believe it is recognized that in holding a casting on the faceplate of a lathe or table of a boring mill, positioning screws should always be used in conjunction with clamps, thus reproducing the effect a conventional fixture which should always be designed to rigidly hold the work from movement without dependence on clamps or bolts.

I recall that the objectionable features of different width slots in various makes of milling machines were overcome in one very well equipped shop by machining the slots in all platens to the same width. Such a plan is, of course, more or less costly and involves very careful work. Once done, however, the difficulties with keys of miscellaneous widths will be eliminated.

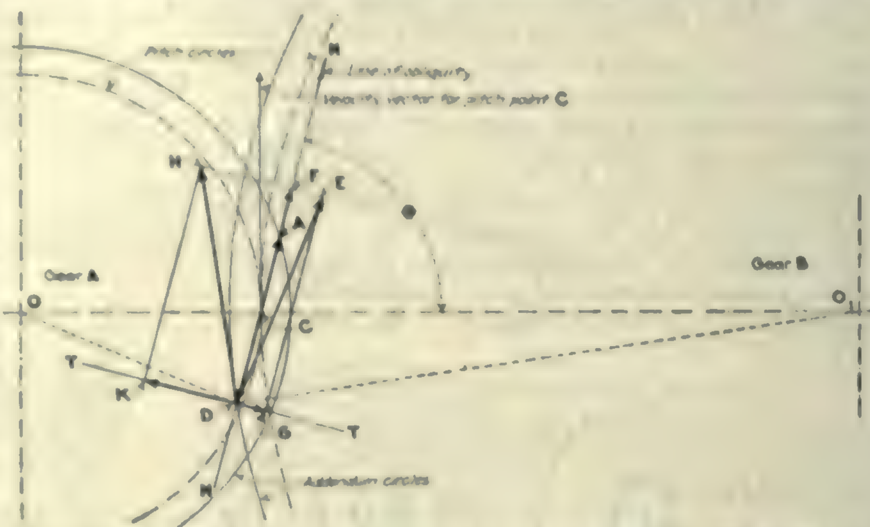
Finding the Rate of Gear Tooth Slippage

By Wm. H. Jefferis

Some time ago a large manufacturing plant experienced trouble with a pair of involute gears, designed to transmit from 50 to 75 hp. at 13,000 r.p.m. One of the faults discovered after running the gears a short time was a very pronounced burnishing effect on the face of the teeth. After being analyzed, it was finally decided that this defect was due to slippage. To obtain the rate of slippage, therefore, the following graphical method was devised.

The greatest amount of slippage occurs at the point of contact which is farthest from the pitch point, and this point may be readily found by the following construction: First, as shown in the accompanying illustration, the line NN is drawn through the pitch point C making the angle θ (equal to 90 deg.—the pressure angle) with the line of centers OO_1. This line is called the line of obliquity and on it lie all points of contact. The path of contact, therefore, must be somewhere on this line. Its limits are found at its intersection with the addendum circles and give DA for the path of contact.

Due to the difference in the diameters of the two gears, the path of contact in approach DC is greater than the path of contact in recess CA. For this reason, we will use the point of contact D and we will now find its linear velocity on the gear B. Taking the distance O_1D (which is the addendum radius) and multiplying it by 2π x r.p.m. of gear B, we get the linear velocity of D in inches per minute. Representing this velocity by a vector in its true direction which is perpendicular



A GRAPHICAL METHOD OF FINDING THE RATE OF GEAR TOOTH SLIPPAGE

to DO_1, we have DH. Now resolving this velocity into its components along the common normal and the common tangent TT perpendicular to NN, we have the lines DF and DK respectively.

The next step is to find the linear velocity of D on gear A. First, we have the true direction of its linear velocity which is perpendicular to radius OD. We also have its component along the common normal, since this normal is the line of connection between the two sliding surfaces and components along the line of connection must be equal. A line drawn perpendicular to DF at F and cutting DE at E, gives the velocity vector DE of D on gear A, and resolving the vector for its component along the common tangent TT we get GD. The rate of sliding will be found to be GK equal to $DG + DK$ since the components along the tangent act in opposite directions. Measuring this distance with the same scale used for vector DH, we get the slippage in inches per minute at this point of contact. The slippage at any other point can be found in a similar manner.

This method also easily proves the fallacy of the common belief among practical men that due to the method of constructing the involute gear tooth, pure rolling contact is taking place at all points of contact. In order to have pure rolling contact there must be no slippage or no components of velocities along the common tangent. This condition will be seen to exist only at the pitch point where the velocity vectors for both gear A and gear B will coincide and be of equal length.

Novel Scale Holder—Discussion

By Elam Whitney

The holder for use with flat scales suggested by P. A. Daschke on page 702 would hardly be justified it seems to me. Triangular draftsman's scales can be purchased for less than the two machinist's scales. The draftsman's scale has the advantage of a beveled edge. Flexible steel scales are graduated on one side only, which would be a drawback to their use, on account of the number that would be required.

Locating Racks in a Milling Machine Vise

By R. A. Follensby

We had several hundred racks to be cut, 14 pitch, 64 teeth, and we were cutting them three at a time in a heavy manufacturing milling machine by means of a gang of three cutters that cut the whole number of teeth at one pass. One cutter of this gang cut 18 teeth in the racks and the others 20 and 26 teeth respectively. The cutter cutting 18 teeth became so badly broken that we could not continue and we decided to cut the remaining racks in two operations instead of incurring the expense of a new cutter.

The special vise in which the work was held is shown in end section in Fig. 1. The bolster *A* was held to the vise body by means of large fillister head screws and the fixed jam *B* was similarly attached to the bolster. There were two moving members *C*, which were nicely fitted to slots in the body of the vise and held against lifting or tilting under pressure by the bolster.

Each moving member had bolted to it, by means of collar-head screws from the outside, the movable jaws, one of which may be seen at *D*. Independent screws, not shown in the sketch, applied the holding pressure to the work.

After the cutter had broken the remainder of the racks were cut by the other two, making 46 teeth in each. We then devised the gage shown in Fig. 2 to reset them for cutting the rest of the teeth.

Two pieces of steel *E* and *F* were fitted together in the form of a try-square, with tongue and groove at the

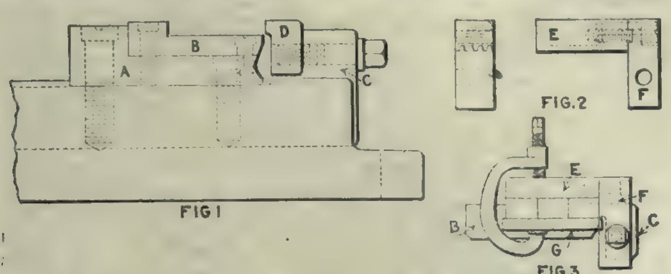


FIG. 1—END SECTION OF WORK HOLDING VISE. FIG. 2—THE LOCATING GAGE. FIG. 3—METHOD OF ATTACHING GAGE

joint and dowel pins for convenience in putting them together. A fillister head screw let into the piece *F* held them together.

After the gage was fitted up and checked for squareness, it was taken apart and rack teeth, corresponding to those in the work, were milled lengthwise of the under face of part *E*. It was then reassembled and fastened in position against the end of the movable jaw *D* of the vise.

With three of the racks in position in the vise and located lengthwise by the teeth of the new gage, the machine was set to cut the remaining teeth in the work by allowing two or three teeth of the cutter to overlap those already cut in the racks and adjusting the table of the machine until the two groups of teeth were accurately engaged.

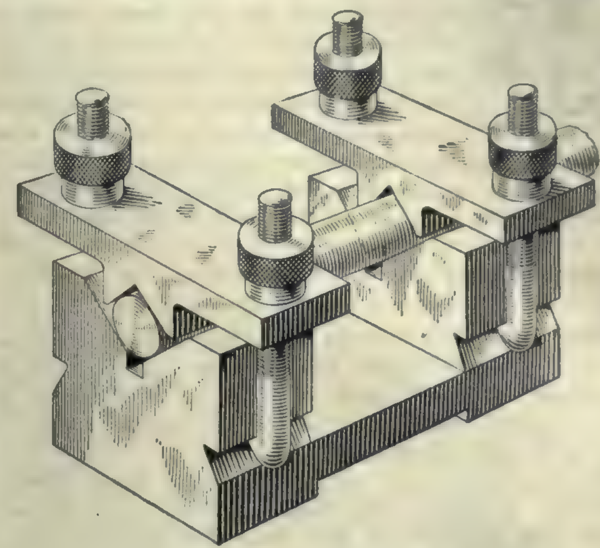
The method of locating the gage on the vise is indicated in Fig. 3, where a partial end view of the latter is shown with three racks in position and the gage held in engagement with them by means of the light clamp while the locating hole was laid off and drilled. The piece *G* was used merely to secure a firm bearing for the clamp across the bottoms of the racks.

Improved V-Block for Drilling

By E. Lytton Brooks

The V-block shown was designed for drilling through holes, as the ordinary straight block lends itself so readily to being drilled into and mutilated at the bottom of the V when the drill goes through with a rush.

The cut away blocks offer no difficult machining problems, and are well worth the making, as they are easier



TOOL MAKER'S V-BLOCK

to handle than an ordinary pair. Two grooves are machined along the bottom to facilitate clamping, and the style of clamp was chosen because it does not foul the drill chuck like the long center screw pattern. Both the block and clamp plate were made from tool steel, hardened and ground to finish. A slight clearance was ground out on the underface to allow the blocks to bear on the ends.

Fitting Hammer Handles

By H. K. Griggs

Much has been written about hammer handles and several devices have been shown to secure the handles in hammers.

A good hammer should have a double taper eye and the handle should fit on the under side of the eye. This is important. After driving the handle as far as possible into the hammer, saw the handle off flush with the outside. The piece sawed off usually provides material to make one or two hard wood wedges. With a thin pointed chisel make a diagonal split in the outer end of the handle. Dip the wedge in glue, drive it in and saw off flush.

Uusually if the handle is fitted properly one wedge is enough, but more can be used if required. Handles thus mounted seldom get loose unless alternately exposed in wet and very dry places. If any looseness is detected another wooden wedge can easily be driven in and if dipped in glue will not get loose. The chief cause of loose handles is that they were not properly fitted in the first place. This being so, no device will keep them tight. The fitting of hammer handles might well be under the control of the safety department in shops large enough to have one, for loose handles are a constant source of danger.

Editorial

WE ADMIRE THE MAN who has the ingenuity and go-get-there spirit to tie his jackknife to a beveled piece of wood and plane a board with it when his wife gives him a job and he has no plane, but we refuse to hire him when we have a real job of carpentry to be done. We want a man *and* his tools. Then why tolerate makeshifts in a shop where real jobs are in order all the time?

Another Abuse of Service

THE PROBLEM of what passes for service, but which is frequently unalloyed nerve on the part of the purchaser, bobs up again and again. Just as an instance of the demands a buyer will make, we cite a case of rather recent date.

The production end of a large plant finally decided that new equipment was needed. They were not sure which tool was best so they wanted to be educated, at the expense of the maker of the machines. So they proposed to several machine tool builders that they send a machine and an operator for three months' trial on their work, the successful machine to get a nice order for quite an equipment. As usual, the builders fell for it, some only part way to be sure, but others all the way, as the entire expense was supposed to be borne by the makers of the machines.

When you analyze this proposition it stands out as a bold bid for educating a production department at the expense of several builders of machines. They do the experimenting as to the best machine and the best tools for this work. They give their experience, the time of their men, the product of their machines and three months' wear, for the education of the production department of the concern which may buy several machines when their education is complete. It is cheap education for the buyer, but expensive for the machine tool industry as a whole. Furthermore, it is absolutely unfair to the buyer who knows what he wants, who does his own experimenting and who has production men who know the best methods of doing work.

If the buyer were willing to pay for his education, as he should, there would be no harm in such a proposition. But the machine tool builder must cover the cost of this so called service in the price of the machine, and the man who does not require it has to pay just as much as the man who must be educated.

The fair method would be to have a flat price without service, and a reasonable charge for all service rendered. It will, of course, be difficult for the builders to enforce such a rule unless all determine to stop the present practice. This can hardly be done until the service abuse is allowed to grow to unbearable proportions. The remedy may have to come from the other side, by the buyers who do not need service or education absolutely refusing to pay the same price as the man who does. Neither remedy is easy of accomplishment, but there is a growing feeling that a change is inevitable and not far distant.

Small Tools Are Small in Size Only

NO MACHINE is better than the tool used in it. If we accept this truism we may expect every manufacturer to be everlastingly on the qui vive for the best tools and constantly trying to make them still better. There are such manufacturers, we are happy to concede, but there are more who are everlastingly trying to reduce the cost of small tools and shutting one eye to the results. The other eye is cocked at the happy reduction in expenses brought about through charging small tools to this class of disbursements.

Costs of small tools are expenses. Expenses should be held down to a minimum—a mighty good rule, by the way—and so everything possible is done either to reduce the expenditures for small tools or else to make them disappear in some mysterious way in the maze of shop rules and bookkeeping.

If Mr. Manager had kept both eyes open he would have seen something more than a reduction in expenses. In fact, he would have seen that there was no reduction at all, but rather the opposite. It takes two eyes to get perspective.

The second eye would have seen a reduction in output or to put it differently an increase in labor cost. Maybe there has been no increase because labor costs always were too high on account of poor tools. Suppose that a tool costing \$5 turns out the product at a cost of \$100 while another tool costing \$10 produces the same work for \$50. Which is the cheaper tool is easy enough to see when one has the figures, but the man who does the work with the so-called cheap tool probably has no idea what might have been accomplished with a good one and so he continues saving pennies on the tool and wasting dollars on the work.

Then, too, if the poor tool is made in the plant the chances are 10 to 1 that it does not cost less than a good one—it only seems to cost less. The amount of juggling one can do with labor, material and especially overhead, intentionally or not, is something surprising. A home-made tool believed to cost \$5 might easily cause a loss of \$10 per piece if made in quantities and sold for \$20.

If a home-made tool were good and cheap it would be more than welcome; if it were good but expensive it would be acceptable; if it were cheap but not very productive, it might be tolerated if there were only one of its kind, but if it slows down production all over the shop, it becomes a nuisance. And that is exactly what poor tools do, whether they are made at home or outside. A home-made drill of inferior quality slows down not only the machine on which it is used but every machine in its neighborhood.

But is there reason to think that a home-made tool is of poorer quality than the standard commercial article? In answer we can only ask questions. Would you expect to build an electric motor as good as one you can buy, and would you shave yourself with a home-made razor before trying it out on somebody else? Have you the equipment, the material, the facilities and expe-

cially the knowledge of the man whose sole business it is to make tools?

And then there are the makeshifts. It is bad enough when you make a tool just like any other of its kind, only not quite so good, but when you make makeshifts you act in very much the same way as if you were regularly going through the movements used in resuscitating a half-drowned man every time you breathe.

Worst of all is it to keep a defective tool rather than buy a new one, to reduce the output of a $4,000 milling machine to one-third of its capacity because you hate to throw away a crooked arbor.

Don't forget that in the running of a machine shop small tools are small in size only.

The Machinery Market in South America

WITH FACTS and figures which are striking, the November issue of *Commerce Monthly*, the trade organ of the National Bank of Commerce of New York, calls attention to the favorable position of the United States with respect to future trade with South America. It stresses the valuable relationships which have been established and points out the great improvement which has been made in shipping facilities since 1914.

In the period from 1910 to 1913 it is shown that but 15 per cent of the southern continent's total imports came from the United States. By 1917, due to the great impetus given foreign trade generally as a result of the war, South America reached a point where 46 per cent of her needs were supplied by America. That the post war depression has had but little effect on the trade established, is shown in the imports for 1920 which show the United States still greatly in the lead and supplying 42 per cent of the total.

The South American export trade with the United States is no less striking. Before the war she sold us 20 per cent of her outgoing products. In 1917 we took 42 per cent and in 1920, 33 per cent of her goods. That we should hold the abnormal war position is hardly to be expected. Recent statistics, however, point clearly to the fact that future trade with South America will be permanently larger than ever before.

There is a lesson in these general statements for *American Machinist* readers. South America today is closer to us than she has been at any previous time in history. On the one hand, American travel thither and study on the ground has brought about an appreciation, not only of the vastness of the continent, but of its tremendous possibilities. On the other hand, clear thinking and far seeing people in those southern republics have derived an inspiration from the example set them by their northern neighbor. History is repeating itself. To those republics, as has been the case in America, expansion has come to mean nationalization and nationalization has brought about strength and elevation of view. Not only are they advancing their frontiers, but the ground already conquered is rapidly being made, in each republic, the scene of an intensive agricultural and industrial development.

The tool manufacturer will do well to give thought to this market. The various republics in 1910 bought $305,069 worth of American metal working machinery. In 1917 their purchases from us for this class of goods more than doubled, reaching $795,449. By 1920, in the face of a worldwide depression and depreciated exchange, the figures reached $1,764,419, more than five times those of 1910.

The future in South America for the machine tool industry of America is one of great promise. An era of industrial and economic development, of railway and power expansion, understood and appreciated by but few, is not merely conceived but actually under way.

The Personal Element in Precision Grinding

PRECISION grinding is an operation in which the individual skill of the operator counts for much. There are so many factors entering into the production of perfect work that personal skill is always likely to be at a premium in work of this kind.

We recently dropped into a little shop with a large reputation for good work and found it busy, as usual, not on ordinary, low priced contracts but on a lot of shafts for an automobile transmission which had to be *right*. These shafts were from the shop of one of the best known quality cars in the country. They were not sent out to this small shop to save money but to secure a better pob than the factory could obtain with the best grinding equipment money could buy. The factory had the machinery and it had good men, but they were not good enough to get the very best results, which they desired.

Two men, experts in grinding, run this little shop and are reaping the rewards of long years of careful study and experience in grinding. They have good grinding machine equipment of course, the same as the automobile shop has, but they have more; they have the personal skill and knowledge which enable them to get just the right results. They know the right wheels to use, the proper fit of bearings, the importance of proper dressing of the wheel and many other points that have a bearing on the product.

There is a growing demand for better grinding and with it is coming the opportunity for men who really know modern grinding machines and grinding practice. We can think of no more promising field for young mechanics who are ambitious to excel in their chosen field.

Just Suppose

JUST SUPPOSE somebody came to you and told you that you might get much better results in the shop by making certain changes which had been tried out by A.B.C. and X.Y.Z. and found to work well; wouldn't you naturally tell him that you know your own business best and that, anyhow, your conditions are different and that such schemes may be all right in some shops but not in yours? No, sir! not in yours.

And now suppose your friend comes to you and says that he gets much better mileage out of his Vix tires than out of the Nix brand you use, recommending at the same time a carbureter he has tried out with glorious results and a spark plug which will spark when the battery is nearly dead. Wouldn't you just naturally tell him that you know best how to run your own car and that, besides, those things may be all right on his car but that they would never work on yours?

Of course not. Nobody is as big a fool as that, but when it comes to running a shop—that's different. So it is, but—

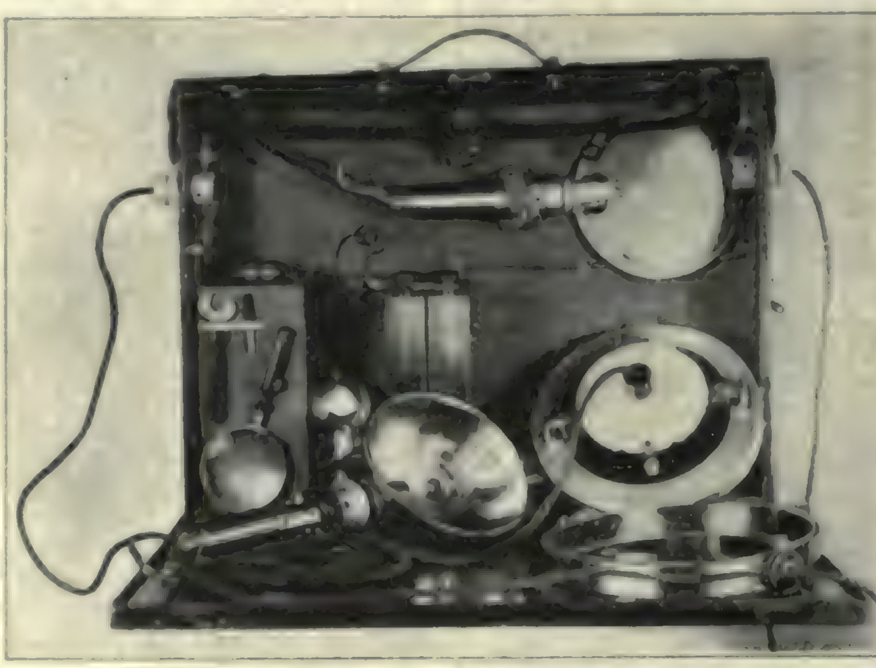
Just suppose.

Shop Equipment News

Elverson Oscilloscope

The Elverson oscilloscope is an optical-mechanical device for visually slowing the motion of rapidly moving mechanisms so that an observer can easily study just what is taking place. The apparatus, which is shown herewith in portable form, is built by Herbert Kennedy & Co., Ltd., London, England, whose representative, Peter Davey, is at present in this country and located at the office of John H. Faunce, 8 Bridge St., New York, N. Y.

The mechanism consists primarily of a commutator, shown on the right side, which flashes a lamp or lamps, so as to synchronize with the motion of the object to be examined. These lamps are specially designed and constructed so as to give an instantaneous flash, such as cannot be obtained with a filament. They are filled with neon gas, through which a discharge takes place from one electrode to the other. They have the peculiarity of improving with age. The commutator referred to is in reality a special form of gear box driven direct from the mechanism to be studied. In this gear box are contact breakers operated by means of cams, which control the flashing of light. Current for the lamp comes from a small 4-volt storage battery, through special coils and condensers, making the instrument independent of outside connections. On the gear box is a switch plate by which the operator can make the object appear stationary or moving at one per cent of its normal speed. A part moving at 1,000 r.p.m. seems to move but 10 r.p.m., so that its motion can be easily studied. There are also two slides which give two or four flashes per revolution, for use in studying vibrations or gyrations in rapidly moving parts.



ELVERSON OSCILLOSCOPE MOUNTED IN A PORTABLE CASE

This gear box will control flashes up to 28,000 per minute, which means that almost every kind of high-speed machinery can be studied in action as though it were at rest. By moving the outer dial, which is graduated in degrees, the position of the object being studied can be varied, the graduations showing exactly the relation of the two observations. By this means the exact period of the opening and closing of a valve, or a similar period in any mechanical movement, can be accurately determined and the action visually studied.

For studying the periods of vibration the slides shown are of particular value. One slide controls the stationary and the other the creeping position. Pulling the slide out to the first notch doubles the number of flashes, and the second notch gives four flashes per revolution. As the gear box is driven positively from or in relation to the shaft being studied, increasing the number of flashes clearly shows whether or not the period is at shaft speed.

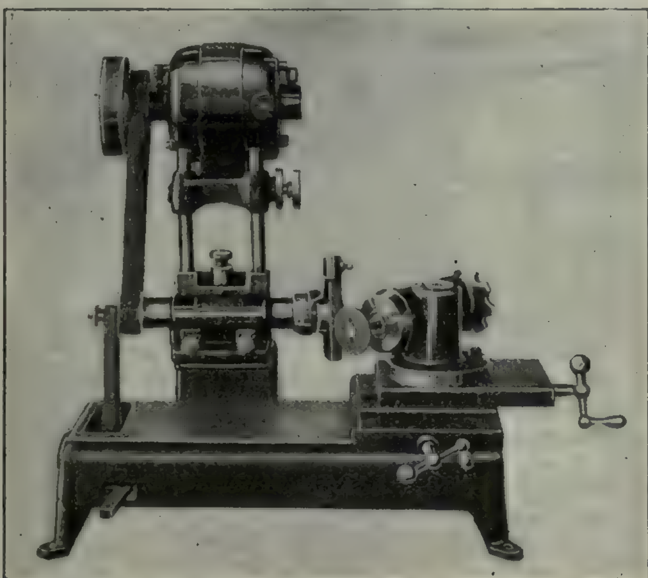
When the critical period is reached, two distinct images appear. If these appear with the double flash, the period occurs at the speed at which the shaft is running. If the double image appears when the flashes are four times the shaft speed, then the vibration period is at double the engine speed. Experience with the device will show many points of vital interest to designers of all kinds of machinery, especially that which runs at high speed. With the knowledge thus obtained showing exactly what happens under running conditions, defects can be detected and better machinery designed. The use of this device shows so much that could formerly only be guessed at, that its applications are very wide. Among some of its uses have been the detection of gas-engine valves which did not seat until after bouncing three or four times, of oil systems which were not functioning properly, of knot-tying machines which were not getting the correct motions, of the actual working of magneto breaker points and of the distortion of airplane propellers.

With the oscilloscope, designers and builders of automatic machinery of all kinds, can study the exact movement of any part under actual working conditions, which takes into account the deflection of parts, the rebound after a sudden contact, and many other points of vital interest. It is not necessary to have a dark room in which to operate the machine being tested, although direct light should be cut off. The intensity of the light from the oscilloscope is sufficient to give the illumination necessary. The observer needs no auxiliary apparatus through which to view the mechanism under test, as its action is evident to the naked eye.

Sapihl Portable Electric Valve and Toolpost Grinding Machine

An electric-driven portable grinding machine having a wide range of uses has recently been placed on the market by the General Tool & Equipment Co., 70 Monroe St., Chicago, Ill. The tool, which is designated as the Sapihl portable electric grinding machine, is adapted to general use.

The chief feature of the device is that all running parts are equipped with ball bearings, both in the motor and in the wheel and work spindles. The accompanying illustration shows the device arranged for grinding the poppet valves of automotive engines, with a valve held in place in the chuck. The chuck can be indexed to give any angle desired to the valve, and it is mounted on a compound slide so that it can be both traversed across the wheel and fed in toward it.



SAPIHL PORTABLE ELECTRIC GRINDING MACHINE

The work-carrying spindle is rotated by means of connections from the grinding spindle, although it can be disengaged while the motor is running. The reamers for machining the valves in the motor block can also be sharpened in the machine, thus insuring that the same angle is obtained on both the valve and the seat.

The motor and spindle unit can be detached from the base and employed separately on machine tools for light grinding operations. It can be readily mounted on the toolpost of a lathe for performing both internal and external grinding. The motor is driven from a convenient lighting circuit, so that it may be attached wherever a lighting socket is available. It is controlled by means of a snap switch on the cord. It is adjustably mounted on the two upright bars, and can be raised by means of a knurled screw for tightening the belt, and then clamped.

The spindle is mounted in double-row S. K. F. self-aligning bearings. The height of the spindle can be varied by means of an adjusting screw. Both internal and external work can be done, extension spindles being furnished for the latter. A heavy extension spindle can also be furnished for large internal grinding.

The machine can be employed as an ordinary abrasive wheel for the general uses required around the shop, such as sharpening tools and grinding contact points.

"Marvel" No. 2 Portable Motor-Driven Draw-Cut Hacksawing Machine

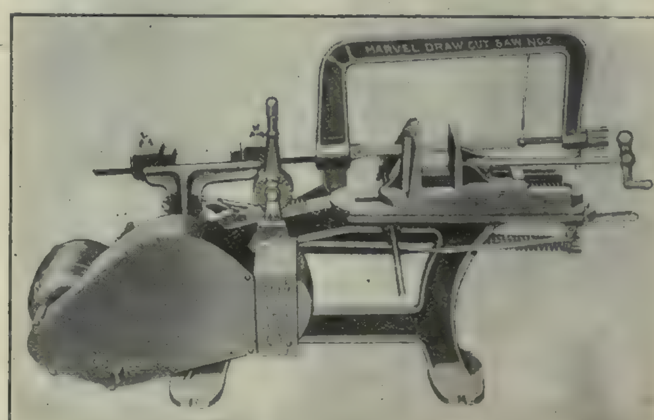
The Armstrong-Blum Manufacturing Co., 333 N. Francisco Ave., Chicago, Ill., has recently placed on the market a portable motor-driven style of its "Marvel" No. 2 draw-cut hacksawing machine. The machine, which is similar in general characteristics to that described on page 215, Vol. 40 of *American Machinist*, has a capacity for work 6 x 6 in. in section on long stroke, and 8 x 8 in. on short stroke. Blades from 12 to 17 in. in length can be used.

The motor is attached to the rear of the machine, so that the chips from the saw do not get into it, and it is connected by means of a silent chain to the driving crankshaft. The gears, sprockets and chain are entirely inclosed in a cast-iron housing, and run in oil. The motor is of ½ hp. and can be furnished for the style of electric current that is available, for either power or lighting circuits.

When the machine is furnished with a motor that can be operated from a lighting circuit, a plug receptable is attached to the top of the switch box, so that the motor can be easily connected to any available lamp socket by means of an extension cord. In this way, the machine can be moved to the place where the work is to be done, and connected to a convenient lighting circuit.

The portable feature is of particular value when work is being done on structural or ornamental iron, on sheet metal, or on parts that cannot be easily transported in a garage or machine shop. The whole machine can be mounted on a small platform truck, so that it may be moved to any part of the plant where a job must be done. This truck mounting is particularly useful for maintenance and millwright departments.

An inclosed externally operated fused switch is attached to the front of the gear housing, and all wiring between the switch and the motor is inclosed in conduit.



"MARVEL" NO. 2 PORTABLE HACKSAWING MACHINE

The starting handle on the front of the machine is connected to the switch so that the method of operation is just the same as that of a belt-driven machine. The motor and the machine are started by moving the handle to the left, and they are stopped by moving it to the right. Thus, no clutch is required. When a cut is completed, the saw frame trips the starting handle and automatically opens the switch and stops the motor.

The vise holding the work is only 19½ in. from the floor. The length overall of the complete machine is 52 in., while the extreme width is 18 in. The machine weighs 350 lb. net, and 450 lb. when crated for shipping.

Towmotor Model C Gasoline Industrial Tractor

An industrial tractor driven by a gasoline engine and capable of general use about a machine plant has recently been placed on the market by the Towmotor Co., 1226 East 152nd St., Cleveland, Ohio. The accompanying illustration shows the Model C machine, which has a normal drawbar pull of 1,150 pounds.

One of the principal features of the machine is the small turning radius, as the minimum outside turning radius is only 5 ft. 3 in. The machine is driven by the two rear wheels and steered by the two front ones. Cast-steel disk wheels fitted with Timken bearings are provided. The tires are solid rubber; the front ones are 16 x 3½ in., and the rear 22 x 3½ in. double.

A four-cylinder, four-cycle motor stated to deliver 23 brake horsepower at 2,000 r.p.m. is employed. A battery is mounted under the truck for ignition and for operating the starting motor. A thermo-syphon cooling system is provided. The 6-gal. gasoline tank feeds by gravity and is located in front of the driver. The clutch has a single plate, and the transmission one speed forward and one reverse.

Fabric universal joints are placed between the transmission and the rear axle, which is of the internal-

TOWMOTOR MODEL C GASOLINE INDUSTRIAL TRACTOR

gear-driven type. It is full-floating, runs on Timken bearings and gives a speed reduction of 8 to 1. The frame has a depth of 9½ in. and rests on semi-elliptic springs at both the front and rear. Brakes of the internal-expanding type are located on the rear wheels. The machine has a speed from 1 to 8 miles per hour.

Bumpers made of ⅜-in. steel plate are provided at both front and rear for the full width of the chassis. These bumpers give protection to the vital parts of the machine and serve for pushing operations. Couplings on both the front and rear are adjustable for height. The wheel base of the machine is 40 in. Its overall length is 72 in., and the width 40 in. It weighs about 2,900 pounds.

Rockford Milling Machine Co. Spring Collet Chuck

A chuck for holding spring collets has recently been placed on the market by the Rockford Milling Machine Co., Rockford, Ill. The device is intended for gripping small rods, straight shank drills, milling cutters and parts that are to be rotated in a spindle.

As the accompanying illustration shows, the chuck consists of a body to which is attached a shank at its rear end and which has a tapered hole at the front

ROCKFORD SPRING COLLET CHUCK

end. The collet fits the tapered hole in the nose of the chuck and is drawn back in place by a wormwheel threaded on the inside to fit the threads on the end of the collet. It can be quickly moved in and out by turning the worm with the key wrench. Turning to the right draws the collet against the taper and closes it uniformly from all sides. Turning to the left forces the collet out.

The small nose on the collet makes it possible to bring work very close to the chuck. The shank of the drill or milling cutter is gripped throughout almost its entire length, so that rigidity is increased and the tendency to crystallize and break the cutter is reduced. There are no projecting parts to catch the hands of the operator.

The device is made of hardened and ground alloy steel. The shank can be furnished to fit any spindle of standard taper. The chuck is adapted particularly to lathe as well as to milling machine use, as when gripping stock no draw-in attachment is necessary. The chuck is ordinarily made in three sizes having B. & S. tapers of 9, 10 and 11, respectively. Collets up to 1 in. in diameter can be held.

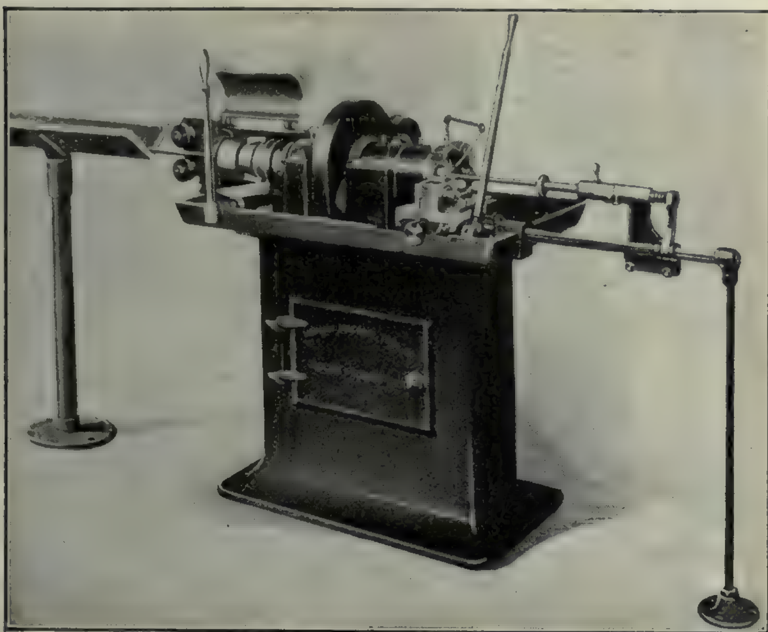
Changes in "Modern" Cutting-Off Machine

The cutting-off machine made by the Modern Machine Tool Co., 601 Water St., Jackson, Mich., for cutting pipe, tubing and solid bars, both round and hexagon, has recently been altered in design so that it appears as shown in the accompanying illustration. The specifications and general dimensions of the machine are the same as formerly, as it is made in sizes having maximum capacities of 1, 2 and 3 in. outside diameter.

The principal changes lie in the method of handling the stock and the positions of the control levers. Although the No. 1 machine is equipped with the roll feed, such as formerly used, the two larger sizes are now provided with a double live roller feed for feeding the stock through the spindle. An automatic stop is provided on all sizes of the machine for gaging the length of the piece being cut.

The stop for the stock is operated from the tool

block. The arrangement is such that as the toolblock is moved out to clear the tool after the cut, the last part of its travel moves the stock stop about $\frac{3}{16}$ in., and brings it up to position for properly locating the work. As soon as the toolblock is fed in to start the cut, a spring causes the stop to move back clear of the work



"MODERN" CUTTING-OFF MACHINE

again. In this way the stop does not wear due to the rotation of the work, and the work itself can drop away from the tool after it is cut off. A stop pin is arranged so that the operator can tell when the tool is clear of the work.

The double live roller feed for feeding the stock through the spindle is driven through a worm and gears from the cone pulley shaft. As the machine is slowed up to accommodate large stock, the feed is also slowed. The feed rolls run continuously. They are so trunnioned and connected with the lever operating the collet that the movement opening the collet brings the rolls simultaneously up to the stock. A further slight pressure on the lever feeds the stock through the spindle against the stop. The back movement of the collet lever throws the rolls clear of the stock and closes the collect.

The lever controlling the collet is placed in a vertical position, and the mechanism altered so that movement is much easier than in the former model. In running the machine, it is not necessary for the operator to remove his hands from the two levers. A pull of the left hand on the collet control lever opens the collet and feeds the stock through the spindle up to the stop. A push closes the collet; and on stock up to 3 in. in length of small diameter there is no perceptible wait for the feeding of the stock.

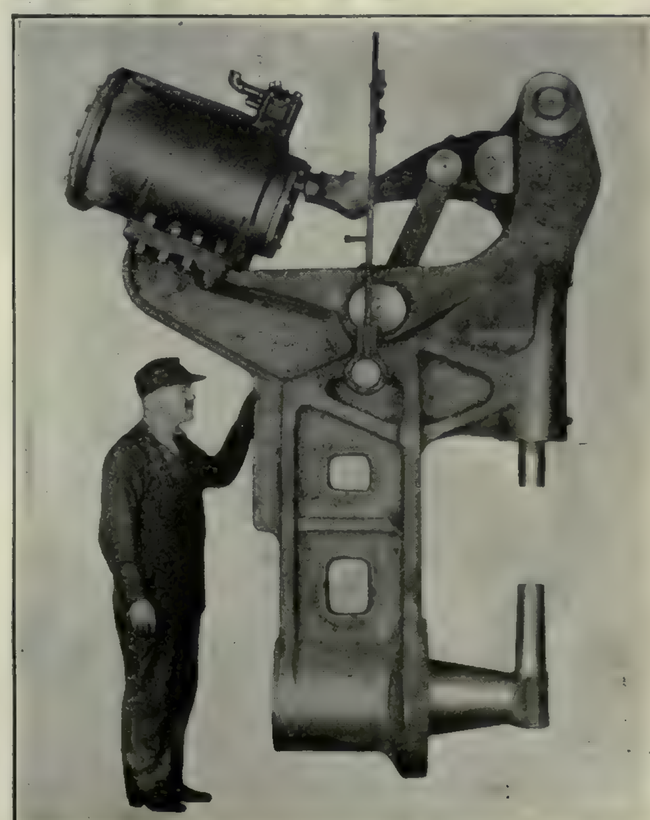
A movement of the right hand on the tool feed lever then causes the tool to feed into the work. When the cut is finished, the reverse movement of this lever pulls the tool from the work and brings the automatic stop into place ready for positioning the next piece. Since a very large number of pieces are cut off per hour, the economy of effort and time on the part of the operator is of considerable importance and enables an increase in the rate of production of the parts.

Hanna Last-Head Boiler Riveting Machine

The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has just completed and shipped the large riveting machine shown in the accompanying illustration, for use when riveting through the manhole the last head in a boiler. The reach of the unit is from 14 to 18 in., and the gap 35 in. The capacity is 1,000 tons. The machine may be arranged with either a straight-push hydraulic actuating mechanism, or with the Hanna pneumatic mechanism. The diameter of the cylinder is 18 in., and the stroke of the die $5\frac{3}{4}$ inches.

The machine is arranged for portable use in two positions, and suspension is made with the dies vertical. It swivels about a point close to the center of gravity, so that the stationary die can be swung on and off the manufactured head of the rivet in a direction very nearly parallel to the line of travel of the die. The mass or weight of the riveter is thus not lifted nor lowered during riveting.

The distance from the center of the beam stake, which is of forged alloy steel, to the end face of the die standing thereon is 30 in., allowing a 60-in. shell to be accommodated. The length of this die can be varied in conjunction with the opposite die to take care of shells as small as 42 in. in diameter. The distance from the axis of the dies to the long face of the throat is 16 in. The machine is used on high-pressure containers, in which the rivets are $1\frac{1}{4}$ in. in diameter and the plates $1\frac{1}{2}$ in. thick, requiring a heavy machine. It has a weight of 9.900 pounds.



HANNA LAST-HEAD BOILER RIVETING MACHINE

Midwest Box Rails and Steel Stringers

In order to give speed and ease of installation when erecting mechanical equipment, particularly overhead members such as lineshafts, a system of anchorage material in the form of rolled steel sections designated as box rails and steel stringers, is now being manufactured by the Midwest Steel & Supply Co., Inc., with general offices at 28 West 44th St., New York, N. Y.

The box rails are a sort of continuous socket insert; a good idea of them can be obtained by referring to Fig. 1. They are considerably heavier than the ordinary socket inserts, and have a cross-sectional area that is considerably greater, so as to give strength. They can be furnished in any length required, and are usually built into the ceilings or walls of concrete buildings during erection. A surface slot is left exposed, and through the use of a special bolt which can be slipped into the slot at any point and given a quarter turn, anchorage support can be provided for machinery, motors, transmission lines, sprinkler systems and apparatus that need be supported from the ceiling or wall.

The rail can also be employed for supporting trolley beams for monorail conveyor systems, in the side walls of buildings for carrying crane rails, and in the floor for mounting large presses and machinery. Sections of box

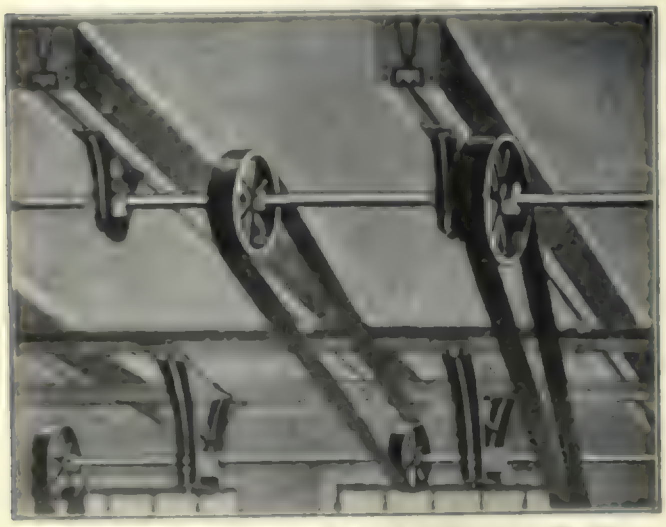


FIG. 1—MIDWEST BOX RAILS IN POSITION

rail can be inserted vertically into side walls of storerooms and stock rooms, and brackets for carrying shelves or bar stock can be clamped to them. The advantage of this method of installation is that practically any type of bracket can be used, and the space between them can be readily varied.

Since the box rail is usually installed with its outside face flush with the concrete or brick, it can be employed as a base for electric motors. It thus provides a range of adjustment sufficient to take care of the belt slack without cutting out a piece of the belting.

The steel stringers are also rolled steel sections of various sizes, and can be furnished in even foot lengths. They are more directly related to the intallation of machinery and transmission lines, and in conjunction with standard bolts and clips they form a system for supporting lineshafts and countershafts, as well as other mechanical equipment. Fig. 1 shows a pair of stringers supported by bolts in the box rails, while Fig. 2 shows the stringers attached to overhead I-beams and carrying smaller cross stringers. The stringers are adapted to any type of building contruction, as they are attachable to either wooden or steel girders.

One of the principal features of the system is its flexibility, as adjustment in either direction is provided, and units can be added, taken away or re-positioned to take care of additional equipment, changes in location

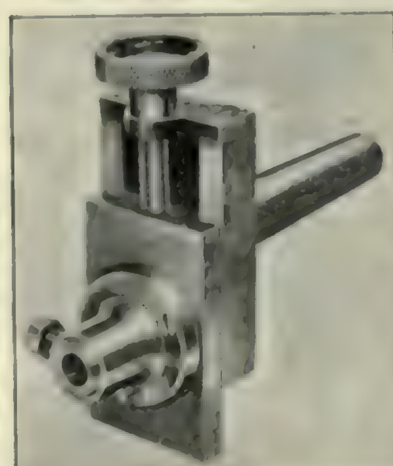
FIG. 2—MIDWEST STEEL STRINGERS CARRYING LINE SHAFTING

and such contingencies that arise. In the erection of the stringers, no holes need be made, nor tools except wrenches employed.

Industrial plants can carry assorted lengths of steel stringers in stock to provide for emergencies such as breakdowns or the erection of temporary countershafts. In this way, the steel stringers can be employed instead of wooden ones. Of course, they are not affected by shrinkage or warping under varying temperature conditions, as are the wooden stringers.

Bruce Precision Eccentric Boring Head

The Precision & Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., has recently added to its line the Bruce precision eccentric boring head that is illustrated herewith. The tool is intended especially for application to drilling and milling machines when boring jigs and fixtures, and also when index boring. The two members sliding on each other are provided with a gib to take up wear. One member carries a shank to fit the spindle of the machine, and the other an adaptor to hold the cutting tool. The eccentricity of the tool can be varied by means of the micrometer screw.

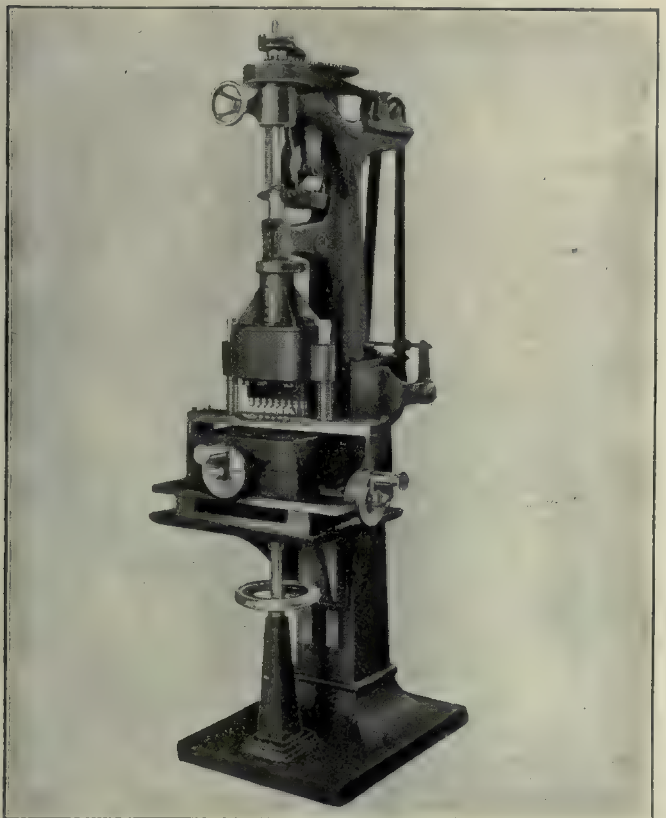


BRUCE PRECISION BORING HEAD

The head is made in four sizes, the capacities being, respectively, ⅜ to 1½ in., ½ to 2½ in., ¾ to 4 in. and 1 to 6 in. The adaptors furnished with each size permit of holding different sizes of drills, so that the tool can be used for both drilling and boring.

Hoefer Special Ball-Bearing Multiple-Spindle Drilling Machine

The machine shown herewith has recently been developed by the Hoefer Manufacturing Co., Freeport, Ill., to provide both speed and accuracy on light drilling work of a certain class. The work shown on the machine is a die plate employed in the manufacture of accounting machines for punching the cards, although with modifications the machine can be employed for other work of a similar nature.



HOEFER SPECIAL MULTIPLE DRILLING MACHINE

The machine itself is the regular high-speed, ball-bearing drilling machine made by the concern. It is equipped with an automatic cam feed and return motion, so that practically the only work required of the operator is indexing the jig and replacing the drilled parts. The head itself is heavy enough to maintain alignment of all the parts. It has nine drilling spindles, all driven from the main spindle of the machine. It is counterbalanced by a weight in the column, but springs are also added between the head and the die plate to assist in raising it after the cut has been made. The springs can be seen on the two hardened guide rods that keep the head and the jig in correct alignment relative to each other.

The work is located by means of dowel pins on the upper table of the indexing jig, which is provided with an oil basin for cutting compound. The pins aid in properly replacing the work, should it be necessary to remove it. The work-holding table is placed on the compound table of the machine, so that it can be moved both longitudinally and transversely. The pitch of each screw is such that one turn moves the table the exact distance between the holes in the work. Across the top of the jig there is a heavy steel plate in which are located the liner and the slip bushings which guide the drills. The guide rods for the head are also secured to this plate. The arrangement is such that the plate does not interfere with the movement of the work and the compound table.

The die plate being drilled in the illustration given is from $\frac{1}{8}$ to $\frac{3}{8}$ in. in thickness, and has 12 rows of 45 holes each. Since the holes are too close to drill adjacent ones, every fifth hole in a row is drilled at the same time, so that a row can be completed in five operations. The center distance between adjacent holes are not permitted to vary more than 0.0005 in. It is stated that the 540 holes in a plate can be drilled in 22 min., although from 3 to 4 hr. are required to drill them by means of a single-spindle machine.

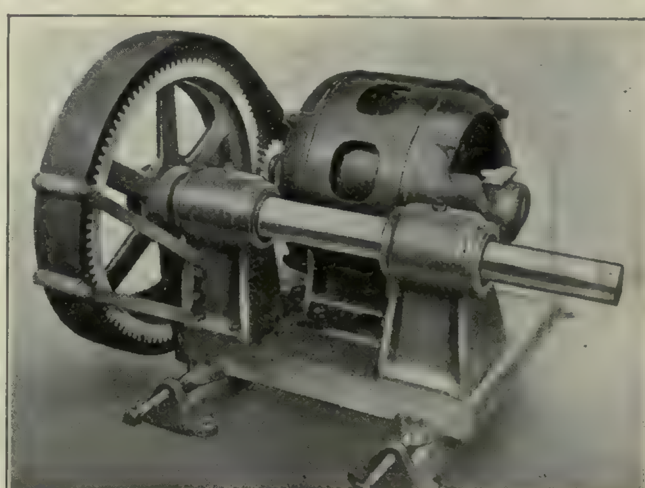
Motor Base with Speed-Reducing Gears

A cast-iron base for electric motors, having as an integral part a secondary shaft and speed-reducing gears, has been placed upon the market by the Bridgeport Motor Co., Inc., Bridgeport, Conn. It is intended for use in places where space is limited and where it is desired to drive a lineshaft directly from the motor without resorting to the extreme diameters of pulleys that would otherwise be necessary to obtain a large speed reduction with a plain belt drive.

The secondary shaft is mounted in two pedestal bearings having bronze sleeves and the ring oilers usual to motor construction. The driven gear is of cast iron and the motor pinion of rawhide, composition, fabroil or any other of the materials used for noiseless gear drives. Permanent gear guards form a part of the unit.

The smaller member of the secondary drive is keyed to the shaft opposite the main gear, and may be a plain pulley or a sprocket according to whether the drive is to be by belt or silent chain. The unit may stand upon or be suspended from cast-iron screw-adjusted guideways for floor or ceiling mounting, thus providing adjustment of center distances to maintain belt tension.

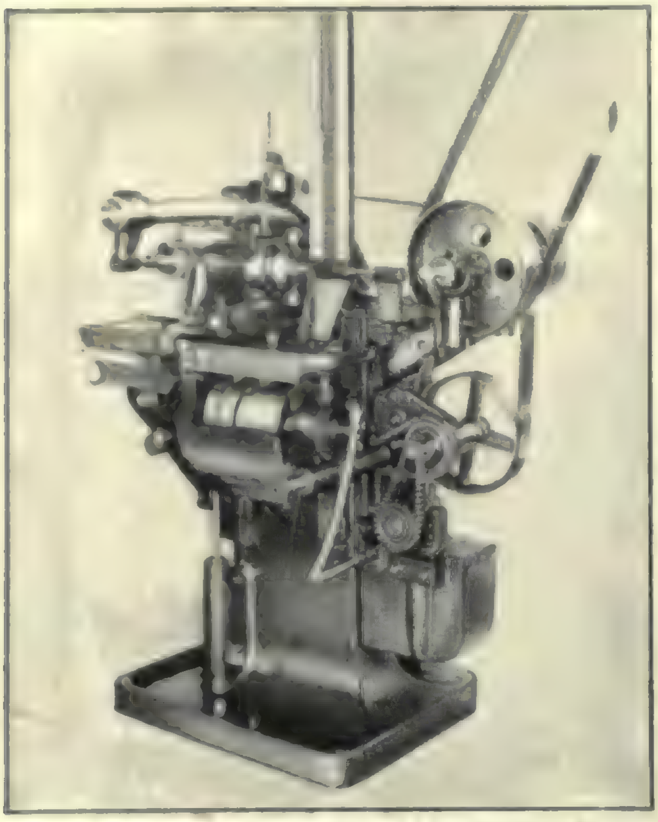
The unit is complete as shown in the illustration with gear, pinion and guards, but without the motor. It can be furnished to specifications to suit any standard make of motor from $\frac{1}{2}$ to 50 hp., and with gear ratios of 3, 4, 5, 6 or 7 to 1. Larger or smaller units or other gear ratios will be furnished upon order.



MOTOR BASE WITH SPEED-REDUCTION GEARING

"Standard" Automatic Milling Machine

The Standard Engineering Works, Pawtucket, R. I., has recently added to its line of milling machines a machine for automatically milling the squares on taps and other small work where a square is required. The machine, which is herewith illustrated, is fully automatic, having magazine feed and a mechanically opened and closed collet.



"STANDARD" AUTOMATIC MILLING MACHINE

Two cutters are used on the arbor to straddle mill the work. After the first pass the work is withdrawn from between the cutters and automatically indexed 90 deg.; and then the other two sides are milled. An adjustable work stop is provided which insures the same length of cut on all pieces of a lot. The work when released from the collet falls on an inclined screen on the table, from which it rolls into a chute which carries it to a box on the floor.

The drive is from a countershaft to the rear shaft of the machine by a 2½-in. belt. Power is transmitted to a jackshaft directly below the rear shaft, then through a silent chain to the worm and wormgear to the drum cam, which has a pathway cut to move the table.

The spindle is mounted in phosphor-bronze bearings with means provided to take up any wear which may occur. It is driven by a 3-in. belt from the rear shaft. A crank is provided by which the machine may be turned over by hand when setting up. One man can operate three machines, as all that is required is to keep the magazines full. The normal production on ⅜-in. stock is stated to be 500 pieces per hour per machine.

Oil is supplied to the cutters by a chain-driven geared pump running at a constant speed. The tank is located at the rear of the machine and the oil drains from the table through flexible hose back to the tank. The tank has two compartments divided by a fine mesh screen, so that only clear oil is drawn into the pump. One collet, a countershaft and wrenches are furnished as regular equipment. With the equipment, the weight of the machine is 1,200 lb. The floor space occupied is 27 x 38 inches.

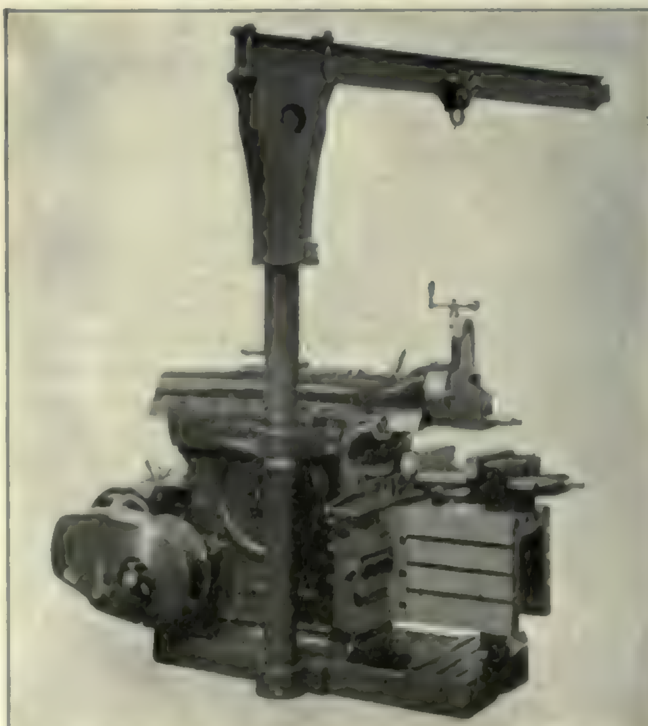
Gould & Eberhardt Jib Crane for Shapers

A jib crane to facilitate the handling of heavy work in and out of the vise of a shaper has recently been developed by Gould & Eberhardt, Newark, N. J. The crane eliminates the use of overhead traveling cranes for this work, and is intended especially for railroad shops, steel mills and industries where heavy work is handled.

As can be seen by the accompanying illustration, the crane is attached to the frame of the shaper in two places, and is located on the side of the machine opposite that on which the operator stands. Since the machine is driven directly by a motor and no belts are in the way, the crane can be revolved completely around. The crane will handle the maximum weight of work that the machine is capable of doing.

The mast is made of heavy wrought-steel pipe and securely clamped to the frame of the machine. The boom is an I-beam of sufficient strength to carry 1,000 lb. at its outer end. A trolley for carrying a chain block or motor hoist runs on the boom. A cap attached to the mast carries a ball and socket type of bearing, on which the cast-steel upper pintle rests. The boom is thus properly aligned at all times, so that it can be swung with but slight side pressure.

The machine itself has all levers within easy reach from the operating position, so that the operator can start and stop the machine and still remain close to the work being done. It has single-pulley drive and a selective-type gear box, with heat-treated steel gears running in oil. Eight changes of speed, ranging from 9 to 115 strokes per minute, are available.



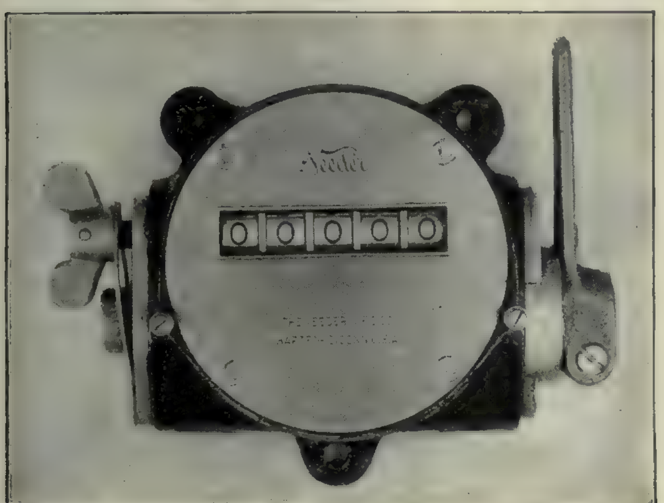
GOULD & EBERHARDT JIB CRANE ON SHAPER

Veeder Heavy-Case Reset Ratchet Counter

The Veeder Manufacturing Co., Hartford, Conn., has recently brought out the stroke counter herewith illustrated, under the name of the Veeder heavy-case reset ratchet counter. The device is especially applicable to heavy presses and other machinery where it is subjected to severe strains from rough usage, vibration or careless handling. The case is extra heavy and the counting mechanism of unusually rugged construction.

The figure wheels are of large size, enabling the dial to be read with ease from a distance of 10 ft. or more. A substantial stop limits the movement of the operating lever to the amount necessary to register on the dial. The lever is adjustable upon the stem and may be set in any desired angular position. A sealing screw of special construction fastens the dial to the case and prevents unauthorized tampering with the reading.

One complete turn (or less, according to the position



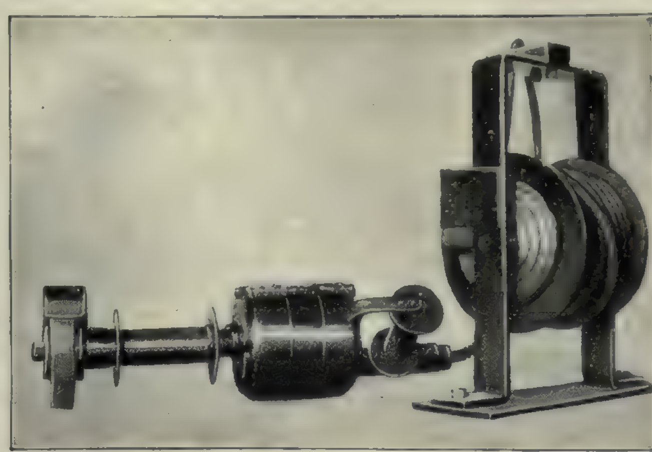
VEEDER HEAVY-CASE RESET COUNTER

of the figures) of the wing nut on the side of the case opposite the operating lever immediately returns the reading to zero. The counter is ordinarily provided with a five-figure dial and reset as shown in the illustration, but it can be furnished if desired with a six-figure dial by omitting the resetting feature.

Forbes & Myers Reel for Portable Electric Grinder Cord

The accompanying illustration shows a reel that has recently been developed by Forbes & Myers, 172 Union St., Worcester, Mass., for holding the flexible cord that is attached to a portable electric grinder or drill. These tools are ordinarily connected to a light socket by means of a flexible cord which is allowed to drag over the floor as the operator moves from one position to another, so that the cord frequently receives injury from being walked on or catching on sharp projections. Preventing the cable from dragging on the floor greatly increases its life.

In the reel there is a spring strong enough to wind up the cable and keep it off the floor, but not strong enough to annoy the operator as he uses the tool. The reel is adapted to use with different types of portable electric-driven tools, but is regularly furnished as shown herewith with the Model 35 portable electric grinder, together with 35 ft. of flexible cable. With the



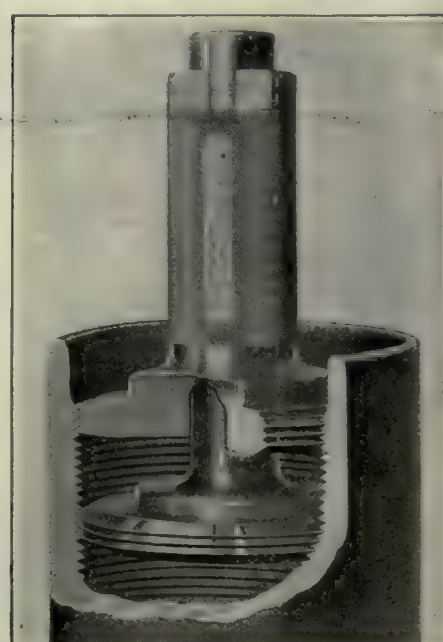
FORBES & MYERS REEL FOR PORTABLE GRINDER CORD

reel placed centrally in a room, either on the ceiling or on a column, the length of cable is sufficient to reach with the tool practically all positions in a room 60 ft. square.

Four wires are incorporated in the cable. Three of them are for the three-phase current which is ordinarily obtained from the lighting circuit. The fourth wire is a ground wire connected to the frame of the grinder and also to the frame of the reel. When the frame of the reel is connected to a water pipe or other permanent ground, danger to the operator from electric shock is minimized.

Pratt & Whitney Double Plug Pipe-Thread Gage

The accompanying illustration shows a gage recently placed on the market by the Pratt & Whitney Co., 111 Broadway, New York, N. Y., for measuring the taper of inside pipe threads. In use, the inner plug is first screwed down into the thread by hand, and is then followed by the outer plug, both parts being set tightly by hand. The witness line on the inner gage should come opposite the zero line on the graduated upper end of the handle. Variation from the true taper can be read directly on the scale. As marked on the handle, each division represents a variation of 0.002 in. in the pitch diameter in a length of 2 in., this length being the distance covered by the gage. The method of marking enables very rapid reading of the error in the taper.



P. & W. DOUBLE PLUG PIPE-THREAD GAGE

News Section

Coffin Foundation Fund Announced

For encouraging and rewarding service in the electrical field, the General Electric Company has set aside a fund of $400,000, to be known as the "Charles A. Coffin Foundation," the income from which will be distributed each year in prizes to its employees, recognition to lighting, power and railway companies for the improvement of service to the public as well as fellowships to graduate students and funds for research work at technical schools and colleges.

The foundation will be controlled and administered by a committee appointed by the board, which will distribute the $20,000 income as follows:

First—Eleven thousand dollars in prizes for the most signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art.

Second—A gold medal, to be known as the "Charles A. Coffin Medal," will be awarded annually to the public utility operating company within the United States which during the year has made the greatest contribution toward the use of electric light and power for the convenience of the public. The company receiving the medal will also receive $1,000.

Third—A similar medal to the electric railway company within the United States which during the year has made the greatest contribution toward increasing the advantages of electric transportation for the convenience of the public. The company receiving the medal will also receive $1,000.

Fourth—Five thousand dollars is to be awarded annually for fellowships to graduates of American colleges and technical schools who, could, with advantage continue their research work either here or abroad, or some portion of all of the fund may be used to further the research work at any of the colleges or technical schools in the United States.

The foundation was created by the company as an expression of appreciation for the work of Charles A. Coffin, who, up to May 16 last, was head of the General Electric Company.

Car Shortage Shows Decrease

A decrease of 16,262 cars in the shortage of freight cars on November 15, compared with that on November 8 was shown in reports received today by the Car Service Division of the American Railway Association from the rail carriers of the country. The demand for cars in excess of the current supply on November 15 amounted to 1[illegible] cars, compared with 174,498 one week prior to that time.

The shortage in box cars totaled 82,523 on November 15, a decrease of 7,721 within a week, while the shortage in coal cars amounted to 42,827 cars, 2,702 fewer than on November 8. A decrease within the week of 4,130 was reported for stock cars, the total shortage amounting to 15,856. The shortage in refrigerator cars totaled 8,519, a decrease since November 8 of 2,264, while there also was a decrease within the same period of 69 in the shortage in coke cars which brought the total to 270 cars.

Reports filed with the Car Service Division also showed that at the same time there were 4,945 surplus freight cars of all classes and in good order scattered throughout the country on November 15.

Conference on Radio Standardization

The Bureau of Standards of the Department of Commerce has called a conference on radio standardization to be held on Friday, January 12, 1923, in New York City. The desirability of calling a general conference on radio standardization has been apparent in many ways, and this call is issued by the Bureau of Standards at the specific request of the following associations and organizations: Institute of Radio Engineers. National Radio Chamber of Commerce. Radio Apparatus Section, Associated Manufacturers of Electrical Supplies. National Retail and Dry Goods Association. American Radio Relay League. Radio Corporation of America.

The purpose of the conference is to consider broadly (1) whether a formulation of standards for radio apparatus and service shall be made, (2) if so what general classes of apparatus or service should be included, and (3) what procedure shall be recommended for carrying out the conclusions reached by the conference. If the conference decides that radio standards should be formulated, it is expected that they will be prepared with special consideration of the wide range of interests which are concerned with the subject, and that these standards may ultimately be adopted with the approval of the American Engineering Standards Committee as an American Standard.

Southern Iron Industry in Full Swing

The Southern Metal Trades Association advises that practically all furnaces now are operating in the Alabama district, and that a great majority of furnaces throughout the South now are again in production, with tonnage as a whole for the entire district larger than it has been in almost three years. Extremely large tonnage orders are being received, and pig iron sales over the South are picking up steadily from week to week. Alabama district prices remain practically unchanged, ranging from $27.50 to $28.50. Considerable reductions in stock have been noted the past five or six weeks due to the large demand.

Class 1 Railroads Report Decrease in Earnings

Incomplete reports just filed by the railroads with the Interstate Commerce Commission show that 102 class 1 roads having a total mileage of 137,506 miles, had a net operating income in October of $51,761,300. This compares with $65,548,900 for the same roads in October, last year.

Operating revenues for the 102 roads totaled $332,952,900, an increase of 1.8 per cent above those for the same roads in October, last year, while operating expenses amounted to $261,070,300, an increase of 7.6 per cent above the same month in 1921.

Fifty-three roads in the Eastern district, representing a total mileage of 46,362 miles, had a net operating income in October of $23,579,900, compared with $30,565,500 for those roads in October last year.

Weights and Measures Men Meet December 8

The annual meeting of the institute will be held on Dec. 8, 1922, at 2 p.m. in Assembly Room No. 3 of the United Engineering Society Building, 29 West 39th St., New York City. The president will review the general situation affecting the activities of the Institute and make suggestions for the coming year.

A special feature of the occasion will be an address by A. G. Christie, professor of mechanical engineering, Johns Hopkins University.

New Locomotive Works for Poland

According to a report received from Poland, H. Cegielski of Posen, proprietor of extensive machinery works at that place, will start the erection of a third Polish locomotive manufacturing plant in the early part of next year. Largely interested in this new works is the well-known Belgian firm of Cockerill at Seraing in Belgium. Meantime the Polish Railway administration has placed an order for 100 locomotives with the above named Cockerill works, these engines to be delivered in the course of the year 1923. The construction of quite a number of important engineering plants is under consideration, Poland thus offering quite a market for machinery and tools.

First Radio Exposition

The first American radio exposition will be held in Grand Central Palace December 21 to 30. To date fifty manufacturers making radio apparatus have contracted for space, and these include the most important firms in the country. Added to what these makers will have to contribute, there will be various features from other sources to make the exposition a most interesting one.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

ABOUT 60 years ago in an essay upon the United States, the great English economist, John Stuart Mill, said in effect that "the American people when confronted by a grave economic question have often seemed upon the point of answering it wrongly but their common sense has in the end prevailed and they have *acted* wisely."

The history of the United States since Mill made this observation has justified his confidence in the ultimate economic sanity of the people. The greenback movement, the free silver movement and various other economic heresies that have from time to time been popular have each died a natural death when it came to a final show down, and there seems to be every probability that the ghosts of radicalism by which the stock market has been so much scared since the election will soon be dissipated as by discussion the sunshine of common sense and intelligent self interest is directed upon them.

This at least seems to be the sober second thought of the American financial world and as a result the security markets have been stronger and their tone at the end of the week was distinctly better. There is no reason why a sound investment security should not be worth as much now as when it was selling 10 points higher. The value of the property which it represents is in most cases greater. The prices of commodities have not wavered, reports from industries and corporations have continued favorable, dividends in some cases have been increased and in others resumed after long lapses, and prosperity is widely advertised by the continuing distribution of corporation surpluses in the form of stock dividends. There is no doubt that an autumn trade of impressive volume is being carried on at reasonably profitable prices.

Money is, moreover, slightly easier and business men are mostly optimistic. These facts have been obscured by the political clouds coming out of the West, but they are becoming manifest to all who realize that few radicals live up to their promise once they get to Washington, and the indications seem to favor a gradual recovery in the stock and bond markets as investors regain confidence and commence to look for bargains.

The seasonal demand for money has apparently passed its peak. Interruptions in the heretofore continuous increase in the bill holdings of the Federal Reserve System have been reported and commercial loans of member banks have been declining fitfully since the middle of October. Our banking resources are so far in excess of the needs of commerce that interest rates are likely to decline again and surplus banking funds, as in the past, are likely to find their way into good securities which yield more than the going rate for money.

In the commodity markets no sensational movement of prices has taken place. Sugar advanced quite sharply. The Cuban stocks of old crop sugar are now completely exhausted but the new crop will be soon available and it is possible that its impact will cause a temporary decline.

Rubber is up to 27 cents as the prospect of co-operation in the control and limitation of supply becomes more definite. Cotton is quiet as the market waits for the Government estimate due December 12th, but the figures, whatever they may be, will not change the facts of supply and demand, which seem fairly equated at the current price level.

Hides have reacted slightly after a prolonged advance, but wool has been climbing higher almost every day for many months and no one in the trade seems to expect an early decline. The much discussed lagging of prices of agricultural products, which is held up as the chief obstacle to trade expansion, does not greatly affect cotton or wool, and the advances in grain and livestock have narrowed the price spread between the various groups of commodities more than has possibly been realized. As long as there is no unemployment and wages continue high further declines in commodities are not to be expected, and if the efficiency enforced by competition keeps down the costs of distribution and merchants do not unwisely force up prices by endeavoring to recoup all their inventory losses in this one season continued good trade seems to be assured.

Railroad earnings for October were somewhat disappointing. The failure of the roads to keep pace with the transportation needs of the country is clearly shown in recent figures of car loadings. Though more freight has been offered than at any time in the history of the country the roads have at no time succeeded in carrying as much as they did in the fall of 1920, and traffic congestion has increased the burden business has had to carry.

The intention of the Farm Bloc to force the much needed reduction in freight rates is therefore announced at an unfortunate time, for public opinion will favor some constructive action looking toward cheaper and more efficient transportation rather than arbitrary rate slashing, and in such action the compulsory consolidations contemplated by the law will occupy first place. These consolidations are therefore likely to become important stock market influences as time goes on. All industries are caught in more or less degree between the mill stones of high labor and material costs and the natural resistance of higher prices, and many of them are taking the merger route to effect savings in production and gain greater competitive power. The absorption by Bethlehem Steel of Midvale and Cambria,—providing the Federal Trade commission does not interfere—and the contemplated packers' merger are cases in point. Nor do I think the tendency should be discouraged. From big and open consolidations the public has much to gain and nothing to fear, because they can be quickly destroyed when they become oppressive.

The ship subsidy has passed the House, but it has been vitiated by the amendment which practically compels its renewal every year by Congress and there is small chance that it will pass the Senate. It will not be as much of a loss as believed by its supporters, who have been viewing its defeat through rose-colored glasses, and with the Government's income dropping off steadily its defeat will be a relief to tax payers.

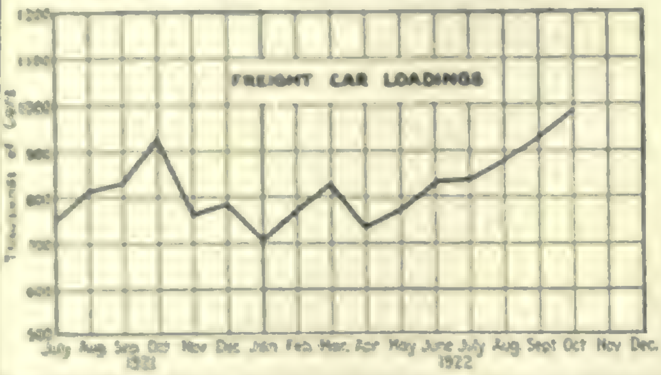
From abroad there was little significant news during the week, though the experiment of the Greeks in executing a few of the leaders who guided them to military disaster must be set down as worth attention and some may consider it a progressive step. The volume of German paper money is increasing so fast that the process threatens to become multiplication instead of addition, and it is only a question of time before the worthless mark is replaced by foreign currency. The reflections of Germany's weakness are apparent in the unsteady undertone of the foreign exchange markets, where further declines, except in sterling, are rather widely expected, and in the virtual cessation of the flotation of foreign loans in this country.

Postal Receipts Show Business Recovery

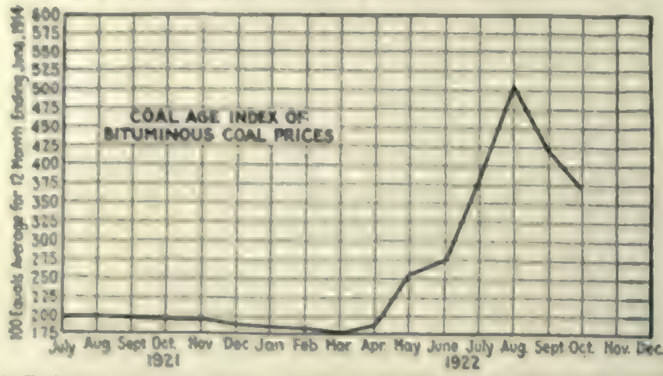
Present business recovery is reflected in United States postal receipts according to the National Bank of Commerce in New York. A review of these receipts for the past three years shows, furthermore, that they provide an index of both seasonal and cyclical variations in commercial activities.

"Reports from fifty representative cities throughout the country, covering the period from January 1920 to October 1922, evidence striking similarity in general seasonal trend," says the December number of the bank's magazine, *Commerce Monthly*. "Receipts are high in the early months of each year, reflecting spring trade. They decline with midsummer dullness and rise again with the coming of fall trade. They reach their peak with the arrival of Christmas activities.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railway Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



FREIGHT car loadings mounted up rapidly during October with an average weekly loading of 992,219 cars for the month as compared with 936,386 in September. Beginning with 968,169 cars loaded for the week ending Oct. 7, there was a rapid increase each week, the loadings reaching 1,014,480 cars for the seven-day period ending Oct. 28, the highest point attained since 1920. Heavy loadings of coal, grain and merchandise were the features of the movement, only the serious car shortage preventing, doubtless, the highest loading mark ever recorded in American railroad history.

Automobile production for October recovered much of the ground lost during September, a total of 217,098 cars and 21,416 trucks being produced as against 187,128 and 18,656 respectively. As compared with October, 1921, there was an increase of 82,364 in cars and 8,603 trucks produced. The October production brings the total car output for the ten months of 1922 up to 1,913,439 and the truck output up to 200,302. The re-opening of the Ford factories and an adjustment of the coal situation were factors largely responsible for the increase over September. Production schedules for November indicate an output close to that of October.

Bituminous coal prices, as indicated by *Coal Age* index, continued their downward movement during October from the high point reached in August. The index for October was 370 as against 412 in the month previous, the spot prices for the same periods standing at $4.48 and $5.08 respectively. Continued mild weather during the month, a shortage of cars and a lack of demand for steam coal have been contributing factors in causing the price decline.

Comparative Prices of Shop Supplies

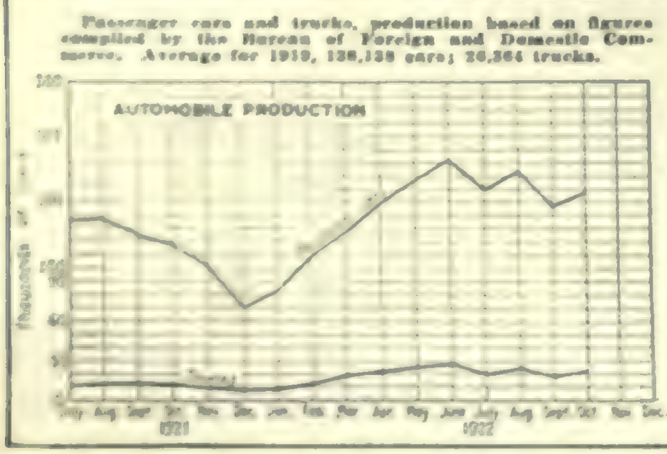
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.......	$0.0295	$0.0295	$0.0273
Cold finished shafting.......	per lb.......	0.0378	0.0378	0.0373
Brass rods.....	per lb.......	0.171	0.1700	0.15
Solder (½ and ½)	per lb.......	0.24	0.23	0.20
Cotton waste..	per lb.......	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.	per 100......	3.11	3.11	....
Lard cutting oil	per gal.....	0.59	0.575	....
Machine oil ..	per gal.....	0.36	0.36	....
Belting, leather, medium....	off list......	[illegible]–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list......	55% @[illegible]	50%@ 65–10%	50%@ 60–10%

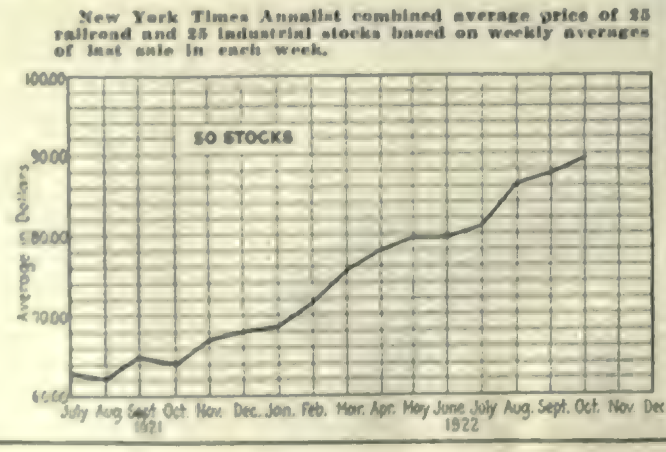
Share markets in New York, as reflected by daily compilations made by New York *Times Annalist*, show a continuance of the upward movement during the month, the average price of 50 stocks, 25 rails and 25 industrials, reaching $89.88 as against the September average of $87.85. The high point during the month was reached on Oct. 21 with an average of $91.32 from which mark prices declined to an average of $88.37 on Oct. 28. Industrial stocks continue to lead the upward movement, more particularly the railway equipment issues, all of which have booked a large volume of business.

Skilled metal workers are scarce and rates are high. In the New York district tool makers are being paid 75, bench hands and lathe hands 60 cents per hour. Philadelphia reports a range of rates which is wider and somewhat higher, toolmakers receiving from 60 to 90, bench hands 50 to 85 and lathe operators 50 to 90. The Detroit district range for toolmakers is between 75 and 80, bench hands 50 to 55 and lathe operators 70 to 75 cents per hour. Cleveland reports show toolmakers' rates ranging between 50 and 75, bench hands between 40 and 60 and lathe operators between 35 and 65.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Business Conditions in England

General Outlook Brighter—Collapse of Germany and Taxation Retards Recovery—Machinery Industry Slightly Improved

By OUR LONDON CORRESPONDENT

DURING the last few weeks, industrial affairs have been pushed aside in Great Britain by electioneering, and "the revolt of the under-secretaries" has brought about a position in which, as is usual, political affairs have been held of greater importance than more direct efforts to improve the economic position. It is, however, at last quite generally recognized that trade cannot be talked up and anyone who expresses the opinion that conditions are improving is usually now ready to put but a modest estimate on the immediate value of that improvement. We are learning very frequently and quite effectively that we are over-burdened with taxation, and that until this load is lifted real improvement cannot be expected. Colonel O. C. Armstrong, until recently the president of the Federation of British Industries, has expressed the opinion that the outlook is rather brighter than it has been during the past 18 months, but he went no further than to suggest that there are slight signs of revival in a certain number of industries. Few will assert that engineering and shipbuilding are among these; in fact it is sections of the textile trades and the coal trade that offer the most encouragement to optimism.

Effect of the German Collapse

We are now as a body perceiving what the collapse of Germany must mean, and have recently been told that, with Russia out of the market and Germany and Austria in the same position, we have lost some 12 per cent of our total export trade as done in the year before the war. It will be obvious therefore that even with the same population and the same standard of living it is necessary for us to find markets equivalent to those mentioned, and the suggestion is that, to effect the compensation, we should look to South America and the Far East. The latter area has in fact sent a number of enquiries of late, particularly for metal products. It has been urged that the British Colonies might take the place of the lost markets. But they have always been good customers, and their purchasing power for British goods, considering the unit of population, is much higher than that of our European markets. At the same time the total population, and therefore the total potential demand, is by no means comparable, and if Canada, Australia, New Zealand, and British South Africa are all regarded as a single market the population concerned is not equivalent to more than say three Londons.

Our figures relating to unemployment have been somewhat variable of late, but, after a setback of a few weeks, improvement is again being reported. Any movement of wages rates is nearly always a decline and so far during the year the official reports indicate a net reduction approaching four million pounds in the weekly wages of about seven and a half million people, any increases being almost negligible. The general percentage of unemployed trade unionists is more than 14½, the percentage of unemployed workpeople insured under the State scheme being nearly twelve. Although these figures indicate a condition which is bad enough, engineering as a whole is in worse case. According to a recent report of the Amalgamated Engineering Union, nearly 80,000 were unemployed or close on 25 per cent of the membership. Since the Armistice a sum of 281¼ million pounds has been expended officially on unemployment relief, one way and another. Even the undertakers are complaining: one such person included in the reasons for his business failure "bad trade caused by the prolonged low death rate."

Improvement in Steel Market

The latest report of the London iron and steel market suggests a slight improvement, with, to take one item, brisk business in the sheet steel market; but as regards stainless steels, while their applications are being extended attempts towards an increased rate of production are hampered by difficulty in obtaining greater supplies of chromium. Some of the home railways have been ordering rails and rolling stock. Also it is reported that orders are being placed for wagons by private traders for the first time since the de-control of the railways. In shipbuilding there has been some slight improvement and the practically depleted slipways, etc., of Vickers, Ltd., Barrow, will soon be partly occupied in the production of a 20,000-ton passenger liner for the Orient Company, with oil-fuel boilers and turbines driving through single-reduction gearing. Some measure of revival is expected in shipbuilding generally, as soon as wages have been re-adjusted. The Armstrong-Whitworth combination have obtained a contract for a floating dock at Southampton, the largest ever projected; its length will be nearly 1,000 ft., so that it will readily accommodate the "Majestic," which is 912 ft. long with a gross tonnage of 56,000. More than 20,000 tons of steel will be required and the work will occupy about eight or nine months. The dock is being constructed at the firm's shipyard at High Walker on the Tyne. Their old shipyard at Elswick is now occupied mainly by the locomotive works and pneumatic tool, small oil engine and other factories.

Boiler Makers Show Prosperity

In common with some other firms, Armstrong-Whitworth have secured orders for locomotives for India. The locomotive industry is not particularly flourishing, and in order to secure orders some very low prices have been quoted; in fact one firm has decided not to quote again until their competitors have sufficient work in the shop to prevent this practice of cutting. Whatever may be the case with other boiler-makers, Babcock & Wilcox, Ltd., continue prosperous, and have apparently placed their dividend on a regular 16 per cent basis, the reserve amounting to nearly two million pounds. Getting down to smaller items, for some reason or other, ball-bearing firms have been doing better of late.

Developments in air travel may be recorded, viz., the opening of the line from Manchester through Croydon, near London, to Rotterdam and Amsterdam, the journey occupying about four and a half hours. Extensions through Hamburg to Berlin are in contemplation, thus doubling the time of the journey.

How our automobile industry is handicapped by taxation, as compared with your own, was mentioned in the course of the annual dinner of the Society of Motor Manufacturers and Traders, when it was stated that per vehicle the average taxation on your side is £2, 8s. whereas on this side it works out at about £18, 17s. per annum. The society, by the way, will be exhibiting at the British Empire Exhibition of 1924, and a marine motor exhibition which will be held in 1923. The fortunes of the automobile industry have usually been thought to depend markedly on the result of the London Show; but some of its participants are becoming vocal on its excessive cost. According to a recent estimate our automobile production capacity is four times the home absorption capacity—hence the need for exports in this line.

Of the machine tool industry it will be sufficient to mention that some of the locomotive building firms have made extended trials with the oxy-acetylene cutting process for shaping frame plates on machines of planer type. A Gateshead maker of grinding machines has recently, by means of segmental blocks, removed by surface grinding 23 cubic inches of cast iron per minute and even more.

Westinghouse Ships Big Order to Chile

The third shipment of electrical equipment for the Chilean State Railway, consisting of six complete electric locomotives, the largest shipment of electric locomotives ever made, recently left the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Co. The shipment was valued at $700,000 and represented a partial fulfillment of the $7,000,000 contract awarded the Westinghouse International Co. by the Chilean State Railways.

Thirty-nine electric locomotives, 15 for road freight service, six for express passenger service, 11 for local passenger service and seven for switching service, are to be built by the Westinghouse Co. for the Chilean Railways. The six locomotives in the recent shipments are of the road freight type and weigh approximately 103 metric tons each. They are capable of maintaining an average speed of 35 miles per hour when hauling a 770 ton train on any part of the line between Valparaiso and Santiago, except the Tabon grade.

Washington Notes

By Paul Wooton

The Supreme Court has denied a petition for a writ of certiorari sought by Clarence E. Reed and the Reed Roller-Bit Company to review the decision by which the lower courts held for the Hughes Tool Company in the latter's claim that a patent was valid for an hydraulic force-feed lubricator employed with a rotary roller, oil-well drill-bit.

The Supreme Court has denied a writ of certiorari sought by the Pyle-National Company to appeal from the decision of the lower court dismissing its suit against the Oliver Electric Manufacturing Company alleging patent infringement of parts adapted for use in the Pyle locomotive headlight. The denial was on the ground that the petition was filed too late. The lower courts held that there was no infringement as the use of the parts from the Oliver company came within the repairs classification and that the headlight as a system was not duplicated. The Pyle-National Company had contended that only parts made by it were suitable for replacements.

The wage board at the Washington Navy Yard is understood to have recommended a reduction of one cent an hour in the pay of machinists. Under the present scale machinists are receiving 73 cents an hour. This reported action has brought forth a storm of protest from the machinists who are employed at the Navy Yard who contend that the board, under the law, must recommend an increase to 87.5 cents per hour, which they say is the rate of pay in private industry in the Washington region.

Legal Penalties Not Included in National Safety Codes

Clauses relating to legal penalties or to methods of enforcement will not be included in the safety codes approved by the American Engineering Standards Committee. This policy was established at a meeting of the A. E. S. C. in New York on Oct. 20.

This action was taken on the suggestion of the Safety Code Correlating Committee, which acts in an advisory capacity to the American Engineering Standards Committee.

It is the feeling both of the men engaged in the furtherance of standardization in industry and of practically all state officials that legal penalties for failure to conform with established state safety codes and methods of enforcement can best be decided by each state for itself.

Swedish Railways Try Motor Cars

Early in November the Swedish State Railways received the first three motor cars from a German firm at Kiel, to be tried on several sections of the railroad. These benzine motor cars are built of steel, having at each end a driver's stand, and capable of carrying 75 passengers. A benzine motor of 160 hp. acts as propelling power and the greatest speed is 80 kilometers per hour.

Novel Clock Tells Daily State of Your Business

Included among twenty-five forms presented in a treatise on budgeting as a means of business control, issued by the Fabricated Production Department of the Chamber of Commerce of the United States, is a novel clock arrangement by which the small manufacturer can tell at a glance the daily state of his business.

Clocks, or dials, are devised for each of the principal activities of the business. Each clock has two hands, a red one, pointed at the budget allowance, which remains stationary for the entire month, and a black hand, which is daily set at the amount of money spent by each department. The dials can be arranged so that they can be conveniently contained in a flat box 2 in. deep, 24 in. wide and 50 in. long, designed for hanging on the wall.

The idea was conceived and put into operation by a manufacturer of optical goods, who found that his organization could be conveniently divided into the following five groups: Material, Factory, Administration, Sales and Advertising. The five executives at the head of these departments are placed into a business of their own and are told what the results of their month's activities should be, together with the amount of money they may spend to produce these results. The Sales Manager is told how much in orders he is expected to get to keep the factory running; the Factory Superintendent, how much goods he must get out and how much accounts receivable he must create to provide the funds necessary in the following month; the Purchasing Agent, how much material is necessary to keep a well balanced inventory and to take care of the plans of the Sales Department; the Advertising Department and Administration, how much money they may spend in carrying out these plans.

A copy of the pamphlet "Budgeting for Business Control" may be secured by writing direct to the Fabricated Production Department, Chamber of Commerce of the United States, Washington.

Manufacture of Steam and Electric Railroad Cars: 1921

The Department of Commerce announces that the census reports show a decrease in activities of establishments engaged in the manufacture of cars for use on steam and electric railroads during 1921, as compared with the year 1919.

In 1921 there were 105 establishments engaged in the manufacture of steam-railroad cars and the total value of their products amounted to $314,394,867, as compared with 99 establishments for 1919 with a total value of products of $538,222,831. The decrease in the total value of products was $223,827,964, or 41.6 per cent.

During this same period there were 10 establishments engaged in the manufacture of electric-railroad cars and the total value of their products was $14,856,068 as compared with 7 establishments for 1919 with a total value of products of $18,441,976.

Iron and Steel Markets in September

Canada was the largest purchaser of American iron and steel during September, according to the Iron and Steel Division of the Department of Commerce, taking 41,417 tons. Japan held second place with 22,328 tons. The shipmnets to other important markets were: Cuba, 7,656 tons; Mexico, 6,193; Brazil, 6,133; China, 5,689; United Kingdom, 4,306; Chile, 4,229; Argentina, 4,145; Chosen, 3,403; India, 2,909; Australia, 2,403; Colombia, 2,303; Philippine Islands, 2,224; Peru, 1,562; Rumania, 1,463; Venezuela, 1,304; Hongkong, 1,074; British South Africa, 979; and Panama, 978 tons.

The decline in total iron and steel exports which began in June continued through September. The total for the month amounted to 130,728 long tons, only 57 per cent of the exportation during May, which is the record month of the year, and a drop of 11 per cent from the August figure.

Total exports for the first 9 months of 1922 were 1,597,204 long tons, composed principally of steel rails, black steel sheets, iron and steel bars, and rods other than wire, and boiler tubes.

Further Decline in Structural Sales

A marked seasonal decline in the sales of fabricated structural steel in October is announced by the Department of Commerce from reports made to the Bureau of the Census. October sales amounted to 54.9 per cent of shop capacity, compared with 61.6 per cent in September.

Reports received from 140 identical firms from April through October, with a shop capacity of 221,790 tons per month, show the following actual tonnages booked each month and the percentage of shop capacity represented by these bookings. A revision of these capacities in accordance with a uniform standard is now being undertaken by the Bureau of the Census but the results are not yet complete.

	Tonnage Booked	Per Cent of Capacity
April	191,05	86.5
May	172,260	77.7
June	153,278	69.1
July	141,907	64.0
August	143,515	64.7
September	136,587	61.6
October	121,763	54.9

Austro-Russian Industrial Syndicate Formed

A number of well known Austrian machinery companies, including the Linz Locomotive Works of Linz, the Austrian Arms Factories of Steyr, Ltd., of Steyr, and Brevillier & Urban have formed a syndicate with several Russian firms for the purpose of marketing the Austrian product in Russia as well as to establish new factories in Russia. All kinds of machinery and tools will be made and sold, and special interest will be paid to agricultural machinery for which there exists a tremendous demand all over Russia, and especially in the Ukraine and the Caucasus. It will be well remembered that these districts were formerly very extensively supplied by American manufacturers.

Market for Machine Tools in Dutch East Indies

The markets in the Netherlands East Indies in 1921, says the Bureau of Foreign and Domestic Commerce, absorbed more than four times as much machinery as in 1911. During that period the share of this business secured by American manufacturers has expanded nearly 22 times, namely, from 264,000 guilders to 5,701,000 guilders (1 guilder=$0.402).

The following table is given from the statistics published by the government of the Netherlands East Indies, giving the returns for 1920 and 1921, and shows the machine tools and other machinery imported into the archipelago, as well as the principal countries of origin and the extent of the participation of each:

IMPORTS OF MACHINE TOOLS IN 1920 AND 1921

		Machine Tools	
		Value in Guilders	Per Cent of Total
United States	1920	865,165	6.7
United States	1921	890,370	19.4
Great Britain	1920	947,298	7.3
Great Britain	1921	517,441	11.3
Netherlands	1920	3,301,131	25.4
Netherlands	1921	2,279,957	49.7
Germany	1920	448,489	3.8
Germany	1921	740,958	16.2

IMPORTS OF OTHER MACHINERY AND TOOLS IN 1920 AND 1921

		Other Machinery and Tools	
		Value in Guilders	Per Cent of Total
United States	1920	3,908,266	25.7
United States	1921	2,372,946	12.7
Great Britain	1920	2,047,808	13.5
Great Britain	1921	2,521,888	13.5
Netherlands	1920	7,390,396	48.6
Netherlands	1921	10,145,387	54.5
Germany	1920	1,086,485	6.9
Germany	1921	2,634,318	14.1

American participation in the machinery trade of this archipelago is really much greater than the above figures would indicate, because the customs returns makes no allowance for trans-shipment cargo, and German, British, and American machinery shipped by way of the Netherlands would be credited to the latter country. Vast quantities of machinery are so shipped.

The sales problem for this territory, therefore, is complicated by the fact that large quantities of machinery for use in this archipelago are purchased in the Netherlands. Ordinarily it will be found necessary to arrange for sales effort in both the Netherlands East Indies and the Netherlands if a consistent program is to be developed for covering this territory. The Bureau of Foreign and Domestic Commerce can supply information regarding machinery dealers covering this territory.

The market in the Netherlands Indies is a very attractive field for sales effort for a number of reasons. In contrast with conditions in Europe, the exchange ratio is not very unfavorable and the fluctuations in exchange have settled down to narrow limits. Business is practically stabilized, and it would appear that these markets have escaped from the worst of the influences resulting from the war.

This territory is a very large one, extending a greater distance from east to west than the width of the United States and from north to south a distance comparing to that from Canada to the Mexican border.

Japan Importing Heavily from Germany

Japanese imports from Germany have been increasing and are now greater in volume than before the war, according to Japanese periodicals received by the Department of Commerce. For the year ended May, 1922, these imports amounted to 83,310,000 yen (1 yen equals $0.4985), an increase of 22,150,000 yen over the 1913 imports.

The amount of imports from Germany for the first five months of this year exceeded by some 35,000,000 yen that for the first five months of last year, and it is generally believed that this year's total will be over 100,000,000 yen, if the same rate of increase is maintained until the end of the year.

Bulgarian Imports of Steel and Machinery

The Bulgarian Government has just published the statistical returns for the year 1921, according to which the country imported 185,785,000 Lewa worth of machinery and 351,784,000 Lewa worth of iron, steel and manufactures thereof. The machinery imports consisted chiefly of agricultural machines and implements, all kinds of industrial machinery, machine tools and saw-mill machinery.

Compiles Five Foot Book-Shelf of Foreign Trade

The completion of a Selected Bibliography of Foreign Trade, 1922, in which are listed the leading authorities on various aspects of International Commerce, is announced by the National Foreign Trade Council, of India House, Hanover Square, New York, from whom copies can be obtained.

This Five Foot Book-shelf of Foreign Trade contains fifty titles dealing with training for foreign trade, the history and geography of foreign trade, the practical administration of an export business, and with all phases of ocean transportation.

Advice on Export Problems Offered by Experts

The organization of a Trade Adviser Service to act throughout the year as a medium for the interchange of experience on foreign trade problems, was announced today by the National Foreign Trade Council, India House, New York.

"This service," says O. K. Davis, secretary of the Council, "is intended to provide foreign traders with a confidential answer to those intimate, personal, or unusual problems which cannot be handled in a satisfactory manner through existing Governmental or private agencies. It will be of very practical assistance to foreign traders in improving the technique of export organization, sales methods, foreign advertising, commercial credits, traffic management and similar matters.

The general chairman of the Trade Adviser Service is E. P. Thomas, President, U. S. Steel Products Co.; A. E. Ashburner, American Multigraph Sales Co., is vice-chairman; and C. J. Warren, Remington Typewriter Co., is executive chairman.

Big Italian Steel Works Reorganized

Reorganization of the Ansaldo Steel Works is being effected by the formation of a new company, bearing the same name, having a capital of 200,000,000 lire divided into 1,000,000 shares of 200 lire, says Consul Leon Dominion, Rome, in a report to the Department of Commerce. According to press notices, the Banca Nazionale di Credito has subscribed for 1,250 shares, and the Gio, Ansaldo Co. for 998,750 shares. The new company has taken over the principal plants of its predecessor, among which are the Sampierdarena machine shops and locomotive works, Sestri Ponente dockyards, Borzon yards, Fegiano railroad car works, Campi cannon foundry, Delta steel works at Cornigliano Ligure, Campi electrical works, Multedo iron foundry, Cornigliano steel works and bronze and aluminum plants.

The purchase price of these establishments is stated to be 28,405,800 lire, and payment has been made to the old Ansaldo Co. by means of 142,029 shares of the new company. The new company furthermore assumes liabilities amounting to 40,261,339 lire on bonds issued for the account of the plants it has taken over and which are guaranteed by mortgages.

About 45,000,000 lire in bonds remains in the hands of the old company, which also retains its ownership in the Cogne mines, Aosta hydro-electric plants, Murlo lignite mines near Siena, Pa manganese mines near Sassari, Lauriano Po cement and lime factory near Turin, automobile factory at Turin, and dockyards at Voltri.

Commercial Travelers' Guide to South America

The new revised edition of the "Commercial Travelers' Guide to Latin America" has just been released by the Department of Commerce. It is an encyclopedia of the countries south of the United States. It is the only complete and up-to-date "Baedeker" for the traveler. Everything that a foreign representative should know is included within its 698 pages; salesmen's equipment, steamship routes and railroads, connections and rates, schedules of sailings, postal and cable services and rates, hotel accommodations in the various cities, restrictions on travelers, duties on samples and advertising matter.

Whether you may wish to reach Bogota or Barinas the little volume will tell you how to get there. Every Latin-American market is listed and described, and every city of any importance is fully covered. It contains suggestions and advice as to the best time of the year to visit certain countries, the best methods to be employed in covering a territory or approaching a prospective field. It is replete in sound advice to the uninitiated and helpful hints to the experienced traveler. This work is the result of years of careful tabulation, research, and first-hand study by Mr. Filsinger, assisted by a corps of experts of the Department of Commerce in Washington. The price is $1.25 prepaid and may be secured by application to the Superintendent of Documents, Government Printing Office, Washington, D. C.

Immigration Policy To Be Taken Up by Congress

With one bill already being whipped into shape, and a marked revival of interest by organizations concerned in the subject, it is probable that the question of a permanent immigration policy will occupy much more attention at the winter session of Congress than had been anticipated last summer when the temporary 3-per cent quota law was extended for two years.

The only concrete proposal that has made its entrance into general capitol comment thus far, and which it is understood is being drafted into a bill, is to replace the 3 per cent law with one permitting annual admission of quotas equal to 2 per cent of the foreign born residents of the United States according to the sensus of 1910, divided by nativity, and with the stipulation that an entire family of immigrants, regardless of its number, shall be considered as a unit. This stipulation naturally would increase the number admitted above the actual 2 per cent. Experts are studying immigration reports to determine just what effect this would have on the actual inflow.

The general sentiment of congress, however, appears to favor some form of selective immigration, coupled with a maximum limitation feature. There has been no definite centralization of ideas on this point, however.

It had been expected that determination of a permanent immigration policy would be left for the Sixty-eighth Congress, inasmuch as the temporary law now runs until June 30, 1924, but the subject is being agitated to such degree that action may be taken by the present Congress before it expires.

Business Items

The New Process Gear Co., Syracuse, N. Y., has sold the entire issue of $2,000,000 first mortgage 6½ per cent bonds to S. W. Strauss & Co., New York City.

The Stanley Rule and Level Co., New Britain, Conn., has begun work on a 60-foot addition to its forging department on Summer St., Southington, Conn.

The American Can Co. declared a dividend of 1½ per cent on the common stock. This is the first dividend on the junior issue since the company was organized in 1901. The dividend is payable Feb. 15 to stockholders of record Jan. 31. The regular dividend was also declared on the preferred stock.

The Charles E. McGill Machine Co., recently organized in Binghamton, N. Y., by Charles E. McGill, for several years president of the McGill & Holford Co. of that city, have started operations on Commercial Ave., where they will produce their line of textile machinery. Plans have been made for a modern factory to be erected during the coming year.

The Studebaker Corporation, in its report for the third quarter, shows a total production of 87,951 cars as against 58,163 in 1921. The total production for 1922 is expected to be about 110,000.

The Imperial Electric Co., Akron, Ohio, has completed a new foundry, and outside work in brass castings will be taken on, officials of the company announced last week. The new plant is the only oil burning foundry in Akron. Samuel B. Myers, formerly of Dayton, is now identified with the plant, having been connected with the Utah Copper Co. before going to Dayton.

The Langhaar Ball Bearing Co., Aurora, Ind., is now building a new factory and remodeling an additional shop adjoining the structure, the company's business having outgrown the present capacity.

The American Screw Co. directors have voted a fifty per cent stock dividend and have called a meeting of stockholders for Dec. 1 to approve the action. The company has now $3,000,000 stock outstanding and at the end of 1921 its surplus was $2,962,372.

The Waterbury Rolling Mills, Inc., makers of brass, bronze and nickel silver sheets, of Waterbury, Conn., has recently increased their capital stock from $200,000, to $600,000.

The Branford Brass Foundry Co., Inc., of Branford, Conn., incorporated a few weeks ago to engage in the brass foundry business, organized the past week by the election of the following officers: Hugh A. Cox, president; Frederick A. Ells, secretary; and Robert L. Rosenthal, treasurer.

The American Pin Co., manufacturer of brass goods, pins, etc., of Waterbury, Conn., has recently increased its capital stock from $600,000 to $1,500,000.

The Stanley Works, New Britain, Conn., manufacturers of rules, levels, etc., has recently purchased property on Elm Street, their city, from the New Britain Machine Co., and the Damon Coal Co. The property will be utilized for their own operations.

The Manufacturers' Association of Bridgeport, Conn., held their annual meeting during the past week, and elected the following officers for the ensuing year: George M. Eames, of the Singer Manufacturing Co., president; Summer Simpson, president of the Raybestos Co., first vice-president; T. Rice Davis, second vice-president; and R. G. Farrell, treasurer.

The Western Iron Stores Company, Milwaukee, Wis., John A. Camm, president, held a house-warming in its newly organized and arranged store, on Saturday, Nov. 25.

The Alexander Millburn Co., Baltimore, Md., has been appointed exclusive representative of the Wilson Welder and Metals Co., 132 King St., New York City, for its products in Maryland, Virginia and the District of Columbia. The company will carry in Baltimore a large stock of color-tint welding metals and plastic arc welding machines for distribution in that territory.

The Ford Motor Co. of Canada, according to reports, will let a contract in the near future for a new factory at Ford, Ontario, with a floor space of approximately 625,000 square feet and of one story steel construction. One of the features of the new structure will be the application of direct motor drive throughout instead of overhead transmission. It is expected that the new plant will be in operation by May or June of next year.

Personals

Charles S. Cole, president of the Premier Manufacturing Co., novelty manufacturers, etc., Sandy Hook, Conn., has recently been made president and a director of the W. & B. Douglas Co., manufacturers of pumps, of Middletown, Conn.

DALE D. BUTLER, secretary of the W. & B. Douglas Co., manufacturer of pumps, etc., Middletown, Conn., has recently been elected president of the Middletown Chamber of Commerce.

MARSHALL CUTTING, formerly with the Wickwire-Spencer Steel Corporation, of Worcester, Mass., has recently accepted a position with the Wiley-Bickford-Sweet Co., Worcester, as credit manager.

GEORGE R. WOODS, general manager of R. S. Stokvis & Sons, Inc., New York City, has returned from a business trip to his home office in Holland.

FREDERIC HAVEY, foreign sales and relations manager for the Saco-Lowell Shops, manufacturers of cotton and textile mill machinery, Boston, Mass., recently returned from the International Textile Machinery Exhibition, in Bradford, England.

W. B. ANDERSON, manager of the Boston branch office of the Barber-Colman Co., manufacturers of milling cutters, hobbing machines, etc., Rockford, Ill., has been appointed a member of the finance commission of Swampscott, Mass., for a period of three years.

GEORGE MACNOE, manager of the Boston office of W. B. Connor, Inc., has been recalled to New York to take charge of the contractors' sales department, handling heating and pumping equipment.

J. S. TOOHEY, formerly with the Wallace Tractor Co., Racine, Wis., is now with the Racine Tool and Machine Co., as chief engineer.

A. A. HELLER has taken over the management of the International Oxygen Co., Newark, N. J., in place of L. W. Hench, secretary and general manager, resigned.

C. G. BIGELOW, formerly associated with the American Sheet and Tin Plate Co., has been appointed chief mechanical engineer of Jones & Laughlin Steel Co., at their South Side plant to succeed M. W. Hale who resigned recently.

FRED C. SEVERIN, formerly with the Betts Machine Co., and B. H. TRIPP, for a number of years associated with the Chicago Pneumatic Tool Co., have formed a partnership to deal in used machine tools, with offices at 25 Church St., New York City.

CHARLES E. BEESON has been elected vice-president of the Pittsburg Steel Co. He has been connected with the company since 1901 and has served as a director and member of the executive committee.

W. C. REITZ, secretary and treasurer of the Pittsburg Steel Products Co., has been made a director of the Pittsburg Steel Co.

E. R. SMITH has been made vice-president of the Fitchburg Machine Works, makers of the Lo-Swing lathe.

L. F. CARLTON, for eighteen years connected with the Consolidated Press

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Nibbling Machine, Rapid

A. C. Campbell, Inc., Waterbury, Conn.

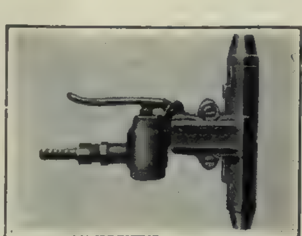
"American Machinist," October 12, 1922

The machine is for cutting irregular forms from sheet metal, celluloid, or fiber and is a small punch press that does its cutting by means of a cylindrical punch and die. The work may be pushed or pulled in any direction by hand, or the machine follows a templet attached to the sheet. The punch has a central pilot, and the ram is so set that this pilot does not at any time come above the surface of the work. Closed outlines may be cut. With an attachment, circles of any size up to 28 in. in diameter can be cut. The double-ended reversible punches are about $\frac{5}{16}$ in. in diameter.

Vibrator, Pneumatic, for Foundry Use

Malleable Iron Fittings Co., Branford, Conn.

"American Machinist," October 12, 1922



The vibrator or "rapper" is intended for use chiefly in the core-rooms of foundries for rapping core driers or core boxes when removing cores. It operates upon the principle of a pneumatic hammer, but is not intended to deliver a blow of any moment. It may be used anywhere that a supply of air under a pressure of 20 lb. or greater is available. It may be kept on the molding bench, so that it can be picked up as readily as a mallet and pressed against the work.

Casehardening Compound, "Nitrol"

American Kreuger & Toll Corporation, 522 Fifth Ave., New York, N. Y.

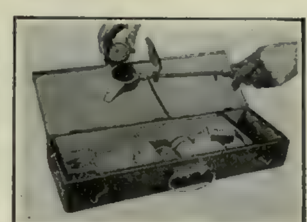
"American Machinist," October 12, 1922

The compound is a nitrogenous powder that can be employed for surface-hardening iron and steel under practically any condition. Rusty objects can be hardened as well as polished ones. The compound is furnished in two grades, Grade A being used for surface hardening and Grade E for pack hardening to depths up to $\frac{1}{16}$ in. The Grade A or sprinkling powder melts at 1,200 deg. F., and does not give off poisonous or obnoxious fumes. Cast steel or alloy pots similar to those employed for cyanide may be used. When carburizing in pots, the parts are packed with Grade E Nitrol and then heated in the usual manner up to 1,475 to 1,550 deg. F. for from three to eight hours. The parts are removed and quenched in the usual manner, either directly from the box or reheated to 1,425 deg. F. and quenched.

Soldering Iron, Heated by Chemical Action

International Sales Co., 921 Southern Bldg., Washington, D. C.

"American Machinist," October 19, 1922



The soldering iron does not employ heat from an outside source, but utilizes chemical reaction to bring it to the proper temperature. In a receptacle cast in the soldering iron is placed a small tin container holding the required mixture. The head of a special match is inserted through an opening, a perforated lid closed over the receptacle and the protruding match-end lighted. Instantly an intense white glow appears through the holes in the lid and the iron is ready for use. The heat from this application lasts about 10 min. The iron and a supply of briquets and matches are housed in a metal-lined box with a hinged lid and handle.

Toolholder and Interchangeable Cutters, Combination

Morris Tool Co., Inc., 30 Church St., New York, N. Y.

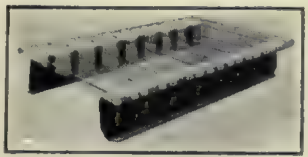
"American Machinist," October 12, 1922

At the cutting end, the holders have two projecting arms in which bolts hold the cutters. By turning the holder over and fastening the blade on the other side the height of the cutting edge is changed. Both straight and angle holders can be furnished. Each blade has two cutting edges. They are made for turning, cutting-off, threading and facing. It is merely necessary to grind the top slope when sharpening cutters. The large cross-sectional area provides for conducting the heat from the cutting edge, so that heavy-duty work can be performed. Holder sizes, twelve, from $\frac{1}{4}$ x $\frac{5}{8}$ x 4 in. to $2\frac{1}{2}$ x 3 x 24 in. Blade thickness: from $\frac{1}{8}$ to $1\frac{1}{2}$ inches.

Platform, Lift-Truck, "Steeleg"

Barrett-Cravens Co., 1328 W. Monroe St., Chicago, Ill.

"American Machinist," October 12, 1922



The top of the platform is made of wood and can be furnished from $\frac{3}{4}$ to 2 in. in thickness, depending upon the class of work for which it is intended. Flathead countersunk bolts fasten the boards to the steel legs or skids. The legs are made of heavy-gage flanged steel plate and have vertical ribs to prevent buckling. The upper flange has a wide bearing for the top, and a turned-up edge which protects the ends of the boards. The legs do not wear or shrink as wooden skids do, so that the truck can always be run under the platform.

Bearing, Roller, Radial and Thrust

Whitney Bearing Corporation, 467 E. Ontario St., Chicago, Ill.

"American Machinist," October 12, 1922

The rolling action is obtained in this bearing by means of cylindrical disks. The periphery of each disk is parallel to the axis, and the diameter is twice the thickness, regardless of size. Both conical surfaces of the bearing have the same angle. The rollers operate between parallel surfaces to eliminate the end thrust and friction occurring on tapered rollers. The load is transmitted to the face of the roller only in a direction perpendicular to the axis of the roller. The several series of rollers are carried in separate ring cages. The adjustment spring is automatic and keeps a uniform pressure on the bearing.

Indicator, Speed, No. 748

Brown & Sharpe Manufacturing Co., Providence, R. I.

"American Machinist," October 19, 1922

The indicator registers the number of revolutions of shafting, motors and revolving parts in either direction, and measures both high and low speeds equally well. The design of the indicator is different from that of the former models. The readings are taken on one side only. The device can be quickly set at zero and registers up to 5,000 revolutions by steps of five revolutions, although much faster speeds can be determined. The two arrows on the face of the dial indicate the figures to use for the different directions of rotation. The figures showing through the small round windows on the dial register steps of five revolutions directly. The small inside dial registers hundreds of revolutions. The fiber handle serves as an insulation for the operator against electricity. Three points are furnished, a steel point for ordinary speeds and rubber points for high speed.

Clip, paste on 3 x 5-in. cards and file as desired

Co., has been appointed Western sales manager of the V. & O. Press Co., designer and manufacturer of high grade power presses and sheet metal working machinery, Brooklyn, N. Y. He will make his headquarters at 549 Washington Boulevard, Chicago, where the company has established its office, and it is intended to carry a stock of presses in that city for immediate shipment.

Obituary

HEDLEY P. CARTER, vice-president, treasurer and sales manager of the H. C. Cook Co., manufacturers of sheet metal novelties and tools, Ansonia, Conn., died at his home in that city Nov. 19. Mr. Carter, who was 51 years old, and was very well known in manufacturing circles throughout the East. He came to the Cook Co., five years ago, from the Stanley Works, New Britain, Conn., with which concern he was associated for 16 years.

CHRISTIAN LOUIS BERGER, founder of and for sixty years actively engaged in the management of C. L. Berger and Sons Co., Boston, manufacturer of scientific instruments, died Nov. 19, at 80 years of age. Mr. Berger was born in Stuttgart, Germany, and came to America in 1862. He is survived by two sons, Louis H., and William A., both active in the management of the business.

HENRY L. KINSLEY, Wellesley, Mass., New England representative of the Warner & Swasey Co., machine tools, died Nov. 22, at the Natick Hospital, Natick, Mass., following an operation. Mr. Kinsley appeared on the road to recovery immediately after the operation, but on Tuesday serious complications developed. He was a native of Stoughton, Mass., and was born 68 years ago. Practically all his business life was spent in the machine tool industry. He represented the Warner & Swasey Co. with offices at Boston for more than 15 years, and probably was one of the best known machine tool men in the New England territory. Previous to his association with the company he was with the Fairbanks and the Manning, Maxwell & Moore companies.

Book Reviews

The Manufacture and Uses of Abrasive Materials. By Alfred B. Searle. One hundred twenty [illegible] pages, illustrated. Cloth boards. Published by Isaac Pitman & Sons, 2 W. 45th St., New York, N. Y. Price 85 cents.

This book is one of a series known as Pitman's Technical Primers. It is a brief, [illegible] book on grinding. [illegible] because it is elementary. [illegible] definitions of [illegible] metal by grinding [illegible] abrasive [illegible] abrasive and [illegible] of [illegible] and wheels.

No attempt is made to give elaborate descriptions and illustrations of individual grinding operations, nor are the practices of individual concerns cited. In that respect [illegible] the author [illegible] with explaining the various kinds of grinding machines and operations. Definitions are plentiful and well stated. On the whole, a valuable book.

Stores and Materials Control, including Procurement by Manufacture and by Purchase. By Madison Cartmell, Consulting Industrial Engineer. Four hundred forty-five 6 x 9 in. pages, with illustrations of report and record forms. Cloth boards. Published by the Ronald Press Co., 20 Vesey St., New York, N. Y. Price $4.50.

This book is characterized by its thoroughness and its clarity. The author did a hard job well and did not quit until he was through. In scope, the book is pretentious, undertaking to cover principles of materials control, procurement by manufacture, procurement by purchase, and the problem of what system to adopt. Yet when the importance of stores and materials control is realized, it is seen that the whole field, as chosen by the author, must be covered, in order to make a book sufficiently comprehensive for the needs of management. Such realization justifies the treatment of the general subject of the procurement and handling of materials, from the initiation of the order for their purchase of manufacture to the shipment of the finished product.

The first part, under the general heading "Introductory," treats of the problem of materials control and the organization of control.

Part two, "Principles of Control," takes up the records and mechanism of control, the stores record form, pricing the stores records, operating the stores records, classification and symbolization, symbolization of cost records, the costing of orders, control of inventory, standards and specifications, arranging and equipping the storesroom, stowing material, taking inventories, organization of the materials control department.

The third part, "Procurement by Manufacture," includes the subjects of organization of the production control department, graphic production control, operation of production control mechanism.

Part four, "Procurement by Purchase," tells of the function of the purchasing department, the article, the market, seller and buyer, the price, the written contract, effecting the delivery, the completion of the purchase contract, some legal aspects of purchasing, organization and personnel.

Part five, "Adopting a System" explains systems, records and forms.

While the subject of materials control has been explained as it applies to both large and small organizations, it is treated more particularly from the viewpoint of the large plant. That viewpoint was taken because the author believes that "basic principles apply to both classes alike," and that "the only safe policy for the small plant that is to hold its own lies in simplifying and adapting the methods tested out in the big plant and found essential to sound operation, without slurring over or emasculating them."

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Electric labor-saving devices, fractional horsepower electric motors, electric lamp shades and fittings, wireless sets and appliances, felts of all kinds, canvas, duck, and leather cloth, linoleums, automobile-hood cover materials, pressed and molded glassware, glass lamps, chimneys, tools, emery, flint, and glass paper, general hardware, especially patented hardware—Australia. Agency desired. Terms, cash against documents. Reference No. 4432.

Electrical supplies, such as lamp cord, fixtures, glassware, electric globes, motor appliances, heater appliances, insulators, dry and wet batteries and specialties—Peru. Agency from manufacturers desired by representative in the United States. Reference No. 4439.

Steam engine of 50 horsepower, to be supplied by an existing English water tube boiler with pressure of 120 pounds; also punching and slotting machinery; high-speed machine lathes; band saw for steel, leather, and wood; and small furnace for iron and brass foundry with crucible one-half ton capacity—Brazil. Purchase desired. Quotations c.i.f. Brazilian port. Terms, cash against documents. Reference No. 4460.

Trade Catalogs

Portable Electric Tools and Shop Equipment. The Black & Decker Manufacturing Co., Baltimore, Md. Catalog No. 5 for 1923 which has just been issued by this company is a fine example of the printer's art and the Black & Decker organization deserves praise for the excellent arrangement of the illustrations and subject matter. The company's complete line of portable electric tools and shop equipment devices is shown with an illustration for each type. The complete specifications with other matter of general interest is set forth for each machine. Featured in the publication also are the company's lectroflater electric compressor, the No. 2 hand lectroflater, the No. 2 wall lectroflater and the No. 2 carriage lectroflater.

Drill Presses. The Sibley Machine Co., South Bend, Ind. This company has issued a new catalog describing the features of its line of single spindle drill presses. Points of especial interest are described in detail and specifications for each type are included.

Lithoform. The American Chemical Paint Co., 1126 South Eleventh St., Philadelphia, Pa. A process for making paint hold to galvanized iron is described in a new publication, Bulletin No. 9-B, just issued by this company. The publication tells what Lithoform does, gives directions for its use and treats of the Lithorizing process as applied to galvanized iron.

Multi-Graduated Precision Thread Grinders. The Precision and Thread Grinder Manufacturing Co., 1932 Arch St., Philadelphia, Pa. A new catalog, consisting of bulletins, in loose-leaf binder, has just been issued by this company containing a general description of its line of products. The various styles of machines are illustrated with a detailed discussion of the construction, use and maintenance of each.

Forthcoming Meetings

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

American Institute of Weights and Measures, annual meeting December 8, 1922, United Engineering Societies' Building, 29 West 39th St., New York City. Chas. C. Stutz, 115 Broadway, New York City, is secretary.

National Exposition of Power and Mechanical Engineering, Dec. 7 to 13, 1922, Grand Central Palace, New York City, Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, Nationa Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16, Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21, Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

New and Enlarged Shops

Machine Tools Wanted

Ala., Attalla—Attalla Motors Co.—machine shop equipment.

Conn., New Britain—B. F. Clark, South Main St.—equipment for proposed automobile service station.

Ia., Dubuque—Belsky Motor Co., 6th and Iowa Sts.—repair machinery for garage, including lathe, drill press, air compressor, etc.

Kan., Wichita—G. Manlove, 115 West 2nd St.—South Bend power lathe, (used preferred).

Ky., Louisville—Pittsburg Fuel Co., 231 West Main St.—16 or 18 in. lathe with power attachment.

Mass., Boston—Keystone Mfg. Co., 53 Wareham St., (manufacturer of metal toys) —geared type punch press with 4 in. stroke, Bliss or Consolidated preferred (used).

Mich., River Rouge—Whitehead & Kales, South Dearborn St., (structural steel and machine work), M. Davis, Purch. Agt.—complete tool and die room equipment; also machine shop equipment, including lathes, millers, shapers and multiple drill.

Mo., Webster Groves—Webster Groves Auto Repair Co.—medium size power punch press.

N. Y., Buffalo—J. Ballatin, 1722 Jefferson St.—machinery, tools and equipment for \$75,000 automobile sales and service station.

N. C., Raleigh — Structural Supply Co., Box 1133, (steel and iron products), D. B. Irwin, Purch. Agt.—sheer and punch, 6 x 3½ in. angles, 6 x ½ in. flats, ¾ in. through ¾ in.; lathe for bolt threading, 1½ in. max.; small drill press, 1½ in. through 1 in.; forge, rivet portable hand blower; bar bender, 1 in. square, cold bend; also equipment for light structural plant (used.)

O., Cleveland — Cuyahoga Boiler Wks. Co., 1210 Main St.—belt driven power punch, 18 to 22 in. throat, to take ⅞ in. hole in 3.4 in. material (new or used).

O., Cleveland—W. L. Streit, 2336 West 42nd St.—one 36 in. bar folder and a 36 in. squaring shears.

O., Columbus — C. J. Maddox, 16 East Broad St.—compressor, blacksmith and machine shop equipment for the Buckingham Mines, Ltd., Asquith, Twp., Ont.

O., Dayton—G. W. Shroyer & Co., 2nd and Main Sts.—machinery, tools and equipment for automobile sales and service station.

Pa., Pittsburgh—Pittsburgh & Lake Erie R.R., South Smithfield St., C. M. Yohe, Purch. Agt.—42 in. boring mill with side head; also a 24 in. shaper.

Va., Ashland—Fuqua & Stone (automobile repairing)—drill press.

Va., Ashland—Rawlings Motor Co.—drill press.

Va., Fredericksburg—City Repair Shop, City Manager, Purch. Agt.—10 ft. lathe and drill press.

Va., Fredericksburg—Dice Motor Co.—lathe and drill press.

Va., Fredericksburg—Fredericksburg Motor Co., 613 Princess Anne St.—drill press.

Va., Fredericksburg—A. S. Haislip Motor Co., Princess Anne St., L. Bowie, Purch. Agt.—lathe for repair shop.

Va., Fredericksburg—Horton & Simpson, 105 Commerce St.—reamer for automobile repair shop.

Va., Fredericksburg—C. M. Humphry & Son, 605 Commerce St.—lathe and drill press for automobile repair work.

Va., Fredericksburg—W. B. Jenkins, 65 Princess Anne St.—25 cycle motor, single phase, 110 volt a.c.; also lathe.

Va., Fredericksburg—Jones Motor Co.—shop tools, wrenches, vise, etc.

Va., Fredericksburg—Service Motor Co.—lathe, drill and bench tools.

Va., Hopewell—F. Bowles—lathe, drill press and other machinery for automobile repair shop.

Va., Hopewell—Petersburg Motor Co.—lathe, drill press, etc.

Va., Hopewell—Red Front Garage—lathe and drill press.

Va., Richmond—Godsey & Fry, 718 East Cary St. (machine shop)—milling machine.

Va., Richmond—C. E. Johnson, 822 West Main St. (machine shop)—No. 3 or 4 milling machine, 20 in. lathe, 20 in. shaper, medium drill press and bench tools.

Va., Richmond—H. E. Lang, 10 South Madison St. (welding and repair shop)—large lathe.

Va., Richmond—Seventh St. Garage and Repair Shop, 7th and Leigh Sts., C. A. Skinner, Purch. Agt.—drill press.

Wis., Chippewa Falls—F. A. Bigler, 15 River St. (garage)—drill press, air tanks, gasoline storage tank and pump.

Wis., Eau Claire—Automobile Gasoline Gauge Mfg. Co., c/o E. G. Kuehl, 1607 Emery St.—machine tools and machinery for the manufacture of gauges.

Wis., Eau Claire—J. C. Blaski—automobile repair machinery for proposed garage.

Wis., Eau Claire—K. N. Knudson, 307 North Farwell St.—repair shop equipment and air tank for proposed garage.

Wis., Eau Claire—Paige-Ford Motor Car Co., Wisconsin and North Farwell Sts.—repair shop machinery for proposed garage.

Wis., Lancaster—Grant County, H. Mink, Highway Comnr.—drill press, chain hoist and grinders for repairing road machinery.

Wis., Milwaukee—W. A. Sandrock Co., 1217 4th St. (structural steel)—punch press.

Wis., Waupun—Landaal Bros. Co.—automobile repair machinery for proposed \$50,000 garage.

Wis., Wausau — Hall Garage Co., 107 Scott St.—automobile repair machinery for proposed \$40,000 garage.

Wis., Wisconsin Rapids — Wood County Bd., c/o E. Morris, Comr.—machine shop equipment.

Ont., Wiarton—G. Golden, Berford St.—complete equipment for proposed \$45,000 garage and automobile repair shop.

Machinery Wanted

Calif., Los Angeles—R. J. Fleming, 506 Bryson Bldg. — cannery equipment for plant, capacity 20,000 cans per 10 hour run, tomatoes chief product; also saw mill equipment, to be used in connection with cannery to be erected in Mexico.

Calif., Orange—N. T. Edwards—ice manufacturing machinery.

Colo., Seibert—Seibert Settler (newspaper)—cylinder press for power equipment.

Conn., Bridgeport—J. H. Southey, 576 Gurdon St. (machinery dealer)—3 elevating trucks or transveyors, 18 x 30 in. bed, 8 to 10 in. rise.

Fla., Ocala—Marion County Ice Co.—electrical ice making machinery.

Fla., St. Petersburg—Times, P. Poynter, Purch. Agt.—No. 8 or No. 14 linotype machine.

Ga., Cogdell—Morse Lumber Co.—woodworking machinery, including boring and turning machines.

Ill., Chicago—Blue Valley Creamery Co., 700 South Clinton St.—butter making and cream separator equipment for proposed creamery at Duluth, Minn.

Ill., Chicago—United States Gypsum Co., 205 West Monroe St.—machinery and equipment for proposed gypsum block plant at Oakfield, N. Y.

Ind., Evansville—Mid-States Rubber Co., c/o J. Hopkins, Secy., Never Split Seat Co., Morgan Ave.—machinery and equipment for rubber products plant.

Ind., Indianapolis—N. Todd, 415 Lemcke Bldg.—ice manufacturing and cold storage machinery and equipment.

Ind., New Haven—New Haven Silk Hosiery Co., H. Bauer, Purch. Agt.—labeling machines, bobbins and skein winding machinery.

Ia., Dubuque—P. T. Bowen, 2127 Gold St. —special mixing machinery for the manufacture of magnesite stucco.

Kan., Baxter Springs—Dr. J. H. Boswell —zinc mill equipment, crushers, rollers, belting, pulleys, shafting and bearings (used preferred).

Kan., Wichita—Business Printer, St. Croix Hotel, 116 North Topeka Ave.—job printing equipment.

Kan., Wichita—C. W. Owens, c/o G. W. Miller, 112 East 2nd St. (job printer)—power job press with Miller feeder (used).

Kan., Wichita—G. Roderick, 1112 East Douglas Ave.—Barned saw machine, jig saw, belting, planer, boring machine, Stanley miter box and small tools for cabinet making.

Ky., Louisville—National Forge Co., 1572 Cherokee Rd., W. Clark, Pres.—foundry equipment.

Me., Lewiston—W. S. Libbey Co.—machinery for new woolen mills at Hinsdale, Mass.

Md., Cambridge—Dorchester Fertilizer & Lime Co., L. Webster, Pres.—complete machinery and equipment for fertilizer plant (new).

Mass., Boston—Tileston & Hollingsworth Co., 49 Federal St.—additional machinery for paper plant at 892 River St., Hyde Park.

Mass., Gloucester — Savoy Dye House—additional machinery for laundry and dye house, including extractors, motors, etc. (used).

Mass., Waltham—Clayton Mfg. Co., 157 High St., (knit goods), E. Clayton, Purch. Agt.—one Scott & Williams, 18 in., 10 cut machine and one Shields automatic cutting and piling machine.

Mich., Detroit—G. B. Bright Co., Engrs., Marquette Bldg.—96 ton ice making machine for plant of Random Lake Ice Co., 064 Locust St., Milwaukee, Wis.

Mich., Detroit—Dept. Purchases & Supplies, 700 Marquette Bldg., Congress St., G. J. Finn, Comr.—one automatic electric welding outfit for the Dept. of Street Railways.

Mich., Detroit—Michigan Stamping Co., 11631 Mack Ave.—equipment for making metal stampings, for proposed addition to plant.

Mich., Highland Park—Ford Motor Co.—equipment, consisting of conveyors, transferring and assembling machinery for proposed assembly plant at Chicago.

Mich., St. Joseph—J. T. Townsend—refrigerating machinery (motor).

Mo., Chula — C. S. Steel — job printing press, newspaper press, paper cutter, linotype, belting, hangers, shafting, bearings and pulleys.

Mo., Joplin—Joplin Mchy. & Renting Co., 301 Virginia Ave., A. E. Maitland, Purch. Agt.—14, 16 and 18 in. rock crushers; also 24 and 26 in. rolls (used).

Mo., Joplin—Landreth Mchy. Co., 301-5 East 4th St. (machine shop)—vertical boilers, 3 to 12 hp.; also 2 air compressors up to 250 ft. capacity.

Mo., Joplin — White Mining Co., 1518 Kentucky Ave., O. White, Purch. Agt.—6 Chicago pneumatic air compressors, belting, hangers, shafting, crushers, rolls, bearings and gas engine.

Mo., St. Louis—The Bd. of Pub. Serv., 208 City Hall—Two 200 hp. oil burning, water tube boilers, 2½ ton ice plant and 10 ton refrigeration plant for proposed service station and power plant, at St. Louis Training School for Feeble Minded at Scott Farm.

Mo., St. Louis—G. A. Bull, 6026 Waterman Ave.—2 oil pumps and 2 tanks for filling station on Hogan and North Market Sts.

Mo., St. Louis—Grace Sign & Mfg. Co., 425 South Main St.—shafting and small machines for proposed sign factory on 2nd and President Sts.

Mo., St. Louis—Modern Auto Parts Co., 1803 Park Ave.—dollie, rectifiers and welding parts.

Mo., St. Louis—Oak Hill Express and Transfer Co., 3609 Gravois Ave.—550 gal. oil pump and tank for use at 4119 Fairview Ave.

Neb., Saint Edward—Advance—25 lb. light 12 point type, mailer and other printing equipment.

N. Y., Ashville—W. F. Meyer—machinery and equipment for cider mill to replace that which was destroyed by fire.

N. Y., Buffalo—Automatic Tire Machine Co., 19 Push St.—machinery and equipment for proposed factory for the manufacture of tire machines and appliances.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Copper outlook improved, electrolytic, quoted at 14⅜c. as against 14⅛c. per lb., in New York warehouses. Zinc prices also working higher; 7⅝c. quoted, as compared with 7½c. per lb. last week. Lead market quiet with slight advance in East St. Louis. Linseed oil demand small but prices steady; lubricating oils, however, firmer in price with market slightly improved.

Declines—Pig-iron prices continue to decline. Steel shapes, plates and bars still frequently quoted under the $2 per 100 lb. level. Independent makers, however, adhere to the $2 base on steel plates; with attractive tonnages on railway equipment quoted as low as $1.90@$1.95. Heavy buying of tank plates, for oil storage continues.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.55
Northern Basic	30.27
Southern Ohio No. 2	30.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.27
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.64
Virginia No. 2	37.17
Basic	27.50
Grey Forge	29.14
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	27.50
Basic	27.50
Bessemer	30.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5
Cincinnati	4.5
Cleveland	2.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	[illegible]@2.60	4.19	3.70	4.00
No. 12	2.60@2.70	4.24	3.75	4.05
No. 14	2.70@2.75	4.29	3.80	4.10
No. 16	2.90@3.05	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35@3.50	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.60	5.00	4.50	4.95
Nos. 17 and 21.	3.75@3.90	5.30	4.80	....
Nos. 22 and 24.	3.90@4.05	5.45	4.95	5.40
No. 26	4.05@4.20	5.60	5.10	5.55
No. 28	4.35@4.50	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{5}{32}$ to $\frac{3}{8}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.37½
Tin, 5-ton lots, New York	36.87½
Lead (up to carlots), St. Louis 6.95@7.00; New York	7.50
Zinc (up to carlots), St. Louis 7.05@7.10; New York	7.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.75	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.75	7.00
Zinc	3.00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.00	7.25
IC, 14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11¼
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13¾x13¾, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¾x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville... per net ton		\$7.25@7.50	
Coke, prompt foundry, Connellsville... per net ton		7.50@8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40–10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$5.00	\$3.90	\$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55–5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.50	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	30–10%	40½%	50%
Heavy grade	20–5–2½%	30–5%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	65–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. Y., Buffalo—[illegible] Furniture Co., [illegible] Ave.—machinery and equipment for furniture factory.

N. Y., Buffalo—J. H. Kraemer & Sons, Inc., 1439 Main St.—machinery, tools and equipment for plumbing and steam fitting [illegible].

N. Y., Buffalo—National Brake Co., [illegible] Bldg.—machinery and equipment for proposed plant for the manufacture of [illegible] and brake equipment at Bridgeburg, Ont.

N. Y., Brooklyn—Wenna Knitting Mills, [illegible] Vermont St., G. Schwartz, Purch. Agt. —knitting machinery.

N. Y., East Aurora—Zapf Lumber Co.—machinery and equipment for new planing mill.

N. Y., Fort Covington — International [illegible] Co., J. F. LaCombe, Purch. Agt.—belt lacing machines.

N. Y., Geneva—Bd. Educ., C. W. Rice, Pres.—vocational equipment for proposed high school.

N. Y., Hamburg—Bd. Educ.—vocational equipment for $[illegible] high school.

N. Y., Jamestown — Jamestown Store Front Co., 23 North Main St. (manufacturer and installer of store fronts and equipment)—complete machinery and equipment to replace that which was recently destroyed by fire.

N. Y., Johnson City—Endicott-Johnson Co. (manufacturer of shoes)—machinery and equipment for proposed factory at Binghamton.

N. Y., New York — L. Schlenker, 223 [illegible] St. (shoes)—one 100 lb. drop hammer.

N. C., Anderson (Edenton P. O.)—Anderson Tractor Co., W. S. Anderson, Pres.—machinery and equipment for the manufacture of tractors.

N. C., Carthage—Bogg Bros. (machinists, etc.), L. E. Bogg, Purch. Agt.—portable [illegible] cutter and acetylene welding outfit.

N. D., Underwood — Underwood Dry Cleaners—dry cleaning machine.

O., Ashland—J. E. Matthews Produce Co. —cold storage machinery and equipment.

O., Columbus — Bd. Educ., Tower and High Sts., J. L. McCune, Clk.—receiving bids until Dec. 11 for two 12 in. speed lathes, three 30 in. band saws and other equipment for manual arts department.

O., Columbus—Columbus Brick & Terra Cotta Co., Kresge Bldg., W. T. Matthews, Purch. Agt.—brick making equipment for plant at Union Furnace.

O., Columbus—J. S. Maclean & Son, 150 West [illegible] St. (manufacturer of office furniture, etc.)—woodworking machinery, saws and planer.

O., Delaware—Automatic Incubator Co., W. [illegible], Pres.—will take bids early in 1923 for woodworking machinery and some metal working equipment for incubator plant.

O., Ottawa—G. W. Kahle—woodworking machinery.

O., Sandusky — Blackwood Steel Fdry. Co.—foundry equipment for casting factory at Parkersburg, W. Va.

Pa., Allentown—V. R. Boyer, 212 North 11th St.—abattoir equipment, refrigeration machinery and cold storage equipment.

Pa., Ambler—E. Ott, 711 Rosemary St. (laundry)—washing machines, 4 or 6 [illegible] capacity.

Pa., Canton (East Canton) — Silverdale Creamery Co.—complete mechanical cooling system for milk plant.

Pa., Corry—D. A. Hillstrom—furniture manufacturing and woodworking machinery.

Pa., Freedom—Freedom Oil Wks. Co., E. Craig, Mgr.—[illegible] crane.

Pa., Germantown (Phila. P. O.)—Chel[illegible] Mills Co., Haines and Stanton [illegible] Whitin quiller with one 378 spindle [illegible], one Davis & Furber bob[illegible].

Pa., Lebanon—Lebanon Honey Cake Cone Co.—[illegible] machinery for proposed factory.

Pa., Lebanon — [illegible] Mfg. Co. [illegible]—machinery and equipment for factory.

Pa., Marcus Hook — [illegible] Co., [illegible], Purch. Agt.—[illegible] and [illegible] machinery.

Pa., McKees Rocks—Federal [illegible] & [illegible] Wks.—machinery and equipment for 3 story steel works.

Pa., Phila.—H. C. [illegible] & Co., A and [illegible] Sts. (manufacturer of hosiery)—full fashion machines, sewing machines and [illegible].

Pa., Phila.—Amer. Ice Co., 6th and Arch Sts.—conveyors, etc., for proposed ice plant on 11th St. and Washington Ave.

Pa., Phila.—Baccelieri Bros., 924 South 11th St. (manufacturers of furniture), P. Baccelieri, Purch. Agt.—turning machines, planers, saws, tenons etc.; also kilns for lumber for new factory at Berlin, N. J.

Pa., Phila.—Bennett & Aspden Co., Krams and Fenton Sts.—additional broad looms for proposed addition to textile mill for the manufacture of upholstery.

Pa., Phila.—P. Brosz, 2511 West Huntingdon St., (woodwork, etc.)—band saw, planers, etc., for new shop.

Pa., Phila. — Brown-Phelps Hosiery Co., 21st and Clearfield Sts., T. E. Brown, Purch. Agt.—additional knitting machines, etc.

Pa., Phila.—Bush & Diamond, Jasper and Thayer Sts.—broad looms and accessories for proposed rug factory.

Pa., Phila.—The city, 216 City Hall, T. F. Armstrong, Purch. Agt.—50 ton refrigerating plant for city hospital.

Pa., Phila. — Continental Leather Co., Tacony St. and Van Kirk Ave.—additional leather working machinery for new plant.

Pa., Phila.—Stephen Green Co., 15th and Arch Sts.—presses and other printing equipment for proposed plant on 34th and Market Sts.

Pa., Phila. — Jones Printing Co., 1515 Sansom St., W. Jones, Purch. Agt.—presses, paper cutter and accessories for plant.

Pa., Phila.—Merchants & Evans Co., 2035 Washington Ave., A. Evans, Purch. Agt.—cutting machines, brakes, furnaces and sheet metal working machinery for new addition.

Pa., Phila.—J. H. Reed, 435 North Broad St.—automatic full fashion hosiery machines, etc. for new plant.

Pa., Phila.—Rodgers Engraving Co., 1318 Arch St.—machinery and equipment for proposed engraving and printing plant.

Pa., Phila.—Wolstencroft Felt Mfg. Co., Mulberry and Bridge Sts., I. H. Wolstencroft, Purch. Agt.—additional sets and finishers for the manufacture of felt.

Pa., Pittsburgh — Duquesne Steel Fdry. Co., Farmers' Bank Bldg.—equipment for foundry, to replace that which was destroyed by fire, at Kendall (Coraopolis P. O.).

Pa., Pittsburgh—D. L. Hamlin, Inc., 123 38th St.—grain conveying machinery.

Pa., Pittsburgh—Union Steel Casting Co., 62nd and Butler Sts.—crane.

Pa., Pottstown—G. W. Corbett, 63 High St. — foundry equipment for the manufacture of steel castings.

Pa., Pulaski—Pulaski Grist Mill, W. McConnell, owner—machinery and equipment.

Pa., Sharon—Sharon Furniture Mfg. Co., 255 Wilkes Pl.—saw and saw table.

Pa., Slatington—J. A. Brush—printing machinery and equipment for new 3 story plant.

Pa., Uniontown—Brown Coal Co.—electric coal tipple machinery and equipment.

Pa., Warren — Colonial Rug Wks., 410 Laurel St., C. M. Mayhood, Purch. Agt.—dyeing machinery and looms for the manufacture of rag and fluff rugs.

Pa., Watsontown—Watsontown Door & Sash Co.—machinery and equipment for addition to factory.

Pa., Williamsport—Standard Wood Pipe Co., East Jefferson St.—sawmill equipment.

Pa., Woodlawn—Bd. Educ.—equipment for vocational department of new $250,000 high school.

R. I., Pawtucket—Bd. Educ.—vocational equipment for proposed $1,200,000 high school.

R. I., Woonsocket—Rhode Island Knitting Co., Jeffers St.—equipment for proposed addition to knitting mill.

S. C., Greenville—E. M. Wharton, Davenport Apartments—stamped steel automatic loom stop, recently patented.

S. C., Kingsville (Gadsden P. O.)—Congaree Timber Land Co., J. E. Belser, Pres.—lumber and sawmill machinery.

Tenn., Chattanooga—Continental Mchy. Co., G St.—machinery and equipment to replace that which was destroyed by fire.

Tenn., Chattanooga—Oager Lime & Mfg. Co., James Bldg., M. P. Kennedy, Secy.—stone crusher and crushing machine, 200 ton capacity.

Tenn., Memphis — DeSoto Hardwood Flooring Co., 1014 Sledge Ave., R. A. Taylor, Mgr.—equipment for proposed addition to plant.

Tex., Bonham—Catron Mfg. Co. (manufacturer of pumps, etc.)—machinery and equipment for plant (new).

Tex., Canyon—Bd. Educ.—vocational equipment for $100,000 school.

Tex., Comfort—Faust Motor Co.—about a dozen pieces of sheet metal or tin working machinery.

Tex., College Station—A. & M. College Print Shop—proof press, stand, single and double galley press for power equipment.

Tex., Kerens—J. W. Maby & Co. (sheet metal)—8 or 10 ft. cornice brake.

Tex., San Antonio — Freeman Printing Co.—pony cylinder press, 25 x 38 in., Meihle preferred, power attachment.

Va., Alexandria — Herfurth Engine & Mchy. Co.—300 ft., 3 lb. air blower (used); oil engine, 75 to 100 hp. (used); 7½ x 7½ in., 9 x 9 in. and 10 x 10 in. ice machines, belt driven, enclosed type (used.)

Va., Ashland—R. J. Chisholm, R.F.D. 4—gas engine, mandrel and a 28 in. circular saw.

Va., City Point—Wilson-Hock Co., (machinery, etc.), N. Wilson, Mgr.—8 in. steam separator; rotary dryer about 7 ft. diameter, 90 ft. long, to dry with direct or semi-direct heat 50 ton of limestone per hour; outfit to dry-grind mica to 75 or 80 mesh.

Va., Fredericksburg—J. E. Brickert & Co., 303 Charles St.—test bench complete with armature winder and under cutter, also small lathe and electric hand motor.

Va., Front Royal—Proctors Grist Mills—complete machinery to replace that which was destroyed by fire.

Va., Hopewell—Hopewell China Plant—clay working machinery.

Va., Hopewell—Hopewell Printing Co.—pony press.

Va., Hopewell—Tubize Artificial Silk Co., J. L. Brown, Purch. Agt.—spinning machinery.

Va., Richmond—Allegheny Box Co., 601 Byrd St. (manufacturer of wooden boxes)—multiple boring machine.

Va., Richmond—S. E. Kane, 119 South Lombardy St. (printing)—cutting and stapling machines, also job press.

Va., Richmond—E. T. Macdowell, 203 East Main St.—12 x 18 in. job press, paper cutter and stapling machine.

Va., Richmond—Palace Steam Laundry, 203 West Cary St., C. D. Griffis, Purch. Agt.—3 washers, one 26 in. extractor and collar and cuff machinery.

Va., Richmond — Richmond Corrugated Paper Co., 7th and Byrd Sts.—combination roll, rewinder and sheet chopper.

Va., Richmond—R. A. Siewers, 612 Cumberland St. (contractor)—4 siding machines.

Va., Richmond—T. & E. Laundry Co., Inc., 926 West Broad St., L. E. Hardy, Purch. Agt.—whole shirt unit, collar and cuff machinery and 2 large washers.

W. Va., Charleston—Griffith, Foster & Rhodes—equipment for the manufacture of skylights, blow pipes, heating systems, etc.

W. Va., Glen White—E. E. White Coal Co.—machinery and equipment for proposed coal tipple.

Wis., Belgium—Krier Preserving Co.—canning machinery, belting, shafting, power equipment, including boilers, engines, pumps and steel stack for cannery at Random Lake.

Wis., Crandon—F. H. Himes—planing and sawing machinery for proposed saw and planing mill.

Wis., Eau Claire — Lang Canning Co., Mill St.—canning machinery, belting and shafting for proposed addition to cannery.

Wis., Green Bay—J. C. Krueger, 1000 Crooks St.—sheet metal working machinery.

Wis., Hartland—J. Hurley—dairy and power machinery for proposed factory at Hustisford.

Wis., La Crosse—Anderson Vulcanizing Co., 215 State St.—vulcanizing equipment.

Wis., Madison—Karnack Studios Co., 24 East Wilson St., T. Munchow, Purch. Agt. —equipment for the manufacture of incense burners, metal and plastic art novelties, etc.

Wis., Madison — Madison Supply Co., 615 East Washington Ave.—power and bottling machinery for proposed bottling works.

Wis., Menomonie—Dunn County, [illegible] Stewart, Comr.—$12,750 worth of road machinery, including patrol graders and equipment for county repair shop.

Wis., Milwaukee—C. Daniel, 1741 Teutonia Ave. (carpentry and millwork)—one band saw.

Wis., Milwaukee—Excel Mfg. Co., 3402 South Pierce St. (millwork) — additional woodworking machinery.

Wis., Milwaukee—P. Hoff, 64 Locust St.—ice making machinery, electrically driven.

Wis., Milwaukee—Milwaukee Auto Specialty Mfg. Co., 711 Chestnut St., W. J. Raley, Purch. Agt.—one paper press.

Wis., Milwaukee—Milwaukee Enameling Co., 406 6th Ave., J. M. Reitzler, Purch. Agt.—enameling ovens.

Wis., Milwaukee—Milwaukee Times, 349 Grove St., H. Towell, Purch. Agt.—one stereotyping outfit and one cylinder press, motor power.

Wis., Milwaukee—Palmolive Co., 42 4th St.—soap making machinery and kettles for proposed addition to factory.

Wis., Milwaukee—J. J. Tadyck, 1394 8th Ave.—sheet metal working machinery.

Wis., Milwaukee—Vollbrecht Cut Stone Co., 753 Canal St., A. J. Vollbrecht, Purch. Agt.—traveling crane.

Wis., Milwaukee—Wisconsin Steel & Dock Co., 253 3rd St., (marine repairs, etc.), F. W. Stevens, Purch. Agt.—power saws.

Wis., Rosholt—M. C. Colrud—feed grinding machinery with gasoline engine or motor power.

Wis., Wausau—Marathon Shoe Co., 1st Ave. and Cedar St.—additional shoe working machinery for proposed factory.

B. C., Kilgard—Comrs. of Sumas Dyking Dist.—receiving bids until Dec. 28 for an 8 ton hand operating traveling crane. Estimated cost $4,000. G. P. Moe, Kilgard, Engr.

N. B., St. Johns — Stephen Brick Co., Prince William St.—machinery and equipment to replace that which was destroyed by fire.

N. B., St. Johns—Stetson-Cutler & Co.—sawmill equipment.

Ont., Collingwood—Canadian Postal Lock Nut Bolt Co., F. A. Bassett, Mgr.—equipment for the manufacture of bolts, screws and rivets, later for steel stamping.

Ont., Ford — Ford Motor Company of Canada, P. W. Grandjean, Secy.—special metal working machinery for the manufacture of autos and tractors.

Ont., Goderich—W. Baechler—machinery and equipment for proposed woodworking plant and sawmill.

Ont., Hamilton—Duro Constr. Co., Ltd., 306 Landed Bank Bldg., C. W. Bowser, Purch. Agt.—woodworking and general contractors equipment.

Ont., Harrow—T. R. Flood Flour Mills—equipment to replace that which was destroyed by fire.

Ont., Mount Dennis—Electroplax Co. (manufacturer of insulation equipment)—machinery and equipment for plant to replace that which was destroyed by fire.

Ont., Owen Sound—Bd. Educ., W. H. Wright, Chn.—general equipment, including tools, woodworking and metal working lathes, etc., for proposed technical school, physics and chemistry laboratories.

Ont., Paris—Penmans Ltd.—equipment for proposed woolen mill at St. Hyacinthe, Que.

Ont., Petrolea—B. P. Corey—special equipment for making oil, grease and soaps for proposed factory.

Que., St. Lambert—J. Duncan—sawmill equipment to replace that which was destroyed by fire.

Ont., St. Marys — W. Zurbrigg, c/o J. H. Jameson—complete equipment for proposed saw and planing mill at Rannoch.

Ont., Stratford — Stratford Frames & Novelties—woodworking machinery, (new).

Ont., Welland—Welland Cotton Co., J. T. Grantham, Pres.—machinery and equipment for proposed cotton mill.

Ont., Wiarton—Gilpin Bros.—$30,000 worth of woodworking machinery and equipment for the manufacture of flooring and woodenware specialties.

Que., Montreal—Thomas Gold Mining Co., Ltd., 810 Drummond Bldg., T. H. Carveth, 227 Girouard Ave., Pres.—stamp mill and other machinery for mine in Thomas Twp., Porcupine Mining Division, Ont.

Metal Working Shops

Conn., Plantsville—The Blakeslee Forging Co. awarded the contract for the construction of a 2 story, 40 x 42 ft. forge building. Estimated cost $15,000. Noted Oct. 19.

Conn., Waterbury—The Brass City Machine & Tool Wks., 29 Pearl St., is receiving bids for the construction of a 2 story addition to its factory for the manufacture of special machinery. Estimated cost $40,000. L. S. Kipp, 121 Charles St., Engr. and Archt.

Mass., Cambridge—The Cambridge Motor Co., 195 Massachusetts Ave., awarded the contract for the construction of a 2 story, 55 x 200 ft. garage and automobile sales and service station, with 62 x 66 ft. wing, on Massachusetts Ave. and Front St. Estimated cost $150,000.

Minn., St. Paul—The Hamm Realty Co., 681 Minnehaha St., plans to build a 2 story, 150 x 150 ft. garage on 8th and Sibley Sts. Estimated cost $100,000. Architect not announced.

Mo., St. Louis—The Auto Car S. & S. Co., Locust and Leffingwell Sts., awarded the contract for the construction of a 1 story, 134 x 155 ft. garage and service station at 2740 Locust St. Estimated cost $60,000.

Mo., St. Louis—The Automatic Sprinkler Co., c/o T. Sheehan Plumbing Co., 15th and Olive Sts., awarded the contract for the construction of a 2 story, 40 x 110 ft. sprinkler assembly plant, on Olive St. Estimated cost $25,000.

Mo., St. Louis—The Haynes-Langenberg Mfg. Co., 4045-57 Forest Park Blvd., will soon award the contract for the construction of a 3 story, 150 x 200 ft. furnace factory on Bircher St. near Euclid St. C. W. Morton, 1339 Syndicate Trust Bldg., Engr. G. O. Langenberg, c/o owner, Archt. Noted Nov. 23.

N. H., Manchester—C. H. Macrury, 1042 Elm St., awarded the contract for the construction of a 3 story, 50 x 50 ft. garage on Burch and Lowell Sts. Estimated cost $50,000.

N. Y., Brooklyn—M. Galtabiano, c/o T. Goldstone, Engr. and Archt., 50 Graham Ave., will build a 1 story, 100 x 100 ft. garage on Decatur St. and Wyckoff Ave. Estimated cost $40,000.

N. Y., Buffalo—The Williams Gold Refining Co., 2978 Main St., plans to build an addition to its factory. Estimated cost $10,000. Architect not announced.

N. Y., Lackawanna (Buffalo P. O.)—The Lackawanna Steel Co. is having plans prepared for the construction of additions to mills, also new rail and steel mills, furnaces and various shops. Cost will exceed $15,000,000. W. A. James, Ch. Engr.

N. Y., Rochester—The Rochester Taxicab Co., 58-64 Plymouth Ave., N., awarded the contract for the construction of a 2 story, 90 x 200 ft. garage. Estimated cost $125,000.

O., Dayton—The G. W. Shroyer Co., 2nd and Main St., is having plans prepared for the construction of a 2 story, 50 x 200 ft. automobile sales and repair station on North Main St. Estimated cost $60,000. Private plans.

O., Norwood—The Chevrolet Motor Co., General Motors Bldg., Detroit, awarded the contract for the construction of a 2 story, 320 x 500 ft. automobile assembly plant on Smith Rd., here. Noted Nov. 16.

O., Springfield — The Fairbanks Piano Plate Co., Kenton St., plans to rebuild portion of its factory, which was recently destroyed by fire. Estimated cost $40,000.

O., Toledo — The Chevrolet Motor Co., General Motors Bldg., Detroit, awarded the contract for the construction of a 1 story, 91 x 450 ft. automobile transmission plant, here. Estimated cost $225,000.

Pa., Erie—The Northwestern Motors Co., 21st and State Sts., plans to rebuild its factory which was recently destroyed by fire. Estimated cost $200,000.

Pa., Kendall (Coraopolis P. O.)—The Duquesne Steel Fdry. Co., Farmers' Bank Bldg., Pittsburgh, plans to rebuild major portion of its foundry, which was destroyed by fire, here. Estimated cost $300,000.

Pa., Lewistown—The Amer. Refractories Co., Union Arcade, Pittsburgh, has purchased a 68 acre site, here, and will build a plant in the spring.

Pa., New Castle—The National Radiator Co., Central Ave. and Ohio St., Johnstown, will build a 1 story, 30 x 365 ft. addition to its foundry, here.

Pa., Phila.—The Abrasive Co., Tacony and Froley Sts., awarded the contract for the construction of a 1 story, 80 x 120 ft. factory. Estimated cost $8,000.

Pa., Phila.—P. Dandolfi, 41st and Poplar Sts., is receiving bids for the construction of a 2 story, 50 x 200 ft. garage on Wyoming and Mascher Sts. Estimated cost $75,000. Neubauer & Supowitz, 929 Chestnut St., Archts.

Pa., Phila.—The General Electric Co., Witherspoon Bldg., awarded the contract for the construction of a 6 story addition to its switch factory on 7th St. and Willows Ave. Estimated cost $80,000. Noted Oct. 5.

Pa., Pittsburgh—The Englert Mfg. Co., 2133 East Carson St., awarded the contract for the construction of a 2 story, 68 x 120 ft. battery factory on South 25th and Jane Sts. Estimated cost $75,000. Noted Sept. 7.

Pa., Pittsburgh—The Neely Nut & Bolt Co., 46 South 22nd St., awarded the contract for the construction of a 1 story, 120 x 150 ft. and 21 x 113 ft. bolt plant. Noted Oct. 12.

Pa., Pittsburgh—The Pure Oil Co., Chestnut and High Sts., Columbus, O., is having plans prepared for the construction of a 1 story, 80 x 150 ft. garage, here. Private plans.

W. Va., Parkersburg—The Blackwood Electric Steel Corp. is receiving bids on steel for a 1 story, 140 x 230 ft. factory, for the manufacture of castings. Mill, Rhines, Bellman & Nordhoff, 1234 Ohio Bldg., Toledo, O., Archts.

Wis., Cedarburg — The Hansen Canning Machine Co., Port Washington, is receiving bids for the construction of a 1 story, 112 x 112 ft. factory, here. Estimated cost $40,000. Private plans.

Wis., Fond du Lac—The Gurney Refrigerator Co., 64 South Brook St., awarded the contract for the construction of a power house and 3 story, 60 x 140 ft. factory for the manufacture of refrigerators. Estimated cost $60,000. E. G. Vail, Pres.

Wis., Kenosha—C. O. Augustine, Archt., is receiving bids for the construction of a 1 story, 82 x 125 ft. garage for W. Russell, 603 Milwaukee St. Estimated cost $40,000.

Wis., Manitowoc—The Aluminum Specialty Co., 17th and Wollmer Sts., awarded the contract for the construction of a 3 story, 52 x 149 ft. factory and warehouse. Estimated cost $40,000.

Wis., Manitowoc — The Van Lente-St. Clair Corp., 405 West Walnut St., Green Bay, plans to build a 2 story, 57 x 110 ft. garage and repair shop, here. Estimated cost $45,000. B. L. Van Lente, Mgr.

Wis., Milwaukee—The Harley-Davidson Motor Co., 3732 Chestnut St., is having plans prepared for the construction of a 1 story, 80 x 145 ft. addition to its factory. Estimated cost $45,000. Fereral Engr. Co., 444 Milwaukee St., engrs.

Wis., Milwaukee—Leiser & Holst, Archts., 105 Wells St., are receiving bids for the construction of a 1 story, 45 x 115 ft. addition to factory for the Milwaukee Gas Specialty Co., 2017 Clybourn St. Estimated cost $40,000.

Wis., Milwaukee—M. S. Mann, 1219 Holton St., awarded the contract for the construction of a 1 story, 50 x 110 ft. garage on 4th St. Estimated cost $40,000.

Wis., Milwaukee—The Milwaukee-Western Fuel Co., 120 Wisconsin St., awarded the contract for the construction of a 1 story, 120 x 140 ft. repair shop on Clinton St. Estimated cost $60,000.

Wis., Milwaukee—J. M. Nash, 842 30th St., manufacture of special woodworking machinery, awarded the contract for the construction of 1 story, 25 x 70 ft. and 23 x 90 ft. additions to factory. Estimated cost $8,000.

Wis., Waukesha—The Spring City Auto Co., 220 West Main St., is receiving bids for the construction of a 1 story, 65 x 190 ft. garage and repair shop. Estimated cost $40,000. B. Wolf, Mgr. Private plans.

Wis., Waupun — The Althouse-Wheeler Co. will build a 2 story factory for the manufacture of steel towers, wind mills, tanks, etc. Estimated cost $50,000. H. O. Thompson, Mgr.

Wis., Wausau—Oppenhamer & Obel, Archts., Wausau, are receiving bids for the construction of a 2 story, 60 x 60 ft. garage, for the Durant Motor Car Co., 208 Washington Ave. Estimated cost $45,000.

Wis., Wisconsin Rapids—The Prentiss-Wabers Co. plans to build a 2 story, 50 x 110 ft. factory for the manufacture of heating devices for tourists, including enameling, assembling and testing rooms. Estimated cost $50,000. Architect not selected.

Ont., Ford—The Ford Motor Co. of Canada has had plans prepared for the construction of a 1 story, 570 x 1088 ft. and a 2 story, 65 x 1088 ft. machine shop additions to automobile factory. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt.

Ont., London—Middlesex Motors, Ltd., 781 Dundas St., awarded the contract for the construction of a 1 story, 76 x 200 ft. garage and automobile repair shop. Estimated cost $65,000. F. B. Isaacs, Mgr. Noted Oct. 5.

Que., Montreal—Quebec Liquor Comrs., Delormier St., awarded the contract for the construction of a 75 x 100 ft. garage. Estimated cost $50,000. Noted Sept. 21.

General Manufacturing

Calif., Isleton—J. F. Butts Co., 3 Pine St., San Francisco, subsidiary of Warmington [illegible] Co., 3 Pine St., San Francisco, is receiving bids for the construction of a 1 story cannery, 100 x 200 ft. main building, a 1[illegible] ft. warehouse, 34 x 200 ft. wharf, [illegible] ft. cookhouse and boiler room building, also 18 cottages for employees and apartment house to house 200 families, here. Estimated cost $1[illegible],000. W. J. Miller, 417 Market St., San Francisco, Archt.

Calif., Lodi—The Trustees of Lodi Union High School District will receive bids until [illegible] for the construction of a 2 story [illegible] building, a 2 story auditorium, [illegible] manual training buildings, swimming tank and alterations to present structure. Estimated cost $[illegible]. Wright & [illegible] and L. S. Stone, Bank of Italy Bldg., Stockton, Archts.

Calif., Newman—The National Ice Cream Co., 371 Guerrero St., San Francisco, is receiving bids for the construction of a 2 story ice cream plant, here. Wieland-Mazzetti-Wieland, 1002 H St., Modesto, Archts.

Calif., San Diego—M. J. Lyon, Engr. and Archt., 321 Union Bldg., is receiving bids for the construction of a gas plant for 7,000 population at Tia Juana, Mexico, for the [illegible] Investment Co., 321 Union Bldg., who has purchased a 645 acre town site there.

Calif., San Francisco—The General Mfg. Co., Pacific Bldg., awarded the contract for the construction of a 1 story, 140 x 192 ft. [illegible] factory on Railroad, Paul and San Bruno Aves. Estimated cost $35,000. Noted Nov. 16.

Calif., San Francisco—The National Ice Cream Co., 371 Guerrero St., awarded the contract for the construction of a 2 story ice cream plant on Guerrero St. near 16th St. Estimated cost $50,000.

Calif., San Francisco—The Reinhart Lumber & Planing Mill Co., 17th and Kansas Sts., has purchased a 5 acre site in the southern section of the city and plans to build a planing mill.

Calif., San Francisco—The San Francisco Chronicle, Chronicle Bldg., plans to build a newspaper plant, loft and office building on 5th and Mission Sts. M. D. De Young, owner.

Calif., Tracy—The General Milk Co. of California awarded the contract for the construction of a milk plant. Estimated cost $75,000. Noted Oct. 26.

Colo., Denver—The Blaney-Murphy Co., Stock Yards, is having preliminary plans prepared for the construction of a 5 story packing plant on 48th and Gilpin Sts. Estimated cost $[illegible],000. Private plans.

Conn., Waterbury—Raymond Bros., 400 South Main St., awarded the contract for the construction of additions to its plant, consisting of a 1 story, 56 x 85 ft. garage and a 2 story, 40 x 50 ft. bakery. Estimated cost $40,000.

Ga., Atlanta—The White Provision Co., Howell Mill Rd., awarded the contract for the construction of a packing plant. Estimated cost $[illegible].

Ill., Chicago—F. T. Hoyt, c/o A. S. Alschuler, Archt., 28 East Jackson Blvd., awarded the contract for the construction of a 3 story, 1[illegible] x 1[illegible] ft. printing plant on Congress and Laflin Sts. Estimated cost $250,000.

Ill., Chicago—Ronneberg, Pierce & Hauber, Archts., 10 South La Salle St., are receiving bids for the construction of a 1 and 2 story, [illegible] x 140 ft. laundry on [illegible] St. near La Vergne St. for the New Way Home Service Corp., c/o architects. Estimated cost $[illegible].

Ky., Paducah—The Paducah Ice Co. plans to build 2 additional units to its ice manufacturing plant. Estimated cost $70,-000. Architect not announced.

Mass., [illegible]—[illegible] Greene & Co., Engrs., 24 Federal St., Boston, will soon receive bids for the construction of an addition [illegible] and [illegible] and Archts., [illegible] of floor space for the Roubaix Mills, 792 Main St., here.

Mass., Holyoke—J. Wisly, 18 Hitchcock St., awarded the contract for the construction of a 1 story, [illegible] x 12 ft. addition to printing plant. Estimated cost $[illegible].

Mass., Pittsfield—The Pittsfield Coal Gas Co., South St., is having plans prepared for the construction of a 2 story addition to its gas plant. Cost between $1[illegible],000 and $[illegible],000. Harding & Seaver, 7 North St., Archts.

Mich., Highland Park—The Ford Motor Co. awarded the contract for the construction of a 1 story transfer building on Manchester Ave. Estimated cost $400,000. Noted Nov. 2.

Mich., Lansing—W. S. Holmes, Archt., Tussing Bldg., will receive bids in the spring for the construction of a 4 story, 84 x 250 ft. cold storage plant on Kalamazoo St., for the United Produce Co., c/o Architect. Estimated cost $200,000.

Mich., Petoskey—The Petoskey Portland Cement Co. is having preliminary plans prepared for extending factory, stock house and power plant. Estimated cost $500,000. J. C. Buckley, 1st Natl. Bank Bldg., Chicago, Engr.

Minn., Morgan Park (Duluth P. O.)—The Universal Portland Cement Co. will build a 2 story, 18 x 100 ft. addition to its raw material mill and a 2 story, 68 x 247 ft. burner building. Estimated cost $249,500. Noted Aug. 3.

Mo., St. Louis—The Johansen Bros. Shoe Co., 3640 Laclede Ave., awarded the contract for the construction of a 4 story, 55 x 105 ft. addition to its shoe factory, also a 3 story, 47 x 71 ft. administration building on Laclede St. near Grand Blvd. Estimated cost $100,000.

Mo., St. Louis—A. B. Plows, 1010 North 10th St., is having plans prepared for the construction of a 3 story, 35 x 140 ft. factory for the manufacture of mattresses. Estimated cost $25,000. E. J. Lawler, 1028 Chemical Bldg., Archt.

N. J., Hammondton—The Littlefield Ice Co. awarded the contract for the construction of a 3 story ice and storage plant. Estimated cost $50,000.

N. Y., Jamestown — The Clarke Baking Co., 809 North Main St., plans to rebuild major portion of its bakery on Richmond Pl., which was recently destroyed by fire. Estimated cost $50,000. Architect not announced.

N. Y., Jamestown—The New Ice & Coal Co., 925 Clinton St., plans to build an ice manufacturing plant. Estimated cost $18,-000. Architect not announced.

N. Y., Rochester—The Rochester Gas & Electric Corp., Clinton Ave., N., plans to build a complete new water gas plant, capacity, 4,000,000 to 5,000,000 cu.ft. per day, on Platt St. J. Haftnkamp, Supt.

N. Y., Rochester—The Rochester Packing & Cold Storage Co., 78 Front St., awarded the contract for remodeling and building an addition to its plant. Estimated cost $200,000.

N. Y., Sheepshead Bay (Brooklyn P. O.)—The Superior Ice Co., Inc., 50 East 42nd St., New York City, will soon award the contract for the construction of an ice plant on Ave. Z and East 17th St., here. Estimated cost $250,000. W. Mortensen, 209 West 76th St., New York City, Engrs. and Archts. Noted Oct. 5.

O., Akron—The General Tire & Rubber Co., 1708 East Market St., awarded the contract for the construction of a 1 and 3 story, 40 x 180 ft. and 60 x 100 ft. additions to its factory. Estimated cost $100,-000. Noted Nov. 16.

O., Cleveland—The Richard W. Kaase Co., 2836 Lorain Ave., awarded the contract for the construction of a 2 story, 88 x 150 ft. bakery. Estimated cost $150,000. Noted June 1.

Okla., Ardmore—The Consumers Light and Power Co. plans to build a 6,000 ton cold storage house. Estimated cost $100,000.

Ore., Haines—The Commercial Creamery plans to rebuild its plant which was destroyed by fire. Estimated cost $75,000. A. H. Goodhue, Pres.

Pa., Johnstown — The Edward Hahn Packing Co., Hickory St. and Baltimore & Ohio R.R., is receiving bids for the construction of a 3 story, 48 x 108 ft. and 24 x 112 ft. addition to its packing plant. Estimated cost $65,000. Private plans.

Pa., Oakmont—The Valve Bag Co. of America, 2444 Summit Ave., Toledo, O., awarded the contract for the construction of a 2 story, 74 x 94 x 157 x 158 ft. addition to its paper bag factory. Noted Oct. 19.

Pa., Phila.—The Amer. Ice Co., 6th and Arch Sts., awarded the contract for the construction of an ice manufacturing plant on Duncannon and Mascher Sts. Noted Nov. 16.

Pa., Phila.—The National Biscuit Co., 10th Ave. and 15th St., New York City, awarded the contract for the construction of an 8 story, 150 x 257 ft. bakery on 12th and Glenwood Ave., here. Estimated cost $1,000,000.

Pa., Phila.—The Paper Mfg. Co., 562 Cherry St., awarded the contract for the construction of a 6 story, 120 x 180 ft. paper factory on 5th St. and Willows Ave. Noted Oct. 12.

Pa., Pittsburgh—The Auto Truck Equipment Co., 7511 Penn Ave., and A. G. Wickersham, Archt., 517 McClure Ave., Homestead, are receiving bids for the construction of a 1 story, 31 x 99 ft. auto trim and paint shop at 7505 Penn Ave.

Pa., Pittsburgh—The Crandall McKenzie Co., Jenkins Arcade, awarded the contract for the construction of a 2 story, 30 x 60 ft. addition to its dyeing plant at 7029 Chaucer St. Estimated cost $10,000.

Pa., Pittsburgh—The F. J. Kress Box Co., 2930 Liberty Ave., awarded the contract for the construction of a 3 story, 70 x 155 ft. addition to its box factory. Estimated cost $40,000. Noted Nov. 16.

Pa., Ridgway—Hyde Murphy Co. will build a 4 story, 60 x 90 ft. addition to its woodworking factory.

Pa., Tullytown — The Megargee Paper Mills, 16 South 6th St., Phila., plans to build a paper plant, here. Architect not selected.

R. I., Providence—The Crompton & Knowles Loom Wks., 93 Grand St., Worcester, Mass., will soon award the contract for the construction of a 2 story, 50 x 170 ft. addition to its plant on Harris Ave., here. Estimated cost $60,000. Private plans.

Tex., Dallas—E. M. Thomas, c/o Trinity Constr. Co., S. W. Life Bldg., will receive bids until January 1, for the construction of a 2 story, 75 x 140 ft. ice cream cone factory at 2220-22 South Harwood St., for the Consolidated Wafer Co., 2426 South Harwood St. Estimated cost $10,000. L. D. Pape, Secy. and Mgr.

Tex., McKinney—The Texas Cotton Mills Co. plans to double capacity of present textile mill and industrial housing. Estimated cost $750,000. Engineer not selected.

W. Va., Charleston—The Evans Lead Co., Essex Fells, N. J., awarded the contract for the construction of a 1 story, 50 x 180 ft. and a 4 story, 50 x 180 ft. plant for the manufacture of lead products, here.

W. Va., Clarksburg—The Clarksburg Ice & Storage Co. will build a 1 story, 50 x 120 ft. ice plant. Estimated cost $50,000. Noted Oct. 12.

W. Va., Huntington—The Nightrack Mfg. Co. awarded the contract for the construction of a 2 story, 40 x 120 ft. woodworking factory. Estimated cost $25,000. Noted Nov. 23.

W. Va., Logan—The Logan Ice Co. is having plans prepared for remodeling and building a 22 x 100 ft. addition to its ice plant. A. C. Bishop, 427 Guardian Bldg., Cleveland, O., Engr.

W. Va., Princeton—The Princeton Hosiery Mills Co. will build a 2 story, 48 x 118 ft. hosiery mill. Estimated cost $25,000. Noted Oct. 26.

W. Va., Shinnston—The Alley Glass Co. will soon receive bids for the construction of a glass factory. Estimated cost $250,-000. L. Alley, Pres. Architect not announced.

Wis., Denmark—The Danish Pride Milk Co., 608 North 8th St., Sheboygan, plans to build a 2 story condensery and milk factory, here. Estimated cost $60,000. Architect not selected.

Wis., Milwaukee — The Federal Rug Cleaning Co., 914 Winnebago St., awarded the contract for the construction of a 2 story, 50 x 60 ft. addition to its factory. Estimated cost $20,000. Noted Nov. 23.

Wis., Milwaukee—The Wisconsin Ice & Coal Co., 216 West Water St., awarded the contract for the construction of a 1 story, 114 x 120 ft. ice manufacturing plant on 31st and Galena Sts. Estimated cost $60,000.

Wis., New London—The Wisconsin Cabinet & Panel Co. will build a 2 story, 72 x 112 ft. box factory. Estimated cost $60,000. J. H. McLaughlin, Mgr.

Wis., Sheboygan—The Vollrath Co., West Michigan Ave., awarded the contract for the construction of a 2 story, 180 x 200 ft. enameling factory, including annealing and stamping room. Estimated cost $35,000. D. F. Riess, Secy.

B. C., Vancouver—Cranes Shipyard, Ltd., North Vancouver, plans to build marine ways and repair plant on Georgia and Denman Sts. Estimated cost $40,000.

Ont., Niagara Falls—The Welland Packing Co., Ltd., Welland, awarded the contract for the construction of a packing and canning factory along the tracks of the Michigan Central R.R., here. Estimated cost $44,000.

Que., Hull—The Lion Meade Tire Co. awarded the contract for the construction of a 2 story factory at Wrightville. Estimated cost $75,000.

American Machinist

Volume 57 NEW YORK, DECEMBER 14, 1922 Number 24

Repairing Locomotives in a Milwaukee Shop

Modern Production Methods Applied in a Locomotive Repair Shop—Uses of the Electric Welding Machine and Gas Torch—Time-Saving Devices

BY HOWARD CAMPBELL

Western Editor, *American Machinist*

ALTHOUGH railroad repair shops as a rule are not noted for their modern methods, the West Milwaukee shops of the Chicago, Milwaukee and St. Paul Railway are keeping up with the times both as to methods of production and in handling the work. Material is ordered and delivered in a systematic manner, and

FIG. 1—WELDING SMOKE-BOX RING INTO FIRE-BOX

the old idea of setting up a machine where there was the most space has been discarded for the modern system of grouping. All the machines that are necessary for the machining of any of the major parts are arranged so that the operations can be performed in sequence.

Instead of the machinist or his helper going to the stock room for material, he simply notifies the foreman. The latter makes out an order and drops it into a box attached to his desk. A stock-boy collects these orders every half-hour and within the next half-hour the material is delivered to the machine by a laborer from the stock room.

Another interesting feature of this shop is that the customary method of having parts forged in the blacksmith shop is being largely discarded. Patterns have been made for most of the parts that comprise the link motion and steel castings for these parts are now kept in stock. As the castings are made exactly to size where no machining is required, the expensive forging operation and a great deal of unnecessary machining is saved.

Another saving, and certainly a most sensible one, is assured in the making of drive-bolts. These are turned out of round bar stock, the material being of sufficient diameter to leave a head of the desired size. The stock is much cheaper and the round head, for this purpose, is just as efficient as a hex or square head. If the bolt is loose enough, so that a wrench would have to be used to hold it from turning, it is too loose to use in a place where a drive fit is required. These bolts are used in all places where drive fits are necessary.

Many of the parts that formerly were riveted are now spot-welded together, an electric arc-welding machine being used for this purpose. In Fig. 1 is shown the operation of welding the smoke-box ring into

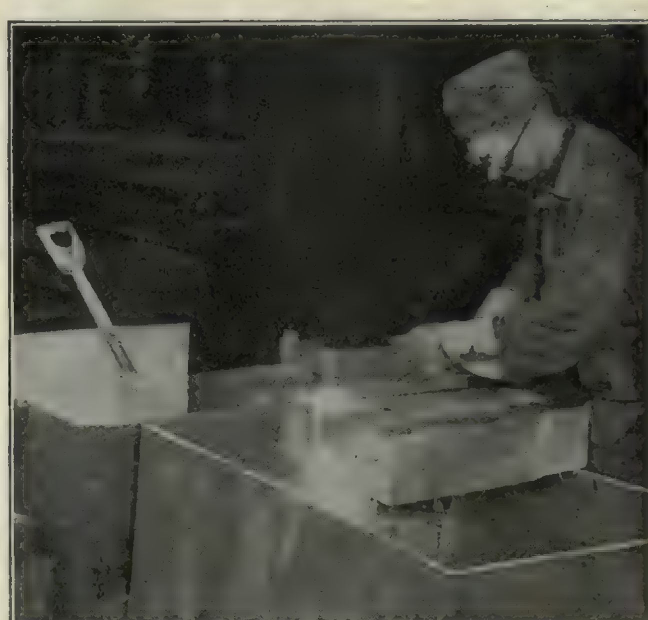


FIG. 2—BLANKING OUT MAIN ROD WITH GAS TORCH

the front end of a locomotive fire-box. The machine is a Burke Electric Arc-Welding machine, using a current up to a maximum of 200 amperes at 50 volts. The seam is welded both inside and outside, a ⅛-in. iron wire being used to make the weld. This makes a much smoother looking job than the old method of riveting and saves the time of drilling the holes and heading the rivets. The time required for riveting in a smoke-box ring was approximately five hours and required the time of four men. One man can easily weld a ring in alone, doing the job in six hours. Door-sheets and flue-

sheets are also welded in instead of being riveted, saving 50 per cent of the time formerly required to assemble these parts. The hopper is welded into the ashpan, using an arc-welding machine made by the C. & C. Elec. Mfg. Co. The current is transformed down from 220 volts to 45 volts, 600 amperes. Scrap strips of boiler plate are used for the welding material. It once

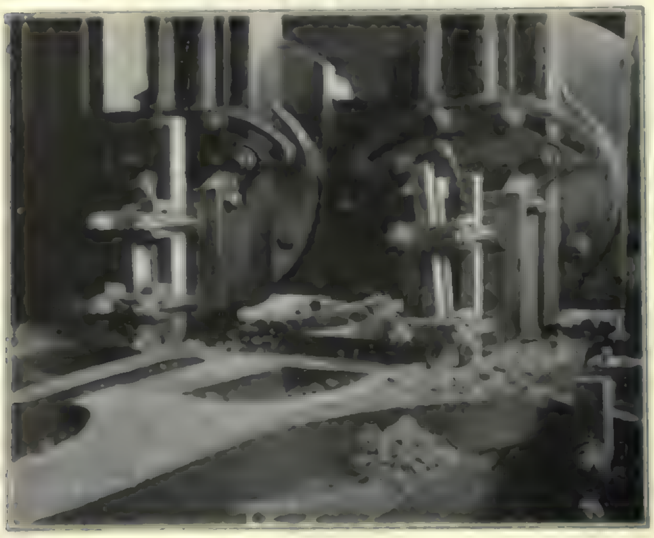


FIG. 3—USING MULTIPLE TOOLS ON PLANER

required from 15 to 18 hours to rivet a hopper in place but now the welding operation takes approximately three hours.

The acetylene gas torch also has its place in this shop. The operator, shown in Fig. 2, is cutting out or "blanking out" the end of a main rod, using a gas

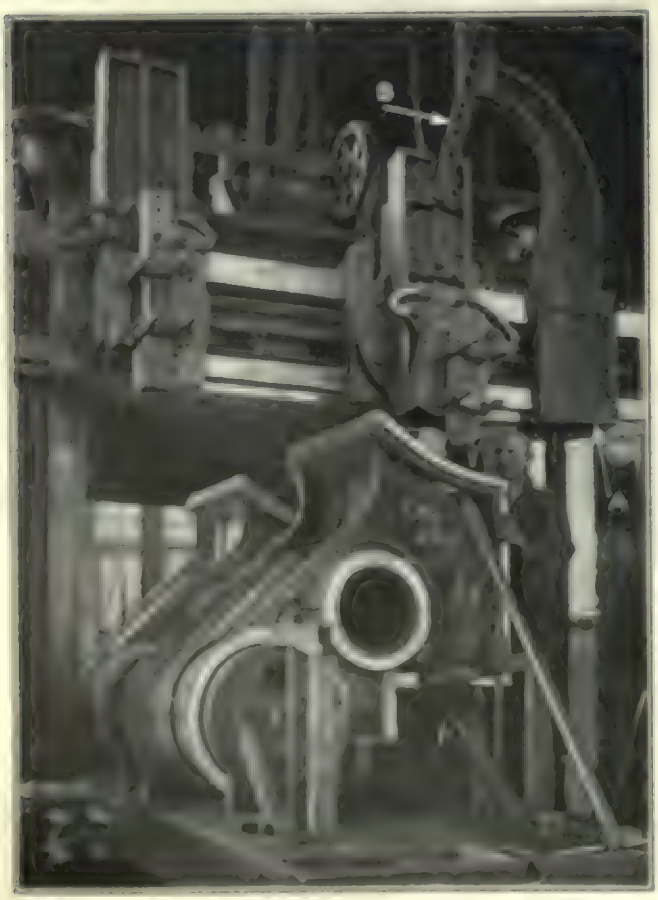


FIG. 4—PLANING RADIUS ON CYLINDER CASTINGS

torch with a cutting tip. The rod is laid out and two holes are drilled at the inner corners of the block, these holes forming the radius necessary in the corners. The rod shown in the illustration is 5½ in. thick and the average time required to cut out the block is 15 minutes. This operation used to take five hours on the slotter. The finishing operation is done on the slotting machine and takes the same amount of time as before, about 3½ hours. Immediately after the block is cut out, and while the rod is still hot, the rod is thrown into the box just the other side of the operator and the hot ends are covered with asbestos, so as to prevent oxidation and the resultant hardness.

That this shop is keeping up with modern ideas of production is evidenced by the use of multiple tools on the planer shown in Fig. 3. The operation is that of planing the side of a locomotive frame. Eight tools are in operation simultaneously, one on each upright of the planer and three in each of the heads on the cross-rail.

FIG. 5—CRANK-PIN TURNING ATTACHMENT

Two of the three tools are set in tandem, each tool taking half of the roughing cut. The third tool is a finishing tool.

Another interesting planer job is shown in Fig. 4. Here the operation of planing the radius on a cylinder casting is shown, using an attachment by which the desired radius is cut as the head feeds across the machine. The arm A, which is of cast steel, is attached to the cross rail and the strap B is attached to it and to the toolslide as shown. As the cut proceeds across the piece, the strap swings on the bolts and the slide is gradually raised, describing an arc as it does so and cutting the desired radius on the casting. This saves the work of feeding the tool up by hand and makes a practically perfect job. The radius can be cut on a pair of these castings set up in tandem as shown in nine hours. This operation used to be done by hand chipping, which took 40 hours, and later by using an air hammer and chisel, which took 20 hours.

Another tool that saves a great deal of time and labor is the crank-pin turning attachment shown in Fig. 5. The attachment consists of a steel sleeve 12 inches in diameter and ¾ in. through the wall, attached by means of machine screws to a head on which a shank is turned. The shank fits into the spindle-sleeve of a quartering machine. The sleeve turns in the journal A which is attached to the support B. The tool, shown at C, is of ½-in. high speed steel. The tool has to be set to turn the pin to the desired diameter. As the work

has just been changed, the tool shown in the illustration is not set for the pin shown. When the machine is in operation, the sleeve feeds along at the rate of $\frac{1}{32}$ in. per revolution, turning at a rate of 12 r.p.m. The use of this attachment eliminates the necessity for pulling out the pin in order to turn it in a lathe as was formerly done.

A set-up for milling the flutes in spiral reamers and milling cutters is shown in Fig. 6. After a series of experiments, it was found that the best results were obtained by using reamers and cutters with left-hand spiral flutes. The reamers produce nice holes and practically never stick in the work, something that cannot be said of straight reamers nor of those with a very gradual twist. Large "bites" are impossible. The largest reamer, *A*, is a frame reamer, used for reaming the frame splice. The next tool, *B*, is a cutter used for milling the jaws in the side rod, as shown in Fig. 7. The third one, *C*, is for milling the keyway in the piston rod, and the fourth, *D*, is a standard taper pin reamer.

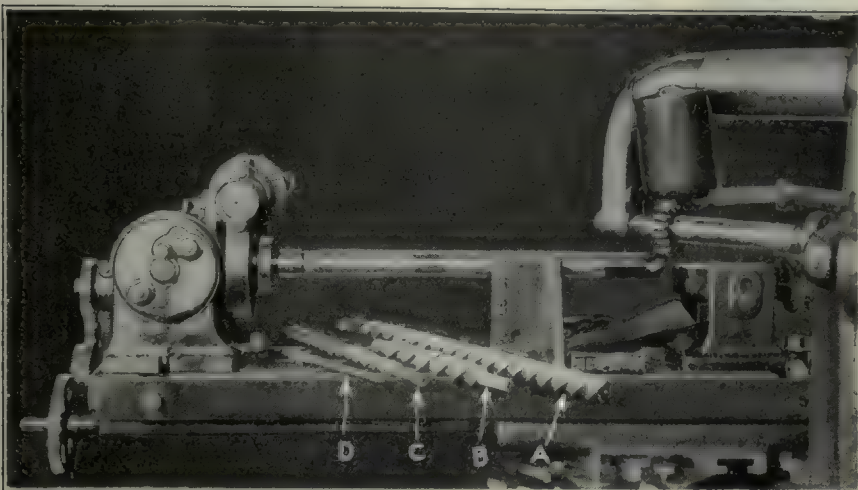


FIG. 6—MILLING FLUTES IN SPIRAL CUTTERS

The cutter used for milling the fork end of the side rod, as shown in Fig. 7, is eight inches long and $1\frac{1}{4}$ in. in diameter. The cutter feeds in on the top of the slot and out on the bottom, making a smooth job. The time is $2\frac{1}{2}$ hours as compared to the old time of $3\frac{1}{2}$ hours on the slotting machine. An application of a universal joint to a reamer is shown in Fig. 8. The joint is so simple that no explanation is necessary. By using this, the necessity for perfect alignment of the work with the spindle is eliminated, thereby saving a considerable amount of time. The job shown is that of reaming out the bearing hole in a link-cheek.

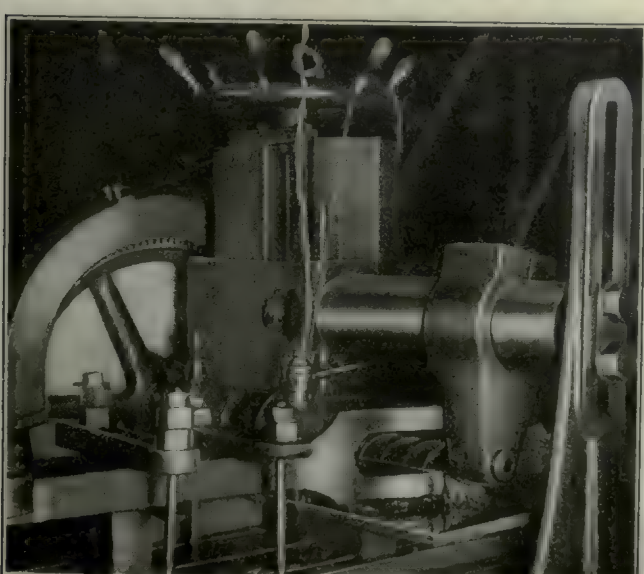


FIG. 7—MILLING FORK END OF SIDE ROD

A jig for drilling the holes in a jet nozzle for a standard stoker is shown in Fig. 9. The piece is locked into the box *A*, which swings on pins, one on each end. Plate *B* contains a bushing through which nine $\frac{3}{16}$-in. holes are drilled, one at a time. Each hole is located by the use of the spring-pin *C*, which slips into each of a series of holes in the end of the box, as it is swung around.

After these holes are drilled, pin *C* is pulled out and locked and spring-pin *D* is slipped into a hole, holding the box central while three holes are drilled through the plate *E*, and three more through a similar plate on the other side of the jig. After this the jig is turned bottom up and pin *D* is slipped into a hole which brings the two holes *F* in line with a pair of bushings in the bottom of the jig. The jig is shown in this position in the photograph, although it hasn't been turned over. The amount of time saved over the time required for laying out this casting is obvious.

A jig for drilling the one hole in a split valve packing-ring is shown in Fig. 10. The old method of making these rings was to turn them, drill them, and then split them. They had to be laid out for drilling. Now they are turned, split, and then drilled, saving the laying out time. One end of the ring is held firmly by the clamp *A* and the other end is locked into block *B*. The knurled screw *C* passes through a hole in block *B* and screws into a swivel nut attached to the plate to which the clamps are attached. By turning screw *C*, the ends of the ring are brought together and clamp *D* is applied. Then the hole is drilled through the bushing shown just under the point of the drill.

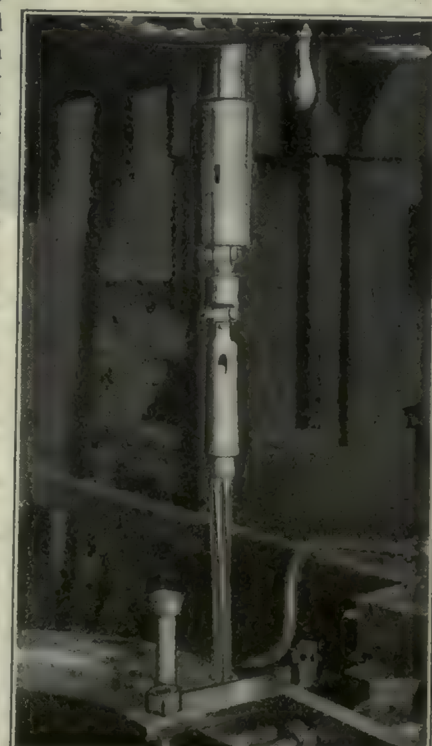


FIG. 8—UNIVERSAL JOINT ON A REAMER

The machine shown in Fig. 11 was built in the shop tool room, and is used for milling the ports in slide-

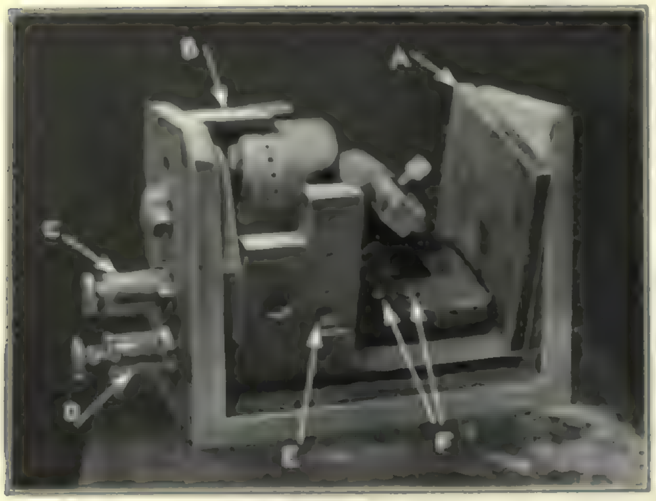


FIG. 9—DRILL JIG FOR JET-NOZZLE

FIG. 10—DRILLING A SPLIT VALVE PACKING-RING

valve cylinders. Little description is necessary as the operation of the machine can be determined by studying the photograph. The cross-rail is bolted to the two angle plates *A*, and to the bottom of each plate is attached a nut in which the screws *B* turn. The handle *C* turns a shaft on which are two bevel gears that mesh with similar gears on the ends of the screws, making it possible to feed the mechanism across the work.

The vertical feed-rod and cross-feed screw operate the same as on any cross-rail. Without this machine, it would be necessary to chip the clearance by hand or air-hammer, then put the cylinder onto a planer and finish the ports, a very tedious operation. This method used to take approximately six hours, while by using the machine shown, the job can be done in two hours, a worth-while saving.

The home-made link-grinding machine shown in Fig. 12 is used for grinding the radius on the inner surfaces of a link. The wheel, shown at *A*, is 2¼ in. in diameter and 3¼ in. long when it is new. The link is held in place by the clamping action of the two bolts *B* through the carriage *C*. The carriage is made of two parallel pieces held together by shafts through either end, these shafts also serving as axles for the four wheels on which the carriage rides. The wheels are V-shaped to fit into the grooves in the ways *D*. The handle *F* is used to

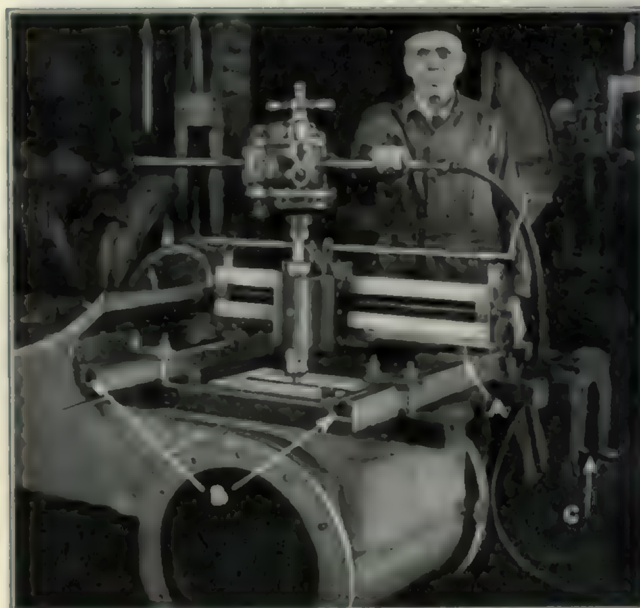


FIG. 11—MILLING PORTS IN SLIDE-VALVE CYLINDERS

feed the carriage past the wheel. The wheel is attached to a slide which can be adjusted for height by turning the handle *G*, attached to an adjusting screw. Although the ways are perfectly straight, the carriage describes an arc as it rides back and forth on the ways, the radius of the arc being determined by raising and lowering the ways by means of the screws *E*. The ways are attached to a large plate *H* that can be adjusted so that the wheel will be worn evenly.

The link shown in the photograph is of the hand-

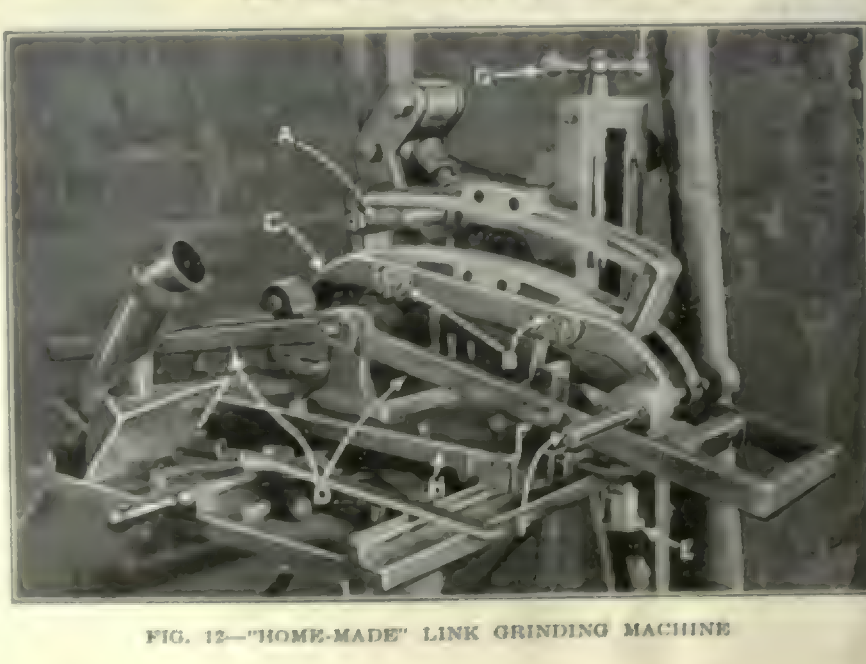


FIG. 12—"HOME-MADE" LINK GRINDING MACHINE

forged type which has been discarded for those of cast steel. Spring steel plates $\frac{3}{8}$ in. thick, made from old locomotive springs, are welded onto the radial surfaces of the cast steel links, and are then ground to the desired radius. When these plates are worn down to the limit, they are replaced. Thus the links are saved, the scrap spring-leaves are made use of, and the time of electric-welding a pair of spring-plates into a link is small compared with the time required for forging a new link.

The mechanism shown in Fig. 13 is a device for pressing cylinder bushings into place, and is counted one of the most valuable labor-saving tools in the shop. It consists of an ordinary air drill, the spindle of which drives a set of compound gearing enclosed in the housing *A*. The hub of the fourth, or driving gear, contains a nut that is threaded to fit a square thread on the screw B. This screw is $2\frac{3}{8}$ in. in diameter and extends through the cylinder, and through a brace and nut on the other end. A ball-bearing thrust washer is placed between the nut which does the pulling and the hub of the plate *C*, to take the wear and facilitates the operation. When the air is applied, the gears turn and the nut threads itself onto the screw, driving plate *C* before it and pressing the bushing *D* into the cylinder.

The older and more usual method of doing this job is to heat the cylinder until it expands until the bushing can be pressed or driven in by hand. This, however, is very hard work and the time required for the heating alone is approximately three hours, whereas, with the devices shown here the job can be done in 45 minutes. Heating the cylinder also sets up stresses in the metal which sometimes prove disastrous. The strength of the mechanism is evident from the fact that it has pulled 150 tons in a test.

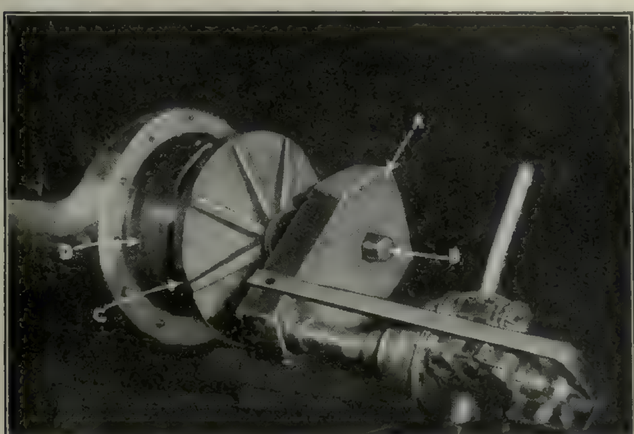


FIG. 13—PRESSING-IN A CYLINDER BUSHING

Time is also saved by the method of fitting the bushing to the cylinder. Instead of boring the cylinder straight, the left, or last half is bored $\frac{1}{16}$ in. smaller than the right, or first half and the bushing is turned to fit it accordingly, leaving the usual amount on each diameter for a press fit. This makes it possible to insert the bushing half-way into the cylinder before power has to be applied, yet the bushing fits just as tightly as though it were all one diameter.

The operation of milling the ports in a valve bushing is shown in Fig. 14, using a Milwaukee No. 3 milling machine and a rotary attachment that is supplied by the manufacturer of the machine. The table of the machine is adjusted so that the cutter is central with the rotary table, then the feed mechanism is applied, through a train of gears, to a worm and wheel on the under side of the rotary table. The two lines *A* are the operator's layout lines. After laying out the casting, the table is fed in until the cutter is through the wall of the casting, then the rotary feed is applied. The top edges of all the holes are milled first, then the bottoms. A gage is used by the operator to be sure that every port is of the correct size and shape.

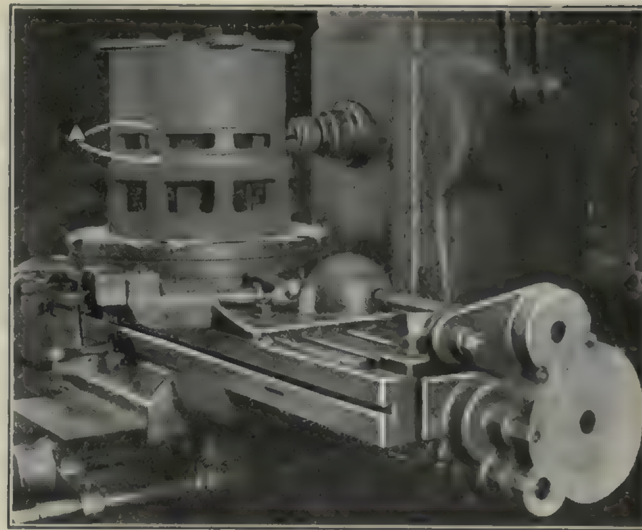


FIG. 14—MILLING PORTS IN A VALVE BUSHING

Grinding and Other Practices in Motor Building

By Frank C. Hudson

There is a general tendency toward making motors and other parts of motor cars so they will be longer lived. Bearings are being better fitted, with due allowance for the oil film for lubrication, and piston pins are being carefully considered. The use of aluminum alloy pistons introduced a new problem in the way of increased expansion in the piston itself as the motor warms up. Where the piston pin is held in the connecting rod it is necessary to have the pin fit the piston very closely, when cold. One builder heats his pistons in hot water before putting the pins in place, thus expanding the pistons so the pins will slip in more easily.

Long service between repairs demands that both the holes and the pins be round, which also applies to the bushings used in some connecting rods when they do not carry the pins. In most cases the holes in pistons are finished by reaming, although some are ground and a few makers have tried broaching. Piston pins are ground without an exception so far as we know, but the grinding practice differs materially from shop to shop.

Piston pins are made in two ways, from steel tubing and from bar stock, and in the latter case the drilling is usually divided into two or three operations. There seems to be a feeling that the steel runs more uniformly in bars than in tubing, and that pins of more uniform hardness can be secured if made from a bar. The holes are usually countersunk to fit a 60-degree center for grinding between centers. In all cases the ends of the pins are either chamfered or the corners rounded. In a few cases the holes in the pins are rough ground, but this is unusual. The general practice is to grind the countersinks to insure a perfect seat for the centers in

grinding the outside, though where the pins are ground on the centerless type of machine, this is unnecessary.

Ever since the centerless grinding machine came into use there have been many questions as to its ability to grind pins round and straight. Time and experience have proved that both are possible on a good machine, properly handled. But here again practice varies widely. Some makers advocate the centerless machine for rough grinding, leaving the finishing to be done between centers. Others, and among them some who are very exacting as to requirements, reverse this process and rough grind between centers, finishing on a centerless machine.

Moreover, they get a splendid job, both as to roundness, straightness and finish, and at a rate of from 12 to 15 a minute. This production could be increased except for the fact that the pins are not allowed to fall into a chute or box but each one is picked out to be sure it is not marred in any way. By this method, with the 0.02 in. left for the finish grind, they secure a beautiful surface which does not require lapping and pins which test round on a Prestwich or other supersensitive gage.

Experience indicates that the centerless grinding machine will produce round work if the pins are round to begin with, while there are some who contend it will perfect pins that are not round. Steering pins, bushings, rollers and the like are being ground in large quantities on centerless machines, the continuous process evidently appealing to production managers. In some cases parts are being redesigned so that they can be finished on the centerless machines. For, while parts with collars can be ground without centers, the advantage of continuous feeding is lost and in many cases it has been found advantageous to omit collars and other protuberances.

The finishing of bushings for the small ends of connecting rods where the piston pins either float or are held in the pistons, is another operation that is performed in various ways. Some bushings are broached, some bored with a single point tool (a diamond in a few instances), some ground and many reamed. The final finishing takes place after the bushings have been pressed into the rods. One builder grinds the bushings after they have been put in place, swinging the connecting rods on a face plate which locates them by the large end. This method insures the holes being at the correct center distance and in alignment with each other. But the hole is not ground to size, as the surface left by the wheel is not just what this particular maker desires. So 0.002 in. is left for finish by reaming. It is contended by some makers that while the ground surface may not appear to be as smooth because of its lack of polish, that in reality it provides a good bearing surface. And further, that if there are any indentations due to the grinding wheel, they are extremely small and serve only as tiny oil pockets.

The bearings at the large ends of connecting rods and the main or line bearings in the crankcase are a different story. Here as with piston pins, there seems to be a leaning toward selective assembly with regard to the high and low limits. The bearings are either selected to give the proper fit on the crankshaft or else they are reamed to fit the shaft by Martell or some similar system. Scraping has been abandoned by nearly all motor builders, as the general opinion seems to be that a reamed bearing is best when properly done.

The "burning-in" of bearings is practiced in a few large production plants and when well done is very satisfactory. The bearings are pinched tight on the shafts and the shafts run until the bearing metal softens enough to conform to them in every particular. The "running-in" of bearings is an entirely different matter and should not be confused with burning-in. Running-in is in reality nothing but a limbering up of the bearings to insure enough space between them and the pins or shafts, for a sufficient supply of lubricant. The methods used vary from running the engine by an electric motor with rods in place and thoroughly lubricated —to running the rods in on a dummy shaft which represents the crank pins. The objection to the latter method seems to be that the crankpin is assumed to be exactly the same size as the dummy shaft, which can hardly be the case. Some builders give every motor a running test under its own power for a given length of time and a few go so far as to tear the motors down and, after careful examination, reassemble them for a short final test and assembly in the chassis.

Report on Gage Steel

The Gage Steel Committee of the Bureau of Standards report that satisfactory progress has been made in the study of the wear of "Ketos" steel. This steel, as hardened, has been worn against itself and against hardened disks tempered at 150, 200, 250, 300 and 400 deg. C. (302, 392, 482, 572 and 752 deg. F.). The results obtained to date indicate that, under the very special conditions of testing used, the steel is increasingly resistant to wear with increasing tempering temperatures up to about 300 deg. C. (572 deg. F.). With higher tempering temperatures the wear resistance decreases. Tests of this steel hardened and tempered at several other temperatures are now in progress.

A few preliminary experiments on a steel which has no hardening transformation in the heat treating range, showed that a scale several thousandths of an inch thick forms on heating to 800 deg. C. (1,472 deg. F.) in an electric furnace with access of air. To obviate oxidation, 4-in. cylinders of this steel were heated in an electric furnace in which illuminating gas was burning and quenched in water. One, previously silver plated, was free from scale and showed a shrinkage of about 0.0001 in. in length and diameter. The other, unprotected, increased 0.0002 in. in length and 0.0003 in. in diameter and a thin scale formed. The difference between the two is evidently the thickness of the scale formed probably on transference from furnace to bath. Assuming that the difference between the change in diameter at the center and at the end is a measure of distortion, there is no indication of distortion on water quenching. Appreciable distortion must then occur with the hardening transformation.

High carbon steels having a hardening transformation during quenching, flake off their scale and this leaves the surface clean. To estimate the thickness of the surface layer so lost, a specimen of 1.10 per cent carbon steel was oxidized in an electric furnace with free access of air and found to lose 0.057 grams (0.88 grains) on removal of the scale. This is equivalent to a surface layer of iron about 0.0002 in. thick. It seems probable, therefore, that if precautions are taken to prevent oxidation in the furnace, scaling will not lead to serious error. Experiments are now under way to study the distortion accompanying the hardening transformation in chrome steel, taking the obvious precautions noted above.

Infection from Cutting Oil

Used Screw Machine Oil a First-Class Germicide—Results of a Careful Laboratory Test on Cutting Oils—Soda Solution a Remedy

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

AN ARTICLE in the *American Machinist* of September 21st, 1922 by Gus Haessler tells of the benefits derived from the sterilization of cutting oil. The article winds up with the following sentence: "Sterilization attacks the problem at its root and oil systems that do not include this process should be regarded as hardly in step with modern sanitary engineering practice." The following remarks are not for the purpose of minimizing the value of sterilization but of putting before the users of cutting oil, which means before the management of practically all machine shops, the facts obtained by an investigation of the troubles resulting from the use of such oils.

At one time, the Singer Manufacturing Company was confronted with these troubles. Many men in the screw machine department and in other departments, where cutting oil was used, suffered from infection which sometimes resulted in sores on the arms or other parts of the body, in some cases causing nausea and other internal troubles and occasionally both. The writer among others was firmly convinced that sterilization was necessary and that it would probably solve the problem. In order to find out how to proceed with the greatest possible amount of assurance, the Lederle Laboratories were asked to make tests of oil, new and used, with and without sterilization and to suggest means of obtaining the best possible results. Three reports were received from the laboratories and one is printed here in full, with the kind permission of the Singer Manufacturing Company.

LEDERLE LABORATORIES
SANITARY, CHEMICAL AND BACTERIOLOGICAL INVESTIGATIONS

39-41 West 38th Street
New York City

SECOND
REPORT

In the Matter of a Series of Bactericidal Tests of Two Samples of Lubricating oil marked "Lard Cutting Oil as Received, 1" and "Lard Cutting Oil after Use, but not filtered, 2." Received from the Singer Manufacturing Company, about April 19, 1916.

TECHNIQUE

Test organism: In all of the tests here reported Staphylococcus pyogenes aureus, grown in beef extract broth for 24 hours at a temperature of 37 deg. C., was the organism against which the germicidal efficiency of the oil was tested.

Environmental factors: Before the beginning of the test the portions of oil which were to be tested were raised in temperature to 37 deg. C., by the expedient of placing them in a body heat incubator for a sufficient length of time.

The operation which marked the beginning of each test consisted in removing the oil from the incubator and inoculating each portion with two-tenths of a cubic centimeter of the 24 hour, 37 deg. C., broth culture of Staphylococcus aureus, which had been filtered to remove clumps; and immediately returning the portions of oil to the incubator. In this manner the temperature environment was maintained and the efficiency of the tested materials measured at a given point.

The amount of each tested portion was twenty cubic centimeters, contained in a one-ounce, glass stoppered bottle which had been sterilized prior to use.

In each of the first five tests the two controls which were included consisted of sterile distilled water and, in one of these, 0.5 per cent sodium chloride had been added before sterilization. In each case, the amount was twenty cubic centimeters.

PROCEDURE FOLLOWED IN MAKING THE VARIOUS TESTS

In test No. 1 the oils were tested without in any way altering them.

In test No. 2 the oils were tested after heating, at 100 deg. C., in flowing steam, one time for thirty minutes. This was done by transferring 50 c.c. or more from each of the samples to a small flask and sterilizing it in that container.

In test No. 3 the oils were heated at 100 deg. C., in flowing steam, two times for thirty minutes each time, before testing.

In test No. 4 the oils were heated at 100 deg. C., in flowing steam, three times for thirty minutes each time, before testing.

In test No. 5 the oils which had been heated at 100 deg. C., in flowing steam once only, were again heated in superheated steam under a pressure of 20 lb. for twenty minutes before testing.

In test No. 6, oil No. 2 was omitted. Oil No. 1 was treated in two different manners to make it germicidal, and was used, untreated, as a control. The treatment of one portion consisted in heating it, in a porcelain casserole, over a free flame for 10 minutes. The treatment of the other portion consisted in adding to it Merck's Xylenol, B. P. 200 deg.—215 deg. C., in the proportion of 1:1000.

In test No. 7 No. 1 oil was heated in a sand bath over a free flame for one hour and forty-five minutes, thereby charring and reducing it in volume to a noticeable extent. Number 1 oil, untreated, was used as a control.

Oil number 2 is a sample of the used but unfiltered oil. The results above reported show it to possess rather marked germicidal properties (Test No. 1) which were not in any way reduced by the subsequent heatings (Tests Nos. 2 to 5 inclusive). In view of the fact that the used oil becomes heated during use, attempts were made to determine whether heating of the fresh new oil would also bestow upon it germicidal powers. Apparently heating does produce such a change, but the amount of heat is upwards of 125 deg. Centigrade. As yet no efforts have been made to

determine definitely the point at which this property is produced, it being the present object to indicate in a qualitative manner that the heating was capable of developing the germicidal property in the oil.

The germicidal property in the used oil, No. 2, is far superior to that produced by the addition to new oil No. 1, of one part to one thousand of Xylenol, although the latter has ten times the germicidal strength of phenol when tested in appropriately constructed emulsions.

It would appear that the course to be pursued in the prevention of the transmission of disease producing bacteria from worker to worker by the new oil, would be to thoroughly mix the new oil which is customarily added to the used oil, and to do so before filtering and heating rather than afterwards. In this way the new oil would be subjected to both the germicidal action of the used oil and to the heating process, which later may tend to produce germicidal qualities in the new product.

These results would tend to indicate that the skin disease among some of the workers was not due directly to the transmission of infectious bacteria by the oil. A plausible working hypothesis is that the change made in some constituent of the oil by heating develops not only some germicidal property in it, but also some skin irritating substance or quality. It is altogether possible that this newly developed substance or property is also the cause of the symptoms of weakness and nausea of which some of the workers complain.

Respectfully submitted,

H. D. PEASE

Director, Dept. of Bacteriology Lederle Laboratories

F. D. BELL

Secretary

To: THE SINGER MANUFACTURING CO.
Elizabethport, New Jersey

This report shows not only that used oil has no more bacteria than new oil but that it doesn't have any at all and also that the used oil is so strong and effective a germicide that it is recommended to mix the new oil with some of the old if danger of infection is feared. The results were so completely at variance with what the writer had expected that nothing but a detailed scientific report would have convinced him and he can well understand that many others will require such positive proof before they can be convinced. It is for this reason that the report is printed in full.

REMEDIAL EFFECT OF SODA SOLUTION

This report was turned over to the shop physician who based his future action on a fact which had not been noticed heretofore but which was now observed, namely that the men who washed the screw machine products in the soda kettle never had sores on the forearms which were bare or on any other part of the body which was occasionally spattered with the soda solution but that their skin would be affected on those parts which were covered and where the clothing might be partly saturated with oil.

As a result of this observation, the doctor advised the men to wash themselves several times a day in a fairly strong soda solution. In addition he gave them some internal medicine and this treatment overcame the difficulty completely. It is to be regretted that the shop physician did not try the two treatments separately in order to find out which was the really efficient one. The fact, however, that the washers were free from trouble on those parts of the body which came in contact with the soda solution would prove to the writer that it is the soda solution which is the effective remedy. Whether the trouble comes from the free fatty acids or from the very fine chips which may get in the pores of the skin or perhaps from some aldehyde which is formed in the oil is not known.

The foregoing is not an argument against sterilization of oil though the report shows that sterilizing at 100 deg. C. (212 deg. F.) is not sufficient and that sterilization does not take place until a temperature of

LABORATORY TESTS ON CUTTING OILS

TEST NO. 1

Oils not treated in any manner, but inoculated with Staphylococcus aureus

Materials tested	Number of organisms surviving after indicated intervals of exposure 6 hours	24 hours
Oil No. 1	36,000	1,200,000
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	2,630,000	770,000
Aq. dest	2,720,000	660,000

TEST NO. 2

Oils sterilized at 100 deg. C., 1 x 30 minutes and inoculated with Staphylococcus aureus

Oil No. 1	4,385,00	2,070,000
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	2,670,000	1,315,000
Aq. dest	2,735,000	270,000

TEST NO. 3

Oils sterilized at 100 deg. C., 2 x 30 minutes and inoculated with Staphylococcus aureus

Oil No. 1	2,110,000	0
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	990,000	950,000
Aq. dest	1,145,000	100,000

TEST NO. 4

Oils sterilized at 100 deg. C., 3 x 30 minutes and inoculated with Staphylococcus aureus

Oil No. 1	3,955,000	1,865
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	10,000,000	6,315,000
Aq. dest	8,000,000	26,500

TEST NO. 5

Oils sterilized at 100 deg. C., 1 x 30 minutes + autoclaving at 20 lb., 20 minutes, and inoculated with Staphylococcus aureus

Oil No. 1	700,000	20
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	6,400,000	4,080,000
Aq. dest	6,200,000	3,825,000

TEST NO. 6

Oil No. 1 heated over free flame 10 minutes
Oil No. 1 with Xylenol added in proportion of 1:1,000
Oil No. 1 untreated, and all inoculated with Staphylococcus aureus.

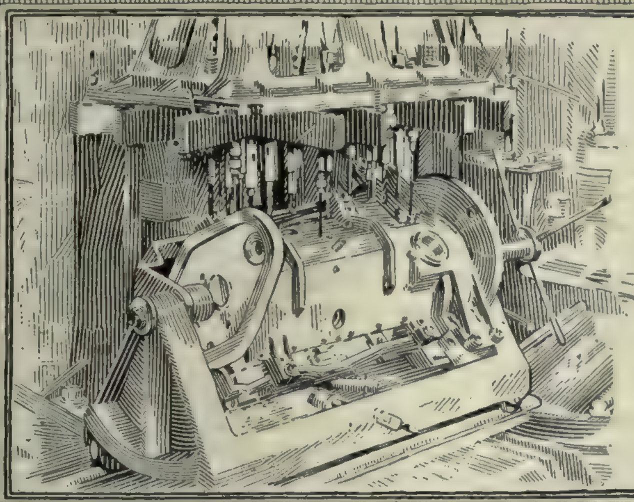
Oil No. 1 heated over flame	1,890	0
Oil No. 1 with Xylenol	3,315,000	590,000
Oil No. 1 untreated	3,300,000	1,770,000

TEST NO. 7

Oil No. 1, heated in sand bath 1 hour, 45 minutes
Oil No. 1, untreated, and both inoculated with Staphylococcus aureus.

Oil No. 1 heated in sand bath over free flame	0	0
Oil No. 1 untreated	6,000,000	1,295,000

125 deg. C. (257 deg. F.) is used. It does point out, however, that sterilization does not eliminate bacteria, because there are none to eliminate. If oil is sterilized at all, it should be sterilized when new. It was also found at the plant of the Singer Manufacturing Co., that sterilization alone did not remove the trouble, but that washing in alkaline solutions did.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Bending Dies for Producing Circular Work—Methods of Forming Bushings—Curling Beaded Work and Similar Parts—Plain and Progressive Bending Operations

WHEN a piece of work is to be formed in a circle there are many ways in which the operation can be done. It requires more than one operation to complete a circular piece, although it is possible to combine operations in such a way that one part will be produced at each stroke of the press. A very ingenious die has been recently designed for producing bushings. The development is interesting and somewhat different from the average run of die practice. The work shown at *A* in Fig. 478 is a bronze bushing which was previously made from a casting. The operations required in the old method were turning the outside diameter, facing the ends and reaming the hole, allowing sufficient stock for line reaming after assembling. A chamfer such as shown at *B* was also machined, so that the bushing would enter the work easily.

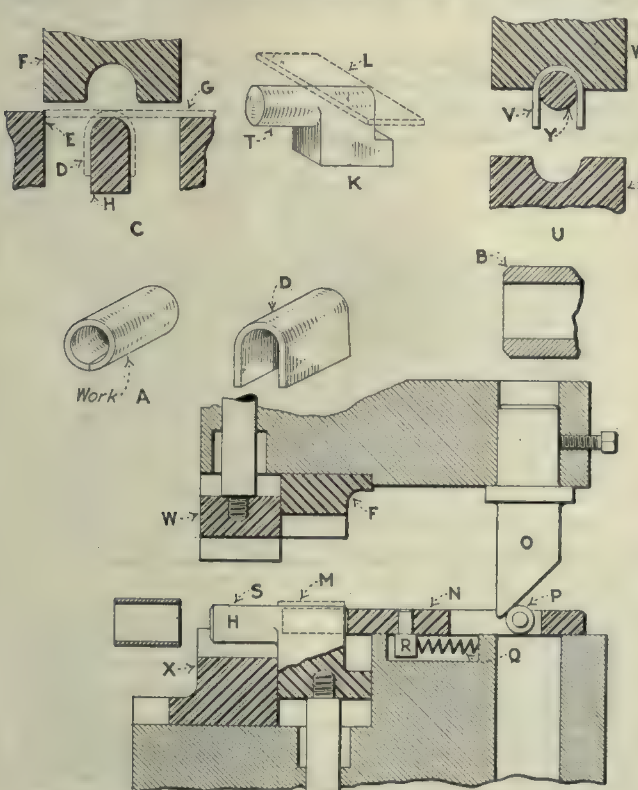


FIG. 478—DIE USED FOR FORMING BUSHING

As a large production of these bushings was required, the die shown was designed to meet the requirements, and it was found that the bushings obtained were within the required accuracy. The bushings were made from strip stock, and before running through the die they were put through a shearing operation which cuts the bevel or chamfer *B*. The die shown cuts the blank to suitable length and does two forming operations at the same time.

The first operation, shown at *C*, bends the work in the form *D*. The stock stops against the portion *E*, and as the punch *F* descends the material is cut off to length at *G*. As the punch continues its downward movement it forms the work over the support *H*. A detail view of this part is shown at *K*, and a piece of work is shown in dotted lines at *L* before it is bent into U-shape. In the sectional view of this die the work is shown at *M* by dotted lines.

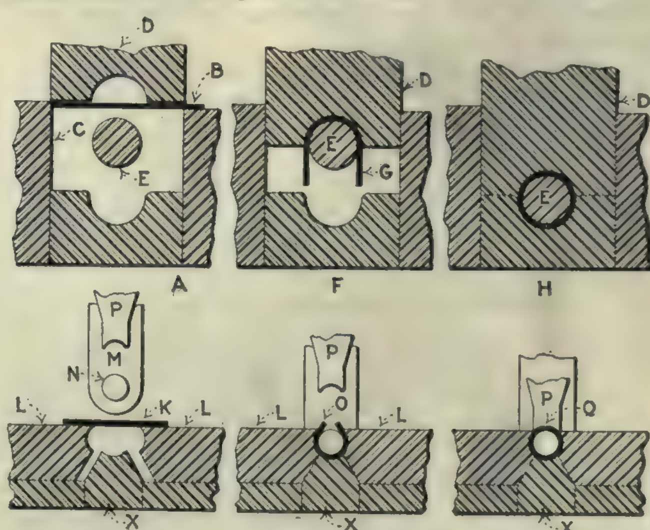


FIG. 479—DIES FOR FORMING BUSHINGS

After the work has been cut off and bent to its first shape, the punch descends and the work is pushed for-

ward by means of a fork-shaped sliding plate *N* operated by the tapered pin *O*, which strikes against the roller *P* set in the plate. A spring *Q* thrusts against the pin *R* on this plate and forces it forward when the punch is withdrawn. As this operation is completed, the fork moves the U-shaped piece of work forward until it lies over the plug end of the support *H*, as at *S*.

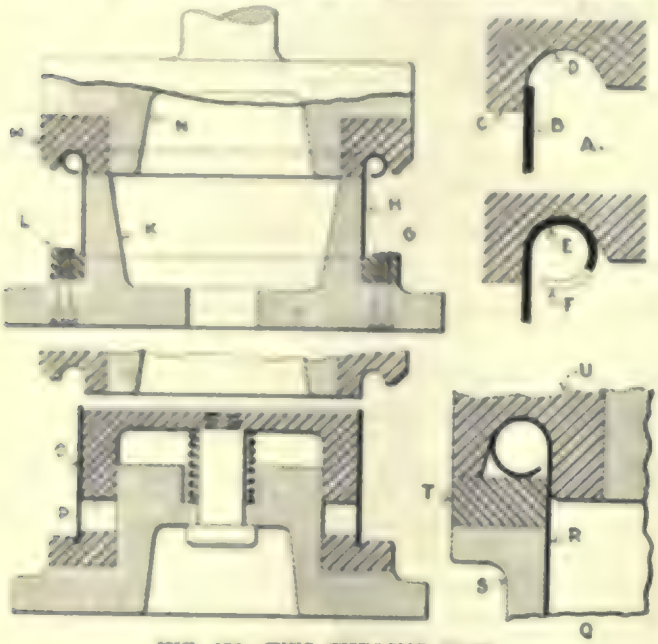


FIG. 480—TWO CURLING DIES

The view at *K* shows more clearly how this piece is moved forward over the plug section *T*.

The second forming operation is shown in the cross-sectional view at *U*. Here the work is indicated at *V*, and as the punch *W* is brought down it strikes the work and holds it on the arbor *Y*. As the action is carried further the work enters the die *X*, to which it is forced to conform, thus completing the circle. The punch ascends after this operation, and at this stage the plate *N* forces a previously semi-formed bushing forward, which pushes off the completed bushing. This operation is repeated so that at every stroke of the press a complete bushing is made.

By using this die with a friction feeding device, the trip of the press can be permanently set so that 90 to 100 bushings per minute can be produced. A bushing of this type is often made with a small oil hole in the center, and if this is desired it is possible to put a punch in the die *F* and a hole in the support *H*. The die is so designed that the parts are interchangeable and various sizes of bushings can be produced.

Other Methods of Producing Bushings

Two other methods of producing bushing forms are shown in Fig. 479. In the example *A*, which employs a curling die, the stock *B* is fed against the edge of the die at *C* to determine the length. The punch *D* is arranged so that it shears the blank and carries it down over the pin *E*, which is supported in a slide by means of heavy springs. The diagram at *F* illustrates the position taken by the blank *G* over the pin *E*. A continuation of the movement downward causes the edges of the blank to enter the lower die and follow it around, thus producing the completed bushing as shown in diagram at *H*. When the punch recedes, the pin follows it upward and leaves the bushing exposed so that it can be removed by sliding over the end of the pin.

Another method of producing the same bushing is shown in the lower part of the illustration. The blank *K* is located on the die *L* and the punch *M* carries a pin *N*, which comes down on the blank and forces it against the anvil *X* and between the movable members of the die. A continuation of the movement causes these two movable members to close in on the work until they have formed it to the shape shown at *O*. Immediately after this the punch *P* strikes and finishes the form as at *Q*, thus completing the operation. The punch *M* which carries the pin *N* is obviously mounted on springs of sufficient stiffness to develop the necessary pressure in forming. These two examples illustrate the application of closing-in attachments to forming operations.

Dies which form a circular bead around the edge of round work and which bend the end of work in a circular bead are also called curling dies. Examples which illustrate the use of curling dies are butt-hinges, water pails, funnels, automobile horns, cooking utensils, etc. All of these parts have a curled portion which is made by a curling die, and although they may be entirely different, the principle used is the same in each case. Fig. 480 shows two examples of curling dies and illustrates the principles employed in work of this kind. At *A* is shown the work *B* which is to be curled in the die *C*. This die supports the back of the work, and as it is brought down the work curls around the formed edge *D* and produces the shape shown at *E*. The amount of curl obtained is governed by the stroke of the press. In most cases the curl is made as shown by the dotted lines at *F*.

A die for curling a round tube of large diameter is shown at *G*. The work *H* is set over a ring *K* and locates on the plate *L*. The punch is provided with a curling die *M* which is located in a body *N*. The operation of this die consists of bringing the punch down on the work until sufficient curl has been produced. In this case the curling die *M* stops against the ring *K*.

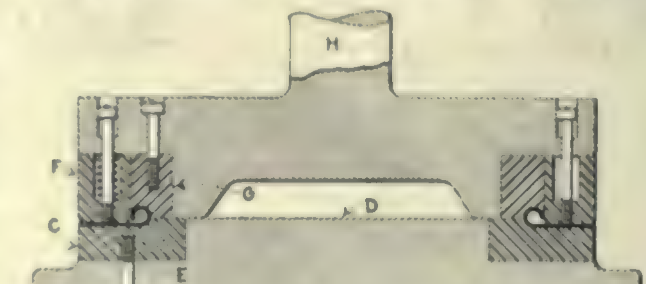


FIG. 481—TYPES OF CURLING DIES

The lower illustration is for a similar operation, although the die is of somewhat different construction. When the punch is in its upper position the work *O* is slipped over the ring *P*, which is mounted on a spring

slide and has an action similar to that of a stripper. The function of this ring is to prevent the stock from buckling when the die is brought down. The work is curled in the same manner as shown above and the construction of the die is somewhat similar.

It is sometimes found necessary to locate work in a bushing rather than on a plug, and at *Q* is shown a diagram to illustrate this method. The work *R* is located in the ring *S*, and the latter is provided with a hardened steel ring *T*. As the curling die *U* comes down on the blank, the work curls in the position shown and strikes against the ring *T* which determines the proper shape.

Examples of Curling Operations

Some other examples of curling operations are shown in Fig. 481. At *A* is shown a piece of work which is to be curled as indicated at *B*. The die used for this operation is shown directly above it. The locating ring *C* is fastened to a cast-iron shoe *D*, and the work locates on a previously formed radius *E* on this ring. The punch is provided with a pressure ring *F*, so that as it is brought down it pinches the work between it and the ring *C*. Then as the punch continues downward the curling die *G*, which is shaped to the required form, curls the work as shown. The pressure ring *F* assists in curling the work as the punch moves to its extreme downward position. The curling die *G* is fastened to the cast-iron punch by means of screws, and the punch is held in the press by means of the shank *H*, in the usual manner.

There are times when work of considerable height requires a curling operation, and in cases of this kind a special press having a long stroke is required. A press of this style is not always available, however, and the work can be located in a sliding die which can be drawn from under the punch for removal purposes. After another piece has been put in, the die is again slid back ready for the next operation.

There are cases where a tube requires curling at both ends, and the die for an operation of this kind is constructed along the same principles as those shown, with the exception that the locating ring at the bottom is made to the form of the curl required and the work is free to float while the curling dies are coming in contact with each other, thus curling both ends.

Sometimes it is necessary to curl a piece of work inside rather than out, as shown in these examples. An operation of this kind can be performed successfully in the same manner, although the stock being curled is forced into a smaller diameter and is therefore likely to wrinkle when it is compressed. If a curl of this nature is to be performed on heavy metal it is often necessary to heat is before the operation in order to insure an accurately formed job.

The lower part of the same illustration shows a cover which is to be curled. In this die the work locates in a pressure ring *K* and rests on a pressure pad *L*. The punch or curling die *M* is provided with a pilot *N*, which locates on the inside of the work and prevents it from buckling. As the curling die is forced down the work is curled, and at the end of the stroke the ring *K* and pad *L* strike bottom as shown in the illustration.

Curling Operation With Work Inverted

At *O* is shown a die for the same piece of work, although the construction is much more simple than the examples just shown. In this case the work is reversed and put in the die in the opposite direction. The work locates on a pressure pad *P* which is suspended above the curling die *Q* a suitable distance so that it will seat properly. The punch *R* on its downward stroke fits over the work, and as it continues downward the curling operation is completed.

In the construction of curling dies it should always be remembered that there is considerable wear on the dies where the metal slides around in curling, due to the friction of the stock around the form, and therefore dies of this kind should be made of tool steel and carefully hardened. The curling surface should be lapped to insure a smooth sliding movement of the stock passing over it during the operation of forming.

The Dealer's Problems

By J. Bainter

The same merchandising methods that were employed during the war for selling supplies to machine shops certainly have no place in the present order of things. Although everyone knows this and dealers have had to revise their methods in more than one particular since the war, some good might result from reviewing the dealer's problems. The fact that the dealers have already survived what is probably the hardest part of the trial is, of course, some encouragement for the future.

The trouble with the present market is that the margin left to the dealer is too small to enable him to continue his business as he formerly operated it. His salvation lies in reducing the overhead expense connected with selling. The outstanding features in such a program are the necessity for a higher turnover and a decrease in the inventory.

Standardization and simplification of lines are the biggest helps that can be given to the dealer. This work can be carried on, of course, by manufacturers within their own organizations so as to decrease the number of their products, although it is especially desirable that types and sizes of equipment be standardized throughout the whole branch of an industry by means of trade associations. Great cuts in inventory have been obtained by progressive dealers through standardization. By stocking only the popular lines and those that have a quick turnover, it is usually aimed to bring a turnover as high as four complete cycles per year. True, this goal is not frequently reached.

All the expenses connected with merchandising are very high, but the one that probably deserves the most attention is that of the salesman's wage. The method of compensating salesmen has been undergoing a slow change, and it is to be expected that the near future will bring out very many bonus and profit-sharing plans. Already such plans have shown their value.

If the European plan of charging the customer for services given him could be adopted, the dealer would be on a very much more secure basis. Although we are not advocating a departure from the American plan, there are many points which the customer should keep in mind when ordering from his dealer. If the buyer knows how to save the dealer from unnecessary expense, the saving that the dealer derives from such transactions will in the end reflect to the buyer himself.

Trade Apprenticeship Progress

This report is the result of the combined study and experience of a group of men experienced in training, familiar with the best method in current use, and also conversant with the literature, equipment, and methods of the best organized training departments in industry.

A long step has been taken in training young men for the Printing Trades. While only a beginning, it shows what can be done in any industry that will develop a well organized central educational department under a progressive committee on education and with competent supervision. The State of Wisconsin set a notable example by adopting trade apprentice laws that encourage both the employers and the apprentices to take advantage of a well-organized system under state supervision. So far as can be ascertained, this is the only state attempting to train skilled mechanics with the aid of an apprenticeship law.

Equal distribution of the burden of training can be accomplished only through frequent solicitation by some neutral body,—someone constantly prodding the less spirited into seeing the necessity for apprenticeship. Not only must other employers be sold to the idea, but also the co-operation of the journeymen must be secured, as well as that of prospective apprentices, their parents, and the schools. Standard training courses must be developed so that a graduate apprentice will be capable of holding a journeymen's job in shops other than his own.

Fulfillment of indentures requires outside supervision such as is possible under an apprenticeship law. The fact that the state becomes a party to the indenture impresses the apprentice with the assurance that he is going to receive some attention and that he is expected to live up to his agreement. After a three-month trial period, any contract of apprenticeship may be cancelled when good cause is shown. The actual ages when boys should serve apprenticeship are from 16 to 20 years, or 17 to 21 years, assuming a four year apprenticeship course.

Co-operation Between Industries and Schools

There are two direct methods of co-operation between schools and industry: Teaching in school subjects which will show the value of apprenticeship; and teaching those subjects in continuation schools which will supplement the practical apprentice courses conducted by the industries. School at the shop or place of business is to be preferred to instruction given in school buildings or away from the plant.

The characteristics of an industrial teacher are likely to be decidedly different from those of a teacher in the ordinary school. He, or she, must have the point of view of the industry which can be obtained only by experience in it. Industry can contribute not only material but also men qualified to teach.

If industry is to get the better class of boys, it must go after them. These boys will rarely go to the factory looking for jobs. Because of the age factor, we will expect to find our best material in either the junior or senior high schools, or possibly through some organization like the Y. M. C. A. or Boy Scouts where energetic boys may be found who have had to drop out of school for economic reasons but who have in them the making of good men. If the teacher will visit the shop often, and likewise, if those responsible for the boy in the shop, will visit the school often, they will find a common ground where suggestions looking to the correlation of school and shop work may be worked out to the decided advance of all concerned.

The length of an apprenticeship varies according to the trade, for the more skillful the work and the more branches, the longer the time required to master it. In the industrial and manufacturing fields, mechanical apprenticeship is more subdivided than with the railroads. They have a tool maker's apprenticeship varying in length from two to five years. Machine operators from two to four years, erecting or assembling two years, autogenous welding one to four years. The railroads combine all of these into one trade under the name of machinist apprentices, and the boy is taught each of them in four years.

Work Schedule for Machinist Apprentices

The school work for a machinist apprentice requires 200 drawings, 640 problems, 300 examination questions. The schedule of shop work covers: cold saw, 2 weeks; drill press, 1 month; shaper, 2 months; slotter, 1 month; lathe, 6 months; vertical boring mill, 1 month; horizontal boring mill, 1 month; milling machine, 1 month; planer, 1 month; brassroom machines, 3 months; toolroom machines, 2 months; air pumps, 1 month; cutout cocks, 2 weeks; triple valves, 2 weeks; brake valves and testing air, 2 weeks; firedoors, grate shaker and reverse gears, 2 weeks; boiler mountings, 1 month; cylinder and frames, 1 month; piston valves, 2 weeks; stokers, 2 weeks; cab work, 1 week; driving boxes, 1 week; spring brake and truck gang, 2 weeks; guide and pistons, 1 week; crosshead and piston bench, 1 week; piston valve bench, 1 week; rod bench, 1 week; link bench, 1 month; reverse lever and shaft bench, 1 month; valve gang, 1 month; welding, 2 months; roundhouse, 6 months; wheel gang, 1 month; layout bench, 2 weeks; miscellaneous, 2 months; giving a total of 48 months.

When a young man or woman just out of school fails to make good, in industry, or in business, the fault may frequently be found in industry itself rather than in the schools. The power to analyze should be a very prominent and conscious aim on the part of the schools, and of students as soon as they become mature enough to appreciate it. The complete solution of this problem so far as business and industry are concerned will be found in having some one in charge of new employees whose duty it should be to lead them through what may be called an adaptation period—the fundamental idea of the vestibule school—and to help them to become adjusted to their new work.

Abstract of a committee report presented at the first annual convention of the National Personnel Association, Pittsburgh, Pa., Nov. 8-10, 1922.

Attaching Gears to Pinion Shafts in Black & Decker Drills

In an article on the manufacture of Black & Decker drills in the October 12 issue of the *American Machinist*, the statement was made that "The gear seats on the pinion shafts are knurled to make the gears a tight fit when pressed on," giving the impression that this method was followed in all drills made by the Black & Decker Mfg. Co. This method which was formerly practiced only on the smallest drill—the quarter inch—has now been abandoned.

The gears in all other sizes have always been keyseated and pressed on the shafts over Woodruff keys, a practice now extended to the quarter inch size.

Industrial Cost Accounting for Executives

Fourth Article—A Summary of the Cost Accounts and Journals—Material, Wages and Burden Accounts—Controlling Accounts—Different Kinds of Journals

BY PAUL M. ATKINS

IN THE previous article we considered briefly the elements which go to make up the cost of the finished product. Here we are to take a hasty glance at the various accounts and journals by means of which these elements are to be recorded. In later articles the details which are passed so hurriedly here or are not mentioned at all are explained at length. It is easier to understand how they all fit together to make a whole if we first look over the entire system even though the details themselves, at this time, are rather hazy and fail to be clear.

The first cost element which was discussed was material and so it may be appropriate to commence our study of the cost records with those needed for it. Before doing so, however, it will probably be well to give the definitions of two or three words which will be used with considerable frequency and about which all writers are not entirely agreed. Their exact definition is not a matter of any great importance just so long as everyone obtains the same idea from their use.

THREE DIFFERENT KINDS OF MATERIALS

From the point of view of cost-accounting there are three different kinds of material around factories: stores, worked material and merchandise. Stores includes all materials which are purchased from outside suppliers as long as they are not changed from the form or condition in which they are received at the plant. Such items as raw stock, rough castings, purchased parts and supplies, when they are bought, not made, all fall under this head.

Worked material is used to indicate all material which has been worked upon in the factory and then sent to the storeroom to be held till needed for other orders. Such things as parts and sub-assemblies, made in some department or departments of a factory to be used on various assembled products are examples. There are not a few parts which might be stores at one time and worked material at another, depending on whether they are bought outside or made inside the factory.

Merchandise is the finished product in saleable condition. It will sometimes occur that parts or sub-assemblies will be sold for repair parts but if they are primarily intended for use in the production of merchandise, they will be treated as worked material and not as merchandise. The reason for the differentiation is primarily a cost-accounting one and is necessitated by the nature of accounts required for recording the several kinds of material. The reason should be clearer after the following paragraphs are read.

Perhaps the most satisfactory way to approach the problem is to investigate first the accounts needed for recording the movement of materials and then to study the journals necessary for preparing the entries for these accounts. In the first place, there should be an account for stores, or more than one if it seems desirable. The stores account should be debited with the value of material purchased and received, and credited when material is withdrawn from the storeroom for use. The balance represents the value of the stores remaining in the storeroom.

There should also be a worked material account, subdivided if necessary, which should be debited with the value of the completed worked material and credited with the value of the worked material withdrawn. The balance gives the value of the worked material remaining in the storeroom.

In addition to this account, in which is recorded the value of the finished, completed worked material, there also will be a worked material in process account in which is entered the value of the worked material while it is in process of being made in the factory. It is one of the most important accounts in the cost system for it provides a figure for an inventory which is otherwise practically unobtainable. Of course, this account should be subdivided if the worked material account is divided, and in the same fashion. It is credited with the value of the completed worked material, the same figure which is debited to the worked material account. It is debited with the cost of the various elements which go to make up the worked material—labor, material, burden, and direct charges.

There should also be two sets of accounts for the merchandise—a merchandise account to be debited with the value of the completed merchandise and credited when the merchandise is sold, and a merchandise in process account which is quite similar in its make-up to the worked material in process account, forming a record of the value of the merchandise being worked on out in the shop. As before, the credit to the merchandise in process account is a debit to the merchandise account. In the same way, both accounts may be subdivided if the nature of the product seems to make it desirable.

WAGES AND THEIR ACCOUNT

So much for the records of material in its various stages. A number of accounts are necessary to provide a record of the different kinds of material and to permit the ascertaining of their value at various stages in the course of their progress through the factory. The records of wages are much simpler and require only one kind of account, the payroll account, though it is not infrequently subdivided for convenience. It is credited with the value of the work done by the employees measured in terms of time or output and debited with the amount paid for labor when it is paid.

It might seem at first glance that since the two amounts are always the same there should never be any balance in the payroll account. If the workers are paid on a weekly basis and the accounting period is taken as a month, it is evident that only occasionally will the two coincide and even when they do, the entries are not made at the same time. Hence it will often happen that wages will have been earned but not yet paid for or payable and so there will be a credit balance called the "accrued payroll" which appears as a

For the author's forthcoming book.

liability on the balance sheet for it represents what is owed to the workers by the company. All the balances of the material accounts, on the other hand, are debit balances and are entered as assets on the balance sheet.

It is now time to turn our attention to the matter of burden and the records needful for that element. In the first place, it is necessary to provide expense accounts in which may be accumulated the expenses as they occur. Only the principal expense accounts, those for the major subdivisions of the business, will be kept in the general ledger. Administration, selling and manufacturing expense accounts are the only ones which need be mentioned here. In later articles it will be pointed out that it is often convenient to divide the manufacturing expense account in two. The debits to these three expense accounts are the charges for indirect labor, indirect materials, repairs and maintenance, depreciation, insurance, outside charges of various kinds and all other items which are a part of the cost of running the business during the period in question.

Since they are expense accounts, they must be closed at the end of the period. The manufacturing expense account is closed into the manufacturing burden account. The selling expense account is closed into a selling burden account, if the company has planned to ascertain the cost of selling the various units of its product. If there is to be no selling burden account, the balance should be charged directly to the profit and loss account.

If there are two burden accounts, the administration expense account should be debited part to one, part to the other. If there is no selling burden account, it may either be debited wholly to profit and loss or part of it to that account and the rest to the manufacturing burden account. There is not space here to explain how the division is made, but it will be discussed in full in a later article on the "Distribution of Expenses."

The handling of the selling expenses is rather outside the scope of the present series of articles. In general, it is somewhat similar to the treatment of the manufacturing expenses, but, to clear the matter up, let us assume that the easy, though not very satisfactory method of charging them all to the profit and loss account is followed, and turn our attention now to the matter of the manufacturing burden account.

The manufacturing burden account is debited with the expenses which are incurred by the various departments which are engaged directly or indirectly in carrying on production and also the proper share of the expenses of those departments which aid production, in other words, the administration departments. The debits, as have been noted, come from the manufacturing and administration expense accounts. The credits are two, one for the earned burden which has been allocated to the product—worked material and merchandise—and the unearned burden which is the balance which should then normally be charged to the profit and loss account.

There are a few other accounts which should be mentioned at this point in connection with the expense accounts. Certain expenses are paid in advance of the time when the benefit from them is received as in the case of insurance premiums. Hence it is necessary to set up a prepaid insurance, for example, to which the insurance premiums can be charged as they are paid, and which should be credited each month when the charge for the insurance for the month is made, to the appropriate expense account.

In some cases, on the other hand, a benefit is received but is not paid for till after the close of the period involved. Real property taxes are an illustration, for

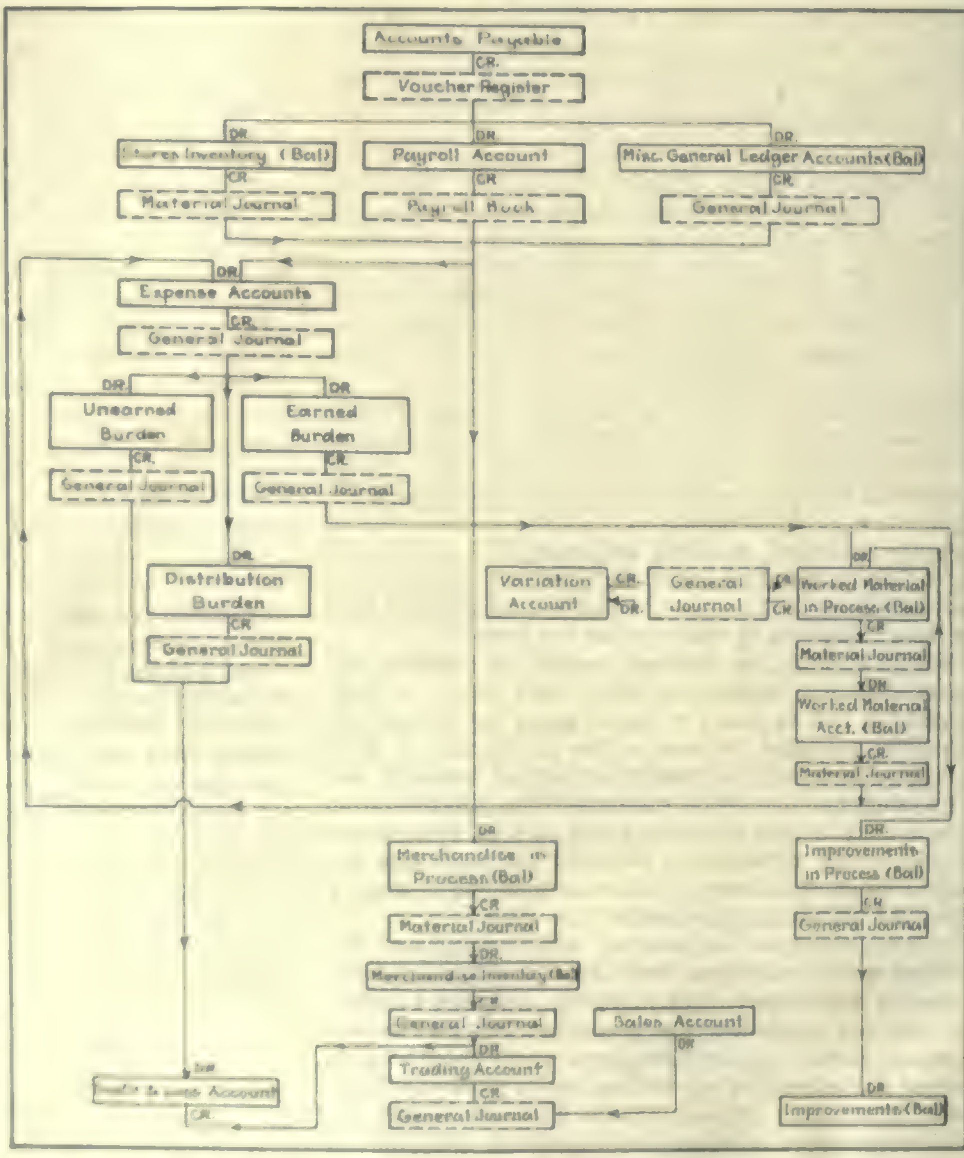


FIG. 2—A CHART SHOWING THE PRINCIPAL COST ACCOUNTS AND JOURNALS

in many instances they are payable and even are not known till the end of the year. It is proper, therefore, to set up a reserve account for taxes, in which may be accumulated a reserve to cover the payments when they come due, the corresponding debits having been made to the monthly expense accounts during the year.

Before passing on to a very brief survey of the journals, one other set of ledger accounts deserves a passing mention. These are the various fixed asset accounts like those for machinery, buildings, tools, furniture and fixtures. There should be one of them for each of the principal groups of fixed assets and they should vary according to the classification made of these items. There will sometimes be an "in process" account for each group, but more frequently, except for very large concerns, there will be only one improvements in process account in which will be recorded the value of the various assets while they are in course of construction.

The operation of fixed asset accounts follows, in general, the methods employed for the worked material and merchandise accounts. There is one important distinguishing element, however, that must be mentioned here. All the fixed asset accounts, with the possible exception of tools, should have a corresponding reserve for depreciation account which should be credited monthly with the amount of the depreciation charged as an expense. They show at all times the amount of the depreciation on that class of assets.

It should be noted that many of the accounts mentioned are controlling accounts supported by subsidiary accounts, often not in account form, which exist elsewhere. The stores and worked material accounts are detailed on the balance of stores and worked material cards. The same is true for the merchandise account, if merchandise is made for stock and not shipped as soon as made. The "in process" accounts for worked material, merchandise and improvements are supported by the record of the order costs in the cost department.

The controlling expense accounts are given in detail in the form of individual expense accounts for each subdivision of the expense classification. The fixed asset accounts and the corresponding depreciation reserve accounts are represented in the form of a plant ledger. All of these details and their relationship to the controlling accounts in the general ledger are discussed in subsequent articles.

It is, of course, necessary to prepare the entries for these accounts in some kind of a journal. For some of the entries a regular general journal is most adaptable, and that is a book which should need no explanation. The voucher register is another form of journal which is very useful and which is frequently used, so it needs no description at this place. Certain rulings for the the voucher register are discussed in a later article. The payroll book is also a well known journal.

There are, however, two other journals, and sometimes a third, which are needed and which are not commonly found. One is the material journal which is ordinarily divided into several parts. One part is for the purpose of recording the withdrawal of stores and serves to control their distribution. Another does the same thing for worked material and under some conditions there is a third for merchandise.

There is also a section for handling the value of the worked material completed and turned into the storeroom, and often one also for merchandise. The material journal provides a simple means of handling what is often one of the most difficult practical problems in cost-accounting and is explained in detail in a subsequent article. Similar in purpose and ruling to the material journal is one for burden, to be used when the machine rate or process method of burden application is employed.

This has been a long article and in the effort to compress a great deal into a small space it reads almost like a catalog. There is in it, however, the skeleton of a whole system of cost-accounting and it will repay careful study. Many of the details, as has been pointed out in places, are developed in later articles, for the intention is to make clear all of the points given to the reader before the series is completed.

To aid in grasping the interrelationships of accounts and journals described in this article, the accompanying chart (Fig. 2) has been prepared. The accounts are shown bounded with solid lines and the journals with dotted lines. Too much must not be expected of a chart which tries to show so much so briefly. It will not bear a minute analysis, but it should be used rather to gain a general idea of the whole subject.

Winning the Coal Saving Game

By Charles W. Lee

The game of saving coal is very popular just now, for obvious reasons. There are good ways of playing it and there are some no good at all. Let me illustrate:

Along comes my doctor with a circular intended to promote something out of a bottle or a keg, which it is claimed will achieve the winning of the coal-saving game, and wants to know what I think of it. (Incidentally, I often wonder why my doctor or lawyer, expects, and very properly so, to send me a bill for any advice asked for by me; whereas he would be much surprised if I were to send him a bill for advice asked for by him.)

After carefully reading the circular, I spoke a sort of parable something like this: A "patient"—which is a very good name for him—comes into the doctor's office complaining of not feeling well. The doctor examines him, finds that he has a mild case of something or other, hands him a filled bottle, and says: "Take a spoonful of this every two hours, eat sparingly, particularly of red meats, take plenty of exercise and get plenty of fresh air. Soon you will be O.K." The patient follows instructions and quickly recovers.

There arrives another patient with something the matter, something entirely different from that which ailed the first one. The doctor gives him a bottle of the very same stuff that he gave the first patient, and the same advice about diet and exercise. Patient No. 2 uses the "medicine," follows instructions and speedily recovers.

Now, doc, (I continued) the stuff mentioned in the circular, it seems to me, is comparable with the stuff in the doctor's bottle. The directions in the circular for running the furnace when using the stuff show a mighty good way to run a furnace anyhow and I think if you will carefully follow these directions you will save coal. Moreover, you will save just as much coal, whether you mix the stuff with the coal or don't. Do you see the point? He said he did.

I am not a chemist or a coal expert, but I am a competent operator of a domestic furnace. If there is any truth in what I told the doctor, it goes just the same for the furnace under the boiler as the furnace in the cellar.

Denmark—Exports of Machines for Metal Working or Wood Working with Drilling (Bore) Machines

"Maskiner til Metalforarbejdning Traeforarbejdning samt Boremaskiner"

Table IX

Country	1910 Quantity 100 kg	1911 Quantity 100 kg	1912 Quantity 100 kg	1913 Quantity 100 kg	1914 Quantity 100 kg	1915 Quantity 100 kg	1916 Quantity 100 kg	1917 Quantity 100 kg	1918 Quantity 100 kg	1919 Quantity 100 kg	1920 Quantity 100 kg
Germany	400	60	527	322	75	4,558	2,393	3,387	1,085		613
Great Britain	37	36	66	178	18	129			673	733	3,281
Norway	51	44	129	64	73	1,002	4,618	4,739	2,157	6,010	2,532
Sweden	513		60	166	3,449	5,553	11,654	8,380	4,326	3,744	2,138
Finland	25		7	1	8	1,016	456	407		683	587
Russia	525	1,800	673	1,064	1,709	6,307	32,784	12,830			
Netherlands	38	217	88	1	3	150	380	1,495	1,068	868	702
Belgium	120	77		44	1					350	3,118
France	159	402	123	68	35		561			1,208	2,785
Italy	83		34	2						115	213
Austria-Hungary	29	26	37	60	166	1,790			128		...
Switzerland		52	5		68						...
Bulgaria			42								...
Portugal										35	310
Spain											1,297
Hamburg				54	35	352					
Iceland and Faroe Islands			63	31	2	23				124	137
Morocco											46
Algiers and Tunis											137
British South Africa										61	237
China				3,387	1,636	174			1,361	360	363
Siam									114		131
Dutch East Indies					4					48	805
British India											439
Straits Settlements											46
Australia		12	97	15	47						289
New Zealand											49
United States									1,152		
British North America				40							
Argentina									127	855	2,633
Brazil											846
Other South American										246	795
Other or Unknown Countries	16	17	15	44	17	90	431	5,746	5,335	126	207
Total (Quantity in 100 kg.)	1,996	2,743	1,966	5,541	7,342	21,804	53,279	36,984	22,721	16,396	24,538
Total Value (Kronen)	400,000	493,000	489,000	951,000	1,255,000	5,127,000	16,401,000	9,831,000	6,566,000	4,687,000	8,547,000

Denmark—Imports of Metal Working Machinery and Drilling Machinery

"Maskiner til Metalforarbejdning and Boremaskiner"

Table X

Country or Region	1910 100 kilograms	1911 100 kilograms	1912 100 kilograms	1913 100 kilograms	1914 100 kilograms	1915 100 kilograms	1916 100 kilograms	1917 100 kilograms	1918 100 kilograms	1919 100 kilograms	1920 100 kilograms
Hamburg	137	109	30	79	203	5					...
Germany	3,798	4,121	5,081	7,461	7,665	2,209	4,223	1,886	2,637	22,295	25,810
Great Britain	236	504	1,244	1,462	847	780	834			206	1,011
Norway	9	184	...			172	170	606	247	391	124
Sweden	268	470	520	541	1,038	2,711	4,750	2,235	5,362	4,461	1,703
Holland	45	129	57	8	19	122		...			...
Switzerland	...	90	4	9	17	...		...		19	14
France	11		...			...		...		46	1
Austria-Hungary	...		...				82	...			...
United States	217	361	487	550	534	673	1,458	2,509		3,537	2,142
Other or unknown countries	22	11	55	53	37	18	68	34	29		
Total Quantity (100 kgs.)	4,743	5,979	7,478	10,163	10,360	6,690	11,585	7,270	8,275	30,955	30,805
Total Value (Kronen)	441,000	467,000	586,000	848,000	868,000	636,000	1,338,000	1,23.8000	1,880,000	4,701,000	5,275,000

Par value of Krone = 26.80c.

Formulas for Cutting and Measuring Threads

Information a Customer Needs for Checking—Practical and Theoretical V-Thread Flats—Distinction Between Helix and Lead Angles—Acme Thread Data

BY JACK WILLIAMS

AN ARTICLE entitled "Gaging Acme Threads Without Special Wires" written by H. A. Pearson, appeared on page 830, Vol. 51 of *American Machinist*. I made a rectigraph copy of this article, which has proved to be of valuable assistance to me in my work. I found, however, upon careful study that only the formulas could be depended on, as there were slight errors which it was necessary to correct in both the text and the constants.

The formula for screws produced the same result as that given for taps. The former read as follows: $4.9937D - 3.8667W +$ outside diameter of screw equals the micrometer reading. The letter D represents the diameter of the wires and the letter W the width of the opening at top of the thread. This formula is open to two serious objections. It is stated in terms of width of opening at the top of the thread when it should have been given in number of threads per inch; its use is limited commercially to threads having a lead angle of six degrees or less.

I have worked out and compiled a set of formulas that should relieve foremen, toolmakers and draftsmen of a great deal of figuring, besides putting an end to a vast amount of correspondence previously required between firms to clear up misunderstandings. The formulas were intended to cover Acme threads, as these threads seemed to be an endless source of trouble, but additional general formulas have also been derived. They are written in a manner easily grasped by the average layman and most of them are in terms of threads per inch, although some of them are also given in terms of pitch to allow the user a choice of mathematical procedure.

My reason for sending in the chart of Acme thread formulas is that I feel that publicity will invite constructive criticism. Possibly someone will either carry the work along and contribute additional data, or compute the maximum error as compared with their own commercial method or with theoretically correct formulas.

The five additional formulas, grouped under IV, which I will explain in detail, are particularly valuable. They may be applied to any symmetrical form of thread, except the square thread, and include the V, U.S.F., Whitworth, Standard International and Acme threads. The formulas for width of flat, however, cannot be applied to rounded or to sharp V threads.

The questions that are asked by shopmen when preparing to make special taps, screws, or gages, are these:

(1) What is the width required at the point of the threading tool?
(2) What is the correct angle of the threading tool?
(3) What is the lead angle to which the tool must be set?
(4) What diameter of wire is to be used in measuring the threads?
(5) What is the micrometer reading over the wires?

The answers to these questions should be enclosed with every shipment of goods so that customers can do their own checking and save the time now wasted in asking for this information, shipping goods back and forth, and arranging credits. If customers would demand it, the manufacturers would be glad to render this service.

At what particular lead angle it is necessary to begin making compensation in the shape of the threading tool is a commercial factor subject to change in accordance with the class of work required. If the lead angle is set at six degrees, and so advertised by the manufacturers, it will soon be grasped by the trade and when customers require especially accurate work they will specify it on their orders. The error in tool angle and consequently in thread angle for a 60-deg. thread of 6 deg. lead angle is 0 deg. 16 min., and for a 29-deg. thread is 0 deg. 10 minutes. A good commercial limit on thread angles is 0 deg. 20 min., so that a 6-deg. lead angle is well chosen and will apply to thread angles of even greater than 60 degrees.

Two main points which strongly emphasize the commercial side of thread measurements are featured in the chart shown in the accompanying illustration. One point, brought out in an exaggerated way, shows the change in angle and the corrected width of the tool point. The other point is the division of the formulas into three groups, one of which applies to all lead angles. The other two apply to lead angles above and below 6 deg. respectively.

Let us use the following symbols to express the answers to the five questions previously mentioned:

(1) $f =$ width at point of the threading tool.
(2) $\phi =$ one-half the corrected angle of the threading tool.
(3) $\alpha =$ lead angle for setting the threading tool.
(4) $D' =$ diameter of the measuring wires.
(5) $R'' =$ micrometer reading over the wires.

In the process of manufacturing, as soon as the answers to (1), (2) and (4) are known, they should be given to the person who is responsible for the tools. In this way, the tools and the proper size of the wire will be on hand for measuring when the work is ready for threading.

Some firms have found out, after delays and an undersized product have resulted, that it is impossible to manufacture a theoretically sharp V-thread for a given pitch diameter. In other words, the formula: Single depth of V thread $=$ pitch $\times \cos 30° =$ pitch $\times$ 0.86603, which was extensively advertised until recently, was not at all practical. For that reason, the formula does not appear in the catalogs of some tool manufacturers. Most of these manufacturers advocate the universal adoption of the U.S.F. thread while others are striving to bring about commercial harmony by persuading their customers to accept the U.S.F. thread on all pitches finer than 30 threads per inch.

Many manufacturers of V-thread tools, such as the

gage makers and those who use pipe threads, are familiar with the following formulas:

N = number of threads per inch P = pitch
Single depth of thread = $0.8 \div N = 0.8P$
Width of flat at top or bottom of thread = $0.03812 \div N = 0.03812P$
Height from flat to theoretical $V = 0.03301 \div N = 0.03301P$.

My reason for explaining the V-thread and its flat is that the same flat should be applied to V-threads of any angle, whether the angle is more or less than 60 deg., and it is not practical to decrease this flat for it is already the smallest flat that can be commercially maintained on a threading tool. Therefore, question (1) does not apply to this form of thread.

The terms "lead," "pitch," "lead angle," and "helix angle" must also be explained. Many engineers and draftsmen are primarily at fault for orders that read: "6 pi. double," "6 P.I. 29 deg. double lead," or "6 P.I. double $\frac{1}{12}$ lead." Such orders merely confuse the purchasing agents and clerks, when they hear the terms "pitch" and P.I. (per inch) interchanged. The pitch is the distance from the center of one thread to the center of the adjacent thread. The lead is the distance from the center of one thread to the center of the same thread, after it has made one revolution, measured parallel to the axis of the screw.

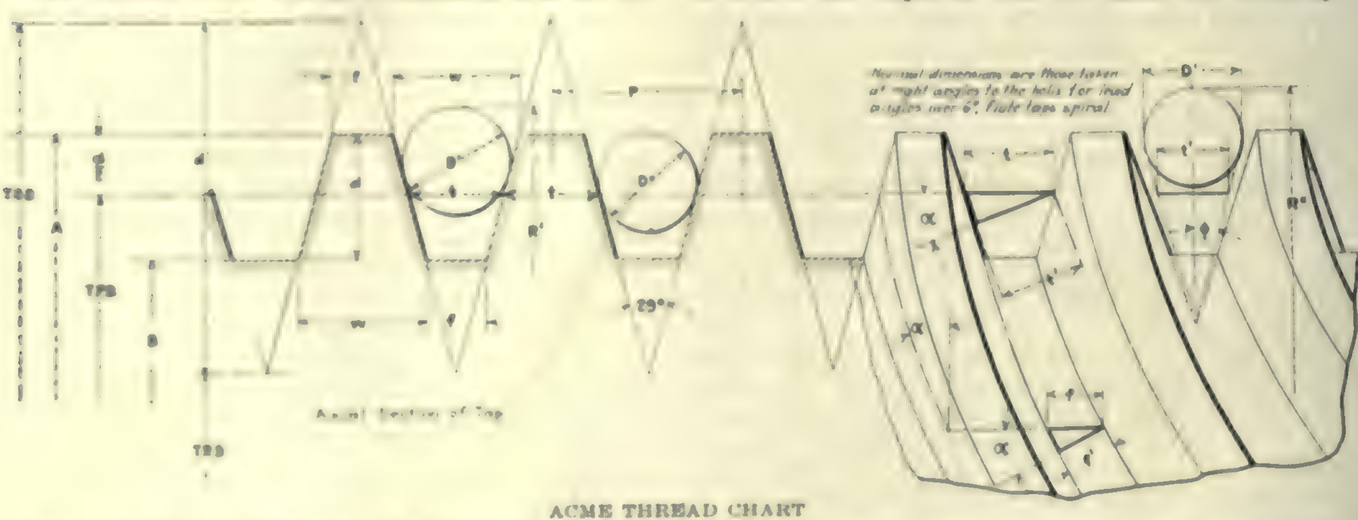
The National Screw Thread Commission does not differentiate between helix and lead angle but gives a formula for finding the helix angle. In my experience, however, the angle to which the workman sets his tool or work, is commonly known as the lead angle. In the Brown & Sharpe Gear Book, the formula is given:

$$\tan \alpha = \frac{\text{circumference}}{\text{Number of inches of spiral to one turn}}$$

But the author carefully avoids calling α the lead angle. Why should this uncertainty be allowed to continue? Is there no one progressive enough to say what is what?

To distinguish between the terms lead angle and helix angle, let us assume a universal milling machine set up to cut a helical flute in a tap, reamer, or similar tool. The table is swung from its zero position to the angle required by the helix and this reading represents the helix angle. The tangent of the helix angle is equal to: $\frac{\pi \times P.D.}{\text{Lead}}$

The lead angle is the angle between the helix itself and the plane normal to the axis of the work at the pitch diameter. It is the complement of the helix angle and its tangent is equal to: $\frac{\text{Lead}}{\pi \times P.D.}$ The *P.D.* in each formula represents the pitch diameter. This distinction is purely arbitrary and is set up solely for the purpose of making the formula clear. In my work, it is well understood but I do not know that the distinction is generally accepted. The following are examples of orders and inquiries that are made out correctly:



ACME THREAD CHART

T.O.D., *T.P.D.*, and *T.R.D.* indicate respectively the theoretical outside diameter, theoretical pitch diameter, and theoretical root diameter.

A = actual outside diameter of tap. The nominal outside diameter of the tap is the actual outside diameter of the screw.
B = root diameter of tap, and also of screw.
L = lead or advance in one revolution.
P = pitch or distance from center to center of adjacent threads.
N = number of threads per inch.
α = lead angle.
d = depth of thread.
d' = theoretical depth of 29-deg. V-thread.
f = standard width of tooth at top and standard width of space at bottom of thread. This is the commercially correct width of thread tool to use for lead angles up to six degrees inclusive.
f' = commercially correct width of thread tool to use for lead angles of over 6 degrees.
θ = ½ nominal thread angle.
t = standard thickness of tooth or space at *T.P.D.*
t' = normal width of space at *T.P.D.*
w = standard width at top of tooth and standard width at bottom of tooth.
D' = diameter of any measuring wire, but must be same or greater than D''.
D'' = commercially correct diameter of wire having contact at *T.P.D.* when α is equal to or less than 6 degrees.
R' = commercially correct micrometer reading over three wires when α is equal to or less than 6 degrees.
R'' = commercially correct micrometer reading over three wires for lead angles over 6 degrees.
ϕ = ½ the normal thread angle.

6 P.I. Acme Screw Thread, Double

6 P.I. 29-deg. Worm Thread, Double

6 P.I., ⅓-in. Lead, 29-deg. Screw Thread, Double

Give either the pitch diameter, the outside diameter, or both. The correct thread section will then be furnished. Other data, such as the number of pieces and the limits should not be forgotten. If 29-deg. threads are cut with thread milling cutters of the proper angle and width of flat, calculated from the formulas in IV, they will measure up to the correct sizes.

Everyone ought to know that 29-deg. threads when used on the lead screws of lathes, or on lifting jacks or valve stems, require a cutter with a flat wider than that of the cutter used to cut a worm thread, because of the difference in the root diameters. Manufacturers consider the word Acme as meaning screw, and, unless some reference is made to worm threads, will furnish Acme screw cut cutters.

If the foregoing paragraph is observed, there should be enough information sent out with each order to answer the five questions by means of the five formulas under IV. This information should prove to be of incalculable value to manufacturers and customers.

I. Formulas Commercially Correct for All Lead Angles
Acme Thread Only

$$P = \frac{1}{N}; \quad N = \frac{1}{P}$$

$$L = \frac{1}{N \times 2 \text{ for double thread, 3 for triple thread}}$$

$$d = \frac{0.5}{N} + 0.020; \quad d = 0.5P + 0.020$$

$$\frac{d}{2} = \frac{0.25}{N} + 0.010; \quad \frac{d}{2} = \frac{P}{4} + 0.010$$

$$d' = \frac{1.9334}{N}; \quad d' = 1.9334P$$

$$A = \text{nominal outside diameter} + 0.020$$

$$B = \text{nominal outside diameter} - 0.020 - \frac{1}{N}$$

$$T.P.D = \text{nominal outside diameter} - \frac{0.5}{N} = \text{nominal outside diameter} - 0.5P$$

$$T.O.D = \text{nominal outside diameter} + \frac{1.43335}{N}$$

$$T.R.D = \text{nominal outside diameter} - \frac{2.43335}{N}$$

$$\cot \alpha = \pi \times N \times T.P.D. \text{ for single-thread taps}$$

$$\cot \alpha = \frac{\pi \times T.P.D.}{L} \text{ for multiple-thread taps.}$$

II. Formulas Commercially Correct for Lead Angles Up to Six Degrees
Acme Thread Only

$$t = \frac{1}{2N} \qquad t = \frac{P}{2}$$

$$f = \frac{0.3707}{N} - 0.0052 \quad f = 0.3707P - 0.0052$$

$$w = \frac{0.6293}{N} + 0.0052 \quad w = 0.6293P + 0.0052$$

$$D' = \text{any wire with same diameter as } D'' \text{ or larger}$$

$$D'' = \frac{0.51645}{N} \quad D'' = 0.51645P$$

$$R' = 4.9937D' - \frac{2.43335}{N} + \text{nominal outside diameter}$$

III. Formulas Commercially Correct for Lead Angles of Over Six Degrees
Acme Thread Only

$$f' = \cos \alpha \left(\frac{0.37069}{N} - 0.00517\right)$$

$$t' = \frac{\cos \alpha}{2N} \quad t' = \frac{P \cos \alpha}{2}$$

$$\tan \phi = \frac{\cos \alpha}{3.86670}$$

$$R'' = \text{nominal outside diameter} - \frac{2.43335}{N} + \frac{D'}{\sin \phi} + D'$$

$$\text{Minimum } D' = \frac{\cos \alpha}{2N \cos \phi}$$

IV. Formulas Commercially Correct for Any Lead Angle
Any Form of Thread

$$f' = \frac{\cos \alpha}{2N} - \tan \phi \ (T.P.D. - B)$$

$$\tan \phi = \frac{\cos \alpha}{\cot \theta}$$

$$\cot \alpha = \frac{\pi \times T.P.D.}{L}$$

$$\text{Minimum } D' = \frac{0.5}{N \cos \theta}$$

$$R'' = T.P.D. - \frac{\cot \theta}{2N} + D' \ (1 + \csc \phi)$$

Automatic Control of Fire in Car Shops

A recent instance of fire control by the use of automatic sprinklers is of special interest to engineers and managers of shops of various kinds. The case in mind was the freight car erecting shop of the Turcot Works of the Canadian Car & Foundry Co., located near Montreal, Can.

The erecting shop is a large one-story building, 80 x 800 ft., all one area. The walls are of brick and glass in metal sash; the roof, light planks supported by unprotected steel beams and trusses. The distance from floor to roof is 39 ft. Five tracks run the length of the building. At the time of the fire they were filled with box cars, 75 in all. The shop is equipped throughout with a dry-pipe automatic sprinkler system controlled by six automatic air valves. Five metal fire curtains under the roof divide the system into six sections.

The fire broke out early in the morning of Oct. 17, 1922, in a box car in the center of the building. It was discovered by the watchman, who gave the alarm. A line of hose was stretched by the night shift at the plant but before this was brought into play the sprinklers overhead began to open. The fire burst through one end and the doors of the car and ignited the corners of nearby cars. The water from the sprinklers blanketed the blazing car and extinguished the fire in the nearby cars, thus confining the fire to the locality of origin.

The performance of the sprinklers was remarkable considering that the roof was 39 ft. high, and the nature of the obstructions to water distribution offered by the box cars. As the fire was directly beneath one of the divisional fire curtains the sprinklers in two sections opened, 10 in one and 11 in the other, 21 in all. The principal fire damage was to the burned box car, but no practical loss resulted, as the car was to be rebuilt. The damage to the building amounted to $50.00.

Federal Specifications for Leather Belting

The following is an extract from the specifications under which all purchases of leather belting will be made by the U. S. Government:

All belting leather shall be made from green salted hides and be free from brands, soft or spongy spots and open grub holes, excepting that when made into belting 30 per cent of the strips in any belt or roll of belting may contain a maximum of 3 open grub holes in each of such strips. The hides shall be tanned with oak bark or a combination of vegetable tanning materials. Animal oils and greases shall be used for stuffing the leather, or a mixture of these and mineral oils in such proportion as will provide maximum strength and pliability.

The use of epsom salts, glucose, barium chloride or other material for weighting the leather is prohibited. All leather after stuffing shall be thoroughly stretched while still damp and shall be left under tension until dry. The grain or hair side shall be finished smooth and the leather shall be thoroughly fleshed.

All strips shall be cut from the center portion of the hide at such distance from the backbone as to include only firm stock, and exclude second quality leather and at such distance from the root of the tail as will exclude all shoulder stock. No sectional strip shall be more than 54 in. in length, including the lap. The minimum length of any strip shall be 36 in. including the lap, excepting that in double belts ½ of the total number of pieces may be between 20 in. and 36 in. provided that these short pieces do not occur consecutively. The minimum length shall not apply to the end pieces of rolls or cut lengths. In single belting the strips shall be joined shoulder end to shoulder end and butt end to butt end. In double belting the strips shall be joined shoulder end to butt end.

In all single belts 8 in. and over in width, backbone center strips shall be used. The backbone mark must appear running lengthwise approximately in the center of each strip. In all double belts from 8 in. up to 10 in. width, backbone center strips shall be used in one ply and the backbone mark shall appear running lengthwise approximately in the center of each strip. The other ply shall be cut from the location prescribed for first quality stock. In all double belts 10 in. and over in width, both plies shall be made from backbone center strips and the backbone mark shall appear running lengthwise approximately in the center of each strip. The same quality of leather shall be used in both plies of all double belting. The length of laps shall be within the limits given in Table I.

TABLE I—LENGTH OF LAPS IN INCHES

Ply	Thickness	Length of Laps	
		Belts under 6 in. in width	Belts 6 in. and over in width
Single	Under 10/64	2½ to 6	3 to 8
	10/64 and over	3 to 8	3½ to 10
Double	Up to 17/64	2½ to 3½	3 to 4
	19/64 and over	3 to 4	3 to 5

The minimum distance between any two laps in the separate plies of double belting shall be 8 in. The points of all laps shall be at right angles to the edge of the belt. All laps shall run in the same direction. The laps of both single and double belts and the plies of double belts shall be thoroughly cemented together. When pulled apart the cemented surface shall not appear glazed or shiny. The maximum variation from the nominal width shall be in accordance with Table II.

TABLE II—TOLERANCE FROM NOMINAL WIDTH

Width of Belting In Inches	Tolerance
Under 2	Not less than nominal
2 to 24 inclusive	1 per cent
Above 24	½ of 1 per cent

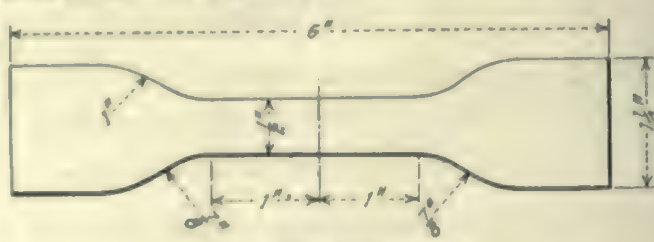
The thicknesses for the different grades of belting shall be in accordance with Table III.

TABLE III—AVERAGE THICKNESSES IN INCHES

Grade	Single Ply	Double Ply
Light	8/64 up to 10/64	15/64 to 17/64
Medium	10/64 up to 12/64	19/64 to 21/64
Heavy	12/64 up to 14/64	23/64 to 25/64

The average thickness shall be determined by measuring the thickness of 20 plies of the belt when rolled and dividing this value by the number of plies measured. No point in either single or double belting shall be more than $\frac{1}{32}$ in. thicker nor more than $\frac{1}{64}$ in. thinner than the average thickness. The excessive use of shims and filler strips and excessive splitting or leveling is prohibited. All belting shall be stamped on grain side with the maker's name and brand, and a stamp indicating the direction in which the belting is to run. Each stamp shall be repeated every 10 ft. throughout the entire length of the belting.

Waterproof dressed belting shall conform to all the requirements of this specification. In addition it shall be treated with a waterproof dressing. Waterproof belting shall conform to all the requirements of this specification. In addition it shall be treated with a waterproof dressing. The laps and plies shall be cemented with a waterproof cement. All leather shall have a minimum tensile strength of 3,000 lb. per square inch of cross-section and an average tensile strength for single belts of 3,750 lb. per square inch and for double belts of 3,500 lb. per square inch. The average shall be determined with five test specimens cut continuously lengthwise of the sample, omitting the lap. Test specimens of the shape and size as shown in the illustration shall be cut with a metal die.



THE TEST SPECIMEN

The laps of both single and double belting shall not open when subjected to a tensile stress of 2,500 lb. per square inch. The opening of the laps shall be determined by testing two specimens cut across the point of the lap lengthwise of the sample. For double belting the test shall be made on the single ply. The average elongation at a tensile stress of 2,500 lb. per square inch shall not exceed 15 per cent. The average shall be determined with the same five test specimens used for determining the tensile strength.

The following stretch test shall be made on the finished belting up to and including six inches in width.

Copies may be had from the U. S. Bureau of Standards, Washington, D. C.

Any section of a roll or belt shall be selected (which shall not be cut) on which gage marks shall be placed 10 ft. apart. Suitable clamps shall be attached on the marks so that the distance between the clamps shall be 10 ft. The section shall then be suspended in a vertical position from one of the clamps. Sufficient weight, including the weight of the clamp, shall be attached to the lower clamp to produce a tensile stress of 750 lb. per square inch of the average cross-section of the section being tested. The section after being subjected to this tension for 15 min. shall show a length between the gage marks not to exceed 10 ft., 7.2 in. (6 per cent stretch).

The clamps shall then be removed and the section allowed to lie loosely on the floor for 17 hr., after which time the length between the gage marks shall not exceed 10 ft. 1.6 in. (1⅓ per cent stretch). The leather shall not crack on the grain side and the laps shall not open at the points when the belting is bent through angles of 180 deg., grain side out over forms as specified in Table IV for the different grades and thicknesses.

TABLE IV—FORMS FOR CRACKING TEST

Belt	Average Thickness Belting Inches	Diameter Form Inches
Single	Under 10/64	1
	10/64 and over	1¼
Double	Up to 17/64	3
	19/64 and over	4

The leather shall not show wrinkles on the grain side (commonly called piping, and indicating looseness of fiber found in side stock or second quality belting), when bent through an angle of 180 deg. grain side in, over forms as specified in Table V for the different grades and thicknesses.

TABLE V—FORMS FOR PIPING TEST

Belt	Average Thickness Belting Inches	Diameter Form Inches
Single	All	2
Double	Up to 17/64	4
	19/64 and over	6

A sample waterproof dressed or waterproof belting, 12 in. long, shall be weighed and then immersed in water at room temperature for 5 hr. When removed from the water the sample shall be wiped and again weighed. The percentage of water absorbed shall not exceed 8 per cent. This test shall be made on every lot of 2,000 ft. or fraction thereof. The sample of waterproof belting tested for water absorption shall be again immersed in water until the total period of immersion is 24 hr. The sample, after removal, shall be allowed to dry under room conditions for 24 hr. The laps and plies shall not open when the sample is bent around the proper form as specified in Table IV.

Brains vs. Hands

By O. C. Richards

We are told repeatedly that the day of the old time foreman is past and that the successful department head of today is quite a different sort of a man from the boss of a few years ago. There is a certain type however that is met with, not infrequently, even in some of our shops that pride themselves on their progressiveness. It is the foreman who wears himself out physically. He performs with his own hands tasks that belong properly to those of others and, in so doing, fails to concentrate his efforts on the more important duty of directing those under his supervision. After being a department head for a number of years, time study and method work presents to me an opportunity for observation that is particularly interesting.

The head of a large department used to spend the first two hours of every morning personally in counting and moving parts from one section of his department to another. This work could have been done by any laborer able to read and write. Later in the day other hours were spent in other sections of the department in much the same manner. In another instance, an assistant superintendent was very anxious to get a greater production from his assembly department. For days at a stretch, he spent practically all of his time in this particular department, with hammer and wrenches, assisting in the actual assembling. The increased production from that particular bench was about the same as would have been obtained by hiring an extra man at the gate. He was the butt of the jokes of the workmen and lost much of the respect of his foremen.

Recently I was engaged in studying a job of rough, unskilled work that involved a considerable amount of handling, several men being employed on the same task. The men were very awkward, particularly in the handling, and needed the attention of their foreman to get them lined up on the job. The foreman, at this particular time, was engaged in placing castings on the benches with a hand controlled electric crane. He was busy at this for over an hour, feeling no doubt, that he was doing his best for the company.

The duties of an efficient foreman require all the energy that he possesses and he cannot afford to wear himself out at tasks that are not concerned with the management of his department. Men can be obtained at a small hourly wage to do all the things of a menial nature. It is far more profitable to take a workman off a production job than for the foreman to neglect his own duties for such things.

A foreman has, of course, a multitude of duties but certain functions stand out so prominently that he must always bear in mind the fallacy of letting anything interfere with them. A considerable amount of time can well be spent in a systematic watching of the quality of the work being produced. The quality will never be higher than the standards demanded by a foreman. A foreman with an eagle eye on the character of the work will have a wonderful effect on the product. Improvements cannot be thought of and worked out by a foreman who is trying to save the price of a day laborer. Also the instruction of new operators is something that is a real art if properly performed. Even if special instructors are assigned to teach the beginner, the foreman will be well repaid for special personal attention in getting him started off right.

A really efficient department head is very careful to keep in touch with the workmen and their troubles. He cannot afford, of course, to become so familiar that he loses the respect he must have in order to be successful. Men like to feel that their foreman is interested in their complaints and it will be found that most of the differences of opinion arising between the men and the management can be settled satisfactorily to both parties if they are taken care of promptly.

It is not an indication of laziness or false pride for a foreman to avoid actual physical labor. His hands can perform no more than one of his workmen while his brains, if he has been properly picked for his job, are worth many times as much to the management.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Carbonizing by Means of the Acetylene Torch

By Milton Wright

In the self-starting device that has become an indispensable part of the modern automobile it is the usual practice to cause the teeth of the pinion of the starting motor to enter endwise when engaging with the corresponding ring gear. The engagement is brought about by sliding the pinion lengthwise of the rotor shaft and, as this action takes place very suddenly and as the teeth of the pinion and ring gear cannot well be expected to be always in exact alignment at the moment of engagement, there is bound to be more or less interference at the ends of the teeth; resulting in rapid wear, both by abrasion and by impact.

Heat treating the pinion to prevent rapid deterioration is a simple matter, but, as the teeth of the ring gear are ordinarily cut directly upon the periphery of the engine flywheel, the heat treatment of this part is quite another matter and it thus becomes a question of making the gear a separate part and shrinking or otherwise securing it upon the fly-wheel involving complications and added expense—or of leaving the gear teeth soft. If the teeth are soft a burr will soon be thrown up by the continued engagement of the starter pinion, causing still further interference and militating against smooth and sure action of the starter.

It is not necessary, nor is it even desirable, to make the entire tooth surface of the ring gear hard, for the trouble is all at the extreme ends of the teeth. The

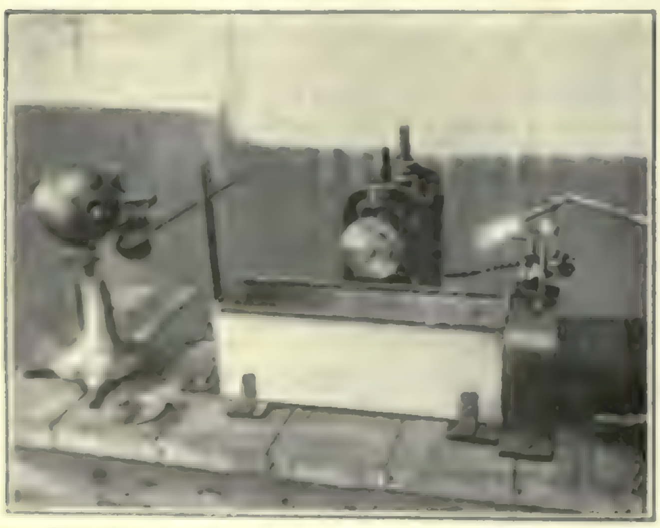


FIG. 1—DEVICE FOR CARBONIZING ENDS OF TEETH IN RING GEAR

ideal condition, therefore, is a soft tooth section with a hard surface only at the entering end. At the plant of the Locomobile Co. of America, Bridgeport, Conn., the problem has been solved in a satisfactory way by what is believed to be a unique application of the acetylene torch; devised by D. G. Roos, production manager of that company.

In order to show the complete working of the method, two photographs of the device—which is at once simple and ingenious as well as effective—are here presented. Fig. 1 shows the device without the work in place and with the acetylene flame burning, while in Fig. 2 a fly-wheel may be seen in place but with the gas turned off, for if the flame had been allowed to play upon the

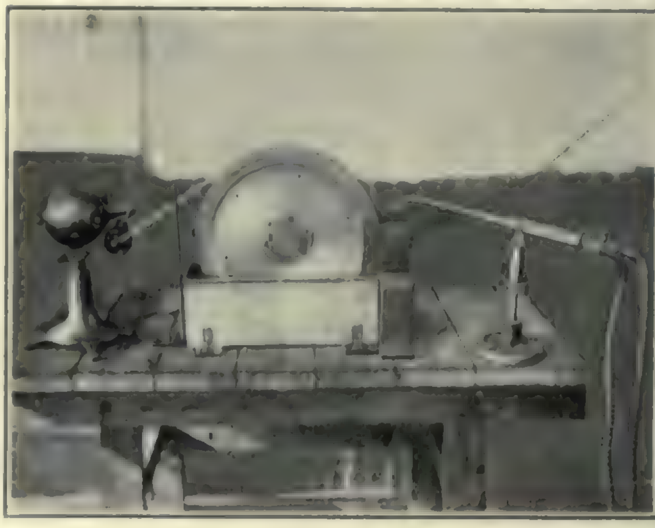


FIG. 2—THE DEVICE WITH A GEAR IN PLACE

stationary gear for the length of time necessary to make the photograph the usefulness of the part would have been destroyed.

The device consists of a standard acetylene torch, with a support to hold it in place; two ordinary shaft hangers with a short special shaft mounted in the bearings to carry the gear to be treated; a box, or trough, of galvanized sheet iron to collect and carry away the water and an electric fan motor from which the fan has been removed and a worm gear speed-reduction device fitted to the shaft to operate a pawl.

Referring to Fig. 1, water is delivered to the device through the valve at *A* and issues from a small jet beneath the platform *B* and directly below the jet of flame. With the gear (fly-wheel) in place as in Fig. 2 the flame plays directly upon the end of a tooth at the point where the latter will contact with the starter pinion and during the interval that the gear is allowed to remain stationary, only the corner of the tooth, is heated to the necessary carbonizing and hardening temperature. The pawl then operates to advance the gear one tooth and the red-hot tooth passes below the platform and stops opposite the quenching jet where it remains during the interval that the next tooth is being heated.

The object of the platform *B* is to keep the flame away from the water jet. It is but a piece of heavy sheet metal and, if corroded by the action of the flame,

is easily replaced. The sheet metal trough is for the purpose of confining the water and prevent it from splashing about. It need not (and does not) contain water, as a drain pipe immediately carries away the surplus.

As the gear is of mild steel it is necessary to carbonize the surface to be hardened, and the carbon for this purpose is already at hand in the acetylene flame. As may be seen from the appearance of the flame in Fig. 1, it is burning with a minimum of oxygen, an amount of this gas just sufficient to bring the temperature to the desired degree being supplied while the heated tooth is enveloped by the surplus carbon-carrying acetylene. A thin shell of carbonized material is thereby formed upon each successive tooth while it remains in the flame. The tooth then passes immediately to the quenching jet below the platform as the pawl advances the gear.

Once set in motion the operation of the device is continuous and automatic until all of the teeth have been carbonized and hardened. The pawl operating mechanism upon the motor shaft is so timed as to allow the gear to remain stationary for seven seconds, which time has been found by experiment to produce satisfactory results, and to consume about one second in advancing the gear. As there are 138 teeth in the gear it easily may be calculated that the output of the device is about three gears per hour, including the time of changing. It requires no attention after starting.

Crosshead Pin That Will Stay Tight —Discussion

By J. T. Towlson
London, England

On page 309, Vol. 57, of the *American Machinist*, there appeared an article under the above title by C. D. Michener. While the pin described by Mr. Michener is good in a way, I do not like it as there is no protection against sidewise movement in either direction should the pin get loose. I should very much fear to use such a pin in "out-of-sight" places, especially for fear it would become adrift as a result of endwise movement.

Retaining the idea of the split sleeve and the expanding mandrel, protection could be given to dangerous

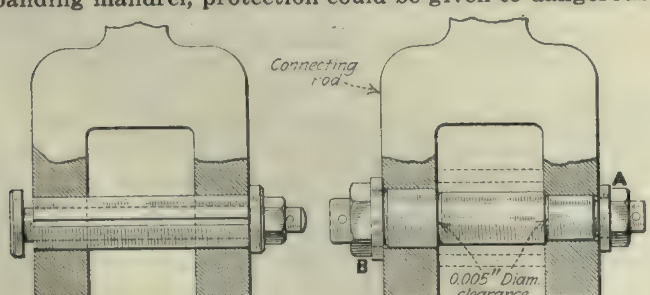


Fig. 1 Fig. 2

FIG. 1—MODIFICATION OF C. D. MICHENER'S CROSSHEAD PIN. FIG. 2—AN ENGLISH STAY-TIGHT CROSSHEAD PIN

endwise movement by providing a head to the expander and a washer larger than the diameter of the split sleeve for the opposite end; leaving a margin of clearance at the "head" end of the expander for tightness when required, as shown in Fig. 1.

A dependable method, adopted by engine makers with whom I am acquainted, is shown in the sketch, Fig. 2. There is, however, one essential requirement for the success of this device, which is not shown in the sketch. It is this: The pin is of chrome-vanadium steel, with all diameters ground to a glass surface. The bore of the connecting rod is bored under size, corresponding to an allowance for a hydraulic pressure fit. The pin, greased with lard oil, is pressed in by hydraulic pressure and then pressed out again by the same means, the useful effect being to burnish and harden the fitting surfaces of both the pin and the hole in the rod.

In assembly, the pin is pulled in by means of the nut *A* and is withdrawn by the nut *B*, the closing in of the jaws of the rod being prevented by the crosshead being in place. A pin so fitted will stay tight, while the center part on which the crosshead brasses wear may be shimmed up when elliptical wear takes place.

Limitation of Piston Aligning Gages —Discussion

By Stanley W. Mills

Under the above title on page 659, Vol. 57, of the *American Machinist* J. T. Towlson criticises the conventional type of gudgeon or wrist pin used in the gasoline engine and suggests a design of ball socket in the piston as a substitute. Both his criticism and suggested improvement are distinctly open to argument.

In the first place, his proposal, entirely apart from the number of parts and consequent complications, involves just as much, if not greater, accuracy in manufacturing as the conventional type of pin bearing in bosses at right angles to piston axis. The removable socket or pad which he shows is in itself a costly piece to make and could not be successfully machined without a great deal of care. It would be a costly and difficult problem to machine the ball end on the rod in line with the large end, without the use of expensive and accurate fixtures and it should be obvious that if the slightest errors exist in the finished pieces, the rod would be cramped when in position in the engine and inevitably cause trouble.

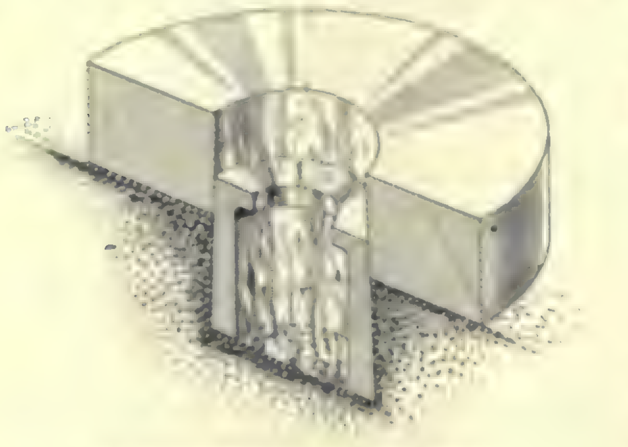
I venture to dispute Mr. Towlson's statement that with a ball socket, the rod is tractable in all directions, unless the greatest accuracy is maintained with respect to concentricity of the socket with the piston, correct alignment of the ball with the large end of the rod and the position of the cylinder on the crankcase. There are other details which I feel would never work out in practice, such as the inadequate means for locking the cap, the objectionable feature of drilling the piston skirt in order to insert the lock screws and the apparent impossibility of assembling the adjustable cap unless made in halves, which would be an impractical construction.

It is of course a fallacy to adhere blindly to past practice just for the reason that that is the way it has always been done. On the other hand, however, a time tested construction such as the conventional form of wrist pin (which in essentials has not been changed since gasoline engines were first produced) is undoubtedly based on a sound foundation. I can state positively that today the straight type of wrist pin, either floating in both rod and piston or clamped in one and bearing in the other, represents the best, most modern, and fool-proof design.

Closing-In Small Round Dies

By P. L. Stohr

Small round dies that have become worn oversize in service can be reclaimed with very little trouble by the following simple method. Bore out a casting, as shown in the sketch, to a drive fit for the die and drive the die into it for a short distance. Lay the die and casting on



CLOSING-IN SMALL ROUND DIES

the forge fire so that the flames will draw up through the hole in the die. As the die becomes heated in the center long before the larger casting, the expansion of the metal will close in the hole and when the casting has become hot the die will drop out into the fire; when it is ready to be hardened in the usual way.

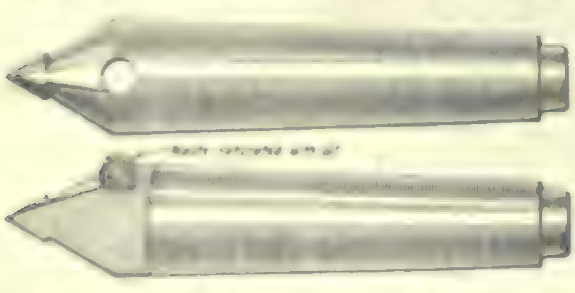
The hole will usually be found so much smaller than before as to require regrinding to size.

Saving Time in Grinding Centers —Discussion

By W. H. Storey
West Croydon, England

Under the above title on page 284, Vol. 57, of the *American Machinist*, Charles Kaufmann illustrates a center which is certainly a time and grinding wheel saver.

Personally I cannot understand why centers are turned solid as they usually are, presenting to the grinding wheel a face of about 1½ in. of which usually



TAILSTOCK CENTER WITH OIL GROOVE

less than ½ in. is used. I found grinding such centers to be a great waste of time, particularly when using a small portable grinder attached to the lathe carriage, and so I had all the centers in the shop cut away identically as shown by Mr. Kaufmann, but, in order to make a further saving in grinding by eliminating it as far as possible, I had a lubricating groove cut out in the tailstock center as shown in the illustration.

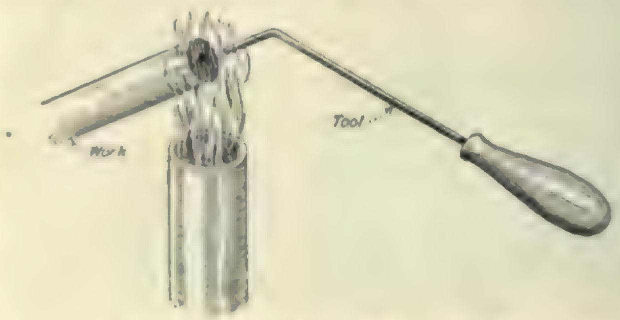
In the top portion of this groove, which is countersunk by means of a drill, a small pad of cotton waste is kept. The waste is saturated with oil which slowly drips right on to the point of the center. If insufficient oil is dripping, all the operator has to do is to press the waste slightly with his finger, forcing a little of the oil out.

A center made with an oil groove as above described will eliminate the necessity of the constant use of an oil can or any of the other usual means of lubrication. Moreover such a center is not liable to be burned, even through the inattention of a careless operator.

Tinning Small Holes

By E. Lytton Brooks
London, England

A piece of copper wire that will easily float or move about in the hole is bent at one end slightly longer than the depth of the hole; cut off about 6 in. long and handled. A piece of round wood or small file handle serves nicely. The work is then heated in the gas flame with solder and flux in the hole, and the copper wire end moved about in it until the inside of the hole



WIRE FOR TINNING SMALL HOLES

is tinned. The copper wire becomes tinned almost immediately and behaves like a small soldering iron. For electrical work paste and acid fluxes should be strictly taboo.

Storing Dies, Jigs and Fixtures

By S. N. Bacon

Wooden shelves for storing heavy punches and dies, jigs and fixtures are uneconomical due to wear and breakage and the standard adjustable metal shelving will be found to be more satisfactory in every way. The usual practice seems to be to locate the heaviest tools on the shelves nearest the floor and the lightest tools on the top shelf. While this method makes use of all possible shelf space a better arrangement and one which facilitates the transfer of tools to the machine and back to shelving is to locate the heaviest tools upon a shelf the same height from the floor as the bed of the machine upon which the tool is to be used. A truck of the proper height should be used and if constructed of wood, the top should be covered with sheet steel without seams or rivet heads, thus providing for sliding the heavy dies and fixtures from the shelf onto the truck and from the truck to the bed of the machine. The shelves below as well as above are used for storage of light and medium weight tools only.

Making Small Shoulder Studs in Double Lengths

By K. H. Crumrine

A line drawing of a shoulder stud of a design commonly used in machine and tool construction is shown in Fig. 1. Many such studs are made on lathes or screw machines and are used without being ground. Others, however, are required to be ground on all diameters, and many must be hardened before grinding. Studs of this type, when made in single lengths, present certain difficulties in grinding. One difficulty is that the distance between the grinding centers is so short as to make it hard to grind the pieces straight. Another difficulty is presented in holding the studs by the short heads for driving, so that both of the principal diameters can be ground at the same setting. In view of these difficulties in grinding when made in single lengths, the double length method as used in our shop may be of interest.

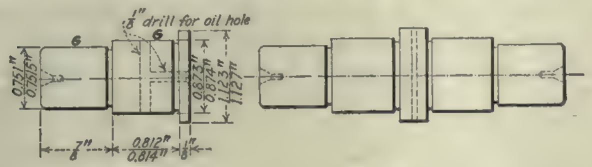


FIG. 1—THE STUD TO BE MADE. FIG. 2—TWO STUDS MADE IN ONE PIECE

The stud shown in Fig. 1 must be hardened and ground on the two smaller or principal diameters and the shoulder under the head must be hard. The stud is made of low carbon machinery steel and carbonized preparatory to hardening. Pieces long enough to make two studs as shown at Fig. 2 are cut off, allowance being made for the parting tool, plus the usual amount necessary to finish the ends. The stock used must be larger than the largest diameter of the stud by an amount sufficient to permit all carbonized metal to be removed from the diameter of the heads after the pieces are carbonized. Next the pieces as cut are centered, the ends squared up in a universal chuck on a lathe or in a collet on a screw machine, the two smaller diameters turned to grinding size and the grinding recesses cut in. The heads or largest diameters of the studs must not be turned at this time but left as large as possible until after carbonizing.

The studs are now ready for carbonizing but after this process are not immediately hardened. Instead they are returned to the machine shop where the excess material is turned off the heads and the cross holes drilled. Turning the carbonized material from the large diameter makes it impossible to harden the heads except under the shoulders and leaves the heads in suitable condition to be cut by the parting tool at the proper time. If the cross holes had been drilled previous to carbonizing, their surfaces would have been carbonized sufficiently to harden and would have made it extremely difficult to drill into for the small oil holes in the ends which are put in later. Next the studs are heated and quenched for hardening and are then ready to grind. Although the double length method of making these studs provides a most convenient way to drive for turning it is in the grinding operation that the value of this method becomes most apparent, as each stud can be completely ground at one holding, being driven by a dog attached to the stud on the opposite end.

After grinding, the studs are ready to be separated and for this operation are cut with the usual parting tool. Next the ends are finished and a spot made in which to start the drill for the small oil hole in the end. The oil holes are drilled in a high speed drilling machine in a separate operation. Should the number of studs required be large, they are made from the bar in a screw machine. A stud is made and centered as usual, but instead of cutting off to length, enough stock is fed out and cut off to make another stud on the opposite end as a second operation. After this the procedure is the same as for the smaller lots.

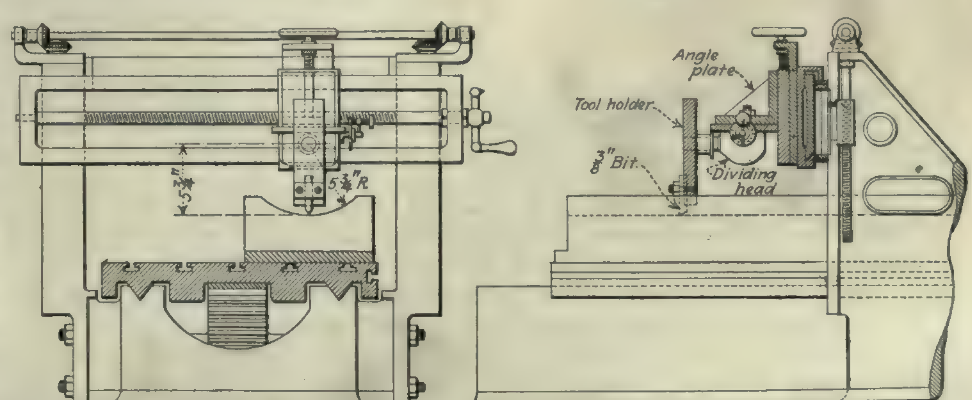
Radius Planing With a Dividing Head

By Robert T. Wilson

The sketch shows how a job of radius planing was done on an ordinary planer by the use of a dividing head from the milling machine, and without a great deal of extra rigging. This adaptation was made and the work done in this way for the reason that we did not have a lathe or boring mill large enough to handle the piece.

The clapper box was removed from the vertical slide of the planer and an angle plate bolted in its place, thus giving us the advantage of the regular vertical feed. The dividing head was secured to the under face of the angle plate with the spindle parallel to the planer table. A piece of cast iron was bored and threaded to screw on the spindle nose of the head in place of the regular chuck or driving plate and at the end of the piece a radial groove of square section was made to accommodate a commercial tool bit, which was held in place by a clamp and stud bolts in much the same way as a planer tool is ordinarily held.

By setting the point of the tool to the required radial distance from the center of the spindle the radius was planed by feeding the tool at the end of each stroke of the planer table by means of the regular index crank on the dividing head. The casting had been cored to approximately the desired shape and we were thus able to remove the amount of metal necessary to secure a good finish.



RIG FOR RADIUS PLANING

Thread Milling Cutters and Hobs

By A. Nugent
Cork, Ireland

A consideration of the elements of the square thread and the modern method adopted for producing it by the process of milling, is helpful when considering the production of circular cutters for this purpose and also the production of hobs for splining and for square and hexagon shafts and kindred work.

Examination of the sketches will show that the annular spaces around the periphery of a cylinder, Fig. 1, and the longitudinal cuts shown in end view, Fig. 2,

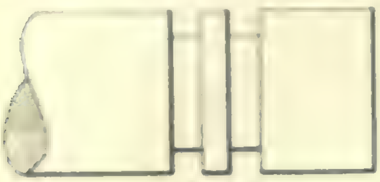


FIG.1

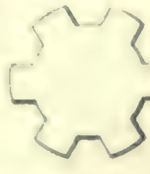


FIG.2

FIGS. 1 AND 2. EXTREMES OF SQUARE THREAD SECTION

are essentially two extreme forms of the square thread. In Fig. 1 the helix angle is zero and in Fig. 2 infinity. The square thread screw then, in all its wide variations of lead, pitch and diameter, is logically some intermediary between these two extremes.

Once we depart from the conditions of the annular spaces Fig. 1 in the direction of the conditions shown in Fig. 2, the helix angles, which for the top and bottom of the thread alike are zero in the first case immediately become two different dimensions, both varying as the lead of the thread.

If we lay out a square thread to a fairly large scale and superimpose the outline of a side and face cutter of a width equal to half the pitch we will see that such a cutter could not produce a thread whose longitudinal section is a true, or approximately true, square.

The deformation is due to the interference of the

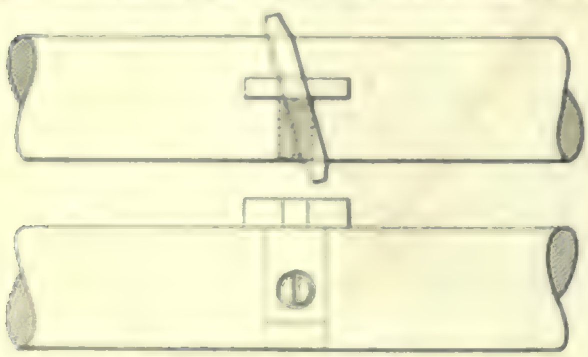


FIG. 3. SETUP FOR OBTAINING THE FORM OF CUTTER

sides of the cutter with the spirally disposed side of the thread as it enters and leaves the cut. The amount of this interference will increase with the diameter of the cutter, the depth of cut, and the lead of thread, for a given diameter of blank.

The true form of cutter for milling a square thread is therefore not of the standard rectangular side and face cutter form but one whose teeth have a curved outline, which curve does not conform to any of the regular curves and is only strictly true for one particular lead, depth of cut and blank diameter of screw.

While it is possible to arrive at this correct curve graphically, such a method involves complex geometrical projection and is in fact of little use to the toolmaker, even when done with the greatest care. The better and more practical way is to generate the desired curve by setting up the machine as though for milling the actual screw, then by mounting on the cutter arbor a blank made of some free cutting metal, such as white metal, we may slowly feed astride this rotating blank a line form tool of the thread space Fig. 3, held in an arbor placed between the work centers of the thread milling machine. An appropriate curve is thus accurately generated which can be afterwards transferred to a tool steel cutter blank by means of carefully made male and female transfer gages and a form relieving tool.

In the case of the generating of splines, this is done on a gear tooth hobbing machine, the basic principle of which is that of a gear (which is the work blank) rolling into a rack (which is the hob), and the natural, mutual alliance between these two members is the regular involute curve.

We have seen, however, in the case of splining that we are fundamentally generating an extreme form of

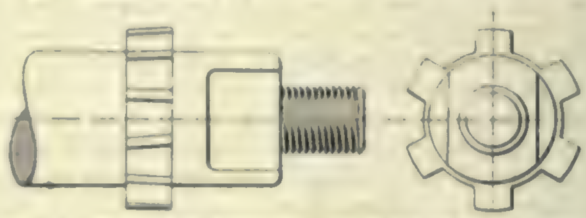


FIG. 4. SHAPE OF CUTTER FOR SPLINED SHAFTS

square thread whose sides consist of straight lines parallel with each other and with a radial line drawn through the center of the thread. In this case the action between hob and work is not rolling contact and requires a hob with a special form of tooth made to a given size and number of splines and a given blank diameter.

We can best arrive at this true form by setting up the hobbing machine as for splining the actual shafts and placing between the work centers a cutter, Fig. 4, whose cutting outline conforms exactly to a cross section of the splined shaft desired. On the hob spindle we then mount a hob blank, previously threaded approximately to the one desired as to pitch, depth of cut and diameter, but made from some free cutting metal as previously indicated, and left sufficiently long to span the arc of contact between itself and the cutter.

The cutter, Fig. 4, will then generate the true shape of hob tooth. By transferring this shape to gages we have a permanent means of reproducing accurate form relieving tools for repeating any further hobs that may be required for that particular size of splined shaft.

Another modern application of the hobbing machine is to the generating of shafts having square, hexagon and other symmetrical sections but which, like the splined shaft, have not the rolling contact relationship involved when hobbing involute gear teeth. In these latter cases hobs with special tooth forms are necessary, and are best arrived at as indicated in the case of splining hobs.

In designing these hobs it should be noted that the normal pitch of the hob must correspond with the circular pitch of the splines, or, in the case of squares or hexagons, with the circular pitch of the points of the cross section. On this account by varying the hob diameter we can, within limits, determine an axial pitch of our hob which will greatly convenience the toolroom when making it. This is evident when the axial pitch of hob $= P$, pitch of splines $= S$, and helix of hob $= A$ degrees. Then: $P = S \times \text{secant } A$.

Editorial

WE WOULD GLADLY invest a hundred dollars if we could be certain that we would get ten thousand in return. Our enthusiasm would still be considerable if we got only one thousand or five hundred or even two hundred. But when it comes to production in the shop we seem to have the idea: ten thousand, or nothing. Just because the profit is not so great we refuse to employ the automatic machine for smaller quantities; we seem to feel that, if it takes three hours to set up the machine, we must gain at least a hundred. Why not take paper and pencil and figure it out?

Standardizing Names of Machine Parts

THERE SEEMS to be no question that the work of standardization which has been going on more or less spasmodically is taking definite root and that we are to have workable standards for many machine parts.

There is, however, a great need of standardization along a line which is too generally overlooked, namely, the standardizing of the names of machine parts, particularly those which are widely used in general machine construction. Take for example, machine screws and bolts with their variety of heads. There is not even an accepted definition as to what a machine screw really is, and when it comes to the shape of the head or the length of the thread we are all at sea.

We heartily approve standardization along rational lines, and we sincerely believe that a standardized nomenclature is of prime importance.

Grinding Machines and Some of Their Problems

THE INCREASING use of grinding as a method of machining metals of various kinds emphasizes more and more the problems which confront both the makers of grinding wheels and grinding machinery, and those who use them in finishing their product. The varying conditions of wheel contact introduce elements which require careful study, but which are too often overlooked by those who see the matter from a superficial standpoint.

A little study of the amount of contact between wheel and work on both internal and external cylindrical grinding, with various sizes of work and of wheels, will soon show the necessity of having various grades of grinding wheels even for the same materials. When it comes to surface grinding it is only necessary to study the entirely different conditions when using the periphery of a narrow-faced wheel or when grinding with a large ring wheel on a surface having considerable area. Here the problem of a continuous or a broken surface must also be met and the wheel selected in accordance with the work.

Then, too, there is the problem of the way in which the grinding-wheel spindle fits its bearings, and the effect of heat in tightening these bearings or in making them more free. In too many cases the wheel spindle bearings receive much more careful attention than the mounting of the work to be ground, and there are doubtless many instances where more perfect work could be secured if more attention were paid to this end of the operation. There is a growing tendency toward wide wheel work and toward more simple machinery.

The whole problem is one of much interest and in which there is ample opportunity for improved design and construction, as well as for skill and experience on the part of the operator.

The Growth in the Number of Aircraft Industries

THOSE WHO FAIL to realize what has actually been done in airplane development and use, and think of it only as a future possibility, are not only lagging behind the procession but are likely to miss considerable business from time to time. For while the output of airplanes is insignificant as compared with the automobile as yet, there are nevertheless several thousand men engaged in the industry which is already providing a market for a large number of machine tools of the higher grades.

As an indication of the activities already under way it is only necessary to note that 72 firms engaged in the manufacture of materials, parts, accessories or supplies are members of the Aeronautical Chamber of Commerce, the national body which embraces nearly all the concerns engaged in airplane development. As an example of the way in which the airplane industry affects other fields, one large concern has made a comprehensive study of metals for airplane work and as a result is supplying the bulk of the bearings for the new airplane motors and also for replacements at the various flying fields.

Machine builders of all kinds will do well to give more attention to the airplane to aid in its development. One of the ways to help this development is to work for suitable landing fields in every city, as these must precede the commercial use of planes on any large scale. Those who are in a position to profit by the development of aircraft should lose no opportunity to put their shoulders to the wheel while the industry is still young and help to educate the public to its possibilities.

Just Suppose

JUST suppose you were an old engine lathe in a railroad shop and that you had been working hard for forty years. And suppose you had rheumatism and St. Vitus' dance and every move you made was agony and you couldn't do your work the way you used to so that your self respect was gone.

You'd give all you possess to have the superintendent come around some day and order you put on the scrap pile so that your miserable existence could be ended.

Railroad shop superintendents don't do humane things like that? Of course they don't, the management won't let them, but—

Just suppose.

Shop Equipment News

Bullard Continuous Turning Machine

The Bullard Machine Tool Co., Bridgeport, Conn., has recently added to its line of vertical machines, the newcomer being the continuous turning machine illustrated in Fig. 1. The turning machine maintains the Bullard characteristics in being vertical, in the use of multiple tools which turn, bore and face without the use of form or sweep tools and in the use of tool slides with large bearing surfaces, of simple tools which are easily adjusted and of flood lubrication to all working surfaces. While at first glance the machine may be likened to the Mult-Au-Matic, it is a distinct departure from it in a number of ways.

As the name implies, the machine is of the continuous instead of the station type. In the latter the tools remain stationary and the work tables are indexed under the different tool heads for each operation. In the former, both the work and the tool head move continuously around the center column and all indexing is avoided. Each operation is performed in less than one revolution of the carrier, a portion of its revolution being reserved for loading the work in the chuck. In the machine shown the loading time is a trifle over one-fourth of the cycle.

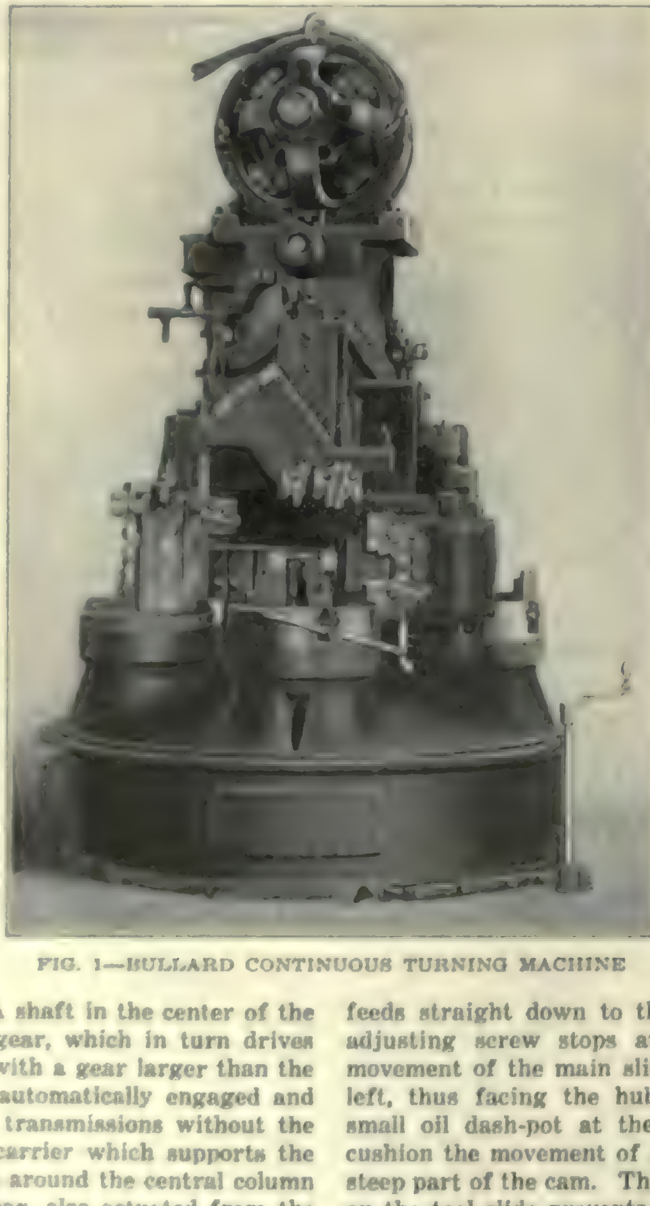


FIG. 1—BULLARD CONTINUOUS TURNING MACHINE

The continuous turning machine is built around a central column, which carries the motor at the top, and just below it the single cam that actuates and times all the tool slides. Everything below the cam revolves around the central column, the work tables being revolved under the tools except during the loading period. A shaft in the center of the column drives a large ring gear, which in turn drives each work table by meshing with a gear larger than the table itself. The gears are automatically engaged and disengaged as in automobile transmissions without the use of clutches. The large carrier which supports the work tables and carries them around the central column is driven by a large wormgear, also actuated from the central power shaft. The speed of the carrier can be varied by changing a single pair of gears, no gear box being necessary.

The detailed view, Fig. 2, gives a good idea of the construction of the tool heads and the work they do. The work shown is a tractor flywheel, weighing about 140 lb. in the rough, this being the first operation. The wheel is held on the inside by the chuck jaws, the piece being chucked during the part of the cycle when the work table is idle. The tool at the left rough turns the outside; those at the right feed toward the center, facing both sides and chamfering the corners after the face has been turned by the tool at the left. The side movement is secured by rack and pinion from the vertical slide.

At the same time, the tools in the central tool slide feed straight in to the work as far as the stops permit and are then moved toward the left by the angular slide as the main slide continues to be forced down by the cam at the top. These operations take approximately three-quarters of the revolution of the carrier, the amount being determined by the work being done. The tools are withdrawn and the table stopped when it reaches the loading position. The piece is removed and another put in its place, ample time being allowed for this work during the idle period.

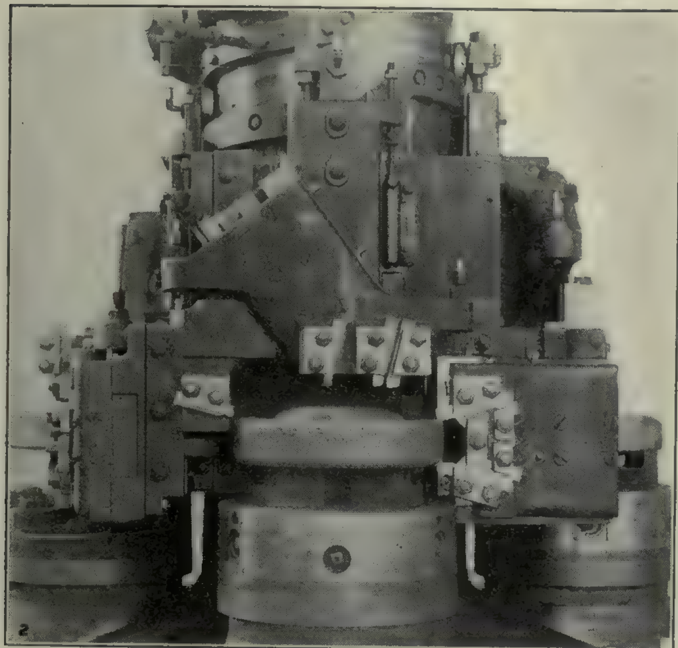
In the meantime the second operation is being performed by the next tool head, as shown in Fig. 3. As soon as this head reaches the loading point, the finished wheel is removed and the one just rough turned on the first spindle is turned over and chucked as shown. In this operation the machine bores and faces the inside of the wheel at the hub, only three tools being used. Here again the tools are held in the angular slide, which feeds straight down to the work until stopped by the adjusting screw stops at each side. The continued movement of the main slide forces the tool head to the left, thus facing the hub. The view shows also the small oil dash-pot at the right of the main slide to cushion the movement of the slide as it drops down the steep part of the cam. The retarding or dragging action on the tool slide prevents digging in of the tools. The illustration likewise shows the construction of the tool slides, the size of which can be estimated by comparing them with the work table, which is 18 in. in diameter.

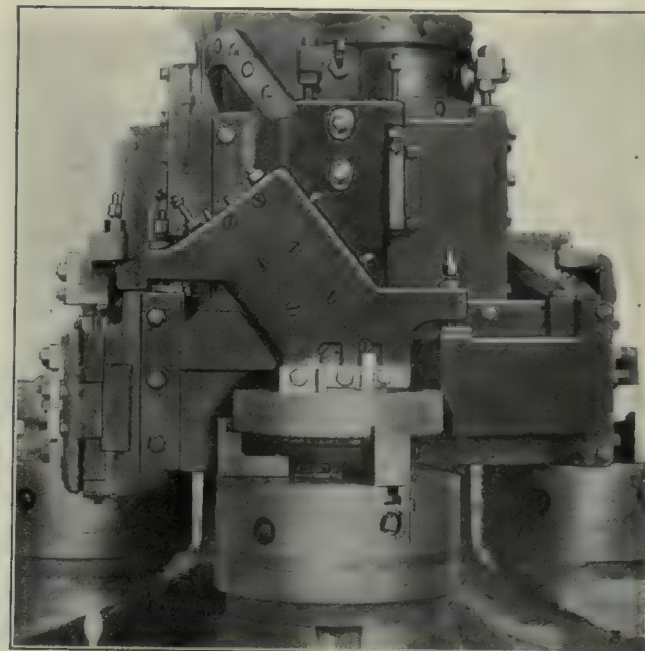
The th rd operation is also on the inside of the flywheel, this operation being the finish boring, facing

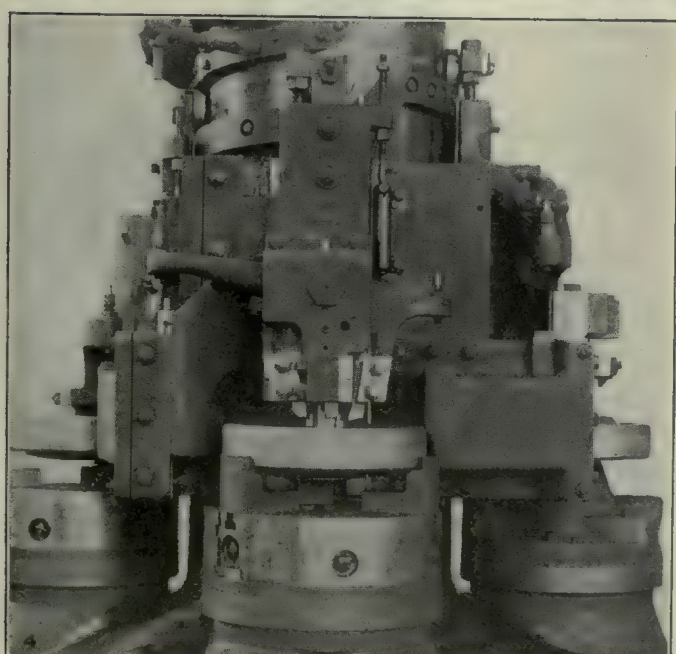
and chamfering, as in Fig. 4. The tool slide has only vertical movement, and the illustration shows the sharp drop of the cam and the large diameter of the cam roller. Fig. 5 shows the finishing operation, which resembles the first as far as the tooling is concerned. The wheel, however, is driven by a central mandrel instead of a chuck, so as to insure the rim being true with the bore. When the wheel is finished it weighs 115 lb., as about 25 lb. of metal is removed in machining.

gear is not a driver, but is merely to insure the quiet and easy meshing of the driving gear when the table reaches the point for beginning its work.

The upper gear is constantly in mesh, while the driving gear drops out of mesh with the central gear when it reaches the loading position, under control of a cam in the base. When the cam again raises the driving gear to start the table, the friction plate on its upper surface contacts the upper gear and brings the driving







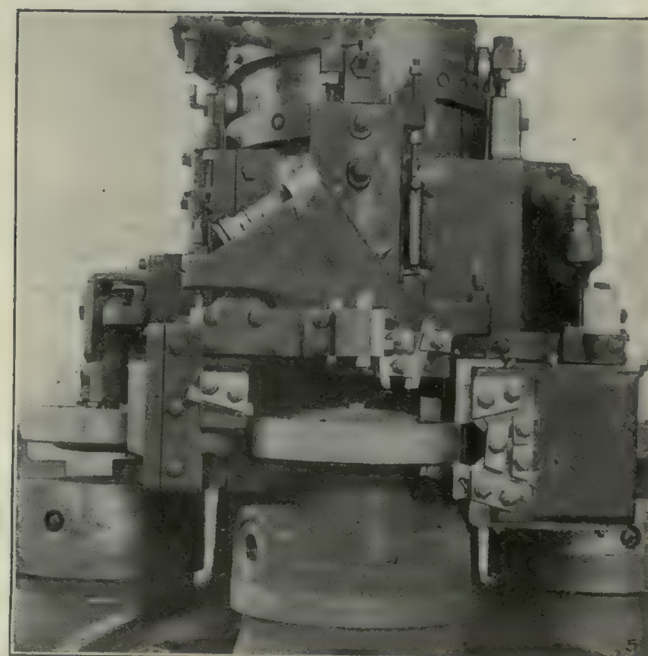


FIG. 2—FIRST CUT ON FLYWHEEL. FIG. 3—BORING AND TURNING THE INSIDE. FIG. 4—FINISH BORING. FIG. 5—FINISHING THE OUTSIDE

A view of the central column around which the carrier revolves with its work tables and tool heads is shown in Fig. 6. The power shaft is shown in the center of the column, and toward the bottom the gears which revolve the work tables. Below the gears is the bearing for the carrier. The work table spindle and its bearing, on the right of the illustration, show a detail of the construction used. The upper or narrow-faced gear up to speed before the cam throws it into mesh with the central gear. The view shows also the length and diameter of the work table spindle, with its bearing at each end. The upper bearing is 7 in. in diameter on the straight portion and 12 in. at the top of the angle.

This machine has been designed to handle work too large for the Mult-Au-Matic, and where a simple, massive machine can secure maximum production with a

minimum of training on the part of the operator. Perhaps the best idea of its simplicity may be had from the fact that it contains but 225 parts, exclusive of the chucks. The largest diameter is 68 in. and the height to the top of the oil piping is an even 10 ft. The weight is 23,500 lb. The machine is so designed that no special foundation is required. It is equipped with a 30-hp. motor, but the maximum used in turning the flywheels shown was about 7 hp. and with the machine running idle about 2 hp. The time of the complete

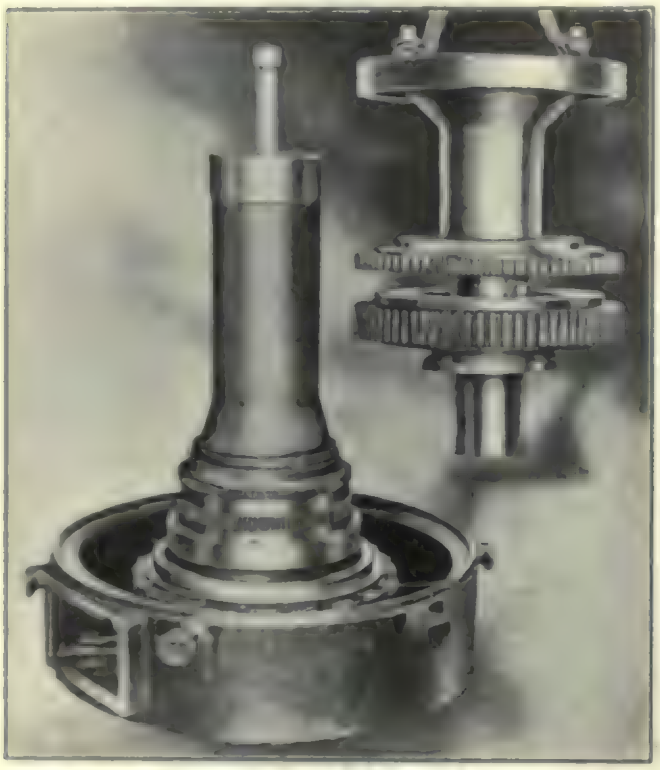


FIG. 6—COLUMN AND ONE TABLE SPINDLE

cycle was 4 min., of which 70 sec. was loading time.

The oiling system includes a very complete filter in which the oil goes first to the underside of the filter screens, so that any solid particles in the oil drop to the bottom and do not tend to clog the filter. The oil to the bearings is piped direct from the filter.

Racine Portable Duplex Bandsawing Machine

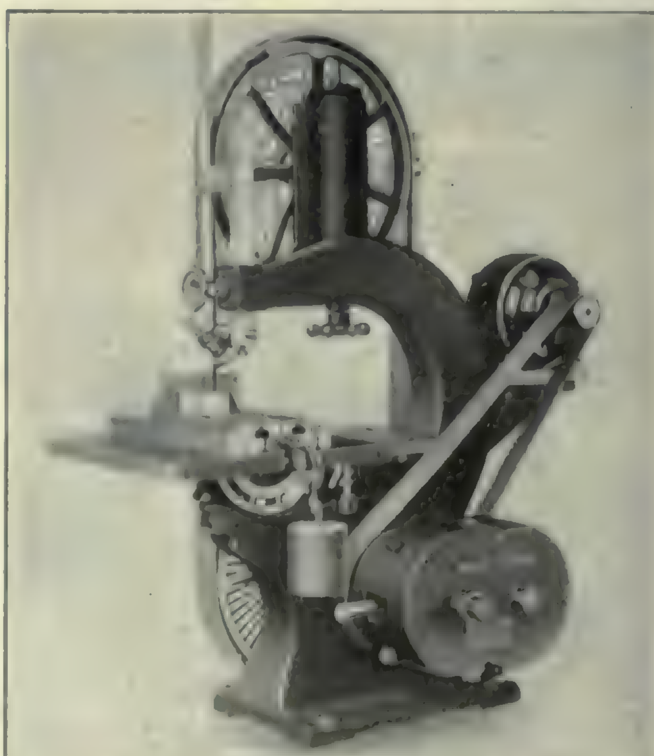
A small portable bandsawing machine of the duplex type for cutting both wood and metal has recently been placed on the market by the Racine Tool & Machine Co., Racine, Wis. The machine is suitable for use in toolrooms, pattern shops, trade schools and places in which light wood and metal cutting need be done.

The accompanying illustration shows the drive side of the machine as fitted for metal work. A $\frac{1}{2}$-hp. induction motor running at 1,750 r.p.m. furnishes the driving power. It is attached to a convenient lighting circuit by a flexible cord, a feature that adds to the portability of the machine. The platform on which the motor is bolted is an integral part of the main frame. The frame provides a capacity from the throat to the blade of 14 in. The capacity between the table and the guide is 5 in. and between the metal-cutting vise and the guide 3 inches.

The wheels carrying the saw blade are of cast aluminum 14 in. in diameter, with the rims machined and covered with rubber bands. They run on ball bearings mounted in grease-packed housings whose positions are easily adjustable. A hand screw is provided to tilt the upper wheel to properly align the blade. The tension on the blade is controlled by a hand screw operating against a spring, so as to give a cushioned tension. The spring serves as a safety device; if chips accidentally fall between the blade and the lower wheel, they will pass around the wheel without breaking the blade. The saw blades used can vary in length from 7 ft. 6 in. to 8 ft. Both the blade and the wheels are protected by aluminum guards mounted on hinges so that they can be swung out of the way to give access to the wheels when changing the blade.

The saw guide is adjustable for blades from $\frac{1}{8}$ in. to $\frac{3}{4}$ in. in width and of any gage. The guide wheel runs on ball bearings. The guide is mounted on a square steel post and is easily adjustable to the desired height. The table is 15x15 in. in size and 16 in. above the bench on which the saw stands. It can be tilted up to 45 deg. and clamped in any desired position.

A two-speed attachment can be provided when it is desired to use the machine for both wood and steel, the change being accomplished by the shifting of one lever. The slow speed enables cutting sheet steel and flats up to $\frac{1}{4}$ in. without the necessity of clamping in a vise. For bar stock, rounds, flats, and shapes up to 3 in.



RACINE PORTABLE BANDSAWING MACHINE

in thickness, the gravity-feed vise can be furnished. The vise is fitted with a quick-acting cam lever to aid in holding material of various shapes. It can be easily bolted to the table and removed. A pedestal 22 in. high can be furnished.

The machine has an over-all height of 39 in. and requires a floor space of 34x17 in. when plain and 34x21 in. with the two-speed attachment for metal cutting. The weight of the plain machine is 200 lb., while equipped with the vise and two-speed transmission for both wood and metal cutting it is 285 pounds.

Thomson Type SP Butt Welding Machine

The Thomson Electric Welding Co., Lynn, Mass., has recently brought out a line of butt welding machines in which appear a number of changes from the former designs, and which are especially adapted to making the so-called "flash" welds.

The platen to the left, which has heretofore been gibbed to the bed and capable of adjustment by means of a screw back-stop, is made rigidly a part of the machine frame. The movable platen is made of cast iron and is much longer in proportion to its width than heretofore, thus insuring a free moving slide.

In the smaller machines the pressure to effect the weld is applied to the movable slide by means of a hand lever and toggle joint through a right-and-left threaded pitman and adjusting nut similar to the pitmans of many punch presses. This combination provides a wide range of adjustment for position of the movable platen, and at the same time enables the operator to apply the maximum welding pressure as the toggle straightens out, thus relieving him of the necessity for severe exertion. In the larger sizes the pressure is applied by hydraulic cylinders.

Primary windings for the transformers may be supplied for any standard voltage from 110 to 550, and for frequencies of 25 and 60 cycles. A five-point regulator switch mounted on the base of the machine controls the flow of current. The secondary coils are flexible, being made up of laminated copper strips firmly clamped to the terminals. The secondary terminals themselves are heavy castings of copper, bolted to the ends of the respective platens, where they form the parts to which the work-holding fixtures are directly attached. This construction eliminates the necessity for platens of solid copper and for sliding electrical contacts.

The transformers are of the open type of ample cross-section to carry all normal currents without resistance heating, and are air cooled. The terminal castings and the platens are chambered and fitted with connections for water circulation to prevent undue heating, by radiation and conduction from the work. The work-holding clamps are of the vertical type and are ordinarily operated by hand levers. Pneumatically operated clamping devices may be furnished if desired, and the machine shown herewith is so equipped.

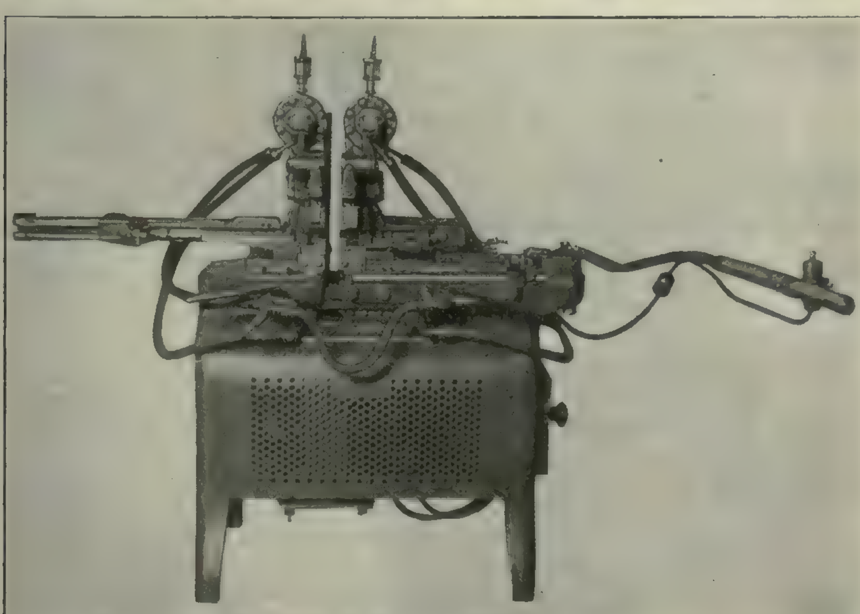
The SP machines are lighter for a given capacity than are those of the older type, yet they are stronger and show a higher electrical efficiency. They are built in five sizes, the smallest having a welding capacity ranging from a rod $\frac{3}{16}$ in. in diameter up to 1 sq.in. in cross-section, while the largest one welds work having cross-sectional areas from $\frac{1}{2}$ to 20 square inches.

Amsler "Elastic-Column" Dynamometer for Hardness Testing Machines

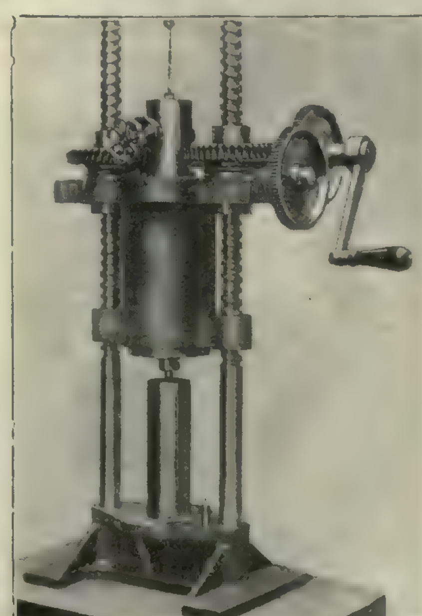
Holz & Co., Inc., 17 Madison Ave., New York, N. Y., have recently placed on the market a line of hardness testing machines employing an "elastic-column" dynamometer and made at the Amsler works in Switzerland. The elastic-column dynamometer is an apparatus employed for measuring and indicating the load exerted by machines that are not used for producing a fracture of the material under test, but rather static deformation with definite predetermined pressure. It is suitable for hardness testing by either the Brinell method, in which an impression is made in the work by means of a small ball, or by the Ludwik method, in which a cone is employed for a similar purpose.

The accompanying illustration shows a small-sized hardness testing apparatus of this sort with the elastic-column dynamometer incorporated in it. The apparatus forms the upper part of the press. The member carrying the ball or contact point is secured to a plate at the bottom of the housing. The total load acting on the test piece is then transmitted by means of several steel bars or short columns in the cylindrical housing. The reaction is born by the upper part of this housing, which is connected to the platten of the machine so as to support the work from below. The deformation of the columns due to the compressive stress is always proportional to the load that they are sustaining. Since the columns are loaded far below their elastic limit, they do not undergo permanent deformation.

In the center of the load-supporting column is another



THOMSON TYPE SP BUTT WELDING MACHINE



"ELASTIC-COLUMN" MACHINE

column that is not subjected to stress. It supports a small piston that moves in a space filled with mercury. Consequently, when the supporting columns are shortened under load, the central piston moves up in its mercury space a distance equal to the shortening of the columns, thus expelling a quantity of the mercury into the capillary tube shown on top of the housing. The quantity of mercury expelled is proportional to the load placed on the work.

A micrometer screw, the end of which is immersed in the mercury, is employed to measure the amount of mercury that has been expelled into the tube. The level of the mercury can be adjusted to any desired height by turning the screw. Thus, after load has been applied, the level of the mercury can be brought back to the point at which it stood before the load was put on, and the amount that the screw is turned may be used as a measure of the load applied. If it is desired to apply a definite load with the machine, as, say, 3,000 kilos, the micrometer screw is turned back three complete revolutions and then the load gradually increased until the level of the mercury returns to its original height. The reading of the load is thus independent of the bore of the capillary tube, so that in case of accidental breakage, the tube can be replaced without influencing the accuracy of calibration.

While the dynamometer is sensitive, it is at the same time of very rugged construction. It can be overloaded only when the testing machine itself is being wrecked. The dynamometer is calibrated by dead load up to its full capacity, and the calibration can be checked at any time by hanging the machine up by the compression plate, the load then shown agreeing with the weight of the machine.

The dynamometer can be mounted in the testing machine in different manners. In the illustration is shown a ball-type hardness testing machine having two speeds. The fast speed enables bringing the ball quickly to the required position, and the slow speed is used to apply the load. The machines are driven by hand levers and are not of the hydraulic type.

With the simple wormgear drive employed there is but little that can get out of order, or be deteriorated by the action of dust and soot such as encountered in heat-treating shops and which is apt to find its way into hydraulic valves. Mountings, both large and small, can be furnished for use on the bench or the floor.

White Motor-Driven Flexible-Shaft Outfits

Small portable motor-driven flexible-shaft outfits have recently been placed on the market by the S. S. White Dental Manufacturing Co., 211 South 12th St., Philadelphia, Pa. The $\frac{1}{16}$-hp. outfit equipped with a Type W motor is illustrated in Fig. 1. The motor is intended for 110-volts alternating or direct current.

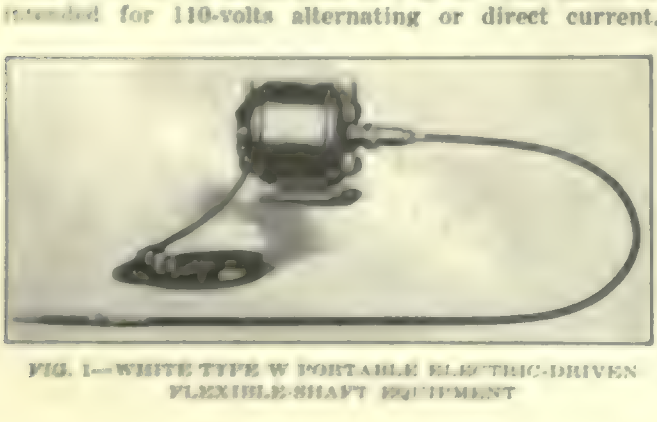


FIG. 1—WHITE TYPE W PORTABLE ELECTRIC-DRIVEN FLEXIBLE-SHAFT EQUIPMENT

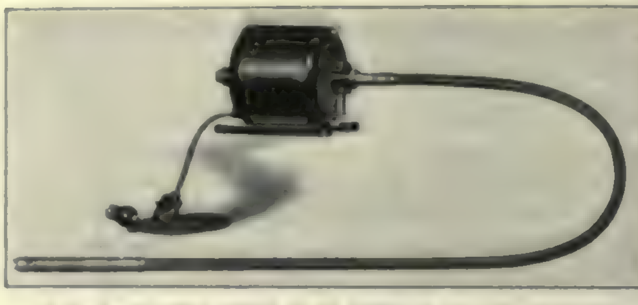


FIG. 2—WHITE TYPE Y FLEXIBLE-SHAFT OUTFIT

and runs at a speed of 3,450 r.p.m. An attachment cord and plug and a push switch are furnished. The flexible shaft is fastened directly to the motor, and carries a No. 7 handpiece.

The flexible shaft has a diameter of 0.15 in., and the casing of $\frac{3}{8}$ in. Either fabric or metallic casing can be furnished in lengths of 36 and 48 in. The flexible shaft itself consists of layers of fine wire, the direction of winding being reversed in each layer. The motor shaft is hollow at one end to receive the end of the flexible shaft, and a special construction of the bearing housing is provided to carry the casing for the flexible shaft. The tool is especially useful for work on small dies and for undercutting mica on the armatures of small electric motors. Complete equipment for all types of work can be furnished, as abrasive wheels, drills, small mills and burs are all available. The handpiece incorporates a small locking chuck by which the mandrels of the tools can be securely held.

An outfit driven by a $\frac{1}{4}$-hp. motor operating on 110-volt alternating or direct current at a speed of 1,750 r.p.m. is shown in Fig. 2. This Type Y motor is for heavier work than the Type W, and is applicable to a large variety of operations such as grinding, polishing and drilling that are required in a machine shop. The shaft of the motor is machined to receive the flat end of the flexible shaft. A screw collar holds the casing securely on the end of the housing. A connecting cord and plug having a push switch are provided.

The flexible shaft is ordinarily furnished in sizes of 0.250, 0.312 and 0.375 in., the size of the casing being $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in., respectively. As with the smaller shaft, helical layers of spring-steel wires tightly laid in strands of three or four wires each form the shaft. The diameters of the wires in the different strands depend on the size of the shaft, and the position in the shaft. The smallest size casing is covered with fabric, consisting of a flat wire spring or helix over which is laid a series of cotton braidings that are treated with varnish, baked and then polished. The two largest casings are metallic, and are more durable although not quite as flexible as the fabric casing.

The No. 8 handpiece has two interchangeable chucks, so that drills and shanks from the smallest made to $\frac{1}{4}$ in. in diameter can be gripped. The chucks are of the three-jaw variety, and provide a rigid grip. The spindle carrying the chuck is hardened and ground and runs in a hardened ground bearing. A thrust washer of anti-friction metal is provided.

The fore part of the sheath or grip practically covers the cap nut on the chuck socket, so as to protect the thrust bearing from dirt and abrasive and permit the operator to grasp the handpiece nearer the working tool. A reservoir for oil is provided in the handpiece. The construction is such that taking down for cleaning can be easily performed. Cutting tools, wheels and similar equipment can be furnished for all types of work.

News Section

Machine Tool Builders Declare Stock Dividends

Important changes in the capitalization of three of the major plants in the machine tool industry of Cincinnati were announced last week by officers of the interested companies.

The companies involved are the R. K. Le Blond Machine Tool Company, the Cincinnati Bickford Tool Company and the Cincinnati Milling Machine Company, all of Oakley.

The Le Blond Company, according to reports, will change the charter of the company from Ohio to Delaware. The company will be dissolved to meet the legal requirements, its Ohio charter surrendered and steps taken to reincorporate under the laws of Delaware.

At the same time questions relative to an increase in capital will be decided, according to E. G. Schultz, treasurer of the company.

The reorganization of the Cincinnati Bickford Tool Company was effected yesterday through the issuance of a charter at Columbus to the Cincinnati Bickford Company, capital $2,000,000.

C. P. Gradolf, secretary of the Bickford company said that the new charter was in effect an authority to increase its capital from $500,000 to $2,000,000 for the purpose of distributing stock valued at $1,025,000.

The newly authorized issues are $1,000,000 preferred 6 per cent and $1,000,000 common. At present a total of only $1,025,000 is to be issued, according to Secretary Gradolf.

Of this, $500,000 will be issued in blocks of 6 per cent preferred at $100 par and the $525,000 common will be issued in $25 shares. The remainder of the authorized capital will be held in the treasury for further expansion.

President A. H. Tuechter said that the $500,000 preferred is to be distributed among the present shareholders.

Yale Begins Lectures on Engineering Profession

Lectures by prominent engineers are being made part of the program of development of the engineering courses in the Sheffield Scientific School of Yale University along broader university cultural lines. These lectures will deal with the engineering profession as a whole—with its history, opportunities and obligations, with its attitude toward public and private needs, its notable achievements, and kindred topics.

Special lecturers are being chosen both for their knowledge of engineering and for their experience in dealing with public problems. The first lecturer was John Hays Hammond. The second will be L. W. Wallace, executive secretary of the Federated American Engineering Societies, and a former member of the faculty of Purdue University. Mr. Wallace, who was vice-chairman of the Hoover Committee on Elimination of Waste in Industry, and who is president of the Eye Sight Conservation Council of America, will speak at Yale on December 12.

Mr. Wallace's subject will be "The Engineer in Industry." Among other things he will discuss the report of the Committee on Work-Periods in Continuous Industry of the Federated American Engineering Societies, which found that the twelve-hour day in industry was economically unnecessary. President Harding has characterized this report as representing his "social viewpoint."

Pennsylvania Road Raises Pay of 30,000

Wage increases aggregating approximately $1,800,000 annually have been granted 30,000 maintenance of way employees of the Pennsylvania Railroad system, John G. Rodgers, vice-president of the Northwestern region of the road, announced in Chicago last week.

The increases ranged from one cent an hour for carpenters, painters and masons' helpers to five cents an hour for assistant bridge and building foremen and will be retroactive to November 1.

The adjustment was reached through a series of conferences between the general managers of the four regions of the road and the Pennsylvania System Fraternity, a company organization.

The Pennsylvania refused to settle with the Federated Shopcrafts when their recent strike was terminated on some roads and instead organized its employees into a company union. The employees then elected representatives to negotiate all differences with the management.

A Triple Convention

F. D. Mitchell, secretary-treasurer of the American Supply and Machinery Manufacturers Association, with offices at 1819 Broadway, New York City, issued last week an advance announcement of a triple convention of the National Supply and Machinery Dealers Association, the Southern Supply and Machinery Dealers Association and the American Supply and Machinery Manufacturers Association.

The convention will be held in Cincinnati, Ohio, May 17, 18 and 19, 1923 with headquarters for all three associations at the Hotel Sinton.

Industrial Engineers Meet in Springfield

At the opening winter meeting of the Western New England chapter of the Society of Industrial Engineers in Springfield, Mass., the discussions related to the topic "The Planning of Work." In a paper on "Sales Forecasts" Walter F. Bachelder, secretary of George W. Prentiss & Co., wire manufacturers, Holyoke, Mass., told of the value of a systematized policy looking to a more even flow of production.

Bradstreet Price Index Shows Advance

Bradstreet's index number of average commodity prices on Dec. 1, for which the first computation was published by Dun's Review last week shows an advance of 3.3 per cent in the general average during October, as compared with an increase of only 1⅝ per cent shown by Dun. As compared with a year ago, the increase is 21.9 per cent.

From the high point of 1920, reached on Feb. 1, it shows a decrease of 33.9 per cent, as against a decrease of 29.5 per cent from the 1920 maximum shown by the Dun percentage. The December average, according to Bradstreet's, stands 58.2 per cent above that of Aug. 1, 1914. In the Dun computation, the December average stood 53⅝ per cent above that date. Food products and textiles led in the advance of Bradstreet's average, as well as Dun's.

Rail Executives Drop Labor Policy

The Association of Railway Executives last week decided to withdraw, so far as possible, from all questions dealing with labor, traffic and public relations, and to restrict the functions of the association to questions of national legislation, governmental action and policies and legal matters with a nation-wide application.

The railroad executives also decided to leave the place of the late Thomas De Witt Cuyler, former chairman of the association, unfilled and to abandon the New York office. Headquarters will be maintained in the counsel's office in Washington in the future.

Today's action marks the passing of nation-wide treatment of strikes and strike threats. Whereas the association dealt as a whole with the shopmen's strike last summer and the threatened strike a year ago, in the future each individual road or each regional executive body will act.

Members of the organization said one of the purpose of today's decision was to get the treatment of labor questions back in the hands of the individual roads. It is impossible, they said, to deal with the railroad workers of the entire country on a just or equitable basis and so long as the system of nation-wide treatment continued they declared it would be impossible to get back to economical operation of the carriers.

The affairs of the association will be vested in an executive committee to be elected annually by the association.

Chalmers Motors Sold

The Chalmers Motor Company in Detroit was purchased at a receiver's sale last week by Boyd G. Curtis, local attorney representing the Maxwell Motor Company. The sale price was $1,987,600.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

LAST week I made a hurried trip through the Middle West, stopping at Pittsburgh, Cleveland, Chicago and Minneapolis as well as some other minor points. At each place I talked with several prominent business men and sought to check off the reports of business conditions received in New York which are not always reliable because they cannot reflect the feeling and temper of the distant communities upon whose confidence in the future and contentment with the present our prosperity is largely dependent.

Summarizing my impression it may be said that those who deal with city people are reasonably busy and expect a good trade through the winter, but that the others whose business is chiefly with the agricultural or rural districts are not optimistic. The latter class say that while the farmer has lately been buying a little more freely he is still heavily in debt and that his purchases have been and will be confined to the things that he cannot do without. As attesting the correctness of this view I had my attention called to the number of small banks that have recently failed including one each at Omaha, Nebraska, Sterling, Colorado, Huntley, Montana, and Andale, Kansas, whose suspension was reported on the 4th of December.

These conditions are generally attributed to the disparity between the price of what the farmer has to sell and the things he must buy and this disparity is in turn chiefly ascribed to the high freight rates and the inability of the railroads to handle the traffic offered.

In Minneapolis it was asserted that the entire potato crop of the Minnesota Valley, said to be worth many millions, was rotting on the farms because cars to carry it could not be had and the proprietor of an important factory in a Wisconsin town told me that he was having all his raw material and output shipped by express because the freight service was so slow. He added that the interest he saved on the capital tied up more than paid the increased cost of transportation.

The railroads realize their predicament. President Markham of the Illinois Central and President Storey of the Santa Fe are both publishing paid advertisements explaining that their hands are tied by over-regulation; but their advertisements do not move the traffic and in their blind indignation the people are writing their representatives in Congress demanding that the Government shall "do something" though there is no general agreement as to what this "something" shall be.

Another cause of discontent is the stampede to declare stock dividends that is reported in the papers. As I sat in the smoking car on my way from Cleveland to Springfield, Ohio, I heard two men commenting upon the headlines over an announcement that the Atlantic Refining Company had declared a stock dividend of "900 per cent." One of them appeared to be a country doctor. The other said he was a farmer. Their language is hardly printable but they were agreed that Wall Street was a den of thieves who controlled the capital of the country and used their power to rob the defenseless and evade taxation.

These observations are recorded not only because they account for the so-called radicalism in Congress but because they connote a discontent that is, I fear, incompatible with the "good times" whose arrival or approach so many are now loudly heralding.

But insofar as concrete fact can be differentiated from the no less important factor of feeling or sentiment, it is to be admitted that they are encouraging.

Cotton, wool and the fabricated articles into whose manufacture these and other staples enter are in fair demand at prices which are satisfactory though they seem to have stopped advancing.

Money is slightly easier at 4½ per-cent for the very best commercial paper and the Federal Reserve statement seems to indicate a continued abundance of credit despite a reduction of 2.1 per cent in the Federal Reserve ratio which reflects a decrease of $27,000,000 in the gold held due chiefly to the effort made to put "yellow backs" into circulation.

Sterling exchange has advanced to 4.56⅛ which is the highest price touched since July, 1919, when the British Government pulled the war "peg" out. This ought to facilitate our trade with that large portion of the world which still measures values in pounds, shillings and pence.

There is no speculation in either securities or merchandise, no one is overstocked and away from the few large cities where wealth displays itself, there is little or no extravagance.

There is a job at good wages for everyone who is willing to work and there is but little idleness.

Wealth, which has been aptly described as "canned labor," must therefore be increasing and the problem of the statesman and the economist is to induce its productive employment. That a solution for this problem cannot and will not soon be found is unbelievable but the doctors have not yet agreed upon the remedy that should be applied. Secretary Mellon advises a reduction in the super-taxes so that private capital will not be driven into tax-exempt bonds whose proceeds are often wastefully employed.

It is doubtful whether Mr. Mellon's proposal is politically practicable with Congress and the people in their present temper but there is much to recommend his suggestion for the weakness of the stock market is largely due to the hysterical eagerness of large capitalists to convert their taxable stocks and bonds into tax-exempt securities. In the case of the railway shares the declining tendency has been accentuated by the fear that the Farm Bloc or the Progressive Bloc or some other Bloc will succeed in securing a reduction in railway rates that will be ruinous because a correlative reduction in wages will not be permitted.

Judging from what was said in the West this is unlikely. The people realize that the railroads cannot function if they are bankrupt and in many quarters the idea of subsidizing them as well as the ships seems to be gaining in favor. The theory is that the cost of transportation is, in the last analysis, a tax upon the whole people which would be more equitably distributed if it were assessed as a tax which everyone would pay instead of being collected from the few in the form of freight charges.

For these reasons and because it is generally wise to buy when most people are alarmed and selling, I continue to believe that the stock and bond markets will now repay the bargain hunter. None of us really think the United States is going to economic perdition, failing which many securities are certain to be worth more than current prices when the present depression has passed.

But of commodities it would not be good judgment to generalize so indiscriminately. None of the staples are any longer subnormally cheap. Even sugar and rubber have passed out of this category. And as for manufactured articles they cannot be advanced much more without raising the cost of living to a level that may provoke an outcry and a buyers' strike.

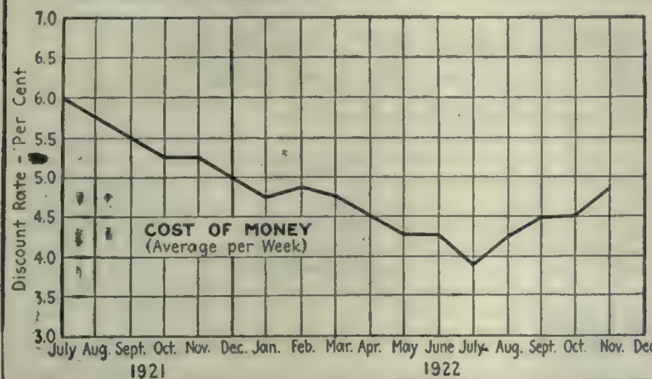
Conservatism and caution on the part of merchants and manufacturers would therefore seem to be advisable, especially as the inflationary power of our redundant money supply seems to have spent itself. This is perhaps explained by the continued disbursement of gold certificates by the banks and the amount of our Federal Reserve currency in circulation in Europe where according to reliable reports it is becoming the preferred medium of exchange in the retail trade of the Continent.

Exports of Steel and Iron Increase

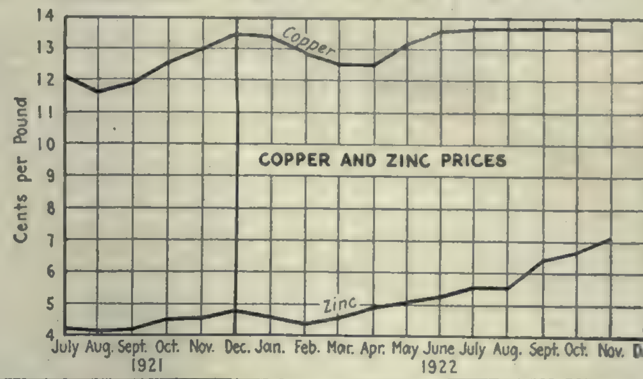
Exports of iron and steel, after declining steadily since June, increased 3,367 tons in October.

According to the official compilation of the Department of Commerce, made public yesterday, the total tonnage shipped abroad during the month was 134,095. This compares with 130,728 tons in September.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



COST of money as reported from the various points in the Federal Reserve System shows a firmer and higher tendency. City and country banks have been in the market for prime commercial paper and an excellent demand has been in evidence with fairly liberal offerings. The range in rates during November was definitely between 4¾ and 5 per cent as compared with an approximate range of 4½ to 4¾ per cent in the month previous.

Equipment shares fell off again during November, the average price of ten representative issues dropping from $106.50 to $100.30, thus showing a full ten-point decline from the high average mark of September. Profit taking has been in evidence to a large extent with the general public manifesting little interest in the market. Declarations of huge stock dividends on the part of many companies is also mentioned as a factor in causing the depression.

Copper and zinc prices, on the average, show but fractional changes during November. The average price on the New York market for the former was 13.598 cents as against 13.632 cents in the month previous. Zinc averaged 7.104 cents as against 6.840 cents in October. Export business in copper continues fair with France and Italy as the principal buyers. In the domestic market there has been a fair volume of business with producers optimistic as to prospects for 1923. The zinc market shows improvement with good support as a result of European buying, and increased domestic demand.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

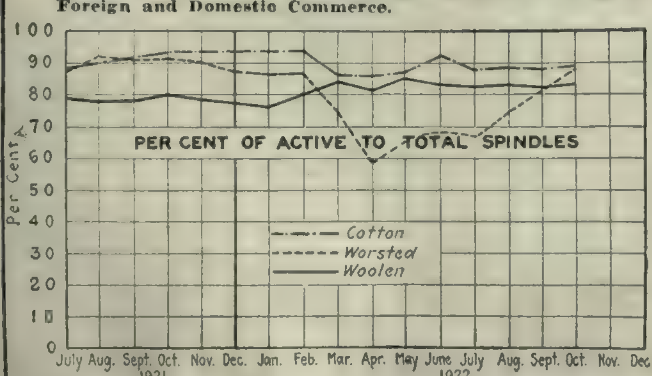
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0378	0.0373
Brass rods.....	per lb........	0.171	0.1700	0.15
Solder (½ and ½)	per lb........	0.24	0.23	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.59	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list........	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

Textile industrial activity in the United States during the month of November compares favorably with the month previous. Cotton spindleage in operation amounted to 85.4 per cent of the total in place as compared with 84.4 per cent in October. In the woolen industry the activity has been nearly the same as in the previous month, November showing 90.8 per cent as against October with 90.6 per cent. Worsted conditions continue to improve, active machinery amounting to 89.1 per cent as against 81.4 per cent in October. The demand for woolens and worsteds continues steady, and cotton yarn prices are strong. Exports of cotton goods continue in good volume.

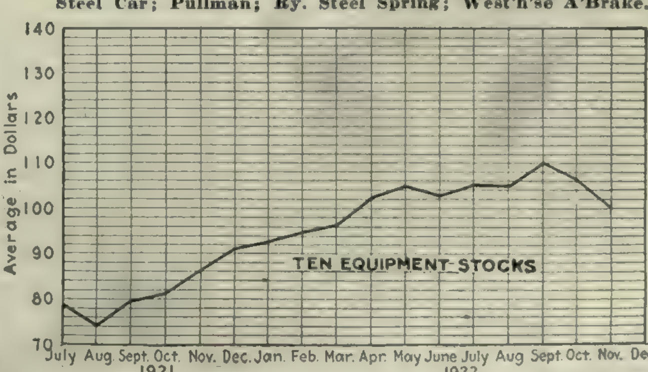
Railroad earnings of American railroads, according to the final report for 189 out of 192 roads of Class 1, showed a net operating income for October of $85,234,000, which represents a return on an annual basis of 4.05 per cent on the tentative property valuation. This compares with a net of $105,425,600 for October, 1921.

Commercial failures in the United States in November, according to reports furnished by Bradstreets, numbered 1758, an increase of 9.8 per cent over the total reported for October and the largest in any month since May. Liabilities totaled 54 millions, 46 per cent above those of October.

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.



Mechanical Engineers Discuss Live Problems

Annual Meeting Draws Big National Gathering—Engineer Seen as Pilot of World's Industry—Eminent Men Discuss Economic Problems of the Day—Keen Interest Shown at All Sessions

THAT America is in need of a new type of industrial leadership was asserted by Dean Dexter S. Kimball of Cornell University in his address as retiring president of the American Society of Mechanical Engineers at its annual convention held at the Engineering Societies Building in New York last week.

"Unless we can in some manner change our industrial system so that we can more nearly attain universal well-being and distribute the fruits of our industry more equitably," said Dean Kimball, "we have no reason for believing that our civilization shall endure, and its bones will full surely strew the shores of time with those of the great civilizations that have preceded us."

The features that characterize our present civilization and distinguish it from those that have gone before it were stated to be: (a) Production in agriculture and that in industry are entirely separated, (b) the problem of transportation is added, (c) the worker is separated from ownership of the tools of industry, and (d) division of labor is carried to a high degree.

The engineer is destined to be a powerful factor in modern industry, according to Dean Kimball, because "modern civilization is largely what the engineer has made it, and the civilization of the future will be largely what he wishes it to be." Dean Kimball expressed his unswerving faith in the ability of the engineer always to feed, clothe and house the human race.

Such men as Secretary Herbert Hoover and Governor Hartness of Vermont he characterized as pioneer adventurers in a field hitherto considered the exclusive territory of the lawyer and the politician. "They are," he said, "undoubtedly the vanguard of a larger invading army." Military rule in government is disappearing and legal rule will be modified by new industrial conditions, continued Dean Kimball, who saw in the engineer a new pilot of the world's industrial machine.

Dean Kimball's address marked the evening session of the opening day, Monday, Dec. 4, the morning having been given over to registration of delegates, conferences and council meetings.

Management Session

The outstanding feature of the Management Session, held Tuesday morning in the Auditorium, was the presentation by title of L. P. Alford's paper, Ten Years' Progress in Management. The paper was presented by title only because of its previous presentation and discussion in many cities during Management Week, Oct. 16-21, 1922.

Among the more important points brought out in the discussion was the feeling that management in the future must come more from the bottom up than from the top down, as in the past, and that greater importance must attach to foremen training. It seemed to be the general sentiment that a better knowledge of economics on the part of major and minor executives was a crying need. In the interests of standardization it was suggested that better definitions of management and its functions should be determined upon in the near future.

An excellent paper on Relieving Industry of Burden was read by Wallace Clark, industrial engineer, of New York. Progress reports were offered by the committees on Standardization of Terminology and Standardization of Graphics by the chairmen, F. E. Town and J. J. Swan.

Machine Shop Session

The Machine Shop Session was presided over by F. O. Hoagland, the first paper being that of Forrest E. Cardullo, Chief Engineer of the G. A. Gray Co., on "A New System of Helical Involute Gearing for Use on Metal Planers." The paper gives six characteristics which are necessary to give satisfactory service, as follows:

> "The gears must give smooth and uniform motion without impacts, vibration or chatter. If they do not do so, variation in the driving force, or in the speed of driving, will be transmitted to the table, causing it to vibrate and produce chatter marks on the work.
>
> "When the gears wear, they must preserve their correct tooth form, so that they will continue to give smooth and uniform motion without chatter.
>
> "It is necessary that the gearing have ample strength, so that it will transmit the maximum force which can be applied by the source of power, without reaching the elastic limit of the tooth material.
>
> "The several gears must have such tooth forms and widths of face that they will run for a reasonable length of time without serious wear.
>
> "Should there be wear of the bearings and shafts which would permit the gear centers to separate by a measurable amount, the tooth forms must be such that gears will still give smooth and uniform motion.
>
> "The tooth forms must be such that the teeth can be correctly produced by an efficient and economical machining process."

Mr. Cardullo then pointed out some of the problems and experiences encountered in designing the new gearing, among these being the objection to the herring bone gears on account of the practical difficulty of obtaining two helical gears of opposite hand, but of exactly equal helical angle, pitch, diameter and pressure angle. Variation in any of these quantities, in the two halves of either gear, or in the pinion, results in an unsatisfactory and jumpy action. It was, therefore, decided to use helical gears, and to give the bull gear a right-hand helix, which would tend to draw the table toward the operating side of the machine. This is counteracted by the feeding pressure of the tools in at least 90 per cent of the work done on a planer. Since this feeding pressure amounts, with the usual form of tool, to about one tenth of the cutting pressure, the helix angle of 5 deg. and 40 min. was fixed upon as best for the bull gear and pinion. The remaining gears of the train have a helical angle of about 12 deg., these being so arranged that the end thrust is distributed between bull pinion, intermediate and pulley shafts. Bronze thrust washers provided with oil by a system of forced lubrication take care of the end thrusts. The frequent reversal of the planer insures the oil being forced between the bearing surfaces and eliminates the lubrication problem.

The Gray tooth has a 14½ deg. pressure angle with a pinion addendum of $3/2\ p$, and a pinion dedundum of ½ p, where p is the normal diametral pitch. The pitch circle is the same as that of the standard involute gear, but the outside diameter is considerably larger in the case of the Gyra, and the tooth is also considerably wider at the base.

Gear chatter is said to be caused by periodic variation in the amount and direction of the tooth pressure. Such variations, when finally transmitted to the table rack, have two components, one in the direction of motion and the other in a vertical direction. The first of these components is harmless, the second produces vertical movement of the table and work. A low-pressure angle between bull gear and table rack tends to eliminate this vertical vibration.

This paper provoked considerable discussion from representatives of the Whitcomb-Blaisdell Co., the Acme Machine Tool Co., the Pratt & Whitney Co., and the Westinghouse Electric Co. The Whitcomb-Blaisdell Co. has also used helical gears for planer drive, and has offset the thrust by changing the angle of the ways from 45 deg. each side of the center to 40 deg. on the thrust side, and 50 deg. on the other.

New Method on Bevel Gears

Under the heading of "Spherical Gears," Charles H. Logue, of the Brown-Lipe-Chapin Co., presented a somewhat novel method of studying bevel gears, by considering their pitch surfaces as being parts of a sphere. By acquiring this point of view, not only are the elementary features of bevel gear design brought out and applied to spur gears, but also the real connection between the two types is shown. This is considered essential to a complete understanding of either type. The author endeavored to point out the necessity for a difference in the design of the teeth, which has not been previously considered, and to present the entire matter in as simple a way as possible.

"Testing Involute Spur Gears"—by M. Estabrook, of the Niles-Bement-Pond Co., first showed the usual methods of testing gears, and then gave details of the Saurer gear testing machine, which records defects in spacing, pitch, tooth curve and eccentricity. The main difference between this device and those generally used is that this not only shows when a gear is defective, but shows what is wrong with it.

Walter Ferris, of the Oilgear Company, presented a paper which described very completely the hydraulic transmission variable speed device of the Oilgear Company, which has already been illustrated in our columns. The results obtained in practice indicate that this method opens a field in which great improvements in machine tool design may be made.

The last paper of the session was on "Power Required for Cutting Metal"—by Fred A. Parsons, Chief Engineer of the Kempsmith Milling Machine Co. This paper gave the result of an investigation extending over a period of more than ten years. The purpose of this investigation was to determine the fundamental laws governing milling, turning, planing and drilling operations on the various metals and alloys used in machine construction. In addition to a very large number of tests made on milling machines constructed by the Kempsmith Co., those reported by Frederick W. Taylor and Professors Bird and Fairfield in previous volumes of the society's transactions have been carefully analyzed, and the following variables studied:

1. The efficiency of the machine.
2. The rate of metal removed in cubic inches per minute.
3. The average thickness of chip before distortion.
4. The front rate on the cutting blade.
5. The material being cut.
6. Spiral angle or shear on the cutting blade.
7. The condition of the cutting tool as to its being sharp or dull.

The meeting of the machine shop section was well attended, and interest was maintained throughout the session.

Education and Training for the Industries

That division of the Tuesday afternoon session devoted to the report of the Committee on Education and Training for the Industries was well attended and of absorbing interest. It showed that many good minds are constantly engaged in the work of planning ahead for the good of industry along educational lines. W. W. Nichols, chairman, read the report of the committee. Three other reports were given, namely, Extension and Correspondence Schools, James A. Moyer; Industrial Education as Represented in Schools, C. R. Richards, and Schools for Apprentices and Shop Training, R. L. Sackett.

Mr. Moyer's report on Extension and Correspondence Schools stated that nearly every state has a correspondence school system supported by taxation. It outlined briefly the usual type of course. In enumerating the advantages of correspondence and extension courses Mr. Moyer said that the student quickly came to recognize that correspondence study has its own peculiar advantages; that it is available to him at any place and at any time; that each paper he submits gets the individual and undivided attention of an instructor; that bluffing is out of the question—he must prepare himself on every part of the lesson; and finally that he must set his own pace unhurried by more brilliant students and unhampered by sluggards. He stated further a result of correspondence courses and university extension classes is the unexpected spirit of democracy to which they have risen, explaining that social groups which ordinarily acknowledge no common interests have learned to know of each other through the common interest in correspondence lessons; and that those brought together in classes, having profited by the same instruction, have been lead through class discussion to discuss their views with the utmost cordiality and freedom.

The report gave some details of results accomplished in the extension courses of universities in Massachusetts and Wisconsin and concluded with a summary of university extension service in various institutions.

Economic Session

Prof. Wesley C. Mitchell of Columbia University and director of the National Bureau of Economic Research, was the first speaker at a joint meeting of the American Society of Mechanical Engineers and the American Economic Association held on Wednesday evening. He spoke largely on the relation between the three views that may be taken of the purpose of production: Subjectively, to fill needs; industrially to make goods; and economically, to make money. The idea was advanced that probably profit making was of the first concern, as it enabled the further building of our economic system and the promotion of the general welfare of all in the community.

JOHN LYLE HARRINGTON
President, A.S.M.E.

Substitution of "the rule of reason and intelligence" for force in an effort to restore in America "the freedom of the individual, be he employer or employee," was urged by E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., who spoke on the "Human Problem in Industry." In developing his subject, Mr. Herr went back into ancient history and told of some interesting conditions and legislation.

Mr. Herr advocated a change in the immigration laws, saying: "With industry dependent to such a large extent upon foreign-born workers, the recent immigration laws threaten for lack of common labor, the return to and maintenance of normal production. It is to be hoped that these laws will be made reasonably liberal and that restrictions will be based on fitness instead of as at present without regard to the immigrant's character or qualification to become an American citizen."

Discussion of the subjects covered by Prof. Mitchell and Mr. Herr was presented by Dean Kimball; H. R. Seager, president of the American Economic Association; John L. Harrington, president-elect of the A.S.M.E.; Ernest F. Du Brul, manager of the National Machine Tool Builders' Association; and Fred J. Miller, past president of the A.S.M.E.

The remarks of Mr. Du Brul which were particularly well received, dealt with the necessity of "selling" economics to the business man, just as has been done with other sciences. Business men are not aware of the good that economic science can do for our conditions, and they are none too well impressed with the more radical type of economic theories that frequently gain hold on the popular mind. Sound economics properly applied, stated Mr. Du Brul, can certainly build a more stable business structure.

Safety Engineering Session

In discussing the Development of Safety Codes, M. G. Lloyd of the Safety Code Correlating Committee, pointed out the need for Federal rather than state laws and codes, so that the manufacturers of machines would know what was required in the way of protection and not have to make changes according to the state into which the machine was going. He pointed out that the average deaths from accident in this country was 76,000 or as many as were lost by the American army in the world war. Of these 12,500 are industrial accidents. This number is decreasing as safety work progresses.

This was followed by a paper by A. D. Risteen on Safety Engineering in Connection with the Compression of Gases, dealing with the safe handling of oxygen, acetylene carbon dioxide, ammonia, chlorine, argon, nitrogen and air.

G. E. Sanford showed a number of lantern slides of good and bad mountings for abrasive wheels as well as diagrams showing the proper kind of flanges.

Thursday, Dec. 7 was given over to simultaneous sessions of the Power, Safety Engineering, Standardization, Ordnance, Aeronautic and Forest Products Divisions.

Aeronautic Session

While four papers were scheduled for presentation at this session, the one on night flying was not available. Archibald Black, who was in charge of the design of the experimental plane in which the first Liberty engine was installed, gave a very complete paper on the Influence of Design on Cost of Operating Airplanes. This gave a great amount of data from various sources, in an endeavor to clear up much prevalent misunderstanding. Diagrams were given showing curves of operating cost for varying duration and speed of flight, reserve horse power, etc. Air Mail Service costs were used as a basis although operators of commercial lines in both this country and England, consider them much too high. These show that planes designed for commercial use and fully loaded, can be operated at a total cost of from 0.030 to 0.032 cents per pound mile or 6.5 cents per passenger mile, exclusive of the cost of obtaining the business. He shows very clearly that, as in so many other businesses, the cost of selling is more than the cost of production. He sums up his studies as follows: The designed duration of flight should not exceed the minimum necessary to complete scheduled trips safely in a head wind and that, for the types considered, should not in any case, exceed four hours. That the factor of safety should be kept to the minimum consistent with the conditions and should in no case exceed six. That high speeds beyond those accompanying the necessary re-

serve power are undesirable and, for the types considered, should not exceed 105 to 110 m.p.h. at 5,000 ft. That climbing speed should be only sufficient to provide a reasonable margin of safety for emergencies, an initial rate of climb of 400 to 500 ft. per min. from the field being the proposed standard. That reserve horse power be kept down to that necessary for required climbing speed. That flying on one of two engines in a plane is impracticable because of prohibitive cost. That flying on two of three engines is reasonable and practicable. That initial rate of climb instead of reserve horse power or speed range should be the measure of safety. That the moderate sized machine is most efficient at present and for the type considered this is from 500 to 600 sq. ft. in wing area.

Ralph H. Upson showed that for the lighter than air machines the non-stop routes should be longer than for planes, 500 miles or more, that the load should be at least 200 passengers or 50 tons of goods per trip, made up of passengers whose time is worth at least $6,000 per year or goods worth $2 per ten hour. Although the New York-Chicago route is the worst possible from a weather standpoint, Mr. Upson believes that a nightly, 12 hour service can be maintained 100 per cent on time for six months of the year, this would however be cut to 93 per cent for the whole year.

Air Navigation, by the late Prof. R. W. Willson and M. D. Hershey was presented by the latter. This pointed out the problems of navigation in long air flights and in cases where the ground is not clearly visible. This in common with the other papers, evoked considerable discussion. A resolution was passed urging the adoption of Federal laws governing inspection and licensing of both aircraft and pilots.

Power Session

The Power division's session was presided over by J. H. Lawrence at which the following papers were read: Tests of a Type W Stirling Boiler at the Conners Creek Power House of the Detroit Edison Company, by Paul W. Thompson; Feed Heating for High Thermal Efficiency, by Linn Helander; High-Temperature and High-Pressure Steam Lines, by B. N. Broido; The Elasticity of Pipe Bends, by Sabin Crocker and S. S. Sanford; and, The Commercial Economy of High Pressure and High Superheat in the Central Station, by Geo. A. Orrok and W. S. Morrison.

Standardization Session

The Standardization Session under the auspices of the Standardization Committee with the American Engineering Standards Committee co-operating, was held Thursday morning with Col. E. C. Peck of the Cleveland Twist Drill Company in the chair. Two papers were presented. The first one was A Program of Standardization of Paper and Printing Machinery, by Wm. J. Eynon. This was contributed by the committee on printing machinery. It was brought out that standardization of machinery and machine parts must be postponed until standardization of paper sizes, types and composition has progressed farther than it has at the present time. Encouraging progress has been made in a few instances, notably by the American Writing Paper Company, but there is still much to be done.

The second paper was one of the most interesting of the session, from our point of view, and attracted some lively discussion. The title was Size Standardization by Preferred Numbers and the joint authors were C. F. Hirshfeld and C. H. Berry, both of the Detroit Edison Company. We have seldom heard a paper presented in better form at an A.S.M.E. session. Perhaps an oversight on the part of the authors had something to do with this. They forgot to bring their slides and as a result the members present had to follow the remarks of the speaker from illustration to illustration. The authors disclaimed any attempt to urge the use of preferred numbers on any industry but they did prove quite conclusively that the subject is one of sufficient interest to merit the careful attention of engineers and manufacturers all over the world. It was brought out in the paper and in the discussion that the Germans have gone far in this branch of standardization although some of the members present seemed to feel that some of the things done in Germany were of doubtful value.

The Ordnance session, with W. H. Marshall presiding heard the following papers: Machining and Lapping Very Deep Holes, by J. B. Rose; and Methods Used in Manufacture of Gun Recoil Mechanism, by R. A. Vail. A feature of the session was the showing of a series of motion pictures illustrating recent developments of mobile ordnance.

An interesting feature of the week's program was the numerous excursions arranged for the benefit of the visiting delegates. On Tuesday the plant of the Wheeler Condenser and Engineering Co., Carteret, N. J., was visited and an inspection of the new Hell Gate power station was held. The Christie Amphibian Gun Mount or Tank gave an exhibition in the Hudson River and attracted great interest.

The visit of the delegates to the McGraw Hill publishing plant at 36th St. and 10th Ave., and an inspection trip of the U. S. S. Maryland at Brooklyn Navy Yard were the features arranged for Thursday.

Social events arranged for the entertainment of the delegates during the session included a smoker, a dinner dance and various excursions for the benefit of the ladies visiting the meetings. Friday evening was set aside for reunions of the alumni of the various technical colleges and dinners were held by the following: Cornell University, University of Kentucky, Princeton University, Purdue University, Worcester Polytechnic Institute and the Massachusetts Institute of Technology.

Officers elected by the society for 1923 were as follows: President, John Lyle Harrington of Harrington, Howard and Ash.

Vice-presidents for two years: William H. Kenerson, professor of Mechanical Engineering, Brown University; Walter S. Finlay, Jr., vice-president of American Water Works and Electric Co.; Earl F. Scott, president of Earl F. Scott & Co., Inc.

Vice-president for one year: Henry H. Vaughan, consulting engineer.

Managers for three years: A. G. Christie, professor of mehcanical engineering, Johns Hopkins University; James H. Herron, president of James H. Herron Co., and Roy V. Wright, editor of *Railway Mechanical Engineer*.

William H. Wiley, and Calvin Rice, treasurer and secretary of the society respectively, were re-elected for the ensuing year.

Making Cast Iron Pipe

"Making Cast Iron Pipe" is the title of a new industrial motion picture shown at the Power and Mechanical Engineering Exposition and elsewhere in New York City this week. The film was made by the Pathéscope Film Service for the United States Cast Iron Pipe & Foundry Co., of Burlington, N. J. It shows the process of casting pipe in sand molds as well as centrifugally.

The centrifugal process of casting pipe was invented by D. S. De Lavaud, a Brazilian engineer, but has been perfected commercially in the United States by the United States Cast Iron Pipe & Foundry Co., which controls the right to its use in this country.

Casting is done in a machine that consists of a permanent, water-cooled mold, traversed longitudinally and rotated, and a pouring device. The only set up necessary is the insertion of a core to form the inside of the bell and to act as a stop for the molten iron.

Pouring is done from a tilting ladle, controlled hydraulically. The iron is discharged into a water-cooled, cantilevered trough, that reaches to the farther, or bell, end of the mold. As the iron runs in, the mold is traversed longitudinally until the pipe is completed. Speeds of traverse and rotation control the thickness of the pipe wall.

Cooling begins as soon as the first iron touches the mold and by the time the pouring is completed the bell end is cool enough to allow the application of a holding device preparatory to withdrawal of the pipe from the mold. As soon as withdrawn the pipe is carried to the annealing furnace. After annealing it is dipped in hot tar, the last operation in its manufacture.

Comparison with the method of casting in sand molds shows that the De Lavaud method requires less equipment and labor beside reducing the time necessary for making pipe from one or two days to a matter of hours, both including cupola work. The actual casting time is very short indeed, because of the necessity of working while the iron is hot. Heat is conserved because the newly cast pipe is taken directly to the annealing furnace. In the same way the tar bath is used after annealing, without reheating. Practically no core making equipment is necessary. It has been found that the centrifugally cast pipe is of very good quality as concerns grain, freedom from blow holes and impurities. It is said to possess greater strength than sand cast pipe, and to offer no difficulties to machining.

Increases Trade Funds $400,000

Appropriations for the Bureau of Foreign and Domestic Commerce are reported to have been reduced by nearly $200,000 below the estimates of the Budget Bureau by a sub-committee of the House Appropriations Committee.

Notwithstanding this $200,000 cut, however, it is the understanding that the total for this bureau will represent an increase of nearly $400,000 over the amount appropriated for the current year. Officials of the bureau are said to be fairly well satisfied with the result as the increase in appropriation will enable the department to carry out many needed improvements in its service to manufacturers.

Business Conditions in Germany

Standard of Efficiency Below Pre-War Level—Industry Burdened by Excess Employment—Machine Tool Industry at Low Ebb

By OUR BERLIN CORRESPONDENT

THE optimists of the business world, who maintained the theory, that the beginning of a business depression, noticeable since September, was a transitory character only and would soon give way to renewed booming under the spur of the money depreciation, have so far been disappointed. The record low point of the mark exchange has, as far as can be recognized, failed to exercise any stimulating influence on the market, rather the contrary is the case. The decline is becoming more and more marked and finding expression already in a gradual rise of unemployment, as is evident from the labor statistics of the National Labor Ministry.

Low Standard of Efficiency

It is a fact that the standard of efficiency, which had greatly improved at one time and ran up to almost 80 per cent has again sunk considerably below this level. Thyssen, the well-known German industrial leader, has lately, in a memorable letter to the Chancellor of State, estimated the present level at 60 per cent. This, evidently, is from observations in his own extremely well organized works. In others, where conditions differ, it is even less. The Rheinische Stahlwerke for instance, one of Germany's largest steel companies, has, in its annual report just issued, stated the standard of efficiency to be 50 per cent. The output of steel per head in this work was, in the last pre-war year, 112,500 tons and is now only 57,000 tons. The report places emphasis on the fact that even the present standard is only maintained by virtue of the costly new equipment and modern labor-saving machines, which have been put in since that time.

The outcry for an increase of production has been heard for a long time. The struggle to this end has up to date chiefly been fought in words, advices and exhortations. Having failed to produce any effect the clamor is now for more active measures, chief among them being the abolishment of the restriction of working time to 8 hours per day. The campaign to this effect is outlining itself quite clearly. It takes its main argument from the coal situation, where the enormously grown imports, chiefly of British coal, are putting the handicaps of production, produced by the so-called revolutionary achievements of the labor class, into glaring relief. The German coal production has gradually declined during recent months. Against an increase of 35 per cent of the mines' complement of workmen, stands a decline of 20 per cent in production.

The fact is, that most enterprises are overstocked with employees. This is particularly pronounced in the case of public works but also applies to private ones. Nothing short of dire necessity can produce the energy required for the process of elimination. Industrial leaders are of opinion that the time of this process has now come, believing evidently that a period of depression will be most opportune. A fight between them and the Government, which is reluctant for political reasons, is being waged deep under the surface.

From the official reports of the National Labor Ministry and of the Chambers of Commerce, the present situation of the machine building industry is the following: The reverse of business, such as has taken place, is most strongly pronounced in the western part of the country, Rhineland and Westphalia, and in the extreme east, Upper Silesia. The various groups of the machine building industry are as yet effected in a different degree. The lines working for transportation, like locomotives, railway car manufacturing and shipbuilding, appear to be in the front rank. In the locomotive industry, it is the decline of foreign orders, chiefly from overseas countries, which has caused a lack of business.

In the railway car industry the full complement of workmen is only maintained in the expectation of orders on reparations account. Business in shipbuilding has become very quiet. Orders from domestic sources have almost stopped and those from abroad can be obtained only by strong efforts and at a sacrifice in prices. Electrical machinery, which so far has enjoyed a privileged position in machine building independent of general market conditions, is still fully employed, but complaining of a strong decline in new orders. It appears that a number of plans for new electrical power stations and extensions have been pigeon-holed. The only exception in this field seems to be railway signal engineering, which was the last to profit from the boom and evidently has not been seized yet by the receding of the tide.

Tool Industry Stagnant

In the machine tool industry the decline of business, commencing in September, has become more acute. The number of orders received for home demand, as well as from abroad, is diminishing perceptibly. The export of machine tools, which in August has exceeded that of July, shows a drop in September. The actual shipments in August were 10,127 units weighing 3,881 tons as against 9,371 weighing 2,983 tons in July. In value this increase was much higher, i.e., 182 million marks in July to 411 million marks in August. By translating these figures into gold marks, this increase, however, not only collapses, but leaves even a deficit.

The July exports show a price per ton of 61,301 marks or, at the average rate of exchange, of 585 gold marks. In August the respective figures were 106,000 paper marks or 400 gold marks. The increase of exports in August falls chiefly to the share of Belgium and Austria, while shipments to Holland, Spain and some other countries show a decline. The grand total of machinery exports in August was 42,850 tons as against 36,380 in July. The respective value was 4,081 million marks in August compared with 1,761 in July. In spite of the increase of the quantity and the apparent rise of value in paper marks, their value, in gold marks, shows no increase.

Great alarm has been caused in the machine building industry by the doubling of the export tax. A special meeting of the Society of German Machine Building Works, which is now heading all German machine building associations, has been convened to protest against this increase and against the view entertained in public opinion, as well as in official circles, that machine builders are reaping enormous profits out of the exchange situation. Various speakers, amongst them Direktor Becker, of one of Germany's largest machine tool building works, the Kalker Machine Tool Works, maintained that freight and the taxes, levied on exports, leave to the manufacturer a net price hardly as high as domestic prices.

Fictitious Paper Profits

The price of raw materials has already reached the world market level. The only advantage remaining to German machine building in comparison to foreign competitors, it was said, is the low cost of labor, which is, however, largely counteracted by the drop in efficiency. Taking into account the cost of transportation and foreign import duties, there is, so it was said, hardly any margin left for the German manufacturer to make his price attractive to foreign buyers.

The profits paid out in paper marks are in no case more than from 2 to 3 times their pre-war figures in spite of the enormous depreciation of the money. This was said in corroboration of the contention that the financial situation of the machine building industry is by no means as satisfactory as it appears on the surface. A scrutiny of the dividends paid in the machine tool industry, which is one of the most fortunate lines, provides, indeed, a striking illustration of this fact. From the annual reports of a number of works just published, the figures in the accompanying table are of particular interest:

It is seen from these figures that the capital stock has increased, but not nearly commensurate with the depreciation of the money. This, in itself, is a healthy sign, as the increase has in most cases been put into the shape of tangible assets. The profits paid out

TABLE SHOWING CAPITAL STOCK AND COMPARATIVE PROFITS OF PRINCIPAL GERMAN TOOL BUILDERS

	Capital million marks 1914	Capital million marks 1922	Profits 1921/22 Paper Marks	Profits 1921/22 Gold Marks	Profits 1914 Marks	Sinking Funds Marks
Kalker Maschinenfabrik Breuer-Schumacher	3,6	7,2	2,430,000	2,000	500,000	7,000,000
Werkzeugmaschinenfabrik Gildemeister	1	4	1,460,000	1,460	60,000	600,000
Deutsche NilesWerke	4	10	4,690,000	4,690	386,000	1,800,000
Scähs. Werkzeugmasch. Bernb. Escher	1,5	5	3,600,000	3,600	150,000	530,000

appear, indeed, huge, but expressed in gold marks they drop down to the level of a mere pittance. Compared with pre-war profits, they are almost nil. This explains better than arguments the cramped financial situation even of works highly prosperous on the surface. The whole capital basis of the works seems absurdly inadequate for the huge and ever increasing sums required in the shape of working capital.

In July all of the German corporations received fresh capital only to the extent of 2,706 million marks, in August of 3,751 and in September of 3,715. In gold money this fresh capital amounted in July to 22 million marks and in September only to 10 million marks. The respective figures for September, 1920, were 48 million gold marks and 1921, 30 millions. The actual value of new investments in industry has, therefore, decreased considerably. In machine building, 84 corporations increased their capital by 833 million marks and 72 new corporations have been formed with a capital of 282 million marks. Machine building by far heads the list in this respect among all other lines of industry.

In view of the business depression, which is apparently continuing the attention given to reparations is strongly increasing. Little is heard as yet of actual results achieved by the Stinnes agreement, which, as will be remembered, is the largest working arrangement made so far for reparations in kind, but greatest interest is focussed on the problem as to how it will work out in practice. Numerous manufacturers are trying to establish connection with the Stinnes combine or similar enterprises, of which an additional number are in the state of preparation.

To the same impulse must be ascribed the renewed attention the Russian market is receiving in Germany. An agreement recently arrived at between the firm of Otto Wolff (which is probably the greatest new company organized since the war and controlling the sales department of a number of iron and steel works of the first rank and also several machine tool works) on the one hand and the Russian Government on the other, has added fresh zest to this movement. This agreement is the first on a large scale for the iron, steel and machinery industry and the largest yet concluded. A similar agreement is nearing completion between the Russian State and the firm of Krupp, only awaiting the solution of the problem of financing. In this connection it may be mentioned that the Society of German Engineers is now publishing in conjunction with the Soviet Government a Russian edition of their journal which is going to be distributed broadcast in Russia through official channels. This enterprise is strongly supported by German industry, which is more than ever alert to the opportunities which the Russian market offers in the future.

Leather Belt Exports Increase in October

According to figures compiled by the Bureau of Foreign and Domestic Commerce, the United States exported 91.1 per cent more pounds of leather belting in October last than in October, 1921, and [illegible] per cent more than in September, [illegible].

Simonds Stimulates Study of Economics

Actuated by the desire to advance the study, and more general appreciation of economics, Alvan T. Simonds, President of the Simonds Saw Co., Fitchburg, Mass., and Chicago, Ill., proposes an essay contest open to pupils of high schools and normal schools in the United States and Canada. Mr. Simonds offers two prizes of $1,000 and $500 for the best essays written by students on the subject: "The Lack of Economic Intelligence and Some of the Injuries it has Caused Individual and General Welfare in the United States since 1860."

Mr. Simonds hopes this contest will interest many in the study of economics, who might otherwise pass it by. He also expects it will aid in creating a public sentiment that will result in the practical study of the subject in secondary schools as part of the training of every teacher. By way of suggestion, the donor of the prizes points to the fact that unemployment, hard times, and business failures are economic disorders, which like the diseases of the human body can be avoided by greater economic intelligence. The essays which Mr. Simonds anticipates should deal with facts of this kind as well as explain concrete examples of injury to individual or general welfare, due to lack of economics intelligence. The readiness of many to accept economic fallacies and to act upon them is another phase of the subject writers may dwell upon.

As a foundation from which the essays may be constructed Mr. Simonds suggests that facts and examples which bear on the subject should come from the history of the United States since 1860 with special emphasis upon the present.

Rules governing the contest have been prepared, and persons interested may obtain copies of them by addressing the Simonds Economic Prize Contest, 470 Main Street, Fitchburg, Mass.

New Enterprises Total $808,719,600

Returns specially compiled by the *Journal of Commerce* indicate that seventy-six new companies were organized under the laws of the principal states during November with an authorized capital of $100,000 or more, involving the sum of $808,719,600. This is the best monthly showing in some time. In November a year ago 720 companies were incorporated with a combined authorized capital of $367,956,100. The October returns of this year showed that 756 companies took out charters, representing a total of $651,577,390.

Since Jan. 1 there were 8,685 new concerns chartered with a combined capital of $7,586,252,390. During the first eleven months of 1921 8,744 companies filed articles of incorporation, representing a grand total of $7,340,539,100.

As usual Delaware easily makes the best showing in the returns, followed by Pennsylvania, New York, New Jersey and Massachusetts.

The increase noted in the figures illustrates probably better than anything else that optimism prevails in banking and industrial circles regarding the outlook for general business.

November Brought More Failures

There were 1,758 failures reported to Bradstreet's for the month of November, an increase of 9.8 per cent over the total for October and the largest number reported in any month since May. Compared with November a year ago failures were 10.7 per cent fewer in number, but there was 64 per cent more than in November, 1920, and over four times as many as in November, 1919.

As regards liabilities, it might be noted that the November total this year, $54,080,825, is 46 per cent in excess of those for October, and the largest for any month since April. The total is, however, 25.7 per cent below that of November a year ago, though 21 per cent above the total for November, 1920. As compared with November, 1919, liabilities for the month just ended are more than six times as great.

Business Items

The Ramsdell Tool and Manufacturing Co., of Worcester, Mass., has recently been incorporated under the laws of Massachusetts, to engage in the manufacture of tools, etc. Their capital stock is $25,000, and the officers are: President and treasurer, Frederick M. Ramsdell, 41 Irving St., Worcester; and secretary, William H. Ramsdell.

The New Haven Malleable Iron Co., New Haven, Conn., has recently increased their capital stock from $50,000 to $150,000.

The Locomobile Co. of America at Bridgeport, Conn., by order of Referee Keogh, has been formally transferred to the trustees of the new Locomobile Co. of America, a New York corporation, controlled by W. C. Durant, president of Durant Motor Co..

The Spotz Manufacturing Co., Inc., of Stamford, Conn., recently incorporated to engage in the manufacture of machinery, etc. (as per item published in a recent issue of the *American Machinist*), organized the past week by the election of the following officers: Harry M. Rice, president; C. A. Spotz, vice-president; Carleton Pratt, treasurer; and A. H. Emory, Jr., secretary.

The Buell Brothers Co., Clinton, Conn., has recently been incorporated under the laws of Connecticut, to engage in the general manufacturing business, making metal novelties, specialties, etc. The capital stock of the concern is $25,000, and the firm will commence business with $25,000. The incorporators are William H. and G. V. Buell, both of Lowell, Mass.; Edgar and S. M. W. Buell, both of Clinton, Conn.

The Brightman Manufacturing Co., located on Marion Rd., Columbus, Ohio, has been reorganized following the purchase of the stock from L. H. Brightman and Mary C. Brightman, by a syndicate headed by William C. Waggoner of Chicago. In the reorganization William C. Waggoner was elected president; J. P. Dodds, who has been general manager, was named vice president and general manager; R. C. Johnson, secretary, and Paul A. DeLong, treasurer. These officers with Thomas

Ferry, of the Ferry Cap and Screw Co., of Cleveland, constitute the board of directors. The concern will manufacture shafting, shafting equipment and steel nuts.

Briggs & Turivas, Inc., Westminster Bldg., Chicago, Ill., has purchased the iron and steel plant of Frederick Cowin and Co., Inc., Joliet, Ill., formerly the Joliet Rolling Mills. The plant is a complete one, consisting of a combination 8-in. and 12-in. finishing mill, 12-in. and 16-in. finishing mill and a 22-in. muck mill. It has a capacity of 5,000 tons monthly of finished iron and steel and five railroads serve the property. Whether the plant will be sold by Briggs & Turivas, Inc., as a going proposition or dismantled by them is not yet known.

The Monitor Controller Co., of Baltimore, manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus have recently established in the south a branch office at 1100 Elm St., Birmingham, Ala. William H. Neville will be in charge.

The Bemis Car Truck Co., 369 Birnie Ave., Springfield, Mass., is about to build an addition to its plant, to cost $15,000. It will be a one-story structure, 55 feet wide by 141 feet in depth.

The Bead Chain Manufacturing Co. of Bridgeport, Conn., manufacturer of the bead chain for electric light sockets, during the past week increased its capital stock from $50,000 to $300,000, same to be used mostly to increase production.

The Westfield (Mass.) Manufacturing Co. has changed its name to the Westwire Co. Production of screw machine products, punch press work and radio goods will continue to be the concern's principal lines.

The Coburn Machine Co., has been incorporated at San Diego, Cal., to deal in automobiles and machinery, and to carry on a machine shop with a capitalization of $50,000, of which $300 is paid up. The incorporators are W. E. Coburn, C. W. Coburn and L. B. Henderson.

The Ross Cutter and Machine Works, Inc., Boston, Mass, is the name of a new company recently incorporated by J. A. Ross and J. E. Bellows, formerly associated with the S. A. Woods Machine Co. The new concern will manufacture woodworking cutters and knives.

The plants of the American and British Manufacturing Co., at Bridgeport, Cann., and at Providence, R. I., have been ordered sold by Judge John C. Knox of the United States District Court of Southern New York district. Bids for the plants will be opened Dec 22 by Receiver George C. Van Tuyl, Jr., at the offices of Messrs. Flaherty, Turner & Stevens, 2 Rector St., New York City. Both plants are extensive, the one at Bridgeport alone consisting of about seven acres of ground, and about sixteen major factory structures, with spur tracks and dockage facilities. A certified check for 10 per cent is to accompany all bids.

The V. & O. Press Co., manufacturer of presses, dies and sheet metal working machinery, and for many years located in Glendale, Brooklyn, N. Y., has started work on a new factory at Hudson, N. Y., where the business will be moved about May 1, 1923. The new building will give improved and increased facilities for the manufacture of the company's high grade products, and will also enable the company to broaden the scope of its operations.

The Delta Manufacturing Co., manufacturer of needles for talking machines, has removed its plant from Lowell to Westfield, Mass., and installed its machinery in the Westfield Power Co. building.

The Ohio Valley Machine Shop, Moundsville, W. Va., has under construction a large addition to its works on Thompson Ave., in that city.

The Watkins Manufacturing Co., Wichita, Kan., through E. A. Watkins, president, announces that it will add a new addition to its plant in the near future. The firm will spend approximately $12,000 on a new machine shop addition and it is proposed also to house a part of the Kansas planing mill in this new building.

The Baldwin Locomotive Works has booked new business amounting to $58,919,345 during 11 months of this year, compared with $26,924,126 for the same period in 1921.

The Studebaker Corp. last week ordered a stock dividend of 25 per cent paid to common stockholders. Directors at a special meeting took the action necessary for the payment of the stock disbursement. The distribution will be made on Dec. 29 to holders of record as of Dec. 16. No action by stockholders is necessary, as the corporation has authorized common capital of $75,000,000 of which only $60,000,000 is outstanding.

Personals

C. G. TAYLOR has been appointed director of purchases of the Westinghouse Electric and Manufacturing Co., according to an announcement by officials of the company. He will have general supervision of the purchasing activities of all plants, comprising the electrical group, including the East Pittsburgh; East Springfield, Mass.; Newark, N. J.; Mansfield, O.; Cleveland, O.; Trafford, Pa.; South Bend, Ind.; Homewood, Pittsburgh, and Derry, Pa., plants.

WALTER B. LASHAR, president of the American Chain Co., Bridgeport, Conn., and well known industrially throughout the United States, is recuperating at the Bridgeport Hospital, after an operation for appendicitis.

William H. Raye, president of the Laconia (N. H.) Car Co., manufacturer of trolley cars, etc., has been elected president of the reorganized Walter M. Lowney Co., of Boston, maker of the famous "Lowney" chocolates, candies, et cetera.

L. M. WAITE has been made general manager of the Garvin Machine Co., Spring & Varick St., New York City.

J. F. MITCHELL, for the past two years in charge of the tool-making department of the Weston Electrical Instrument Co., Newark, N. J., has severed his connection with the company.

G. A. SAWIN, assistant to the manager of the supply department of the Westinghouse Electric and Manufacturing Co., has been elected chairman of the committee on instruments and measurements of the American Institute of Electrical Engineers. He has been a member of the Committee since 1920.

GEORGE J. KELLER, who has been identified with the Hannifin Manufacturing Co., Chicago, manufacturer of air-operated chucking equipment and adjustable boring and reaming bars, has been appointed district representative of the company for northern Ohio with headquarters at 1411 Savannah Ave., Cleveland, Ohio.

GEORGE L. ERWIN, who has been for the past ten years with the St. Louis office of Manning, Maxwell & Moore, is now with the sales department of the Chicago office of Kerney & Trecker. He succeeds H. H. Shierk, who is now with the Chicago sales department of the Miehle Printing Press Co.

Obituary

JAMES J. MCCARTHY who has been prominently indentified in the Railway Supply business for many years died on Nov. 25, at his late residence, No. 4800 Kimbark Avenue, Chicago, Ill., at the age of 80. Mr. McCarthy was one of the original organizers of the Independent Pneumatic Tool Co., and served as a director up to the time of his death. He also organized the Chicago-Cleveland Car Roofing Co., and up to the time of his death had taken an active part in its business.

Forthcoming Meetings

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

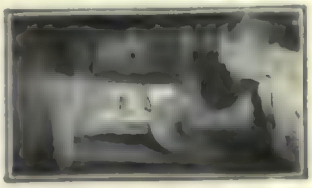
National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Condensed-Clipping Index of Equipment

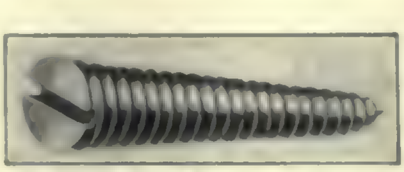
Patented Aug. 20, 1918

[illegible]scope, for Determining Critical Points in Steel, Nilson
[illegible] H. [illegible] & Co., 15 Park Row, New York, N. Y.
"American Machinist," October 19, 1922



The device is for use in determining the critical points when heat-treating steel. The [illegible] of [illegible] that occur while the part is being heated can be [illegible] magnetically. The tool is touched to the steel and drawn away slightly. If the bar or [illegible] remains in contact with the work, the latter is still magnetic and requires further heating. The indicator is magnetized by induction from a permanent magnet which, located within the body of the device, is protected from over-heating by the walls. The Kritiscope is packed in a wooden case with extension rods and a shield. It does not require calibration and is not affected by vibration or rough handling.

Wedge, Take-Up, Hammer Handle
Fayette R. Plumb, Inc., Philadelphia, Pa.
"American Machinist," October 19, 1922



The device provides for retightening the handle in the head of a hammer or hatchet, and consists of a tapered screw of uniform pitch. A slot in the butt end of the screw is for the screwdriver. To fit the screw to a tool, a hole is drilled in the end of the handle somewhat deeper than the length of the screw. It is then reamed to receive the screw, which is driven in until the butt end is flush with the handle. If the head becomes loose in the handle, a slight turn of the screw again spreads the wood uniformly so that it grips in its socket. The screw thread prevents the wedge from flying out under shock.

Drilling Machine, High-Speed, Multiple-Spindle, No. 2A
Baush Machine Tool Co., Springfield, Mass.
"American Machinist," October 26, 1922

In this machine, the feed pressure is applied directly over the center of the drilling area when a gang of drills is being used in one head. Heads of various sizes, both round and rectangular in shape, can be supplied. Four different methods of drive can be furnished, a [illegible] cone pulley, a three-speed change-gear box, motor or belt-driven, or a [illegible]-connected variable-speed motor. Roller bearings are used for shafts and ball thrust bearings wherever required. The machine can be built for tapping in addition to drilling. Capacity in cast iron, twelve 1-in. drills, or the equivalent. Feed, from 0.0018 to [illegible] in. per spindle revolution. Floor space, [illegible] ft. x [illegible] ft. 10 in. Height, 12 ft. [illegible] inches.

Die, Threading, Taper, "Hartness"
[illegible] & [illegible] Machine Co., Die Division, Springfield, Vt.
"American Machinist," October 26, 1922

The [illegible] die has been [illegible] threads of [illegible] [illegible] portion of the thread. The short [illegible] on the die sleeve is pushed [illegible] until the former pin is [illegible] the slot in the ad[illegible] former, and the die withdraws to its extreme position by the pinion lever at the top. Capacity: No. 3 size, threads 1½ in. in diameter at the large end; No. 4, threads up to 2 in. in diameter.

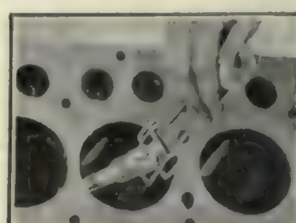
Temperature Regulator, Automatic, Gas Furnace
Chas. Engelhard, Inc., 30 Church St., New York, N. Y.
"American Machinist," October 19, 1922

A generator has been added to the former model to provide the low-voltage current formerly supplied from an outside source. The generator is run by a motor operating on current from a lighting circuit. The position and arrangement of the solenoids have also been changed and the terminal board has been added at the end of the frame. The device is ordinarily connected by means of chain to the valve on the gas pipe feeding the furnace, and is connected electrically to a pyrometer. It has three main parts, the motive power, the escapement mechanism and the timer, the motive power consisting of a $\frac{1}{16}$-hp. a.c. or d.c. motor, an 80 to 1 worm-gear reduction, and a 25-watt, 6-volt, d.c. generator to furnish the power for the solenoids.

Grinding Machine, Internal, Automatic, No. 12
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
"American Machinist," October 26, 1922

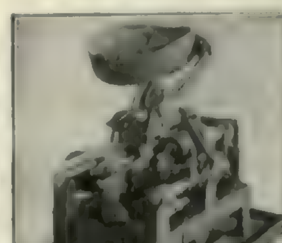
In this machine, an automatic gaging mechanism is incorporated and correlated with the driving and feeding mechanisms. After the operator chucks the piece and starts the feed, the machine will grind to the finished size, automatically trip the carriage feed, and return the carriage to the rest position. The machine is motor driven and equipped with push-button control. The work head is mounted on a circular bearing fitted to a cross-slide. The wheel carriage is reciprocated hydraulically and the driving motor is mounted directly beneath the spindle. The carriage has a maximum travel of 20 in. and six traversing speeds. Capacity, holes ⅞ to 10 in. in diameter; 9 in. in depth. Swing over the ways, 13 in. Floor space, 7 ft. by 4 ft. 2 in. Weight, 4,400 pounds.

Gage, Micrometer, Inside, Self-Aligning and Centering
L. O. Beard Tool Co., Lancaster, Pa.
"American Machinist," October 26, 1922



The micrometer gage is for measuring the diameters of automotive cylinders, the measuring member being held at right angles to the cylinder walls. The gage consists chiefly of the aligning base, the handle and the micrometer proper. It is furnished in three sizes with ranges of 2⅞ to 3 in., 3 to 3⅞ in., and 3⅞ in. to 4⅞ in. One turn of the screw advances it 0.050 in. The barrel is graduated to 0.001 in. and figures indicating steps of 0.005 in. are placed on both the spindle and the barrel, those on the former member serving as a check for the reading. The micrometer is locked by means of the setscrew to preserve the reading, and the base slid forward on the barrel so that the tool can be tilted and removed from the cylinder.

Bolt and Capscrew Shaving Machine
Asa S. Cook Co., Hartford, Conn.
"American Machinist," October 26, 1922



The machine, a re-design of the former model, is driven by a single belt from the lineshaft connected to a countershaft under the pan. Separate carriers hold the tools, which face the shoulder under the head and form the top of the head. A gripping device catches each screw as it falls from the feed race. The hopper is stationary and has an annular groove close to the side walls. The ring at the bottom of the groove is revolved with the agitator so that the outer circle of bolts moves continuously toward the high side, where the bolts are discharged into the feed race and supported by the shoulder under the head. The speed may be varied by the driving gears to keep the feed race full of work at all times.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Ala., Birmingham—Inter City Bus Line, (garage and machine shop)—lathe, drill press, emery wheel and stand, belting, electric drill, arbor press, shaft, 2 ton chain falls, hangers and pulleys.

Conn., Waterbury—F. L. Reid, R. F. D. Route 5, (tool work)—one 14 in. Hendey lathe and other small tool room equipment.

Ky., Louisville—Louisville Garage Co.—equipment for proposed $100,000 garage and service station on 5th St.

La., New Orleans—Auto Hospital, 620 Julia St., A. Bray, proprietor—one electric drill for heavy work, and one 12 in. lathe.

Md., Baltimore—Baltimore & Ohio R.R. Co., Baltimore and Charles Sts., W. S. Galloway, Purch. Agt.—angle straightening machine.

Mich., Ann Arbor—American Auto Sales Co., 310 East Washington St.—milling machine, drill and straightening presses for automobile repairing.

Mich., Detroit—Inter City Bus Line, 207 South Woodward Ave.—drill press, 12 x 14 in. lathe, emery wheel and stand and arbor press (used).

Mo., Kansas City—H. R. Bremer, 413 North Drury Ave., (machine shop)—lathe, motor, chucks and small machinist hand tools.

N. Y., Buffalo—Eagles & Kiener, 3074 Main St. (garage)—tools for repair shop.

N. Y., Buffalo—A. B. Goehler, 288 Genesee St.—equipment for machine shop.

N. Y., Buffalo—E. Hank & W. C. Radel, Genesee and Johnson Sts.—equipment for service station, including 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—E. E. Harris & Co., 22 Maurice St.—equipment, including two 1,000 gal. gas tanks and pumps for service station on Tonawanda and Ontario Sts.

N. Y., Buffalo—J. Kahabka, 1261 Fillmore Ave.—equipment for automobile repair shop.

N. Y., Buffalo—Kensington-Davis Corp., 144 Kensington Ave., R. E. Lynd, Purch. Agt.—equipment for metal foundry and machine shop.

N. Y., Buffalo—Pennzoil Co., Inc., 158 Pearl St.—equipment, including 1,000 gal. gas tank and pump for service station at 2082 Niagara St.

N. Y., Buffalo—Valyear Electric Service Co., 2467 Niagara St.—equipment, including 550 gal. gas tank and pump for service station at 145 Ontario St.

N. Y., Jamestown—Standard Oil Co., of New York, 258 Crescent St.—tools and mechanical equipment for $8,000 gasoline and service station on South Main St.

N. Y., New York—H. Kleinert, 920 Brook Ave., (machine shop)—drill press and small screw engine.

N. Y., Rochester—North East Electric Co., 348 Whitney St., (electric starting systems)—one Wieland standard 6 in. pipe threader and cutter; one No. 66 Jarecki pipe machine (used).

N. Y., Rochester—M. Wagner, 186 Franklin St.—tools and equipment for garage and automobile service station.

O., Columbus—Anchor Concrete Mchy. Co., 530 Dublin Ave., E. F. Olsen, Adrian, Mich., Purch. Agt.—planer and 1 or 2 lathes for factory at Adrian, Mich.

O., Columbus—Capital Lift & Mfg. Co., 302 Comstock Bldg., F. M. Taylor, Purch. Agt.—36 in. lathe and one drill press for proposed machine shop.

O., Columbus—Scott & Leiby, rear 135 North Front St., R. S. Leiby, Purch. Agt.—metal working machinery, including cutting off machine and slotting machine.

Okla., Henryetta—Colonial Supply Co., (manufacturer of oil well supplies, etc.)—machine shop equipment for works at Weleetka.

Pa., Carlisle—Miller Bros.—machine shop and automobile service shop equipment to replace that which was destroyed by fire.

Pa., Pittsburgh—H. D. Shawkey Motor Co., 5526 Penn Ave.—machinery and tools for proposed repair department on Penn and Pacific Aves.

Pa., Pittsburgh—National Tube Co., Frick Bldg., S. M. Lynch, Purch. Agt. — large hydraulic press.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., (manufacturer of patented mechanical articles), C. A. H. Bahde, Purch. Agt. —24 in. shaper.

Wis., Milwaukee—E. Scheunemann, 1445 26th St.—sheet metal working machinery, including brake, bender, etc.

Wis., Sheboygan—F. Heuer, 1608 South 13th St.—automobile repair machinery for new garage and repair shop.

Wis., Watertown—Breuer-Stone, Inc., c/o W. C. Stone, Bank or Watertown Bldg.—machine tools and machinery for the manufacture of specially designed machinery.

Wis., Waukesha—Spring City Auto Co., 220 West Main St.—repair machinery and motors for proposed garage.

Wis., West Allis — G. Richards, 7125 Greenfield Ave.—one lathe for automobile repair work.

Machinery Wanted

Ark., Texarkana — Williams-Hubbard Peanut Co., A. Williams, Purch. Agt. — power paper cutter.

Calif., Los Angeles — Webber McCrea Book Binder Co., 202 East 4th St., A. Webber, Purch. Agt.—ruling machine feeders.

Calif., San Fernando—R. H. Glenn, (job printer)—newspaper press.

Conn., Waterbury—Case Metal Wks.—shear for cutting ⅛ in. brass.

D. C., Wash.—J. A. Wetmore, Acting Supervising Archt., Treasury Dept.—receiving bids until Dec. 28, laundry machinery for the U. S. Veterans Hospital, Bronx, N. Y.

Ga., Union Point — Union Mfg. Co., (manufacturer of hosiery, paper boxes, etc.) —one Payne bobbin winder and one Sargents yarn conditioning machine.

Ky., Salem—G. D. Hearne—machinery and equipment for the manufacture of zinc and byproducts.

Ill., Chicago—G. E. Corbett Boiler & Tank Co., 1332 Cortland St.—three 1 ton electric hoists.

Ill., Chicago—Empire State Ice Co., 76 West Monroe St.—$225,000 worth of ice and refrigeration machinery.

Ill., Chicago — Guarantee Sign Service Corp., 430 South California Ave., W. Dresden, Purch. Agt.—2 power job printing presses, Stone power paper cutter and other printing equipment.

Ill., Chicago — Landfield & Bloom, 128 North Wells St., (printer), V. Notary, Purch. Agt.—Gordon press and paper cutter with power attachment.

Ind., Evansville — Globe, Bosse, World Furniture Co., 600 West Maryland St.—woodworking machinery and equipment for addition to plant.

Ind., Indianapolis—J. Briggs, 3323 Park Ave.—machinery and equipment for the manufacture of stucco and concrete products.

Ind., New Albany—Period Cabinet Mfg. Co.—machinery and equipment for addition to furniture factory.

Kan., Wichita—Alpine Ice Co., 13th and Rock Island Sts., C. M. Beachy, Purch. Agt.—90 ton ice machine, belting, pulleys, hangers, bearings and motor.

Kan., Wichita—Jacob Dodd Packing Co., 21st St. and Lawrence Ave.—refrigeration equipment for proposed plant.

Kan., Wichita—B. Roberts, 1423 North Lawrence Ave. (job printers)—linotype machine (used preferred).

Ky., Whick—G. Noble—additional coal mining machinery and equipment.

La., Arcadia—Bienville Democrat—12 x 18 in. Chandler & Price job press, remelting furnace, linotype and matrix box.

La., Coushatta—Gulf State Land & Lumber Co.—machinery and equipment, electrically driven, for lumber mill and plant.

Mass., Boston—Armstrong Knitting Mills, 99 Chauncy St.—machinery for addition to knitting mill at Roxbury.

Mass., Bridgewater—L. Q. White Shoe Co.—several glass folding machines for present factory (used); also machinery for proposed factory.

Mass., Brighton (Boston P. O.)—M. A. Lang, 238 Western Ave.—machinery and equipment for new bakery at 37 Everett St.

Mass., Brighton (Boston P. O.)—New England Spun Silk Corp., 342 Western Ave., (manufacturer of silk specialties)—additional machinery (new or used).

Mass., Cambridge (Boston P. O.)—Palmer Electric & Mfg. Co., 175 5th St.—one power shear for cutting 14 gauge plate.

Mass., Clinton—Roubaix Mills, Inc., 79½ Main St., (woolen mills)—additional machinery for dye house.

Mass., Dorchester (Boston P. O.)—James Russell Boiler Wks., 9 Dewar St., (boiler specialties)—machinery and small tools for new addition to shop.

Mass., Everett—Bd. Educ., c/o R. Hobbs, E. H. Newton, Chn. Purch. Comn.—woodworking and metal working machinery and tools for manual training department of new high school.

Mass., Fitchburg—St. Francis Mills, (cotton mills), R. B. Lowe, Pres., c/o Parkhill Mfg. Co.—additional machinery for mill.

Mich., Lansing—Federal Drop Forge Co., South Washington St., M. R. Carrier, Genl. Mgr.—drop forge hammers and die sinking equipment.

Minn., Lake Crystal — Graphic, (newspaper)—24 x 30½ in. chassis for press.

Mo., St. Louis—J. Heidemann, 1454 St. Louis Ave.—oil pumps and storage tanks for filling station on Blair St. and St. Louis Ave.

Mo., St. Louis—L. S. Williams, 3232 Pine St. (undertaker)—oil pumps and storage tanks for filling station at 4017-19 Finney Ave.

Mo., Springfield—B. L. Munell, R. O. Box 249 (contractor)—rock crusher.

Neb., Lincoln — Mayer Bros. Co., 1007 19th St., Fairbanks platform scales, to weigh up to 1,000 lb.

N. J., Essex Fells—Evans Lead Co., S. M. Evans, Pres.—machinery and equipment for plant, for the manufacture of lead, red lead, oxide, etc., at Charlestown, W. Va.

N. Mex., Lakewood—G. E. Wedel—knitting machinery.

N. Y., Batavia — Batavia Rubber Co., Robertson St., W. Freeman, owner, (manufacturer of tires and tubes)—machinery and equipment to increase output of plant.

N. Y., Binghamton—Binghamton Caster & Specialty Co., Inc., c/o H. C. Miller, 11 Floral Ave.—machinery and equipment for the manufacture of casters.

N. Y., Buffalo—T. Chaltas, 187 North Pearl St.—candy making equipment.

N. Y., Buffalo—Ebbco Beverage Co., Inc., 449 Woodlawn Ave., C. J. Harnick, Purch. Agt.—equipment for the manufacture of beverages.

N. Y., Buffalo—Hoeffler Ice Cream Co., Inc., 296 Connecticut St.—machinery and equipment for the manufacture of ice cream products for branch plant at Niagara Falls.

N. Y., Buffalo—Lewis Electric Mfg. Co., 1400 Niagara St.—machinery and equipment for the manufacture of mechanical appliances.

N. Y., Buffalo—Seneca Iron & Steel Co., Erie County Bank Bldg.—machinery and equipment for addition to steel works at Blasdell.

N. Y., Cayuta—F. Vandrack, Jr.—one No. 11 or 12 power cutting machine.

N. Y., Chatham—Chatham Courier Co.—power saw with guides, suitable for sawing slugs or solid type-high casts.

N. Y., Cohocton—Wetmiller Dairy & Farm Products Co.—butter making machinery for proposed dairy.

N. Y., Elmira—James Mfg. Co., 700 Madison Ave., (manufacturer of farm equipment, silos, staunchions, etc.)—machinery and equipment for addition to plant.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Electrolytic copper quoted at 14½c. as against 14¼c. per lb. in New York warehouses; copper market, generally, more stabilized. Tin showing betterment in buying; quoted at 38c. as compared with 36½c., last week. Zinc advanced to 8c. as against 7¾c. per lb. Linseed oil firmer, with no change in quotations. Improvement also shown in lard oils.

Declines—Coke and pig-iron prices, softer. Basic and No. 2 foundry iron down $2.50; now $25 per ton at Pittsburgh, including freight from valley. Steel shapes quoted at minimum of $1.90 per 100 lb., Pittsburgh, for delivery in first quarter of 1923; as high as $2.10, however, has been quoted on orders for immediate shipment. Plate tonnages not being placed so readily; quotations now $1.90@$2 per 100 lb., at mill. Plate buying mostly for tank construction and railway use. Bars, $1.90 for first quarter delivery; current business still at $2 per 100 lb.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.55
Northern Basic	28.27
Southern Ohio No. 2	29.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.44
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.64
Virginia No. 2	33.17
Basic	28.00
Grey Forge	28.64
CHICAGO	
No. 2 Foundry local	28.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	30.00

IRON MACHINERY CASTINGS Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cincinnati	4.5@6
New York	5.5
Chicago	4@5
Cleveland	2.5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	4.19	3.70	4.00
No. 12	2.60	4.24	3.75	4.05
No. 14	2.70	4.29	3.80	4.10
No. 16	2.90	4.39	3.90	4.20
Black				
Nos. 17 and 21	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11	3.35@3.50	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.60	5.00	4.50	4.95
Nos. 17 and 21	3.75@3.90	5.30	4.80	....
Nos. 22 and 24	3.90@4.05	5.45	4.95	5.40
No. 26	4.05@4.20	5.60	5.10	5.55
No. 28	4.35@4.50	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
5/32	8.00		12@13
⅛	6.50		11@12
3/16 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.50
Tin, 5-ton lots, New York	38.00
Lead (up to carlots), St. Louis	6.95@7.00; New York, 7.45
Zinc (up to carlots), St. Louis	7.30@7.35; New York, 8.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7@7.25	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.75	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	6.50	7.00
Zinc	3 00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.00	11.00	14.50
IC, 112 sheets	12.30	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.00	7.25
IC, 14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville....per net ton		$7.25@7.50	
Coke, prompt foundry, Connellsville...per net ton		7.50@8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.50	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. Y., Elmira—H. Potter, 428 Erie St.—machinery for the manufacture of radio apparatus and appliances.

N. Y., Merrell—[illegible] Berg Co. (manufacturer of [illegible])—machinery and equipment for branch plant at Perry.

N. Y., Lockport—W. B. [illegible]—machinery and equipment for the manufacture of automobile gears and transmissions.

N. Y., Lockport—[illegible] News Co., 31 Locust St.—[illegible] complete outfit.

N. Y., Mount Morris—Bd. Educ.—vocational equipment for $140,000 manual training school.

N. Y., New York—Bristol Co., 340 East [illegible] St. (manufacturer of furniture)—[illegible] presses and several sizes of [illegible].

N. Y., Owego—Bd. Educ.—vocational equipment for $175,000 high school.

N. Y., Penn Yan—[illegible] Ribbon & Carbon Co.—one [illegible] in. paper cutting machine.

N. Y., Rochester—M. Bednar, 42 University Ave.—one printing press with complete outfit.

N. Y., Rochester—Eastman Kodak Co., Kodak Park—machinery and equipment for refrigeration plant.

N. Y., Rochester—Wood Specialties Inc., 124 Railroad St.—one automatic cutoff saw.

N. Y., Yonkers—[illegible] Co., 247 South [illegible]—test bench to test generators and starters.

N. C., Gastonia—H. H. Groves—equipment for proposed cotton mill for the manufacture of fine combed yarns.

N. C., Gold Hill—[illegible] Electro-Metallurgical Co.—machinery and equipment including conveyors, transmission machinery, etc., for proposed gold mining plant.

O., Cleveland—The city, Comr. of Purchases, City Hall—one 10 ton traveling electric crane with switchboard, switchboard wiring and electric valve controls.

O., Cleveland—[illegible] Co., 2359 East [illegible] St.—one or more hand screw machines, [illegible] in. capacity (used).

O., Columbus—Mathews Lumber Mfg. Co., [illegible] South Central Ave., W. A. Mathews, Secy. and Genl. Mgr.—molding machine, cutoff saw and other equipment for lumber mill.

O., Dayton — The Advance Fdry. Co., Farnell St.—10 to 15 ton electric crane, 40 ft. span (used).

O., Dayton — Crawford, McGregor & Canby Co., Albany St., (manufacturer of golf clubs, etc.)—machinery and equipment for $30,000 addition to plant.

O., Elyria—[illegible] & Co. (manufacturer of juvenile vehicles, etc.)—machinery and equipment for branch plant at Baltimore, Md.

O., Fostoria—Seneca Wire & Mfg. Co.—machinery and equipment for addition to wire products plant.

O., [illegible]town—Amer. Rolling Mill Co., Curtis Ave.—[illegible] alligator shear.

O., Wadsworth — Ohio Match Co.—machinery and equipment for addition to plant for the manufacture of matches, etc.

O., Youngstown—Federal Iron Wks., 70-[illegible] [illegible] (fabricators steel bridge [illegible], etc.)—machinery and equipment to replace that which was destroyed by fire.

O., Youngstown—[illegible] Mantel Co., [illegible] (manufacturer of [illegible])—machinery and equipment to replace that which was destroyed by fire.

Okla., Tulsa—McCallum-Morris Electric Co. (manufacturer of electric fixtures), A. [illegible]—[illegible] job printing [illegible] and bearings [illegible].

Ore., Medford—[illegible]—machinery and equipment for proposed cold storage [illegible].

Ore., Portland—[illegible] Mfg. Co. [illegible] [illegible] [illegible] [illegible] [illegible].

Pa., [illegible]—[illegible].

Pa., Allentown—[illegible] Oil Co. [illegible]—machinery and equipment for [illegible] on 13th St., to replace that which was destroyed by fire.

Pa., Allentown—Traylor Eng. & Mfg. Co.—castings for 60 in. gyratory crusher.

Pa., Bloomsburg—The Bloomsburg Co does not intend to purchase a 10 ton crane, as stated in our issue of Nov. 23.

Pa., Clairton—Bd. Educ., C. A. Bauman, Secy., 411 Calhoun St.—equipment for vocational department of proposed $350,000 Junior and Senior High School.

Pa., Meadville—C. L. Craine—machinery and equipment for the manufacture of patented arch supporters for shoes.

Pa., Narberth—Bd. Educ.—vocational equipment for $165,000 school.

Pa., Norwood—Pennsylvania Equipment Co.—25 ton, 45 ft. boom, 8 wheel locomotive crane, equipped with clamshell bucket.

Pa., Phila.—Midvale Steel & Ordnance Corp., Widener Bldg.—alligator shear for Coatesville works.

Pa., Pittsburgh—Young Paper Mfg. Co., 245 1st Ave., (manufacturer of roofing and tarred felts)—machinery to replace that which was destroyed by fire.

Pa., Ridgway—Hyde Murphy Co., (manufacturer of planing mill products)—additional machinery and equipment for new $25,000 plant.

Pa., Rochester—Rochester Rubber Products Co., M. M. Goettman, Treas.—machinery and equipment for the manufacture of tires, tubes and other rubber products.

Pa., Sheffield—I. Ewan—machinery and equipment for the manufacture of patented baseball playing machine at Atlantic City, N. J.

Pa., Springfield—(Cumberland County)—Bd. Educ.—vocational equipment for $200,000 high school.

Pa., Wilkes-Barre—A. Hildebrand, 91 Wood St.—machinery and equipment for lumber and planing mill to replace that which was destroyed by fire.

Pa., Williamsport — Eureka Paper Box Co., Howard Ave. and Canal St.—machinery and equipment for paper box factory.

Pa., Williamsport—A. B. Faulkner, 720 5th Ave.—machinery for the manufacture of automatic illuminating changeable electric signs.

R. I., Providence—Goldberger & Brody, c/o G. Wolf, Archt., 88 Althea St.—equipment for proposed $55,000 garage on Pearl St.

Tenn., Chattanooga — Fountain City Lumber Co., J. V. Brantley, Secy.—machinery for the manufacture of automobile bodies.

Tenn., Harrogate—Lincoln Memorial University—power molding machine, power mixing machine, belting, hangers, pulleys and bake oven, for bakery.

Tenn., Memphis—W. C. Ellis & Sons Iron Wks., 235-245 South Front St., (heavy iron works, grease and oil machinery and manufacturer of warehouse trucks), H. C. Ellis, Secy. and Mgr.—machinery for plant.

Tenn., Morristown—J. P. Nanney Lumber Co.—24 in. four-side planer and matcher with Shimer heads; chain mortiser for doors and sash; single end tenonner; 12 or 16 in. jointer; 36 in. band saw; circular saw (motor driven machines preferred).

Tenn., Nashville—Southern Door & Glass Co., 218-220 North 2nd Ave., B. R. Patterson, Pres. and Treas.—complete woodworking machinery for small sash and door factory.

Tex., Belle—Jolly (newspaper)—10 x 15 in. Miller press, 6 quarto cylinder folder and Meistang mailer.

Tex., Colorado—T. Hughes, (cleaning plant)—tumbler, dry cleaner, cleaner, still, extractor, oil storage system, belting, hangers and bearings.

Tex., Lamesa — City Blacksmith Shop, Box 602—trip hammer for power equipment.

Tex., Sherman—Buffalo Refining Co.—additional oil refining machinery and equipment.

Tex., Sherman—J. T. Cobb, (manufacturer of soap)—soap press.

Va., Martinsville—A. D. Witten—furniture and woodworking machinery and equipment.

Va., Richmond—G. R. Graveley—machinery and equipment for proposed plant for the manufacture of auto tractors and agricultural equipment at Nansemond (Suffolk P. O.).

W. Va., Fairmont—Imperial Ice Cream Co., G. Strong, Pres.—ice and refrigeration machinery.

W. Va., Kenova—Morgan Bros. Lumber [illegible]—complete machinery and equipment [illegible] the manufacture of hardwood flooring.

W. Va., Lost Creek—Vulcan Coal Co., J. [illegible], Supt.—conveying and mining machinery.

W. Va., Morgantown—Shriver Coal Co., E. Iller, Pres.—mining machinery.

W. Va., Roderfield—Baldwin Pocahontas Coal Co.—tipple and conveying machinery for new mining field.

W. Va., Warwood—Centre Fdry. & Machine Co.—foundry and machine shop equipment.

W. Va., Williamson—G. B. Irvine—lumber mill machinery and equipment.

Wis., Appleton—Milhaupt Spring & Auto Co.—machinery and equipment for general automobile repairs; also for the manufacture of springs.

Wis., Cedar Grove—School District No. 1, M. J. De Master, Clk.—manual training equipment for new school.

Wis., Green Bay—Farmer-Labor Publishing Co., c/o F. H. Shoemaker, Box 51—presses and stereotyping outfit.

Wis., Jefferson—C. Baumann—special machinery for the manufacture of chocolate bars.

Wis., Milwaukee—Atherton Eng. Co., c/o M. H. Fuldheim, 425 East Water St.—machinery for the manufacture of radio supplies.

Wis., Milwaukee—A. Bergenthal, 83 Buffalo St.—power driven refrigeration machinery.

Wis., Milwaukee — Cahill & Douglas, Engrs., 217 West Water St.—3 ton ice machine.

Wis., Milwaukee—Midwest Rolling Mills, c/o J. E. Kiefer, 835 Caswell Block—rolling mill equipment for the manufacture of seamless brass and tubing.

Wis., Milwaukee—G. A. Mixer, 1394 Green Bay Ave., (publisher) — presses, lithographing and stereotyping equipment; also linotype machines.

Wis., Peshtigo—Thompson Bros. Boat Co.—additional metal and woodworking machinery for the manufacture of boats.

Wis., Stevens Point—Whiting-Plover Paper Co.—pulp beaters for addition to beater room at Plover.

Ont., West Flamborough—J. Stutt & Sons—lumber and saw mill equipment.

Que., Montreal—Machine Builders, Ltd., 738 St. Paul St., W.—printing, bookbinding and paper box machinery.

Que., Montreal—W. O'Brien, 600 Mullin St.—complete equipment for small foundry.

Metal Working Shops

Calif., Emeryville — The Westinghouse Electric & Mfg. Co., 1st Natl. Bank Bldg., San Francisco, is having plans prepared for the construction of a manufacturing plant on a 12½ acre site, here. Estimated cost $1,000,000. Engr. Dept. of owners, Union Bldg., Pittsburgh, Pa., Engrs. and Archts.

Calif., Fresno—R. Emirzian, 1002 T St., awarded the contract for the construction of a 1 story garage on Block 99, Lots 27 to 32. Estimated cost $39,765.

Calif., Oakland — The Union Press & Forge Co., Ford St. near Derby St., awarded the contract for the construction of a 1 story forge shop. Estimated cost $6,500.

Calif., Sacramento—The Sacramento Pipe Wks., R St. near 7th St., plans to build a plant consisting of 2 buildings, each 148 x 230 ft., on 16th and B Sts.

Calif., San Francisco—The Bothin Real Estate Co., 604 Mission St., awarded the contract for the construction of a 1 story ornamental iron works on Clementina St. between 5th and 6th Sts. Estimated cost $10,000. Kloeres & Koch, 943 Columbus Ave., lessees.

Calif., San Francisco—J. M. Carlson, 185 Stevenson St., awarded the contract for the construction of a 2 story electrical shop on Minna St. Estimated cost $9,000. Central Electric Co., 185 Stevenson St., lessee.

Calif., San Francisco—L. R. Lurie, Mills Bldg., has had plans prepared for the construction of a 1 story machine shop on 10th and Minna Sts. Estimated cost $15,000. O'Brien Bros., Inc., 240 Montgomery St., Archts.

Calif., San Francisco—S. C. Moore, 133 Kearny St., awarded the contract for the construction of a 1 story, 30 x 110 ft. plating shop on Folsom St. near 19th St. Estimated cost $5,000.

Conn., Fairfield—S. Lowe & Sons Co., 30 Sunfield Drive, awarded the contract for the construction of a 2 story, 45 x 80 ft. addition to its factory for the manufacture of sash pulleys. Estimated cost $25,000. Noted Nov. 16.

Conn., Hartford—Hartford Dispatch & Trucking Co., 105 Albany Ave., will build a 1 story, 40 x 80 ft. garage and machine shop. Estimated cost $40,000.

Conn., Southington—The Stanley Rule & Level Co., New Britain, will build a 1 story, 60 x 60 ft. addition to its forge shop on Sumler St., here. Estimated cost $15,000.

Ill., Chicago — The Fair Department Store, State and Adams Sts., awarded the contract for the construction of a 1 story, 157 x 313 ft. garage at 2454-2520 Lawrence Ave. Estimated cost $185,000.

Ill., Chicago—Ford Motor Co., Highland Park, Mich., is having plans prepared for the construction of a 1 story, 502 x 1,363 ft. assembly plant for automobiles on Torrance Ave. and Calumet River, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Ill., Chicago—The Golden Rule Cutlery Co., Ogden and Sheldon Sts., awarded the contract for the construction of a 3 and 4 story factory. Estimated cost $20,000. Noted Nov. 23.

Ill., Chicago—Muehlhausen Spring Co., 5841 Loomis St., is receiving bids for the construction of a 1 story, 100 x 142 ft. factory for the manufacture of phonograph springs, at 5811-19 South Western Ave. Estimated cost $40,000. Newhouse & Bernhams, 4630 Prairie Ave., Archts.

Ill., Chicago—The Peoples Gas Light & Coke Co., 172 South Michigan Ave., is having plans prepared for the construction of a 2, 3 and 4 story meter repair shop on Homan and Division Sts. Estimated cost $300,000. H. Von Holst, 112 West Adams St., Archt.

Ill., Oak Park—The Madison Motor Co., 810 West Madison St., is having plans prepared for the construction of a 1 story automobile sales and service station at 811 West Madison St. Estimated cost $60,000. Weller & Rippel, 140 South Dearborn St., Chicago, Archts.

Ky., Louisville—The Louisville Garage Co. plans to build a garage and service station on 5th St. Estimated cost $100,000. Architect not announced.

La., Baton Rouge—Louisiana State University will soon award the contract for the construction of a power house, also for an engineering building, 325 ft. long, with 4 wings, each 100 ft. long. Estimated cost $130,000. R. L. Himes, Secy. Building Com.

Mass., Worcester—The Parker Wire Goods Co., 18 Grafton St., awarded the contract for the construction of a 1 story, 120 x 300 ft. wire goods manufacturing plant. Estimated cost $75,000. Noted Nov. 16.

Mass., Worcester — Reed & Prince Mfg. Co., Duncan Ave., awarded the contract for the construction of a 2 story, 60 x 400 ft. addition to factory for the manufacture of screw products, also a 1 story, 90 x 120 ft. annealing room on Nixon Ave. Estimated cost $150,000.

Mich., Detroit—The Michigan Stamping Co., 11631 Mack Ave., had plans prepared for the construction of a 1 story, 140 x 347 ft. addition to its metal stamping plant. Estimated cost $175,000. A. Kahn, 1000 Marquette Bldg., Archt.

Mo., St. Louis—The city, Bd. of Public Service, 208 City Hall, will receive bids until Jan. 2 for the construction of a 2 story, 54 x 225 ft. service building and power plant for St. Louis Training School for Feeble Minded at Scott Farm. Estimated cost $150,000. L. R. Bowen, 304 City Hall, Engr. and Archt.

Mo., St. Louis—F. L. Cornwell, La Salle Bldg., is building a 3 story, 78 x 155 ft. automobile garage and show room on Locust Blvd. Estimated cost $150,000.

Mo., St. Louis—J. Cusamano, 910 Carleton Bldg., awarded the contract for the construction of a 1 story, 127 x 192 ft. garage on 10th St. Estimated cost $40,000.

Mo., St. Louis—H. Foerster, 3539A Giles Ave., awarded the contract for the construction of a 1 story, 50 x 140 ft. iron works at 3907 Bingham St. Estimated cost $25,000.

N. Y., Blasdell—The Seneca Iron & Steel Co., Erie County Bank Bldg., Buffalo, plans to build a large addition to its steel and iron works on a 15 acre site, here. Cost will exceed $50,000. Architect not announced.

N. Y., Brooklyn—J. J. Aaron, c/o A. Goldberg, Engr. and Archt., 164 Montague St., will build a 1 story, 100 x 150 ft. garage on Montgomery St. Estimated cost $75,000.

N. Y., Buffalo—A. L. Dixon, 1034 Main St., plans to build a 2 story, 98 x 200 ft. automobile sales building and garage. Cost will exceed $40,000. Architect not announced.

N. Y., Buffalo—M. Finkelstein, 255 Amherst St., plans to build a garage and service station. Estimated cost $80,000. Architect not announced.

N. Y., Buffalo—The Swan Garage, Inc., 48 Swan St., awarded the contract for the construction of a 3 story, 91 x 115 ft. garage. Noted Nov. 16.

N. Y., New York—The Dept. of Parks, Municipal Bldg., is having plans prepared for the construction of a 4 story service building on 77th St. and Columbus Ave. Estimated cost $500,000. Private plans.

N. C., Gold Hill—The Rodrain Electro-Metallurgical Co. plans to build a complete gold mining plant. Estimated cost $500,000. Architect not announced.

O., Akron—The Ohio Pump & Machine Co., National Bldg., awarded the contract for the construction of a 1 and 2 story, 80 x 260 ft. plant. Estimated cost $50,000.

O., Alliance—The Machined Steel Castings Co., South Mahoning Ave., plans to build a 1 story, 75 x 200 ft. addition to its plant. Estimated cost $100,000.

O., Cleveland—G. W. Deming, 3154 Redwood Ave., and O. G. Deming, 1269 Carlyon Rd., Cleveland Heights (real estate), are having plans prepared for the construction of a 1 story, 40 x 73 ft. and 40 x 54 ft. commercial building and garage on Euclid Ave. and Chardon Rd. Estimated cost $40,000. H. P. Whitworth, 526 Hickox Bldg., Archt.

O., Cleveland—The Grabler Mfg. Co., 6565 Bway., manufacturer of plumbing supplies, awarded the contract for the construction of a 1 story, 50 x 80 ft. and a 3 story, 80 x 80 ft. annealing house and factory. Estimated cost $50,000. W. S. Bayer, Secy. Noted Oct. 5.

O., Cleveland—A. Mechanic, 7829 Carnegie Ave., manufacturer of automobile accessories, is having plans prepared for the construction of a 2 story, 33 x 37 ft. shop on East 82nd St. and Carnegie Ave. Estimated cost $25,000. A. Sogg, 319 Hippodrome Bldg., Archt.

O., Cleveland—The W. S. Tyler Co., 1430 East 36th St., awarded the contract for the construction of a 1 story, 40 x 60 ft. addition to its galvanizing plant. Estimated cost $10,000.

O., Cleveland—The Union Terminal Bus Line Co., c/o Miller & James, Archts., Erie Bldg., is having plans prepared for the construction of a 2 story, 72 x 180 ft. garage and service station on East 9th St. near Central Ave. Estimated cost $60,000.

O., Wadsworth—The Ohio Injector Co., c/o E. J. Young, Pres., is having plans prepared for the construction of a 3 story, 60 x 250 ft. addition to its factory. Estimated cost $150,000. Christian-Schwarzenberg & Gaede Co., 1900 Euclid Ave., Cleveland, Archts.

Pa., East Newport (Newport P. O.)—The Mineral Products Co. plans to rebuild portion of its roofing products plant, which was destroyed by fire. Estimated cost $25,000.

Pa., Fleetwood—The Down Tool Wks. is building a 1 story, 36 x 134 ft. and 24 x 37 ft. factory for the manufacture of high speed drills and tools, on Locust St. Estimated cost $10,000. W. R. Down, owner.

Pa., Phila.—The Franklin Sugar Co., 1045 North Delaware Ave., plans to build a 1 and 2 story machine shop and barrel house. Estimated cost $50,000. Private plans.

Pa., Phila.—C. J. Gilmore, Archt., Fuller Bldg., is receiving bids for the construction of a 1 story, 62 x 155 ft. garage on York Rd. and City Line Ave., for W. B. Margerum, York Rd. and Chelen Ave. Estimated cost $60,000.

Pa., Phila.—F. Nardy, 3840 Spring Garden St., is having plans prepared for the construction of a 2 story, 100 x 138 ft. garage on 18th and Jackson Sts. Estimated cost $80,000. R. A. Schuman, 202 West State St., Trenton, N. J., Archt.

Pa., Phila. — The Smith-Hardican Co., 1606 Cherry St., is receiving bids for the construction of a 4 story, 65 x 80 ft. garage on 20th and Brandywine Sts. Estimated cost $120,000. Private plans.

Pa., Pittsburgh—The Fairmont Creamery Co., 301 Ferry St., awarded the contract for the construction of a 1, 2 and 5 story, 62 x 72 ft. and 38 x 72 ft. sales warehouse and garage on 25th and Smallman Sts. Estimated cost $150,000. Noted Sept. 14.

Wis., Waupun—Landaal Bros. Co. plans to build a 1 or 2 story, 60 x 132 ft. garage on Drummond St. Estimated cost $50,000. Architect not selected.

Wis., Wausau—The Hall Garage Co., 107 Scott St., awarded the contract for the construction of a 2 story, 50 x 60 ft. garage. Estimated cost $40,000.

Ont., Bridgeburg — The National Brake Co., Ellicott Bldg., Buffalo, N. Y., plans to build a branch plant for the manufacture of brakes and equipment, here.

Ont., Collingwood—The Canadian Postal Lock Nut Bolt Co., plans to build a factory for the manufacture of bolts, screws, rivets and also for steel stamping, in the spring. Estimated cost $50,000. F. A. Bassett, Mgr.

Ont., Ford—Ford Motor Co. of Canada, awarded the contract for the construction of a 2 story, 100 x 400 ft. automobile factory on Riverfront St. Estimated cost $250,000. P. W. Grandjean, Secy.

Ont., Wiarton — G. Golden, Berford St., plans to build a garage and automobile repair shop. Estimated cost $45,000.

Pa., Warren — The Warren Garage Co. plans to remodel and build a 2 story addition to its garage.

Pa., Waynesburg — H. Cochrane, Dawson, will build a 2 story, 90 x 120 ft. garage on Greene St. Estimated cost $60,000.

R. I., Providence—G. Wolf, Archt., 88 Althea St., is receiving bids for the construction of a 2 story, 50 x 120 ft. garage on Pearl St. for Goldberger & Brody, c/o Archt. Estimated cost $55,000.

Tenn., Chattanooga — The Continental Mchy. Co., G St., plans to rebuild its plant for the manufacture of machinery, which was recently destroyed by fire. Estimated cost $200,000. Architect not announced.

Tenn., Memphis — The Fischer Heating Co., 51 South 3rd St., awarded the contract for the construction of a 1 and 2 story machine shop, industrial and heating plant, on a 75 x 150 ft. lot. Estimated cost $35,000.

Va., Nansemond (Suffolk P. O.)—G. D. Graveley, Richmond, plans to build a plant for the manufacture of auto tractors and agricultural equipment, here. Estimated cost $25,000. Architect not announced.

Wis., Eau Claire—K. N. Knudson, 307 North Farwell St., plans to build a 1 story, 55 x 94 ft. garage. Estimated cost $40,000. Private plans.

Wis., Eau Claire—The Paige-Ford Motor Car Co., Wisconsin and North Farwell Sts., plans to build a 2 story, 58 x 90 ft. garage. Estimated cost $45,000. Private plans.

Wis., Milwaukee—H. C. Hengels, Archt., 445 Milwaukee St., is receiving bids for the construction of a 2 story, 70 x 150 ft. addition to garage on Grand Ave., for the Welch Investment Co., 105 Wells St. Estimated cost $50,000.

General Manufacturing

Calif., Hayward—E. L. Macabee, Mgr. Hunt Bros. Packing Co., Lower B St., and Chn. of Cold Storage Plant Committee of Hayward Chamber of Commerce, backs movement to finance construction of cold storage plant. Will be constructed either by the formation of a local stock company or b ya corporation already established in Hayward. Estimated cost $100,000.

Calif., Oakland—The Art Rattan Wks., 475 Sutter St., San Francisco, plans to build a 3 story factory for the manufacture of rattan furniture on 24th Ave., here. Estimated cost $20,000.

Calif., Porterville—The Acme Ice Cream Co., 1313 Sansome St., San Francisco, has purchased a creamery plant, here, and plans to remodel and build additions to same, including an ice plant.

Conn., Bridgeport — A. V. Langenegger, 2190 Park Ave., is having plans prepared for the construction of a 3 story factory for the manufacture of corsets on Federal St. Estimated cost $150,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Archts.

Conn., Hartford—The Hartford City Gas Light Co., 565 Main St., plans to build a large addition to its gas plant. Architect not selected.

Conn., Hartford—The Hartford Courant, 64 State St., awarded the contract for the construction of a 2 story addition to its plant, to be used for a printing and mailing room. Estimated cost $50,000. Noted Nov. 23.

Conn., Westport—The Lees Mfg. Co., 320 Bway, New York City, is having plans prepared for the construction of a 3 story, 50 x 150 ft. addition to its cordage and twine factory, here. Estimated cost $75,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts.

Ill., Chicago—The Douglas Bottling Co., 3523 Ogden Ave., awarded the contract for the construction of a 1 and 2 story, 75 x 145 ft. and 23 x 75 ft. bottling works on Ogden Ave. near South Ridgeway St. Estimated cost $40,000.

Ill., Chicago—D. P. Farrell, c/o M. O. Nathan, Archt., 123 West Madison St.,

[illegible] the contract for the construction of a [illegible] story, [illegible] ft. [illegible] factory at [illegible] West Lake St. Estimated cost [illegible].

Ill., Chicago — The Olson Rug Co., [illegible] [illegible] St., awarded the contract for the construction of the foundation of a 5 story, [illegible] ft. factory at [illegible] West Monroe St. Estimated cost $250,000. Noted Oct. 12.

Ind., New Albany—The Period Cabinet Mfg. Co. plans to build an addition to its furniture factory. Estimated cost $[illegible].

Md., Baltimore—The Air Reduction Co., [illegible] [illegible] Ave., New York City, is having plans prepared for the construction of an acetylene plant on Fayette St., here. Estimated cost $[illegible]. [illegible] & [illegible], [illegible] [illegible] Ave., New York City, Archts.

Mass., Bridgewater—The Lapworth Webbing Co., [illegible], will build a 1 story [illegible] [illegible] plant, here. Estimated cost $[illegible].

Mass., Fall River—The Standard Oil Co., 26 Bway, New York City, awarded the contract for the construction of a 1 story oil plant, consisting of a 61 x 53 ft. garage, a 30 x 30 ft. pump house, a 30 x 51 ft. warehouse, storage tanks, etc., on Slade St., here. Estimated cost $50,000.

Mass., Lawrence — The Bellevue Monumental Wks., 44 Manchester St., manufacturer of marble monuments, will build a 3 story, [illegible] x [illegible] ft. addition to its plant. Estimated cost $[illegible].

Mass., Millbury—The Samuel E. Hull Co., 112 Front St., Worcester, awarded the contract for the construction of a 2 story, 55 x 60 ft. shoddy mill, here. Estimated cost $[illegible].

Mass., North Brookfield — The Asbestos Textile Co., Woolworth Bldg., New York City, awarded the contract for the construction of a 1 story, 39 x 50 ft. addition to its textile plant, here. Estimated cost $[illegible].

Mass., Worcester—The Waldorf System, Inc., 169 High St., Boston, awarded the contract for the construction of a 1 story, 65 x 125 ft. bakery, commissary, etc., on Arch and [illegible] Sts., here. Estimated cost, $[illegible]. Noted Oct. 5.

Minn., Duluth—The Blue Valley Creamery Co., 700 South Clinton St., Chicago, awarded the contract for the construction of a 2 story, 90 x 100 ft. creamery on Commerce St. and 12th Ave., W., here. Estimated cost $[illegible].

Mo., St. Louis—The Broderick & Bascom Rope Co., 805 North Main St., awarded the contract for the construction of a 2 story, 81 x 496 ft. warehouse at 4233-35 North Union Blvd. and a 1 story, 142 x 496 ft. factory at 4239-51 North Union Blvd., also smaller building. Estimated cost $158,350.

Mo., St. Louis—The Grace Sign & Mfg. Co., 425 South Main St., plans to build a 1 story, 150 x 260 ft. sign factory on 2nd and [illegible] Sts. Estimated cost $100,000. Architect not selected.

N. Y., Alden—Bd. of Supervisors, Erie County, City Hall, Buffalo, is having preliminary sketches made for the construction of a 2 story, 75 x 100 ft. power house and refrigerating plant in connection with the new county home, here. Cost will exceed $40,000. W. A. Kidd, 524 Franklin St., Buffalo, Archt.

N. Y., [illegible]—W. F. Meyer plans to rebuild [illegible] mill which was recently destroyed by fire. Estimated cost $[illegible].

N. Y., Buffalo—The Automatic Tire Machine Co., [illegible] [illegible] St., plans to build a factory for the manufacture of tire machinery and appliances. Estimated cost $[illegible].

N. Y., Geneva—City plans an election to vote on a $[illegible] bond issue for the construction of a high school, including vocational [illegible]. [illegible], Pres.

N. Y., [illegible]—The [illegible] Hundred Gas [illegible] [illegible] awarded the contract for the construction of a [illegible] story, 40 x [illegible] ft. [illegible] [illegible] station on [illegible] [illegible] Sts. Estimated cost $[illegible]. Noted [illegible].

N. Y., New York—[illegible] & [illegible], [illegible] [illegible] St., will soon receive bids for the construction of a [illegible] story [illegible] [illegible] on [illegible] [illegible] St. Estimated cost $[illegible]. [illegible] & [illegible], [illegible] [illegible] [illegible] [illegible] factory.

N. Y., White Plains—[illegible] & [illegible] Co. is having plans prepared for the construction of a [illegible] story [illegible] on its plant. Estimated cost $[illegible]. [illegible], [illegible] [illegible] Ave., New York City, Archt.

N. C., Cramerton—Mays Mill, Inc., plans to build a weaving mill addition to its plant for the manufacture of yarns into fancy [illegible] colored goods, capacity [illegible] looms. Estimated cost $1,000,000. S. W. Cramer, Pres.

N. C., Lillington—The Cape Fear Gravel Pits, Inc., plans to build a large gravel production plant, also a plant for the manufacture of concrete building blocks and tile. Estimated cost $250,000. C. W. Lacy, Wilmington, Pres.

O., Cleveland—H. E. Roth, 1604 East 117th St., has had plans prepared for the construction of a 1 story, 50 x 100 ft. and 30 x 40 ft. hide factory, office and garage, on West 65th St. near Storer Ave. Estimated cost $50,000.

O., Wadsworth—The Ohio Match Co. is having plans prepared for the construction of a 3 story, 120 x 200 ft. factory. Estimated cost $150,000. Christian-Schwarzenberg & Gaede Co., 1900 Euclid Ave., Cleveland, Archts.

Pa., Allentown—The Trenton Poster Advertising Co., 725 East State St., Trenton, N. J., awarded the contract for the construction of a 1 story, 60 x 125 ft. poster advertising works, here. Estimated cost $20,000.

Pa., Bridgeport—James Lees & Sons Co. awarded the contract for the construction of a 5 story, 43 x 64 ft. textile mill.

Pa., Erie — The Record Publishing Co., 12th and French Sts., plans to build an addition to its printing plant. Estimated cost $9,700.

Pa., Lebanon—The Lebanon Honey Cake Cone Co. plans to build a 2 story factory for the manufacture of cones and byproducts. Cost will exceed $25,000.

Pa., Phila.—The Amer. Ice Co., 6th and Arch Sts., is receiving bids for the construction of a 1 story, 125 x 150 ft. ice storage plant on 17th St. and Washington Ave. Private plans.

Pa., Phila.—Bennett & Aspden Co., Krams and Pechin Sts., awarded the contract for the construction of a 3 story addition to its textile mill for the manufacture of upholstery. Estimated cost $80,000.

Pa., Phila.—Bush & Diamond, Jasper and Thayer Sts., awarded the contract for the construction of a 2 story rug mill on Ontario and Jasper Sts. Estimated cost $50,000.

Pa., Phila.—The Ketterlinus Lithographic Mfg. Co., 4th and Arch Sts., will receive bids Jan. 1 for the construction of an 8 story, 55 x 140 ft. printing plant. Ballinger Co., 12th and Chestnut Sts., Archts. Noted Nov. 23.

Pa., Phila.—The Rodgers Engraving Co., 1318 Arch St., awarded the contract for the construction of a 2 story printing plant on Camac and Cherry Sts. Estimated cost $27,000.

Pa., Phila.—The University of Pennsylvania, 34th and Woodland Sts., awarded the contract for the construction of a 2 story, 34 x 43 ft. laundry on 34th and Spruce Sts. Estimated cost $32,000.

Pa., Phila.—C. E. Wunder, Archt., 1517 Spruce St., is receiving bids for the construction of a 5 story, 173 x 200 ft. printing plant on 34th and Market Sts. for the Stephen Green Co., 15th and Arch Sts. Estimated cost $250,000.

R. I., Pawtucket—Bd. Educ. will soon receive bids for the construction of a 3 story manual training and industrial arts high school on Fountain St. Estimated cost $1,200,000. R. C. N. Monahan, 256 Main St., Archt.

R. I., Woonsocket — The Rhode Island Knitting Co., Jeffers St., will soon award the contract for the construction of a 2 story, 40 x 100 ft. addition to mill for the manufacture of knit goods. Estimated cost $50,000. Private plans. Noted Nov. 30.

R. I., Woonsocket—The Verdun Mfg. Co., Manville Rd., awarded the contract for the construction of a 1 story addition to its textile plant, a 32 x 44 ft. finishing mill and a 26 x 26 ft. garage. Estimated cost $7,500.

Tenn., Memphis—The DeSoto Hardwood Flooring Co., 1014 Sledge Ave., plans to build a 30 x 135 ft. addition to its plant, including dry kilns. Estimated cost $25,000. R. A. Taylor, Mgr.

Va., Front Royal—Proctors Grist Mills plans to rebuild its mill which was recently destroyed by fire. J. J. Proctor, proprietor.

Va., Richmond—The Corley Piano Co., 213 East Broad St., plans to rebuild its factory which was recently destroyed by fire. Estimated loss $235,000.

W. Va., Glen White—E. E. White Coal Co. plans to build a coal tipple. Estimated cost $[illegible].

Wis., Crandon—F. H. [illegible] plans to build a [illegible] x [illegible] ft. saw and planing mill. Architect not selected.

Wis., Eau Claire—The Lang Canning Co., Mill St., will build a 2 and 3 story addition to its cannery, consisting of a main factory, viner and husking buildings, boiler room, garage and sauerkraut factory. Estimated cost $120,000.

Wis., Hustisford — J. Hurley, Hartland, plans to build a 2 story, 75 x 150 ft. creamery and dairy, here. Estimated cost $50,000. Architect not selected.

Wis., La Crosse—The Anderson Vulcanizing Co., 215 State St., will build a 2 story, 30 x 50 ft. vulcanizing station. Estimated cost $15,000.

Wis., Madison—The Madison Supply Co., 615 East Washington Ave., is having plans prepared for the construction of a 2 story, 50 x 60 ft. bottling works and warehouse building. Estimated cost $40,000. R. A. Phillips, 315 Beaver Bldg., Archt.

Wis., Madison—The Valvoline Oil Co., 815 East Main St., is receiving bids for the construction of 2 40 x 50 ft. filling stations, including oil storage tanks, pumps, etc., on Lakeside St. Estimated cost $40,000. H. R. Potter, Mgr. A. D. Conover, Tenny Bldg., Archt.

Wis., Milwaukee — The Excel Mfg. Co., 3402 South Pierce St., awarded the contract for the construction of a 2 story, 60 x 180 ft. addition to its mill work factory. Estimated cost $45,000.

Wis., Milwaukee—The Palmolive Co., 15 4th St., (manufacturer of soap) will build a 1 story, 50 x 50 x 80 ft. addition to its factory. Estimated cost $20,000.

Wis., Milwaukee—The Random Lake Ice Co., 064 Locust St., will build a 1 story, 100 x 125 ft. ice manufacturing plant on Walnut St. Estimated cost $50,000.

Wis., Neenah—The Kimberly-Clark Co. awarded the contract for the construction of a 2 story, 65 x 120 ft. addition to its paper mill. Estimated cost $50,000.

Wis., Plover—The Whiting-Plover Paper Co., Stevens Point, awarded the contract for the construction of a 3 story, 40 x 108 ft. paper factory unit and beater room, here. Estimated cost $50,000. E. A. Oberweiser, Mgr.

Wis., Random Lake—The Krier Preserving Co., Belgium, is receiving bids for the construction of a 1 and 2 story, 50 x 240 ft. cannery, consisting of a main factory, warehouse, sheds and power house, here. Estimated cost $100,000. Private plans.

Wis., Sheboygan—The Vulcan Last Co., Crandon, plans to build a 2 story, 75 x 125 ft. shoe factory, here. Architect not selected.

Wis., Wausau — Oppenhamer & Obel, Archts., Spencer Bldg., are receiving bids for the construction of a 3 story, 50 x 180 ft. shoe factory for the Marathon Shoe Co., 1st Ave. and Cedar St. Estimated cost $60,000.

Wyo., Rawlins—The Producers' & Refiners' Co., Caspar, awarded the contract for the construction of a refinery, 10,000 bbl. capacity, on a 2,800 acre site, here.

N. B., St. Johns—The Stephen Brick Co., Prince William St., plans to rebuild its plant which was recently destroyed by fire. Estimated cost $100,000.

Ont., Goderich — W. Baechler plans to build a woodworking plant and sawmill. Estimated cost $50,000.

Ont., Lindsay—The Gull River Lumber Co. plans to build a dry kiln and lumber warehouse.

Ont., Owen Sound — Bd. Educ., W. H. Wright, Chn., awarded the contract for the construction of a 3 story, 100 x 300 ft. technical school on 5th Ave. Estimated cost $200,000. Noted June 8.

Ont., Petrolea—B. P. Corey plans to build factories for the manufacture of grease, oil and gasoline, also tanks for storing raw materials. Estimated cost $100,000.

Ont., Rannoch—W. Zurbrigg, c/o J. H. Jameson, St. Marys, plans to build a saw and planing mill, here. Estimated cost $25,000.

Ont., Stratford — Stratford Frames & Novelties, plans to vote on by law in January for the construction of a factory for the manufacture of various lines of woodwork. Estimated cost $50,000.

Ont., Toronto—Lawrason & Doughty, 42 Church St., awarded the contract for the construction of a 4 story, 80 x 100 ft. paper carton factory. Estimated cost $150,000.

Ont., Welland—The Welland Cotton Co. having plans prepared for the construction of a 1 and 2 story, 100 x 350 ft. cotton mill on Borger St. Estimated cost $250,000. J. T. Grantham, Pres. Private plans.

Que., St. Hyacinthe — Penmans, Ltd., Paris, Ont., is having plans prepared for the construction of a woolen mill on Girouard St., here. Estimated cost $100,000. J. M. Moore, 489 Richmond St., London, Ont., Archt.

945

American Machinist

Volume 57 NEW YORK, DECEMBER 21, 1922 Number 25

Making Steel Balls

Description of Methods Used by the Atlas Ball Company to Produce Steel Balls—Methods Rather than Skill Produce Desired High Quality

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

TO MAKE A STEEL ball which must be so round that the most refined machine shop methods will not be sufficient to discover a deviation from the ideal, which must be made to a given diameter and shall not be more than $\frac{1}{10}$ of a thousandth of an inch oversize or undersize; which must be of extraordinary hardness throughout and which must be finished to such a high degree of polish and perfection that a strong magnifying glass shall not disclose the minutest impression or scratch, would seem quite a task. If such a feat had been accomplished, say 100 years ago, volumes would have been written about so remarkable an accomplishment. To make thousands of such balls, all alike and all of the same degree of perfection would seem to border on the impossible and yet this is the daily task of the Atlas Ball Company of Philadelphia, Pa.

FIG. 1—INSPECTING STEEL BALLS

We are so familiar with steel balls and their use that we fail to appreciate the remarkable qualities they must possess. Like many other things which we meet daily, we take them for granted. Perhaps the most important lesson we can learn when we follow the manufacture of steel balls is, that method and system are of more importance than individual skill and that they can accomplish things which are beyond the ability of an individual. One hundred years ago it would have required a super-mechanic to make only one ball and it is highly improbable that he would have succeeded. Now millions of balls are made, not by skill, not by super-mechanics, but by application of the proper methods and the proper system.

The ordinary method of describing the manufacture of a product is to begin with the material. We propose to reverse this process because what the observer is interested in is the finished ball and probably the first question he will ask himself is: How is it possible that one can be sure that the balls are made to the proper diameter and all alike, if their allowable variations are so exceedingly small? And so we will begin with the inspection.

The girl, shown in Fig. 1, is engaged in the task of inspecting the finished balls. It will be noted that she wears gloves. After the balls have been polished it is not permitted to touch them by hand because, though they may be oiled, the touch of the finger will cause them to corrode, not immediately but some time later.

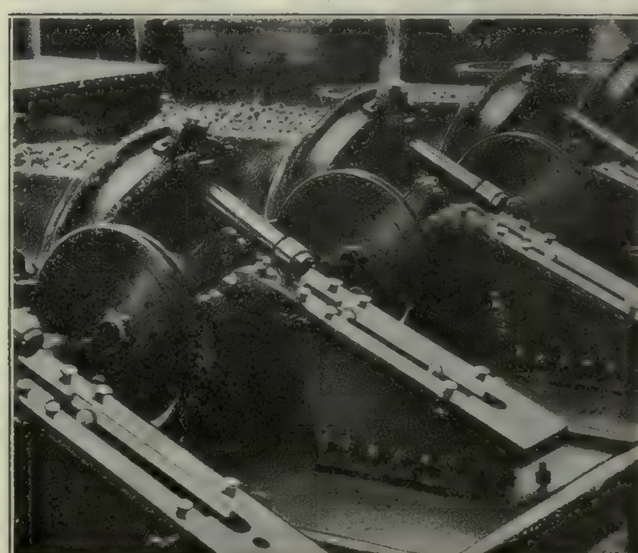


FIG. 2—MECHANICAL GAGING DEVICE

The balls to be inspected are laid on a slightly inclined desk so that a white cardboard placed at the end will throw a bright reflection of light on the balls causing them to appear partly a bright white and partly dark. That portion which is turned toward the card board appears white.

The inspector has another piece of cardboard in her hand which she inserts under the balls causing them to turn. She is constantly moving them so as to expose new parts of their surfaces to the bright reflection. The minutest scratch can be discovered in this manner. Sometimes there is a de-carbonized spot in the ball, a

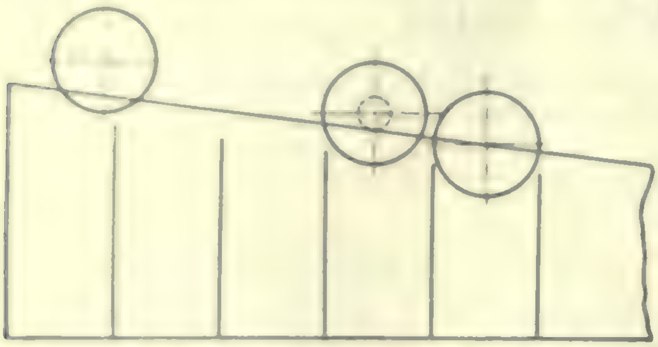


FIG. 3—DIAGRAM SHOWING ACTION OF BALLS, ROLLING DOWN THE INCLINED PLANE OF THE GAGING DEVICE

spot which is not quite so hard as the rest of it. Such a spot appears like a faint cloud. Balls which are not perfect are removed by means of a pencil-like magnet, which the inspector holds in her right hand. When inspecting the smaller balls, she holds a small chamois bag in her hand into which she drops the imperfect balls

It is interesting to watch how the little magnet is manoeuvred. The ball is picked up at one end and lifted

FIG. 4—TESTING STANDARD BALLS BY THE MINIMETER

by the magnet. Holding the pencil at a certain angle, the ball is made to slide along the magnet until it reaches the non-magnetic center when it drops into the open chamois bag. The entire operation goes very quickly. And, by the way, the upright pieces of cardboard are of such a size, and are so placed that the exhaled breath is deflected toward the operator, thus guarding the balls against corrosion.

The balls which are found to be imperfect on inspection may have different degrees of imperfection. There may be a single very small scratch or impression which, of course, makes the ball unfit for this particular size but allows it to be repolished for a somewhat smaller size. It should be remembered that balls are ordered not merely of standard size, such as for instance ¾ in., but that they are often required to be, let us say, ¾ in. plus 0.001, or maybe minus 0.001 in. When the imperfection is slightly deeper grinding may take it out. Whatever is done later on with the imperfect balls they are always followed up as "imperfects" and if it is found that a second grinding does not remove the imperfection, the ball is scrapped.

There are some balls which are merely unsuited for the particular size for which they were intended, others have real defects and must be scrapped. It is for this reason that the inspector is provided with a tray with a number of partitions in which the different kinds of imperfect balls are placed after inspection.

Before the final inspection the balls are measured. All Atlas balls are guaranteed to be not more than 0.00005 in. above or below the desired size. When speak-

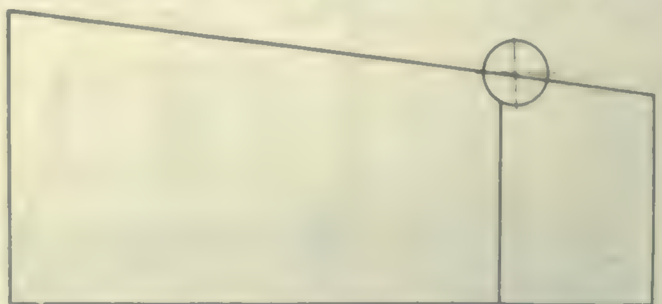


FIG. 5—DIAGRAM SHOWING PRINCIPLE OF GAGING DEVICE AS USED BY THE ATLAS BALL CO.

ing of the amount of finish left for a certain operation or of the amount of tolerance, the Atlas people speak in tenths of a thousandth so that when they say that a ball should be 20 over-size, it merely means that it should be 0.002 in. larger than the nearest standard size.

A common way of sorting balls is to let them run over an inclined plane such as shown in Fig. 2. The plane is made by two beveled straight edges which are set at a slight angle so that the opening at the top is somewhat less than that at the bottom. In some factories balls varying as much as 0.001 are inspected that way and the space under the straight edges is provided with 10 divisions so that if, for instance you were inspecting half-inch balls, a ball of 0.4995 in. would drop at the top of the inclined plane in a compartment; another one which would be exactly ½ in. would drop in the 6th compartment, whereas one of 0.5004 in. diameter would drop in compartment 10. In this manner, it is supposed that the balls in each compartment are of the same nominal diameter and perfectly to size within $\frac{1}{10}$ of a thousandth. This method, however, is not sufficiently refined to be absolutely sure about the correctness of size.

In Fig. 3 the action of the inclined plane is shown in diagrammatic form. When the ball is resting on the inclined plane somewhere near the top, its center is quite some distance above the incline; when it has come to the last compartment, that is, the one in which it will drop, its center is exactly on the incline. On the last but one, the center of the ball is so near the incline that the ball while rolling down turns on an exceedingly small diameter. The small circle shown is the one on which it turns.

We see then that the ball has considerable speed at the upper part of the incline and that, though it has been rolling for some time and might be supposed to have gathered speed, yet it will have exceedingly low speed when it is about to drop through the slot. It is therefore likely that great accuracy will be obtained at the lower end of the inclined plane but that the speed at the upper part is too great to be sure as to the exact compartment in which the ball will drop. Besides, to work correctly, the two straight edges must be very straight, something which is not easy to get or to maintain.

The Atlas Company, realizing these conditions, does not attempt to separate the balls into 10 different sizes. The company starts out by making the balls so nearly correct that the only thing necessary is to apply the "go" and "no-go" gage, in other words, to eliminate those balls which are either too large or too small. For this purpose the inclined plane or rather the two straight edges are set again at a slight taper but there is only one up-right in the box below, thus making two compartments. When setting the testing apparatus a standard ball is used which, before using, is compared by the chief inspector with Johansson blocks.

Figure 4 shows the action of testing a standard ball. The minimeter used for this purpose will indicate ac-

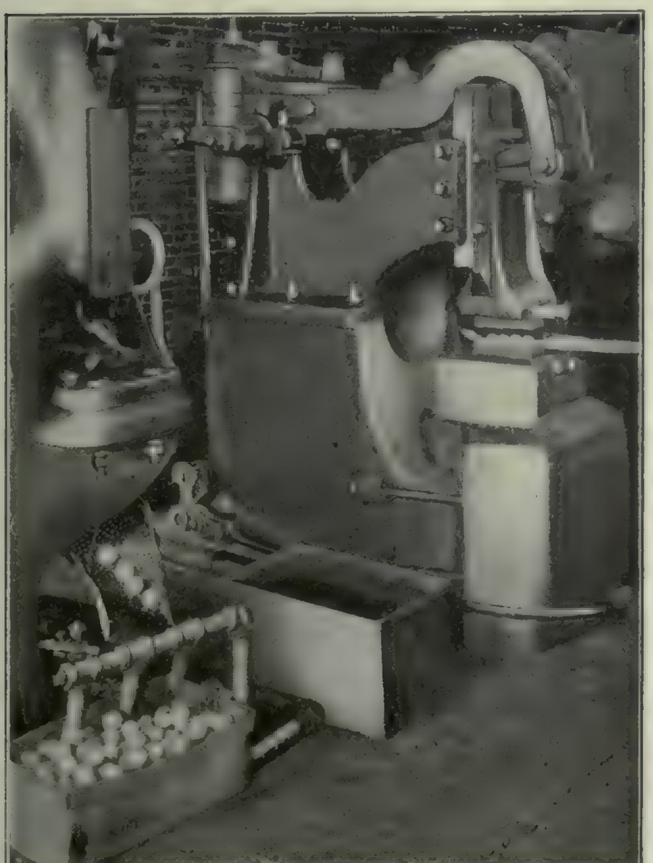


FIG. 6—FORGING STEEL BALLS. ALSO SHOWING HOT PRESSED BALLS COMING FROM THE PRESS AND COOLING DEVICE

curately to a 40th of one thousandth, that is to say, it compares to that limit though it does not measure. Johansson blocks are piled up to the correct size and the minimeter is set so that the hand points to 0. A magnifying glass in front of the dial of the minimeter makes it possible to make this setting very accurate. The standard ball is compared with this minimeter setting and if the result is satisfactory the ball is used for the setting of the straight edges of the inclined plane.

In Fig. 5 the inclined plane is once more shown in diagram. This time it is arranged as the Atlas Company arranges the device, that is, with only one partition. The straight edges are set so that the standard ball will drop to the right of the partition. The setting is made so accurate that a ball of the correct size will fall and strike the partition as is shown in the illustration. The vertical center line of the ball is slightly to the right of the partition.

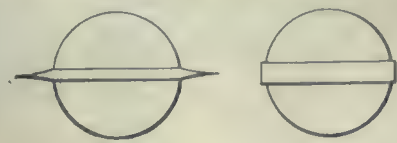


FIG. 7 FIG. 8

FIG. 7—DIAGRAM SHOWING NATURE OF FIN PRODUCED BY COLD PRESSING. FIG. 8—DIAGRAM SHOWING HOW FIN IS CHANGED BY ROLLING BETWEEN HARDENED PLATES

Should a ball be ever so little too small it will drop to the left of the partition. In either case, its speed before dropping is very small. With this arrangement of the straight edges it is unimportant whether these straight edges are really straight or not so long as there is only one point at which the standard ball will drop.

As a matter of fact, the balls used for setting the machine are not the standard size but the maximum and minimum allowable sizes. As Fig. 5 is arranged, the minimum size ball has been used so that all balls dropping to the right of the partition are above the minimum whereas all balls dropping to the left would be below the minimum and should be rejected.

After the balls have been gaged in this manner they are once more run over the inclined plane, this time set for maximum so that all balls dropping to the left of the partition are below the maximum while those dropping to the right are above the maximum and are therefore rejected. At the end of the two inspections we have balls which are above the minimum and below the maximum and therefore correct. In reality, two gaging machines are set up at the same time, one for "go" and the other for "no-go." As we have seen how inspection takes care of size and quality we will show now how this quality is obtained.

Sizes of Balls Made

The balls made by the Atlas Company range regularly from ⅛ in. to 2½ in. Larger balls are also made but not as a regular product. Such a wide range of sizes requires, of course, different methods of manufacture. It is rather remarkable, considering the wide range of sizes that in the main the same methods are used, there being certain differences only in the first operations.

The smaller balls up to $\frac{7}{16}$ in. are cold pressed. Larger ones up to 1½ in. are hot pressed and still larger sizes are forged. A number of balls are forged at the same time under the Bradley hammer. This operation is shown in Fig. 6 and needs no further explanation. In the foreground a press for hot pressing is shown and 4 balls are rolling along a sheet toward the box in which they are received. It will be noticed that a pipe is arranged over this box. This is a compressed air pipe which assists in cooling the balls.

The cold pressing of the smaller balls is done on a rivet machine and offers no difficulties except that it is necessary to cut the slug closely to size so as to avoid

excessive fin. Such a fin extends around the ball as a thin sheet, shown in a somewhat exaggerated form in Fig. 7. Though the amount of metal in the fin is very small its shape would cause trouble when these balls are placed in the grinding machine. For this reason they are sent through a machine where they are rolled between hardened plates which changes the fin over to a form as indicated in Fig. 8. Though there is

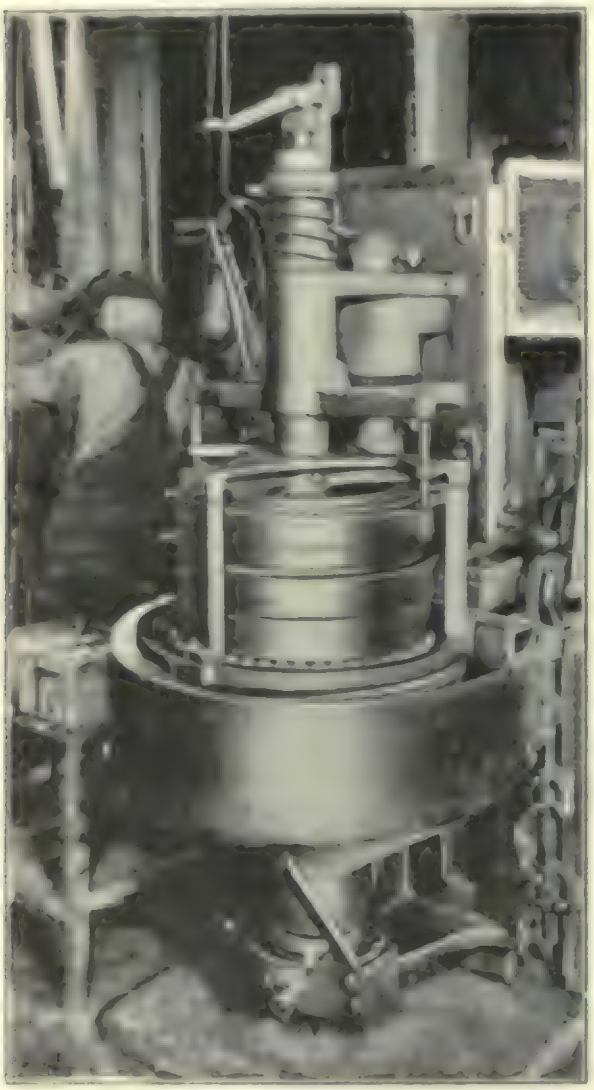


FIG 9—ROUGH GRINDING MACHINE (VERTICAL)

almost as much metal in this fin as there was before, it no longer causes trouble when grinding.

Such fins are not produced by hot pressing or forging. When hot pressing, the heated slug drops automatically from the furnace on to a plate where it is gripped by a pair of fingers and brought in position, after which the fingers retreat just before the upper die comes down. The fin caused by this operation is very small and does not need to be removed. Neither is there a fin when the balls are forged. In that case there is merely a small projection left at the point where the balls are separated. Figure 6 shows how a number of balls are forged at the same time.

The material used for the smaller balls, that is, for those which are cold pressed, is cold drawn wire. The length of the slug is about $1\frac{1}{4}$ times the diameter of the wire. From this the correct diameter for each size ball can be easily calculated. The wire may be 0.002 in. over-size or under-size. The hot pressed balls are made of cold drawn rods which are allowed the same variation from standard, while the material for the forged balls is hot rolled bars with 0.005 in. permissible variation below and 0.009 in. above standard size.

The operations vary to a certain extent according to whether the balls are made of cold pressed or hot pressed and forged material. In the latter case the following list of operations obtains:

First operation — Annealing
Second operation — Rough grinding
Third operation — Hardening
Fourth operation — Rough grinding
Fifth operation — Oil lapping
Sixth operation — Hoffman grinding
Seventh operation — Polishing
Eighth operation — Finish polishing, after which the operations are measuring and inspection as heretofore described.

In the case of small balls, the operations are as follows:

First operation — Rough grinding.
Second operation — Annealing
Third operation — Hoffman grinding in the soft state
Fourth operation — Hardening
Fifth operation — Hoffman grinding—hard
Sixth and Seventh — Rough and fiinish polishing

Allowance for Finish

The amount allowed for finish on the larger balls is 0.050 in. The rough grinding brings them down to about 0.014 in. over-size. The second rough grinding, after hardening, reduces that to 0.008 in. over-size, the oil lapping to 0.0025 in. and the Hoffman machine to 0.0002 in. over-size so that the rough and finish polishing removes $\frac{2}{10}$ of a thousandth regardless of the size of the ball.

In case of the smaller balls the amount allowed for finish is 0.020 in. The first rough grinding when soft, reduces this allowance to 0.012 in. The second grinding, still soft and which is done on the Hoffman machine, reduces this to 0.005 in. over-size. The final grinding, after hardening, also on the Hoffman machine, brings the balls down to 0.0002 in. over-size just as with the larger balls.

Figure 9 shows a vertical rough grinding machine which consists of an upper and a lower spindle, both rotating and *not* in line with each other. The upper spindle carries a disk with a number of concentric V-grooves in which the balls are located. The lower spindle carries a grinding wheel. The eccentricity is such that every part of the rim of the cup-shaped grinding wheel comes in action so that the balls cannot have a tendency to produce grooves in the wheel. The grinding is done dry as it was found that wet grinding was not satisfactory. It will be noticed that the upper spindle is forced down. The amount of pressure, however, is not very great, being about 70 lb. to 100 lb. in all. The rotation of the two members causes the balls to travel in the grooves and the eccentricity of the grinding wheel in relation to the upper member causes the balls also to turn in the direction of the radius of the upper member so that every point of the ball is at some time exposed to the action of the grinding wheel.

When these balls come out of the machine they show a large number of small facets with parallel grinding scratches.

(To be concluded next week.)

Details of Diamond Boring Tools

Recommended Sizes of Boring Bar—Angle for Setting of Tools—Methods of Sharpening—Kind of Diamonds and How They Are Inserted in Tools

BY G. T. LINTING

THE SUCCESS of any diamond boring tool depends quite largely on whether the boring bar which carries the tool is as close a fit in its guide bushings as possible. The boring bars should be as large in diameter as possible, and should be provided with the hardened wearing strips shown in Fig. 1. These strips fit hardened steel bushings in the boring fixture as tightly as possible, and still turn without galling the bar or bushings. The bar itself is left soft.

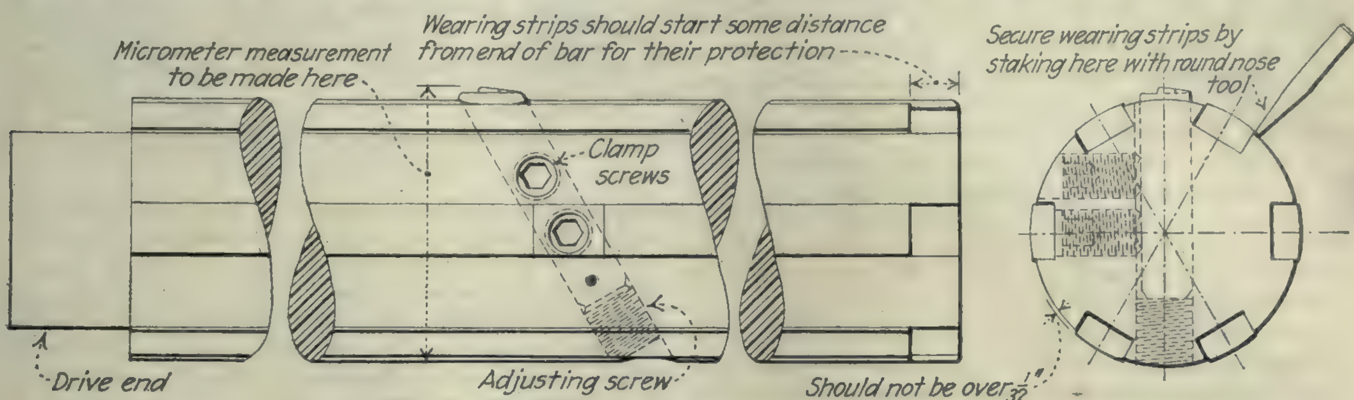


FIG. 1—BORING BAR WITH DIAMOND AND WEARING STRIPS IN PLACE

These hard wear strips in the bar have a certain purpose. After the strips have been worn undersize so that they do not fit the bushings, the bar can be restored by either inserting new strips or shimming up the original strips and then regrinding the bar to fit the bushings. Should these strips by chance become galled in the bushings the bar can be restored to its original size by the method just described.

The method of inserting the wear strips in the bar is as follows: Four or six grooves, depending on the size of the bar, are milled the entire length of the bar to within some few inches on the driving end. The strips may be from ¼ to ½ in. thick and from ½ to 1 in. wide and any length that can be conveniently carbonized and hardened. Any stock that will carbonize and harden may be used. The strips are hardened before they are forced into the bar, the edges having been previously milled to a light drive fit in the slots in the boring bar. The strips are forced into the slots and then staked in tight along the sides, as shown in Fig. 1. Screws are not needed to hold them in place. After the strips have been forced into the bar they are then ground so that they will fit the bushing in the jig.

The holes for carrying the diamond and steel tools are drilled and tapped for holding the tools firmly in place, as well as for adjustment. The tools are set at an angle other than a right angle to the axis of the boring bar, so that the tools can be measured with a micrometer over the edge of the tool and the bar. This setting is also employed in order that a longer tool many be used and may be more firmly held in the bar. The particular angle at which the tool is set is of no importance so long as its setting can be measured over the bar, as the left view in Fig. 1 indicates.

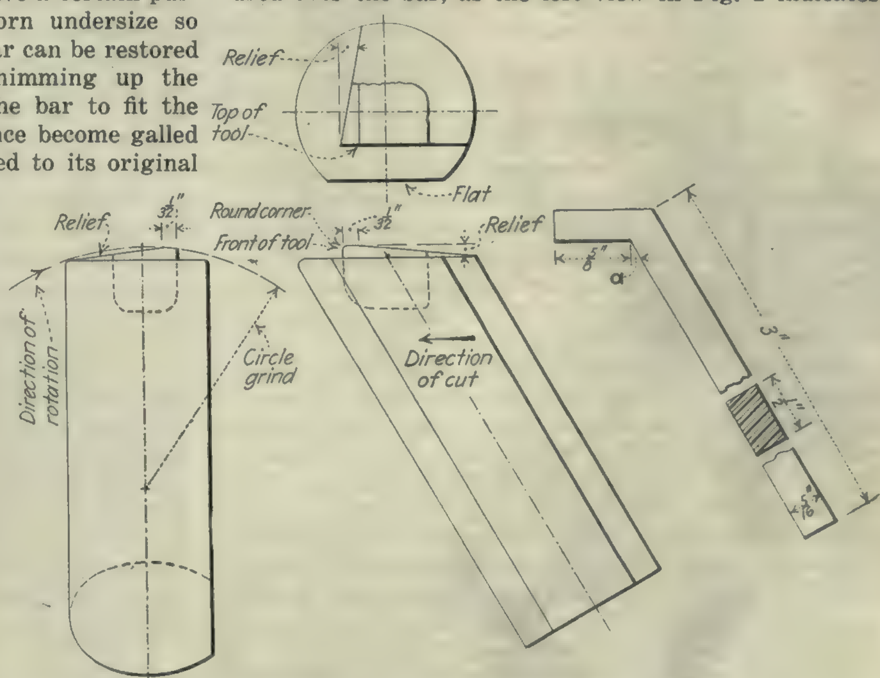


FIG. 2—DETAILS OF SHANK WITH DIAMOND FASTENED TO IT AND GAGE FOR CHECKING RELIEF AND ANGLE

The diamonds used for boring tools should be the finest quality of Brazilian Carbonado. Although they are the kind used for rock drills, they should be selected for a fineness of texture and for freedom from cracks or irregularities in formation. The diamond is first roughly lapped to a cutting edge then fastened in the

This article supplements "Using Diamond Tools in Motor Building" by the same author, published on page 437 of *American Machinist*. The additional data have been furnished at the request of the editors of *American Machinist*.

bottom of a metal mold with brass wire. The mold is then filled with a molten metal, an alloy which has a melting point of about 2,000 deg. Fahrenheit. Fig. 2 gives the details of the shank and the diamond attached to it, as well as the details of a gage for checking the relief and angle.

After cooling, the shank in which the diamond is now firmly embedded is removed from the mold turned to the size desired which is usually from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter and from 1 to 3 in. long. It is put in a dummy bar which has a hole drilled in it at the same angle as the boring bar and of a size to fit the shank. The diamond is then circle ground to a radius shorter than the radius of the hole which it is to bore, and is backed off the same as any fluted cutter leaving about a $\frac{1}{32}$-in. land. The diamond is then relieved at the heel leaving about a $\frac{1}{64}$-in. land parallel with the axis of the bar. A small steel wheel charged with diamond dust is used for all the grinding operations.

The face of the diamond is then ground perpendicular to the axis of the bar leaving the diamond projecting about $\frac{1}{32}$ in. out of the end of the shank. The front of the diamond is ground the same as the face and is relieved slightly toward the back. The sharp corner is slightly rounded so that it will not break off.

The method that should be followed in grinding or sharpening these tools is precisely the same as that employed in sharpening a steel single point boring bar tool except that care must be used, of course, to grind away as little of the stone as is possible. Care should be taken in setting the diamond tool in the bar to see that the cutting edge is parallel to the axis of the bar. To prevent injury to the diamond, the machine operator should be instructed to handle the tools with the same care he uses for any fine tool.

Factors of a Foreman's Success

By Robert Grimshaw

The factors making up a foreman's success might be laid down as the possession of those qualities that make almost any leader successful: Knowledge of his own qualifications, of his defects, of the abilities and limitations of those with whom he comes in contact, of the activity in question, and of the ability to impart his knowledge and make himself obeyed.

But some things might be pointed out as the potent factors in a foreman's success. They may be worth cultivating if nature has not been generous in this connection at birth, and if opportunity and environment have failed to make amends for those qualities which nature has neglected.

Perhaps the first factor that might be particularly singled out as desirable, is openmindedness. This is the willingness to admit that others do, can, or have an inherent right to know something; or can even be on the right side of a disputed question.

On broad general principles, the foreman is assumed to know more, even in petty details, than those under him. But if he cannot show this to the satisfaction of others he will be set down as wrong. Once his fallibility and ignorance are shown to exist and to be backed by his tacit or other declaration of infallibility, his influence for good, his strenuous seeking for progress in the work, his most earnest efforts for the betterment of his operatives' condition, are weakened, if not entirely destroyed.

Six Ways of Securing Co-operation and Interest from Your Men—Discussion

By Edward O. Perry

The article by E. O. Kuendig under the title given above on page 680 of *American Machinist* corresponds with the views and practice of the writer during long experience in the management of help.

I know of no condition in life where the Golden Rule is more applicable than in the relations between the employer and employee. Never ask a man to do anything that you would not willingly do yourself if you were placed in his position. Give them the benefit of every doubt, but remember that under good management there should be few doubts. Hard work and good pay, honestly earned, give greater satisfaction than any other policy I know of.

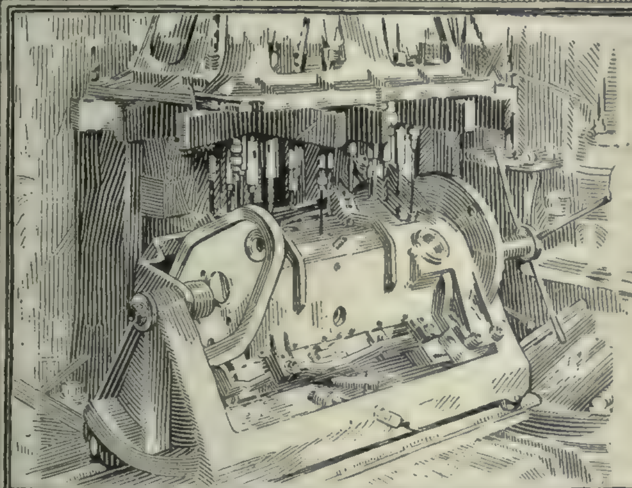
Operating on Straight Piece Work with a Heart in It

I will cite one case among many that came under my supervision where the policies mentioned by Mr. Kuendig were carried out to the utmost. It was in a plant manufacturing heavy, portable railway equipment, and which in addition to office and engineering departments, consisted of machine, foundry, blacksmith, boiler, paint, pattern and minor departments. The greatest number of men employed at any one time during my administration was about 1,100. It was an old institution and had been in the hands of a receiver for several years, but through the generosity of some of the people of the city in which it was located, funds were furnished to place it in operation again.

After a preliminary investigation of the plant, I took a position with the company as general superintendent and proceeded to make radical changes.

Straight piece work, with a heart in it, was the first innovation. In its introduction I met with bitter opposition from the workmen, the cause of which I soon located in a radical group that had been driven out of a large plant then on strike in a neighboring city. With this knowledge, I soon got rid of the trouble through the elimination of that element. I made it my duty personally to urge the acceptance of piece work by every one opposed to it. In order to make a good start, I personally set the prices and hired the help, and in general remained in close touch with every one along the line. In less than three months we had the machine shop and foundry on piece work, and the well filled pay envelopes of the men in those two departments were sufficient influence to bring the remaining departments into line without further effort. Before that time I had selected from the shop a cleancut, bright looking machinist for the position of chief inspector and rate setter, and I never regretted the selection, as he proved one of the most loyal and honorable men that ever worked for me.

It would be encroaching too much on your valuable space to describe all that was done to insure harmonious relations between the workmen and the company. There were secured for the former higher wages than they had ever had, and for the latter more profit than they had expected. More than that, the employers had the right to complete control of their business in all its details, without question from anyone, either inside or outside of their plant. All this was accomplished in the most satisfactory manner and perfect confidence established between the workmen and the company.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Piercing Dies Begun—Principles and Important Points of Piercing Dies—Plain and Button Dies—Punches, Dies and Strippers

PIERCING dies are often used for producing holes in work which has previously been blanked or formed, and also occasionally for making holes in flat stock from the strip. We have already discussed the use of piercing dies when the operation consists of blanking and piercing in progressive dies, and several points which have been mentioned in the preceding articles are also applicable in the design and construction of piercing dies.

Dies of this kind may be roughly divided into several types, although the dividing line is not sharply defined and the classification cannot be made very distinctly. Roughly speaking, however, the grouping is as follows:

Plain piercing dies, which are so designed that they handle plain blanks of various shapes or pierce the holes in sheet stock according to the requirements of the work.

Button dies, in which the dies are made in separate units and inserted in their proper locations in the die shoe. This form is economical, so that in manufacture and upkeep it is often used when the holes are a considerable distance apart. Button dies may be standardized to advantage when work is of such a nature as to require a number of them. Blanks of standard outside diameter can be made up according to the size of the holes required, after which it is only necessary to bore and lap the hole and fit the button to the die shoe.

Multiple piercing or gang dies are used when a number of holes are to be pierced close together in a given piece of work. Both dies and punches are of somewhat different construction than those previously described. The details of design and various points of importance will be mentioned specifically later in this article.

Perforating dies are often required in ornamental brass and silver work and for such parts as armature disks, slotted radial plates and both plain and cylindrical work requiring perforations of various shapes and sizes.

The construction of piercing dies is comparatively simple, yet when a number of holes are to be pierced in an irregular piece of work, the design must be carefully made and a construction used of the most approved form if best results are to be obtained. The designer who applies his knowledge of fundamental principles to the construction of dies and who studies not only the design but its application in actual practice, considering carefully at the same time the upkeep and preservation of accuracy, will discover new points of interest continually and find fresh food for thought in the solution of each problem presented. A number of important points regarding the design of piercing dies are given herewith; others will be mentioned in detail later.

(1) Laying out the work. The importance of this matter has been emphasized in previous articles several times and in the design of piercing dies also it requires fully as much consideration as those previously mentioned. A decision must be reached as to the best type of die for the work in hand and in what manner it can be handled most advantageously.

(2) Thickness of stock. It is essential that the thickness of the stock should be in correct proportion to the amount of material around the holes which are to be pierced. If the allowance is not sufficient the work cannot be pierced so as to obtain good results. Hence, this point should be considered at an early stage in the design. The diameter of the hole is also important, as it is not practical to punch a hole smaller in diameter than the thickness of the stock. When holes of smaller size than this are required, a drilling operation is usually necessary.

(3) Location of work. A great deal depends upon the shape of the work and whether the piercing die is to operate on strip stock or on separate blanks previously punched. The location depends to some extent on the relation which pierced holes must bear to other holes, slots or surfaces. Therefore the method of location must take these matters into consideration and must at the same time provide for the possibility of slight variations in the blanks. Obviously this matter depends very largely on the general shape of the work and its requirements. Particular attention must be paid to work requiring a high degree of accuracy.

(4) Guide for punches. Piercing punches are often small in size and therefore easily broken. Attention must be paid to proper support in order to avoid such a contingency. Usually the stripper plate acts as both

---

For the authors' forthcoming book.

guide and support, having a function somewhat similar to that of a bushing in a drill jig. In point of fact, bushings are often used in the stripper plate to guide and support the piercing punches and prevent breakage. The stripper plate therefore must be located carefully and so arranged that it can be used as an accurate

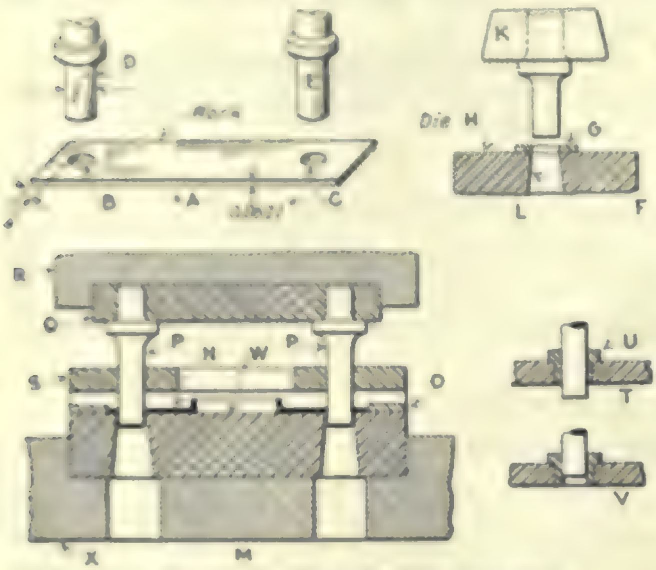


FIG. 482—PRINCIPLE OF PIERCING DIES

location and suport for the punches. Several examples illustrating this point are given in this article.

(5) General points in design. Consider carefully the operation to be performed as a whole. Look at it in a broad-minded way and with a large amount of common sense. Take up each point in design carefully and analyze the operation to make sure that suitable provision has been made for all contingencies. Consider the operator from the standpoints of both safety and convenience. Finally, design the dies so that they will produce the work in the shortest possible time, well within the required limits of accuracy and with suitable provision for upkeep when worn or broken through use, misuse or neglect.

Principles Involved in Piercing Dies

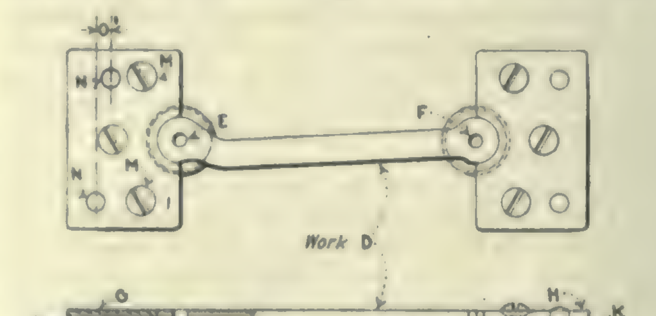
In piercing metal such as steel it is customary to allow an amount of stock around the hole to be pierced equal to or greater than ½ the diameter of the hole. It is possible to allow less stock than this in exceptional cases but it is not advisable, as there is always the possibility that the blank will be distorted when piercing so that the resulting product will be unsatisfactory. When a blank is to be produced having an amount of stock around the hole which is less than half the diameter of the hole, it is advisable to make a test by piercing a few pieces in a simple die rather than to design and construct one of more complicated form which may, under test, prove unsatisfactory. The experiment will demonstrate whether the stock will stand the strain of the piercing, and if found impractical to use a piercing die it may be better to produce the hole by means of a drilling operation.

Another important consideration in the design of piercing dies is to make sure that a hole of smaller diameter than the thickness of the stock is not required. In such cases the punch is subjected to an excessive strain due to the small diameter, so that it will not withstand the pressure and thus causes a great amount of trouble by breakage. Under certain conditions modifications may be found possible, but only after a series of tests has determined the advisability of it.

The principles involved in piercing dies are illustrated in Fig. 482. In the example shown at *A* the work is to be pierced at *B* and *C*. The blank is 6 in. long, 1 in. wide and 0.062 in. thick. The diameter of the holes to be punched is ½ in. and the distance between the end of the work and the holes is ¼ in. The punches for this piece are shown at *D* and *E;* and at *F* is shown a section of the die in which it is apparent that the work *G* rests on the die *H*, and that the punch *K* descends until it has passed through the work and entered the hole *L* in the die. When work of this kind is pierced, a slug is produced which passes through the die and bolster of the press and is generally caught in a box placed in a suitable position. As in blanking dies, the work must be carefully located when piercing is to be done, and the method of location selected is naturally governed by the shape of the piece which is to be pierced.

In the diagram at *M* a sectional view of a piercing die is shown which is used for piercing eight holes in the work *N*. This piece is round in shape, and it is located by "nesting" it in the locating ring *O*. The punches shown at *P* are fastened to the punch plate *Q* which is screwed to the punch holder *R*. Attention is called to the manner in which the punches are guided by the stripper *S*. In the diagram the punches are shown after they have passed through the work and are ready to be withdrawn.

In order to prevent the punches from binding or cramping in the work, it is necessary to use a stripper as indicated. It is apparent that when the punches are withdrawn the metal comes up with them until it strikes the stripper, which sheds the work so that it can be



A	B	C	D	E
½	¾	¼	¼	1°
¾	¾	⅝	¼	1°
1	¾	⅜	¼	1°

FIG. 483—APPLICATIONS OF BUTTON DIES

taken out of the die and replaced by a new piece. When the work which is to be punched is made of tough stock or when a hole of small diameter is being pierced, the stripper is of great assistance in stiffening the punch and guiding it to a correct location. In many instances it is found necessary to fit the stripper with bushings

in order to support it rigidly and at the same time provide accurate location. In the example *T* a stripper plate is shown having a bushing *U* mounted in it.

The diagram at *V* shows the punch in its furthest upward position, and the designer may note that the punch is not entirely withdrawn from the stripper or bushing when the punch-holder is raised. Referring to the section of the die shown at *W* to hold the work *N*,

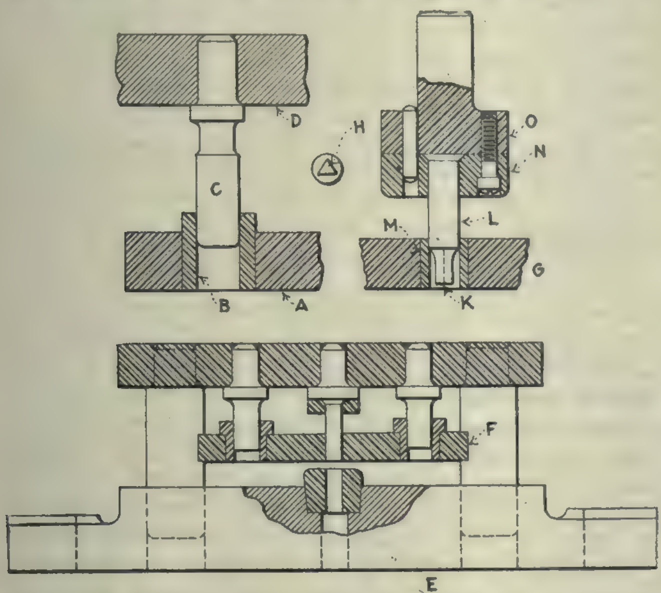


FIG. 484—STRIPPERS, STRIPPER GUIDE PINS AND PUNCH FOR HOLE NOT ROUND

it will be noted that the die is of solid construction mounted in a die shoe *X*. There is a considerable amount of steel used in this die which is unnecessary and the construction would be simplified considerably if button dies were used for this piece.

Button Dies

An application of button dies to a piece of work where the holes are a considerable distance apart is shown in Fig. 483. It also illustrates how dies of this sort may be standardized to some extent, thus simplifying and cheapening the manufacture. Primarily, a button die may be considered as one in which one or more cylindrical pieces of steel are substantially held and located in a die-shoe. Each button or disk has a hole through it for the punch to pass through after the work has been pierced.

At *A* the die shown is a cast-iron shoe having two button dies *B* and *C* mounted in it as indicated. The work *D* which is to be pierced at *E* and *F* is nested or located by means of the two plates *G* and *H*. The button dies project somewhat above the face of the die-shoe, and it is therefore necessary to make the locating plates of a corresponding height. The reason for setting the dies so that they project above the face of the die-shoe is to permit them to be ground a number of times when they become dull, thus giving long life to the dies. The locating plates, being built up to a height such that they conform to the height of the die, can be very easily adjusted after each grinding by taking off a corresponding amount from the filler plates. These latter plates are indicated at *K*, and both location plates and fillers are held by screws *M* and dowel pins *N*.

The dowel pins are staggered as shown at *O* in order that replacements of the parts may be made so that they will always come in the same position. By staggering the holes, errors in replacement of plates will be evident when reassembling after grinding, and as the plates can be put back in the original position only, incorrect assembling is avoided. When tapping the hole shown at *P*, care should be taken that it is tapped deep enough so that the screw will not bottom after the die has been replaced after grinding.

We have previously taken up the standardization of punch holders, punches and dies for blanking purposes. As button dies are used frequently, we have given in the lower part of the illustration just considered a table which shows the dimensions of button dies used for piercing various sizes of holes. In all cases the dies project ¼ in. above the face of the die-shoe and the angle on the sides is one degree. It is not necessary to fasten the dies into the shoe, because the slight angle of taper makes them fit so snugly that screws or dowels are unnecessary.

Strippers for Piercing Dies

Strippers for piercing dies are more important than those used for other purposes, as it is often necessary to support the punches by means of the strippers, particularly when punches are small and delicate. When button dies are used for piercing holes the stripper is often mounted on the punch holder. The method shown in Fig. 484 illustrates a construction somewhat different from that used in blanking dies. Here the stripper *A* is provided with a bushing *B* and a guide pin *C*, the latter being held in the punch holder *D* as shown. When the stripper is mounted in this way an accurate and

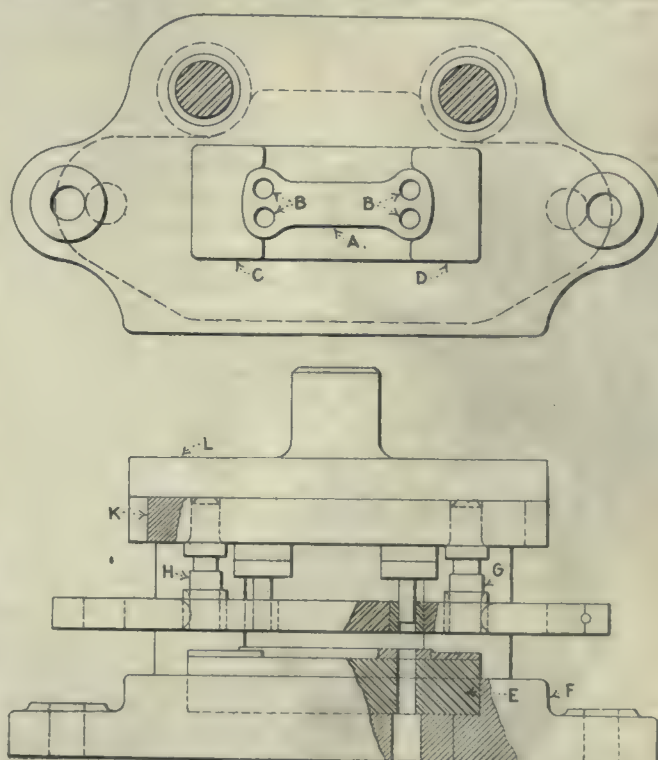


FIG. 485—DIE HAVING CAM STRIPPER

rigid support is obtained, which is essential for accurate piercing operations.

At *E* is shown the general arrangement when mounting a stripper of this sort. Stripper *F* contains two bushings and two guide pins which fit the bushings. The springs used in this stripper plate are not shown, as the diagram is only intended to illustrate the method in which the the guide pins are used. A button die is

shown in position, together with the punch which is used for the piercing operation.

It is frequently necessary to provide a bushing for the punch as previously mentioned, particularly when a small diameter or irregular shape is used. The punch in the example shown at *G* is of triangular shape, as indicated at *H*, and it has been shaped down as shown at *K* while the body *L* is round so that it fits the bushing *M*. The punch in this instance is of the wire type, and it is held in position by the cap end and the thrust is taken by the punch holder *O*. A construction of this kind is very frequently used in piercing dies, and it will be found satisfactory in many cases.

Cam Stripper

A cam stripper is often used in piercing operations, and its use is in connection with presses of special design. The operation is entirely automatic and is controlled by the ram of the press. This type of stripper comes down on the work and assists in holding it down and straightening it out if there should be a wrinkle in it, always assuming that the stock is not too thick. This stripper also keeps the work straight and in position so that it does not shift as the punches enter into it and pass through it. It remains in position holding the work until the punches have been withdrawn, after which it moves upward with the ram of the press. An arrangement of this kind has the advantage of preventing the blow against the lower side of the stripper plate, which with stationary strippers occurs on the return stroke of the slide, because the play necessary between the die and the face of the stripper permits the punched bar or sheet to draw up against the plate before stripping.

In Fig. 485 is illustrated a die in which a cam stripper is employed. The work *A* has four holes to be pierced in it in the positions indicated at *B*. The work locates in the set edges *C* and *D* and also on the die *E*. On account of the position of the holes, which are close to each other, a button type of die is not used in this case. The die is mounted in the usual manner in a shoe *F*. The stripper is provided with two guide pins at *G* and *H*, these being mounted in the punch *K* held in the punch holder *L*. The piercing punches in this case are of the wire type similar to those described in the preceding illustration and the general construction of the dies is of the sub-press or pillar type.

What About Machine Tool Prices? —Discussion

By F. P. Terry
Belfast, Ireland

The editorial under the above title on page 311, Vol. 57, of the *American Machinist* introduces a very interesting subject at the present time. Without doubt many intending purchasers are still "holding off" for further reductions, though there are many exceptions. The editorial mentions "That the machine tool builder has never charged enough for the product of his brain and skill," wich is undoubtedly true in substance and in fact. Why this is so it is not difficult to understand, but we cannot blame the builder, and, if the time has now arrived for a better state of affairs, he is fully entitled to the extra forthcoming. No doubt, in the past, machine tools have been the means of building up huge fortunes for the purchasers. They have been purchased on the basis of what they cost to build, after which they have been put to work producing articles that have been sold on the basis of what they will save, bringing profits to the manufacturer in many cases far beyond the wildest dreams of the machine tool builder.

If we look back a little into the history of machine tool building, we find that engineering firms began by building their own tools and in some cases supplying a few other firms with certain specialties at a good price on the take it or leave it principle, by which method they disposed of all their production, and it was this state of affairs that started firms to specializing in machine tools. The outlook was rosy and a few firms made money, but they soon found that they were up against a most unhealthy competition and unless prices were cut to the bone users of machine tools made them themselves, and many cases could be given where this was not only done but that the machine tool builder's own tool was used not only to provide a design but to produce its kind.

Some thirty years ago I was employed by a large firm engaged in producing several kinds of engines and hydraulic machinery. They had several good radial drilling machines without any maker's name thereon, and on enquiring into this, I was told that the old man some years before had purchased a radial drilling machine from a well-known machine tool firm and after getting a quotation for half a dozen was so staggered at the price that he decided to go into the business. The machine purchased was stripped down, drawings and patterns made, and from that time on they just made others as required. That he was stealing the machine tool builder's brain and skill he never gave a thought, although he was most particular about his own products.

A Well Known Occurrence

Hundreds of cases of this sort could, no doubt, be given by machine tool builders; many could be given by myself, but I never heard of a firm building its own supplies of other kinds, such as typewriters, time clocks, etc. Consequently it was this state of affairs that compelled the manufacturer of a turret lathe to make its cost as near as possible to the ordinary lathe, regardless of the saving it would effect, and so on throughout the line.

Only a short time ago I was in charge of a machine shop wherein to get machine tools always brought on a long debate on the enormous price, yet this same firm never hesitated a moment over foundry equipment, "owing to the labor saving effected," and a rough contraption of a few castings and bright drawn bars that would shake sand in or out of flasks would be ordered off hand regardless of what it cost to make. "It will soon save its cost" was the principle worked upon, and quite right too, but why it is not recognized more with machine tools is difficult to understand. Machine tools frequently save their cost many times over in what they produce, for which cash is drawn, and some manufacturers see and realize this, but it is regrettable more do not look closer into the matter. If they did, we would not see so many shops full of relics that have passed their day and generation, and the machine tool trade would be as busy as it deserves to be. In years gone by a few of these relics were very useful for starting the boys, but today, with lathes and tools simplified for this purpose, there is no excuse for their use, or the space they occupy, and to put a boy to work on relics only tends to injure his chance of success in life.

What's Wrong with the Railroad Shops?—IV

Suggestions Regarding Interchange of Information and Standardization of Parts and Methods—Remarkable Cost Keeping Systems

THOUGH A NUMBER of things were criticised in the previous articles, many more faulty conditions were observed and might have been mentioned, except for the fact that the world does not derive benefit from criticism unless it be constructive. On the other hand no improvement can be suggested unless it is first pointed out where improvement is needed.

This need for improvement may be evident to the outsider, but may not be appreciated by the man who has been working for many years under the criticised conditions. At the same time it must be remembered that the casual visitor may not have the proper perspective; that he sees details only and may condemn the whole because some of the operations are not so good as they might be. Straws will show in which direction the wind blows but, after all, a single straw does not tell us much; it may have dropped from the hay wagon and there may be no wind at all. However, when the place is full of straws and they all point in the same direction, we may safely assume that there is a wind and that its direction is the direction of the straws.

> WHY HAS there been no successful attempt to standardize parts, equipment or methods in the railroad repair shops of the country? The element of competition is absent and the work in all the shops is much the same, yet hardly any two shops do the same job in the same way. The cost keeping systems are bad, but no worse than many that may be found in other shops. We are not concerned with the other shops, however, nor with excuses for existing faults. Neither are we trying to blame anyone for any particular thing nor for the whole situation. Our sole purpose is to point out the more obvious difficulties and to suggest, in so far as we are able, remedies that may be applied without adding appreciably to the expense of the railroads and without running afoul of the regulatory bodies that are undoubtedly with us to stay.

In the case of the railroad shops, there were so many straws that we were confronted with what the Frenchman calls "L' Embarras du choix." It was difficult to choose from the many things we saw those cases which could be handled in a few short articles in such a manner that both the trouble and remedy would be apparent to the reader.

Let us take the matter of the driving wheel lathe and see what improvements a few observations may lead to.

In one shop a hard tool was found in the machine and in another a soft one. These tools were not made of the same kind of steel, yet both had to do the same kind of work, and therefore, might have been identical. For aught we know there may be many different kinds of steel used for this purpose and they may be heat-treated in many different ways. It is almost certain that one or two of the different kinds stand out above the others, and as railroad shops are not competing, there is no reason why all the shops should not use the particular kinds of steel and the particular ways of heat-treating that have been found to give the best results. All that would be needed then is a system of intercourse between the shops, not only of one but of all railroads.

Just imagine a society of master mechanics and superintendents with a paid secretary. All improvements in methods and operations are reported to the central secretary, who, at fixed intervals, informs every shop of the latest developments. If, for instance, a new kind of steel is tried out in one shop and is found superior to what was formerly used, this experience would be circulated. It would not be long before a sufficient number of tests had been made by a number of the shops to show beyond a doubt whether this steel is really superior for the purpose or not. It would probably cause communication of a number of other experiences either with the same steel or with other kinds. Some shops might have used this steel but with different results and might want to know why one shop could use it to advantage when another shop had to abandon its use. In short it would be very probable that there would be an exchange of experiences and ideas which would bring out not only the qualities of the steel under discussion but many other desirable and undesirable features and conditions about shops, equipment and methods. The same would apply to the heat-treatment, the shape, the angles, the dimensions, the supports for tools and whatnot.

This sort of thing cannot be done in the manufacturing industries because there is but seldom a sufficient sameness of material or product, and, even if there were, competition would not permit a manufacturer to make his improvements public and of benefit to his rival. However, such conditions do not prevail in the railroad shops. Here the product is the same—let us say driving wheels—same general shape, same material, same nature of cut, same type of machine used. Furthermore railroad shops are not competing so that there would be no business reason why any one shop should hold its methods hidden from others. We have a set of conditions here which permits of thorough co-operation and which might lead to beautiful results. Maybe there is an organization such as was suggested, but if so it has failed to work for the results are certainly absent.

Such an organization would do what is regularly done by the engineering department of an industrial company having a number of plants. Any improvement in tools or methods in one plant is handed over to all of them and the plant manager who failed to adopt a tested-out improvement would have to put up a very strong argument indeed to escape severe criticism.

This exchange of ideas is merely a method of standardizing. It is the collecting of data and applying them, work which is constantly going on in any well regulated shop. It costs some money but it pays; and, mark, each shop has to do this work for itself while railroad shops

are in a position to do it co-operatively, getting the full benefit for a small fraction of the cost. Not only that, but they would get greater benefit than any single shop would obtain because there are more experimenters and more observers.

It has long been recognized that standardization is one of the most important methods of reducing costs and expediting work, not only standardization of methods but of equipment and product, of tools and operations. Always excepting the exceptions there is very little evidence of standarization in railroad shops. Holes are rebored to any size that will make a clean job and the shaft or axle is fitted to this hole. There is no good reason why there should not be a few standard sizes to which such holes must be rebored. If this were done the male pieces could be made while the other pieces are being bored and they could be made in less time and by less skillful men. Furthermore, they could be kept in stock, thus avoiding all delay. This lack of standardization is not confined to the boring of holes. It is found everywhere, in sizes, in parts, in methods and in equipment.

More and Better Gages Needed

Standardization of parts and dimensions cannot be carried out without proper measuring instruments and gages. These are almost completely wanting. A micrometer is as rare in the railroad shop as in the average foundry, and gages are so conspicuous by their absence that the sight of an occasional one comes as a shock. At that, these few gages are generally of the crudest kind. One may find a rod to gage the bore of a tire and then see the workman try to balance a 12-in. scale at the end of that rod to make up for shortage.

There are many parts which could be kept in stock; there are others which, when not kept in stock, could be made to standardized dimensions and one naturally asks why this is not done.

The answer can only be guessed at. Gages cost money and such expense cannot be charged directly to repairs or maintenance or even to equipment, as is generally understood. They must come as part of a plan of action which may originate with the shop management but cannot be decided upon by them. Parties higher up must give authority to carry such a general plan into effect and they, as a rule, are not sufficiently familiar with shop operations to understand the importance and the ultimate economy which is certain to result from the purchase of fine instruments and gages which are capable of measuring to a much higher degree of accuracy than the rough work of repairing locomotives seems to demand. *Seems* to demand, we say, because, as a matter of fact, just as close limits are required for the proper fitting of locomotive parts as for typewriters and guns. An extra thousandth of an inch in the diameter of a driving axle makes a great deal of difference in the amount of pressure required to force it into the wheel. A few thousandths short in the bore of a tire increases the initial stress greatly.

Another possible reason why so few gages are used may lie in the fact that the rules do not permit the shop to make parts except on definite repair orders. Here again exceptions can be found but it can be stated as a general truth that most railroad shops live from hand to mouth. This minimizes the good effects which standardization might have.

Then there is perhaps that little vicious cycle of reasoning one always finds where conditions are not as they should be. The cycle may be something like this: We do not make more than one piece at a time because we have to fit them anyhow; and we fit them because there are not standard dimensions. We cannot have standard dimensions because we have no gages and what would be the use of gages if we make only one thing at a time and must fit it? Of course, such a complete cycle never passed through anyone's head but all of the elements may have at one time or another.

The thing to do is to break away from all existing conditions, from all reasons, excuses and alibis and start a new deal. Study out what would be the proper method of handling the work and get the best, quickest and most economical result; scheming as if there never had been a railroad shop. See where this ideal method differs from the one now employed and get ready to switch onto the new track. Not suddenly, not by tearing things up by the roots, but gradually, starting in with those things which will give the greatest results in the shortest time and with the least amount of expense.

Standardization is one of the things which can be introduced without a revolution, bloody or otherwise. It can be introduced piece-meal and does not require much equipment. A few micrometers and a little instruction will go a long way.

It does require, however, that the powers at the top should have confidence in the scheme and in the men who are to handle it, and it may be necessary for them to get somebody who is familiar with modern shop methods to help the shop manager over some of the rough places and point the way to him; for rough places there always are when one climbs from a rut onto the broad highway.

It may be argued that standardization cannot be carried out in some cases and would be of no benefit in others and this is undoubtedly true; but one should not condemn a scheme just because it is not one hundred per cent applicable. Such one hundred per cent perfection does not exist and should not be expected, yet the fact that a new method is not applicable to everything in the shop has often been the cause of its rejection when 90 per cent of the work might have benefited by it.

The lack of contact between the average railroad shop and manufacturing plants is vividly exemplified by the case mentioned in the first article where a number of geared head engine lathes were the tools intended for the manufacture of brass parts. Whether the shop was ill advised or whether the purchasing department refused to follow the recommendation of the shop we do not know. It was probably the former because the department was pointed out with a certain amount of pride. That such equipment would be used in any manufacturing plant for that same purpose is almost unthinkable.

Evils of Lump Purchasing

We venture to make a guess which probably is not far from the truth. We know of many cases where a list of equipment was issued to machinery makers and dealers who were invited to bid. In many such cases the entire list was covered by a single dealer who, not being able to furnish the exact equipment asked for, substituted such machinery as he was able to furnish. In doing so it was possible for him to reduce the price on some of the substitutes below what would have been a reasonable price for the machinery originally asked for. As a result that dealer would get the entire order, not because what he offered was superior to what anyone else had to offer, but because the total purchase

price was lower than could be secured by buying some machines from one and some from another dealer or maker. It might very well be that something similar happened in the case mentioned here. Whatever may be the case we consider it a glaring example of inefficiency and perhaps better illustrative of the lack of proper system, proper control, engineering knowledge and knowledge of manufacturing methods than anything else we observed.

One of the points mentioned in the last article was that a skilled blacksmith was making cold chisels and had a set of dies to assist him. Was he making them because the peculiar system of cost keeping made it appear as if the article could be manufactured more cheaply than it could be bought outside? It is of course very unreasonable to suppose that such is actually the case. A manufacturing plant which has all the tools and facilities for making an article in large quantities is certainly able to manufacture it at a very much lower cost than it can be made by hand and in smaller quantities. We say that the cost keeping system may possibly make it appear as if the article were cheaper than it actually is, and we have reason to think so because we found in another shop a system of computing the cost of axles made out of scrap which made them appear to cost less than half of the actual cost.

The amount of scrap used for an axle was not weighed but the finished forging was and it was figured that the amount of scrap originally used was equal to the weight of the finished forging. In order to make some money on the transaction the axles were forged from 16 to 24 in. longer than was required for the finished piece and the stub ends were cut off, that is 8 to 12 in. at each end. These ends were thrown into the scrap and the shop got credit for these pieces at scrap prices. If this shop had been a little bit more daring it might have made the axle forging come twice as long as required in which case the material would not have cost anything at all.

Other Costs Ignored

We hardly want to mention the fact that no loss of freight income was figured in. As a matter of fact this should have been done because if the scrap had been sold it would have been carried over this particular railroad and there would have been an income from this source. Nor was freight charged on scrap brought in from other shops or roundhouses on this road. The ingenious way of figuring the cost of this axle made it appear a very much cheaper article than anything that could be bought. Such bookkeeping, in any other concern, would soon put the company on the rocks but as the shop is only one of the minor elements of a railroad, the glaring faults lose their importance, or at least seem to do so.

That the railroad shop is handicapped in its methods, in its cost keeping and in many other items by the Governmental regulations is well known. We wish to point out here that we are not criticising any particular person or even the entire company. We are criticising conditions as we saw them.

There are many machines in a railroad repair shop which are not used all the time and some which are used only occasionally, but the greater part of the equipment is used quite regularly just as in the average manufacturing machine shop. Even if all of the machines were idle part of the time it would be good policy to have them clean, well adjusted, in good repair and up to date.

The workman cannot take pride in an old relic, particularly when it looks twice as old as it is with its battered T-slots, bent spindles, bare paintless spots, broken handles and the accumulation of dirt of which the lower layer was started 40 or more years ago. If the man takes no pride in his machine the chances are that he takes no pride in his work and that he won't even produce up to the capacity of his machine, small as it may be. It is a well understood principle in the average manufacturing plant that clean and neat surroundings will produce more and better work and keep the man better satisfied. Recognizing the fact that it is more difficult to keep a railroad repair shop in prime condition than most other machine shops because the work done there is repair work and means the dismantling of dirty machinery, realizing all this, we can yet see no reason why some of the railroad shops should be in the extremely dirty condition in which they are. That there is really no fundamental reason is proved by the fact that there are other railroad shops which are kept as reasonably clean as one might expect under the circumstances. However, this much can be said of practically all of them that the equipment is more battered and less taken care of than one finds in the average shop.

Preparation and Properties of Pure Iron Alloys

To protect life and property it is necessary that the architect and engineer know the kind of steel which should be specified for each use. To know what composition a steel should have to stand a certain amount of strain or meet the necessary requirements, the effect on the steel of each of its constituents must be known. The general effects of each of these constituents have long been commonly known, but technical difficulties have hindered really thorough studies of the specific and exact effects of each of the elements. Very pure iron is difficult to prepare, and it is even more difficult to add a controlled amount of some one constituent of steel to pure iron without some contamination.

In the belief that an accurate knowledge on this matter is desired by the engineering profession, and that such knowledge would prove beneficial to industry in general, the Bureau of Standards of the Department of Commerce has just issued Scientific Paper No. 453 dealing with the fundamental principles involved in the manufacture of steel products. The paper is entitled "Preparation and Properties of Pure Iron Alloys," and contains the results of a very careful investigation.

In this investigation iron of practically 100 per cent purity was prepared by an electrical method similar to the method of silver plating in which the metal is deposited from a solution by the passage of an electric current. The iron is plated out leaving the impurities behind. This iron was then melted in a vacuum to exclude the effects of gases which would be taken up from the air if melted in contact with it. The heating was done electrically and the containing crucibles were made of chemically pure magnesium oxide.

Extensive series of alloys were made by remelting this iron in the same manner and adding carbon and manganese. Compositions were varied by small amounts so as to include the entire range of compositions found in ordinary steels. Specimens from these ingots were tested and results compared so as to bring out the effects of each element.

TABLE 21

Switzerland—Exports of Machinery for Working Metal, Wood, Stone, etc.

"Werkzeugmaschinen zur Bearbeitung von Metallen, Holz, Stein, etc."

Country	1909 Quantity q.n.	1909 Value Francs	1910 Quantity q.n.	1910 Value Francs	1911 Quantity q.n.	1911 Value Francs	1912 Quantity q.n.	1912 Value Francs	1913 Quantity q.n.	1913 Value Francs	1916 Quantity q.n.	1916 Value Francs	1922 Quantity q.n.	1922 Value Francs
Germany	1,690	359,931	1,517	517,422	2,736	818,576	3,814	1,141,230	3,754	811,193	3,091	711,532	13,841	2,840,014
Austria-Hungary	444	104,062	481	167,521	896	236,040	1,218	273,772	400	98,757	518	141,574	12,663	2,961,632
France	1,432	418,794	1,145	401,275	1,477	447,577	1,540	456,550	1,876	625,496	2,022	711,900	21,180	6,011,790
Italy	854	186,876	1,297	221,630	1,207	210,186	1,502	268,855	1,658	334,989	3,024	340,775	16,896	3,892,549
Belgium	233	37,934	421	66,525	243	61,815	90	25,651	234	80,009	321	37,270	2	445
Netherlands	55	16,118	132	27,974	100	22,478	185	57,872	288	53,428	223	26,139	59	11,825
Great Britain	184	55,082	153	58,289	204	84,919	191	80,050	209	72,993	104	55,799	533	292,818
Russia	194	33,310	191	38,442	321	59,125	357	83,369	328	89,987	419	91,720	148	84,202
Sweden	7	1,710	51	10,310	70	21,880	48	11,230	22	5,080	17	10,765	110	31,812
Norway	2	820			39	10,210	32	12,840	9	2,225	29	8,130	150	38,955
Denmark	116	20,580	2	400			13	3,342			1	230	5	1,840
Portugal			48	7,055	6	1,200	33	10,230	153	51,550	31	5,702		
Spain	61	9,365	146	27,190	587	73,052	231	34,526	299	58,717	372	63,929	294	62,441
Greece					61	9,050	21	3,400	1	150	46	8,280		
Bulgaria	26	4,000			21	3,188	19	3,224	30	4,400				
Roumania	64	9,900			25	6,980	3	460			41	8,740	193	29,585
European Turkey			19	5,500	277	132,340			22	1,698				
Serbia			12	13,000			1	460			30	4,920		
Czecho-Slovakia														
Yugo-Slavia														
Egypt	18	1,800	1	460	3	2,150			30	7,180	101	26,080		
Algeria and Tunis			7	1,525	1	284	18	1,700	50	7,985	69	14,000	33	5,400
South Africa													4	500
West Africa														
East Africa														
Other Africa											2	300		
Asiatic Turkey			26	3,930	2	540			66	9,000	4	850		
British East Indies	57	11,030	39	5,950	66	10,070	2	370	1	130	29	4,050		
French Indo-China														
Dutch E. Indies	1	200	4	780	3	591							23	3,405
China	1	1,900												
Japan					21	3,625	29	11,887	52	14,400			41	11,855
Australia and New Zealand	48	6,940	33	8,306	81	10,395	4	2,500			1	674	3	1,500
Philippine Islands							113	17,400					14	2,800
Canada	37	7,500	26	23,950	4	1,000	7	3,050						
United States of America	44	18,245	42	21,514	46	24,104	118	54,515	113	55,559	39	23,113	205	46,170
Mexico							3	1,500	4	1,700	1	300		
Central America							19	6,550						
Brazil	1	170	12	2,490	11	1,585	76	11,603	97	20,211	4	500	237	37,640
Colombia														
Argentina	15	3,500	72	7,400	12	4,075	245	42,375	64	9,486				
Chile			53	7,625	32	5,500	1	332	17	2,340	42	7,220		
Other Countries			26	3,880	15	2,850	17	4,117			35	8,290		
Total	5,392	1,289,767	5,956	1,650,343	8,567	2,267,425	9,950	2,625,240	9,785	2,438,663	11,416	2,380,262	66,634	16,393,818

TABLE XI

Switzerland—Exports of Machinery for Working Metal, Wood, Stone, etc.—*Continued*

Country	1916 Quantity q.n.	1916 Value Francs	1917 Quantity q.n.	1917 Value Francs	1918 Quantity q.n.	1918 Value Francs	1919 Quantity q.n.	1919 Value Francs	1920 Quantity q.n.	1920 Value Francs	1921 Quantity q.n.	1921 Value Francs
Germany	9,762	3,669,446	51,444	20,847,428	3,303	1,680,747	1,429	1,254,226	830	751,685	572	406,000
Austria-Hungary	2,346	942,374	6,077	2,538,512	4,590	1,653,417	62	28,371	104	11,854	499	114,000
France	80,483	26,037,485	42,493	16,946,895	25,572	11,699,969	35,444	18,281,927	46,113	19,801,022	16,709	7,338,000
Italy	52,573	15,585,442	14,590	4,187,858	18,903	6,584,501	24,883	7,135,442	12,503	4,386,267	2,357	717,000
Belgium	.....	....	3	2,243	.....	....	2,699	1,096,476	7,402	2,408,493	1,704	620,000
Netherlands	126	24,358	289	62,285	2,613	988,136	3,145	1,198,810	1,765	931,871	563	401,000
Great Britain	2,763	1,013,415	433	342,878	937	679,906	1,422	1,289,317	2,740	2,953,296	1,338	902,000
Russia	1,006	502,399	52	38,963	.....	....	19	8,456	.....	....	.....	....
Sweden	17	9,755	48	26,125	18	12,350	46	26,296	389	201,251	25	15,000
Norway	199	21,505	40	18,001	5	4,365	51	45,177	52	65,406	65	65,000
Denmark	5	4,100	2	853	3	2,200	7	6,950	39	49,608	.....	....
Portugal	53	12,650	23	4,273	2	150	62	41,279	1,122	501,240	21	13,000
Spain	421	80,750	180	70,671	574	339,690	1,143	556,898	2,759	1,214,683	747	340,000
Greece	133	22,200	13	3,000	.....	....	67	31,148	253	80,269	104	38,000
Bulgaria	10	7,000	.....	....	.....	....	.....	....	.....	....	.....	....
Roumania	1,885	599,458	805	225,947	.....	....	139	38,262	5	5,086	.....	....
European Turkey	.....	....	.....	....	.....	....	.....	....	55	23,770	.....	....
Serbia	.....	....	.....	....	.....	....	58	21,229	.....	....	.....	....
Czecho-Slovakia	.....	....	.....	....	.....	....	.....	....	53	38,305	633	583,000
Yugo-Slavia	.....	....	.....	....	.....	....	.....	....	2	2,100	.....	....
Egypt	161	26,655	.....	....	8	7,900	19	15,430	288	115,780	62	25,000
Algeria and Tunis	39	14,900	1	220	142	48,690	174	67,905	32	12,871	.....	....
South Africa	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
West Africa	.....	....	.....	....	.....	....	.....	....	27	9,068	.....	....
East Africa	.....	....	.....	....	.....	....	.....	....	11	2,310	169	51,000
Other Africa	.....	....	.....	....	.....	....	9	8,990	.....	....	.....	....
Asiatic Turkey	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
British East Indies	29	3,600	.....	....	29	6,620	36	11,543	234	164,684	44	24,000
French Indo-China	.....	....	.....	....	.....	....	.....	....	198	76,382	1	2,000
Dutch East Indies	87	21,781	264	54,896	133	33,260	305	143,200	486	196,678	209	112,000
China	46	7,061	.....	....	50	9,600	.....	....	.....	....	.....	....
Japan	35	19,853	1	2,960	8	8,062	1	2,288	127	118,085	423	367,000
Australia and New Zealand	28	3,900	.....	....	.....	....	127	83,800	93	52,209	39	44,000
Philippine Islands	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Canada	.....	....	3	2,030	.....	....	.....	....	12	20,297	.....	....
United States of America	89	28,266	108	48,526	20	10,891	646	667,309	2,608	1,510,927	205	281,000
Mexico	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Central America	.....	....	1	1,006	.....	....	1	1,200	.....	....	.....	....
Brazil	1	120	31	6,025	104	26,783	101	37,398	739	237,295	217	80,000
Colombia	.....	....	12	4,444	.....	....	.....	....	.....	....	.....	....
Argentine	15	3,384	19	7,700	30	6,473	20	15,275	314	134,494	55	30,000
Chile	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Other countries	.....	....	.....	....	.....	....	.....	....	5	3,948	195	95,000
Total	152,312	48,661,857	116,932	45,443,739	57,044	23,803,710	72,115	32,114,602	81,360	36,081,234	26,956	12,663,000

Value of Franc at parity is 19.30c
q. n. = net quintals or 100 kilograms = 220.46 lb.

The Disease Called Drafting—Discussion

By Elam Whitney

On page 643, vol. 57 of the *American Machinist*, Entropy refers to a comparatively new profession as a disease. The writer is of the opinion that this disease seldom becomes chronic as substantiated by the absence of old men engaged in the profession, as they either die before they get to be 45, get a transfer to some other department or enter into business for themselves. The writer could cite many cases of very capable draftsmen and designers who are saving every possible penny toward the purchase of a cigar store, gasoline filling station, etc. A friend who was considered a very good designer, formerly with two of the largest manufacturers of machine tools, resigned at the age of 35 years to engage in photography as a better business proposition. A designer of adding machines, about 37 years of age, has been working for over a year as a street car motorman. In the opinion of some, these men were "old" men, as witnessed by an advertisement in the help wanted columns of a St. Louis newspaper for a successful business man aged 25. At this rate the high school boy of the future will be playing the stock market.

Promotions Are Infrequent

The drafting room does not attract the ambitious, aggressive type and the writer's advice to the young graduate is to learn the profession if he wants something to fall back upon and then get into something else for, just as Entropy states, the promotions made from the drawing room are few and far between. Is drafting a profession or a trade? It is certainly considered a trade in some factories where the drawing room is located in one corner of the machine shop, the master mechanic acting as chief draftsman when he has time. The hours are the same as factory hours, 7 a.m. to 5 p.m. and sometimes until 5.30 or 6 p.m. The rate is an hourly one and the draftsman is "docked" for being late or sick.

Just as fair for the draftsman as the mechanic some reader will say, but either he is incorrect in judgment or unaware that many draftsmen have spent four years or more in an engineering school to acquire the knowledge which the average mechanic will not sacrifice his spare time to obtain. It looks easy to sit at a drawing board and push a pencil, but have you ever observed how few mechanics and tool makers stick to it after a trial? Good tool and diemakers are now averaging more pay than experienced and technically trained designers. The draftsman has one opportunity and that is to become the chief draftsman but the latter seldom resigns. A good tool maker may become an experimental engineer or foreman, tool room foreman, production foreman or chief inspector and any of these positions may prove to be stepping stones to general foreman or factory manager.

Twelve years ago a mechanical paper published a table which recorded two of the largest and oldest manufacturers of machine tools, located in different parts of the country, as working their draftsmen 10 hours daily and 9 hours on Saturday. The war changed this just as it caused a vast change in industry in general.

Drafting requires intense concentration and constant study and several years of the work will put a man into a groove which rapidly deepens into a rut, causing a loss of perspective. Then again the lack of contact with workmen throughout the factory makes the designer unfit for executive work.

The cure is to place the various designers at work in different parts of the factory for certain periods; not exactly an apprenticeship system but more of a post graduate course. This will result in better and more practical designs, better co-operation between drawing room and factory and a field from which may be selected better department heads and other executives.

The Law and Trade Associations

By J. Bainter

The status of trade associations in the eyes of the law has not received much attention during the past few months, but the question is still a very live one and deserves a little attention. Trade associations are regarded by most of the law-makers and executives at Washington as being necessary evils and they are conceded to have a place in the business and industrial world. The trouble is that this place is made a minor one, so that the usefulness of the associations is greatly impaired.

It is perfectly legal for representatives of industrial concerns to get together and talk over methods of production, markets and the many other phases that enter into the conduct of an industry. But when prices are spoken of, and should any reference be made to future prices, then these business men become law-breakers. This hampering of price discussions is what makes the trade associations less useful than they should be, and prevents them from exercising the greatest influence for good that could be given a business or an industry.

The most necessary and the most vital discussion to all business is that on the subject of prices and their control. There is a great deal that can be spoken of on this subject without entering into that field which is morally wrong—the monopoly control of prices for gouging the public.

Although this argument may sound a little unreasonable to Americans in general, it is strictly in accord with the legislation of other countries. Our laws with reference to trade associations make illegal here those things that are approved of abroad. Just viewed from that angle, it seems unfair to American business men to prevent them from co-operating on a subject of such vital importance, particularly when they enter into competition with these foreign manufacturers in export trade.

The chief and best remedy for the situation lies in relieving business of some of the legislation that now encumbers it. Although it may be possible to add some legislation that would be beneficial, the best step would be toward lightening the burden of legislation rather than adding to it. The Edge Law is a step in the right direction, but something more is needed.

What is needed is an amendment of the Sherman Anti-Trust Law, so that it will still prevent the monopolies, for which function it was created, but will not interfere with the ordinary conduct of private business. There is really nothing to be afraid of in this step, as the spirit of the original law can still be maintained. Such a step, allowing trade associations to discuss prices, would be a boon to the associations. It would give to them and to their members the stability that comes from a knowledge of existing business conditions and a reasonable insight into the future.

Testing Abrasive Wheels

Characteristics of Wheels Used for Different Purposes—Machines for Testing Hardness of Bond and Abrasive Qualities of Wheels

By H. H. LaVERCOMBE

THE MANUFACTURER of abrasive wheels is many times unjustly condemned when the proper results are not obtained by the user, owing to the fact that the information given by the user as to what is required is inaccurate. The producers of practically every article requiring to be ground are spending fabulous sums each year for unnecessary labor, power and wheels, through the use of wheels that are not properly adapted to the work in hand. I know of no other line of manufacture or industry where so much personal service is required as in the manufacture of abrasive wheels, and the fact that so much personal service and instruction are given, indicates an earnest desire on the manufacturer's part to give the best there is in him.

Now the fact that almost any abrasive wheel will grind (and it is difficult to tell when the maximum amount of grinding is being done) makes this problem more complex, for an operator will often consider that a wheel is giving satisfactory results when the surface produced is pleasing to him, regardless of the fact that the amount of work done in a given time is ridiculously small. Into this error he is often led by an unscrupulous but persuasive salesman.

Bond of Snagging Wheels

In a wheel, intended for snagging or rapidly removing metal, it is necessary that the bond be of the proper hardness or density, so that it will hold the grains of abrasive material in place until each one has performed its maximum amount of work, and the sharp points have been worn off leaving round or dull surfaces. The worn grains should then be released, allowing new and sharp ones to appear upon the surface. On the other hand, if a wheel is intended to be used for producing a polished surface, it is necessary that the bond be hard or dense enough to hold the abrasive grains until they have performed the maximum amount of work, and yet not long enough to cause the wheel to become clogged with particles of the material being ground and thus produce a glazed surface.

There is a vast difference in the amount of work which may be done, without sacrificing the "satisfactory finish," with wheels of the same grade and grain made by the different manufacturers. This difference may be due to any of the following causes: Accurate or inaccurate grading, careful or careless supervision in the manufacturing departments where the wheels are made, good or bad abrasive material, good or bad bond, proper or improper baking, etc. The writer has in front of him at the present time the analysis of some recent tests with four different makes of wheels showing that the cost of removing one pound of steel with one pound of wheel, ranges from $2.05 to $4.58, despite the following facts, i.e.: each wheel was made by a manufacturer having a national reputation; each wheel was supposed to be of the same degree of hardness or density of bond and to contain the same size of abrasive. Each wheel was expressly recommended by its respective maker's representative for the particular work on which the tests were made.

Effects of this nature in our manufacturing department compelled us to look for the cause, and in doing so we were so impressed that we commenced experiments which finally led to the development of abrasive wheel testing machines. These machines enable us to properly inspect all wheels upon their arrival in our receiving room, in the following manner:

To determine the hardness or density of bond, the wheel is laid on the table of the machine shown in

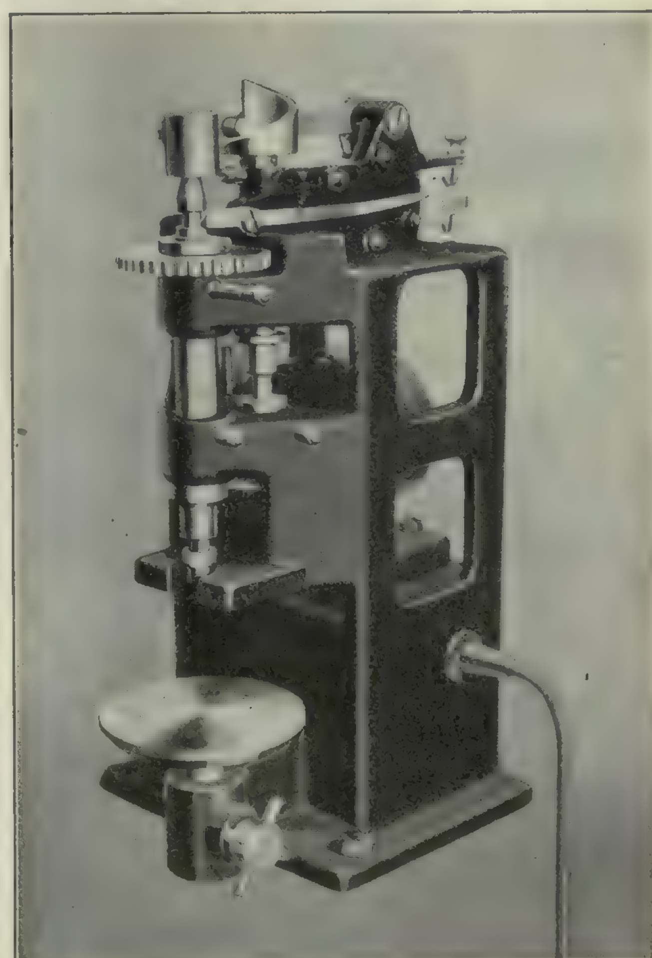


FIG. 1—MACHINE FOR TESTING CHARACTER OF BOND

Fig. 1. When the machine is set in motion, it raises at each revolution, a hammer of the correct weight to a certain height and then permits it to fall on the top of a spindle carrying a flat drill held in contact with the side of the wheel being tested. After each blow of the hammer the drill is turned a fraction of a revolution. When a pre-determined number of blows have been delivered the machine automatically stops and the depth of the penetration may then be readily determined by an indicator which is an integral part of the machine. As the hammer is impelled by gravity the same

number of blows struck in all cases and the area of the face of the drill always being uniform, the record of the resistance offered by the bond is very accurate.

The abrasive capacity is determined as follows:

The wheel to be tested is laid on the table of the machine shown in Fig. 2. A disk of the material to be ground is revolved at the proper speed, being held

FIG. 2—MACHINE FOR TESTING ABRASIVE CAPACITY

in contact with the abrasive wheel under the proper weight. After certain number of revolutions of the test disk made in this manner, the machine automatically stops and the amount of material removed from the test disk may then be readily determined by an indicator which is an integral part of the machine. Complete tests may be made on both machines in about four minutes.

In the work of tool salvaging, we use grinding wheels exclusively to remove the metal necessary to reform the tools. Hence the value of these two machines to us has been inestimable.

Who Has This Information?

Daniel Adamson, of Joseph Adamson & Co., Hyde, Cheshire, England, is looking for a reference to "interchangeability" that he believes was made in a discussion before one of our national societies about 20 years ago. Three degrees of interchangeability were referred to: first, when the spare part could be adapted by slight alteration; second, where the spare part required radical alteration in the workshop before it would fit its intended place, and, third, when the spare part was of such a different pattern as to be useless.

The Foreman as an Element in Management

By Entropy

The point of view in the discussion of this subject seems to depend very largely on the size and kind of shop under discussion. About all that is admitted by all hands is that their problems are "different," which makes the problem very much like all the other problems of management. Take, for example, a shop of my acquaintance, which began some years ago with six or eight workmen, one of whom was called foreman, mainly because he kept time on the other men for the owner who had other things which kept him away for the better part of the day. He was really superintendent, works manager, and about everything except treasurer and sales manager in terms of a large shop.

Then there is another shop, having some hundred or more foremen and two or three hundred straw bosses, in which no foreman performs any functions above those of his title. That is, none of them buy any materials, they requisition it from the stores: they do not decide the wages of their men, except on approval of several other men higher up in the organization. In general, they accept orders as to what to do, accept the men sent them from the employment office and the materials from the stores, which is largely sent them automatically as the work is shunted around the shop on a schedule. They are foremen stripped of most of the things that make a foreman's job interesting.

Looking back over the jobs I have had, and comparing those that I have enjoyed holding with those I enjoyed leaving, I am struck with the fact that those I liked to stay on have been those in which I knew what was going on. When I have been where doors were shut in my face and I was not in "the know" regarding things which vitally affected my work, I was only too glad of a chance to get out. It is very much like a man working in a shop alongside a railroad. If the windows are glazed with opaque glass, "To better distribute the light" he is always wondering just what minute a locomotive may get off the rails and tear into the shop.

Importance of Alloy Steels

An illustration of the importance of alloy steels is given in production statistics recently issued by the American Iron and Steel Institute. Despite an extremely low tonnage for the whole industry in 1921, the relative amount of alloy steel remained very close to its record 1919 figure.

TABLE OF PRODUCTION OF STEEL INGOTS AND CASTINGS AND OF ALLOY STEEL INGOTS AND CASTINGS IN THE UNITED STATES
[000 omitted]

	Total Steel, Gross Tons	Alloy Steel, Gross Tons	Alloy Steel of the Total, Per Cent
1909	23,955	181	0.75
1910	26,094	567	2.17
1911	23,676	481	2.03
1912	31,251	792	2.53
1913	31,300	714	2.28
1914	23,513	646	2.75
1915	32,151	1,021	3.17
1916	42,773	1,362	3.18
1917	45,060	1,644	3.65
1918	44,462	1,787	4.02
1919	34,671	1,481	4.27
1920	42,132	1,660	3.94
1921	19,743	809	4.10

Methods of Machine Tool Design

Principal Uses of Cams in Machine Tools—Cams for Holding and Clamping Devices —Cams as Feed Rate Variators—Contour Milling

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

CAMS are used for so many different functions that it is almost impossible to make a complete list of them. However, we are concerned only with their use in machine tools, and it may be said that in this class of machinery they are used mainly: for drives, for feed, for operating trips, for opening and closing holding devices, for operating magazines, for clamping, for belt and gear shifting devices, for indexing, for timing of movements, for stop motions, for regulating rate of feed, for generating irregular shapes.

Cams are not essential, or even very useful, for drives; cranks or eccentrics can almost always do all a cam can accomplish. They may be useful to a small extent for filing machines or for machines where two or more tools must work on one piece and where they would interfere with each other unless they were timed properly. Cams are the logical means to effect such timing.

We have already seen how cams can be used for feed. Their usefulness for this purpose is due to the fact that they produce a definite length and location of the feed stroke with any desired rate of feed and provide for a rapid advance and return, all without complication of mechanism and without reversing or fast running parts. Where intermittent feed is required they determine the exact time of the feed. One finds cams employed in this manner in slotters. The other uses of cams have been merely touched upon and we will now go a little further into some of them.

The actuating element used for tripping machine parts, such as clutches, etc., is the dog. A dog is a cam of very simple shape; it may be merely a pin or a triangular piece of metal fastened to a moving part and acting on some lever or slide so as to produce the required movement of a clutch, drop worm or other machine element. Sometimes a more complicated construction is used for dogs. When a dog is fastened to a reciprocating part it may be required to be active going in one direction and inactive in the other. In such cases the dog may be hung from a pin and be prevented from movement in one direction by an abutment while movement in the other direction is permitted. The weight of the dog, or a spring, may bring it back to normal when it has been lifted up on its backward course. See Fig. 193.

Similar devices may be used when it is desirable that one should be able to start a feed or drive immediately after it has been stopped and when it is not desirable that the operator should be compelled to hold his hand on the starting lever until the entire dog has passed the tripping point. Cams may also be used for placing certain machine parts in the position where they can be tripped by some other element. Still another function of a cam for the purpose of tripping is preventing a trip from being carried out completely.

We may imagine a clutch somewhere in the mechanism which can be tripped from right to left and vice versa. Let us say such a clutch is used in a tapping mechanism. In such a mechanism the tap should go forward up to a predetermined point, then the clutch should be reversed so as to bring the tap back by revolving it in the opposite direction, after which the same clutch should be tripped again. This time, however, it should be prevented from engaging the mating part on the other side. In short, after starting, the clutch should be automatically tripped from right to left and then from left to right, but should be prevented from completing this latter motion. It should stop in the center where it is out of engagement. This is ordinarily done by interposing an obstruction and doing this by means of a cam.

Cams for opening and closing holding devices are well known. They are used in automatic screw machines and in various other automatic machines where the work can be gripped automatically. Instances of cams for the opening and closing of holding devices for machines outside of the class of screw machines are not generally well known. They are used to a large extent for this purpose in special machinery and particularly for the purpose of gripping a piece and carrying it from one operation to the other. Pieces may be located in a magazine or hopper and a set of fingers, operated by a cam may pick up one piece and insert it in the spindle of the machine.

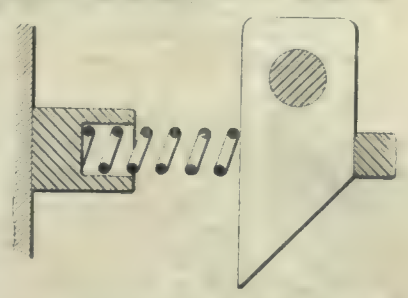


FIG. 193—DOG FOR RECIPROCATING MACHINE PART

After the required operation is completed, another set of fingers may pick up the piece before it is released by the spindle, turn it around, and insert it in another spindle for an operation at the other end. In the case illustrated here, cams are used four times for operating holding devices, twice for the chucks and twice for the gripping fingers. A well-known illustration of this kind is the slotting attachment used with some screw machines. Another illustration is the magazine feed for certain kinds of screw machines. Nothing need be said about these cams, except that they should be quick-acting and, as a rule, *can* be made very quick-acting because the parts to be moved are light and the only work to be done is the work of transferring. Some caution is required in the proportioning of the transfer fingers because too rapid a movement of the piece might make its location uncertain. Another point to be cautioned about is that as a rule the holding device picks a part out of the spindle and must grip it before the piece is released.

For this reason, the gripping must be of a gentle nature so as not to spoil the work or cause too much wear of the fingers by the gripping pressure. As the piece is held gently, it should not be swung around at too great a speed for fear that it may escape from the fingers. There are many kinds of magazine feeds in

existence, some of which do and others do not require cams. The action of such cams is in no way different from cams heretofore discussed. They are, as a rule, slow-acting and do not present any special difficulty.

On the other hand, cams used for clamping devices should be carefully thought out. Where clamping can be done by means of a toggle joint or some other device which can be brought over the center, nothing need be specially considered except the amount of pressure required. Cam and roller should be proportioned accordingly. The toggle joint in itself has provided means for exerting great pressure at the clamp without much pressure at the roller, but in cases where no such device can be employed, great pressure on the roller may be required.

In such cases it is essential that the cam become more and more gentle acting as the clamping point is reached, so as to be able to exert a great pressure without much effort at the circumference of the cam. In such cases there is always the possibility that there will be a certain amount of variation in the piece to be clamped and this may cause insufficient clamping at one time or an extraordinary amount of pressure at another. It is well, therefore, between the cam roller and the point where the clamp is applied to have some element which has enough elasticity to permit of a certain amount of spring.

As a rule, cams used for belt shifting devices are assisted by a spring or weight or some other means by which the shifting of the belt may continue for a short time after the cam has ceased to act. This is often necessary because the amount of time required for shifting is an uncertain element. It may well be that the part of the cam which is used for the shifting is past before the belt has completely changed over from one pulley to another. Making the cam act on a device provided with spring or weight which will complete the belt shifting makes the operation more certain. On the other hand, the uncertainty of timing remains and cannot very well be overcome. It can be held to a minimum, however, by making the belts to be shifted narrow and running them at high speed.

Cams for Shifting Gears

It is not advisable to use cams for automatic gear shifting on account of the uncertainty as to whether the gears will mesh or clash, but for hand shifting devices cams can sometimes be used to advantage. For instance, where there are several sets of sliding gears a cam may be arranged so as to pick up one pair of sliding gears, shift it to left, then to right, then to center, then pick up a second set, shift it to left, then to right, etc., so that the mere rotation of a crank will bring successive feeds or speeds into action without any attention on the part of the operator.

In many cases the indexing is performed by some special device and without the aid of cams. Such a device, however, must be kept in time with the cam and may be started by a cam. In other indexing devices the cam itself may perform this function by moving a lever or segment which performs the operations of withdrawing the locking pin, moving the index wheel, and releasing the locking pin so that it will drop in at the proper spot. The amount of motion which the cam would give to this lever or segment would be more or less uncertain, and if no special provision were made it might well be that the lever would still be attempting to move the index wheel after the bolt had shot in place. To avoid such interference, the lever or other device is often provided with a pawl which is lifted out of action by a pin placed at the proper point. An essential feature of such a device is that the index must be started and stopped at practically zero speed. The stopping especially should be very gradual, so that the momentum of the wheel shall not carry it too far. Not only the momentum of the wheel but that of the turret or other part which is indexed might cause an error in positioning. For that reason the cam must be laid out in such a way that the end of each operation takes place at a vanishing speed.

Timing Cams

One might say that all cams are used for the timing of movements, because they give a closed cycle of operations of which the sequence as well as the nature itself is determined by the cam. However, there are certain cams in use of which the most important purpose is the timing of operations. As a rule such cams take the form of a disk to which dogs can be attached. A clean-cut instance of this kind is furnished by the Brown and Sharpe screw machine in which disks are employed to which dogs can be attached. These dogs operate various levers which start single-revolution clutches. The position of the dogs on the disk determines at what particular point of the complete cycle each one of these clutches shall make its turn and perform its work.

The term "stop motion" is not commonly used in machine tool practice, but is used in the design of other kinds of machines, particularly automatic machines. It indicates a mechanism by which the movement of the entire machine or part thereof is stopped at a predetermined moment. A drop worm or a clutch which can be disengaged by the action of a dog are instances of stop motions. An illustration of a stop motion operated by a cam is the single-revolution clutch which was described before. This clutch is normally out of action because an obstruction, resting against a projection of the clutch, keeps it away from its mating part. When this obstruction is removed, a spring behind the clutch throws it into action. Before the clutch has made the desired number of revolutions the obstruction is once more placed in position and toward the end of the last revolution a cam-shaped projection built onto the clutch rides along this obstruction and causes the clutch to be withdrawn.

Cams are also used for the regulation of the rate of feed. We have no reference here to the fact that the slope of a cam strap or cam groove itself determines the rate of feed but rather that a cam may be used in such a way as to affect the rate of feed produced by some other mechanism. As an illustration of this kind we mention the Cleveland automatic screw machine. In this machine there is one cam for the turret tools which causes the turret to move forward and backward the same amount for each of the different turret positions. There is a fast and slow motion provided, but there cannot be any variation in the slope of the cam. The slow motion, which, of course, is used for the feed, would always have to proceed at the same rate unless some other means were provided to change it. Such means are present in the Cleveland machine in the form of cams.

The cams are of the very simplest nature, being merely strips of metal fastened to the circumference of a wheel of large diameter in such a way that they can project more or less beyond the edge of the rim. As each of the strips is fastened by two screws going through slotted holes, it is possible to set the strip of

metal either parallel with the rim or at a slight angle. The strips operate on a lever which moves the friction disk of the feeding device. Lowering or elevating the friction disk causes the feed to run at a higher or a lower speed. If the strips are set parallel with the rim of the wheel the feed will remain constant so long as one particular strip passes the roller, but the next strip, set further forward or backward, may move the friction disk one way or the other and thus cause a different feed rate. The feed rate, then, remains the same during the passage of one strip past the roller, provided the strip is set parallel with the rim of the wheel. When it is set at an angle, however, it will cause the friction roller to move during the passage of that strip and may cause an accelerating or retarding rate of feed. If desired, strips can be made with a contour which will give any kind of variation to the feed rate during the passage of the strip.

Such a device meets almost all conditions met in practice. The use of a friction device for feed makes the feed rate itself somewhat uncertain, not only because there is necessarily some slip which may vary, in amount according to the condition of feed disks and roller, but also because the rate of speed changes so rapidly for a small amount of adjustment of the roll that it is not practical to depend on this device if a certain predetermined amount of feed must be obtained. In such cases a positive drive for the feed must be employed and the variation in rate must be obtained in some other manner. Figure 194 shows such a device in elementary form.

To make the action of this device somewhat clearer we will take a concrete example. *A* is a piece of work of which the edge must be milled by cutter *B*. The piece is mounted on a turn table which is rotated by means of worm wheel *C* and worm *D*. The piece is supposed to be located centrally on the turn table. It will be seen that when the cutter is at the point *P* the rate of feed is in proportion to the line *OP*, whereas when the point *Q* is opposite the cutter the rate of feed will be proportionate to the line *OQ*. If the same rate of rotation of the worm wheel were maintained, we would have

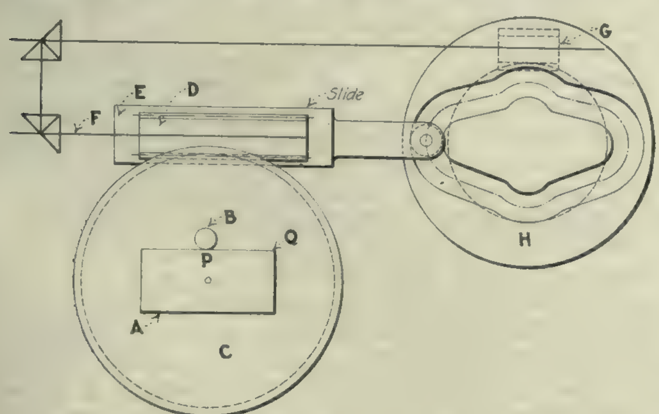


FIG. 194—POSITIVE VARIABLE FEED DEVICE

a much slower feed at *P* than at *Q*, and this would mean that either we will get an undesirable finish at the point *Q*, if the rate of feed is correct for *P*, or else that we will lose considerable time if the rate of feed is correct at *Q*.

The worm *D* with its thrust bearings is mounted on a slide *E*, and is driven by the spline shaft *F*. This shaft also drives a worm *G* through bevel gears, as indicated in the sketch, or by some other means, causing the worm wheel *H* to turn in unison with *C*. Mounted on the worm wheel *H* is a cam which causes the slide *E* to move backward and forward. This movement of the worm *D* will accelerate or retard the movement of the worm wheel *C*, and by giving the cam the proper shape we can give this worm wheel *C* such a variable motion that the rate of feed remains constant at any point of the work. In the sketch the cutter *B* is shown at a certain distance from the center *O*, and it is very obvious that this distance should be variable.

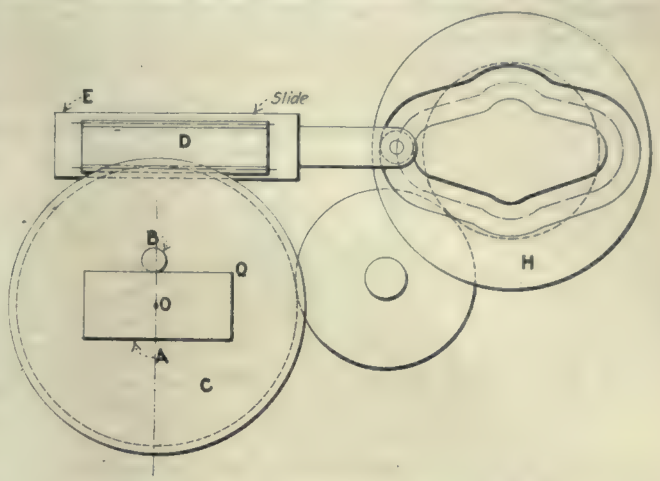


FIG. 195—MODIFICATION OF FIG. 194

This is easily obtained by mounting the cutter head on a slide which is moved backward and forward by means of a templet mounted on or under the worm wheel *C*. By giving the templet the proper shape the cutter can be made to take the proper position in relation to the work while *C* rotates.

With this construction it is rather difficult to lay out the correct shape of the cam on *H*, and for that reason it may be better to modify the arrangement as shown in Fig. 195. In this arrangement the cam is mounted on a spur gear, driven in unison with worm wheel *C* by means of another spur gear mounted on this latter worm wheel and by some idlers. Doing this simplifies the laying out of the cam materially. If the normal movement of worm wheel *C*, that is, when the worm *B* does not have any lengthwise motion, is such that the feed is correct for the point *P*, then we can easily find how rapid the movement of worm wheel *C* should be for a point P_1, located, let us say, 10 deg. to the right of point *P*. We can also figure out how much one inch movement of the worm *D* causes the feed to be retarded or accelerated, so that it is easy to figure at what rate the worm must be moving and in what direction when the cutter is opposite the point P_1.

As the cam rotates in unison with worm wheel *C*, we have found the rate of change in the cam shape at a point 10 deg. removed from the starting point. Working in this manner we can lay out the direction of the tangent of the cam every 10 or 5 or any other number of degrees. It should be noted that the cam in this case necessarily has a reversing action, that is, it sometimes pushes and sometimes pulls the worm slide. At the moment when the action changes from a push to a pull, there will be a certain amount of lost motion between the cam and the roller and this might have its effect on the finish of the work. Though the lost motion may be very small, its effect will be very great for the following reason:

Suppose the cutter to be opposite the point *Q*. The

action of the cam between P and Q has been to retard the movement of C. At Q this movement must suddenly change to an acceleration. If there is lost motion, then there will be neither acceleration nor retardation. In other words, there will be a moment at the point Q when the machine acts as if this device were not in existence, so that the feed will be the same as it was at the point P, which is entirely too fast. To overcome this difficulty, one should make a cam in the form of a face cam and depend on a spring, or preferably a heavy weight, to keep the roller against the cam edge, thus avoiding all lost motion. The cutter slide also should be held against the templet by means of a weight or spring.

The use of cams for generating irregular shapes is well known. Cams used in commercial machines are

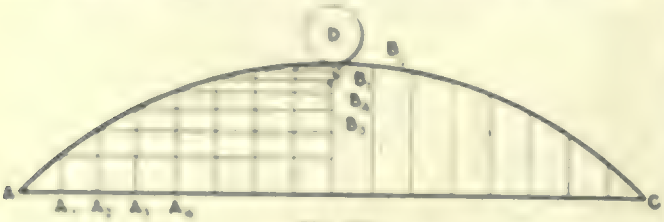


Fig. 196

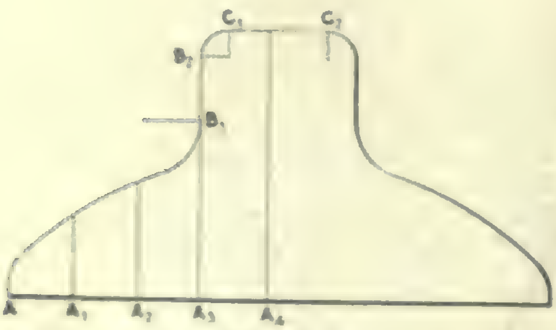


Fig 197

FIGS. 196 AND 197—OUTLINES MADE BY TOOL GOVERNED BY CO-ORDINATE SLIDES

themselves the product of other cams. There are two distinct ways in which cams can be used for generating various contours. In the first place, a cam may be used as a templet, producing a copy of itself. Cams are used in this manner in cam cutting machines and attachments. In the second place, they may be used for the purpose of modifying the movements of some machine element so as to produce an outline depending on the shape of the cam but not a copy thereof.

If we should mount a cam on a shaft, hold this shaft in bearings mounted on a slide and then mount another casting of similar dimensions to the cam on this shaft, we have the elements of a cam cutting machine, or rather of a cam reproducing machine. If a stationary roller is held in contact with the first cam and a cutter of the same size and shape as the roller is made to act on the second drum, then all we need to do to reproduce the first cam is to give it a rotary motion. This principle of making cams is carried out in many modified forms. Cam cutting machines, automatic profiling machines and many special machines depend on this principle.

An entirely different method of making irregular contours is by means of two cams which act on two slides, moving at right angles to each other. This method corresponds with the construction of a curved line by means of its co-ordinates. The abscissas are laid out by one slide and the ordinates by another. In Fig. 196 the curved line ABC is supposed to be made in this manner. D is the cutter. The cams must be so constructed that the distances AA_1, A_1A_2, A_2A_3, etc., are traveled in equal times; and the other cam must be so constructed that the distances BB_1, B_1B_2, B_2B_3, etc., are traveled in equal increments of time.

It is always possible, of course, to make the distances AA_1, A_1A_2 equal, which means that we can give one of the slides a uniform motion by means of a screw or rack or similar device, in which case only one cam would be required to produce the contour; and such a method would probably be followed if a piece of the shape as shown in Fig. 196 had to be produced. If a piece had to be produced such as is shown in Fig. 197, it would no longer be possible to move one of the slides by means of a screw. The distances AA_1, A_1A_2, A_2A_3, are again equal. At A_3 the other slide must move from the point B_1 to B_2 without any further movement of the first slide; which, of course, would be an impossibility because the speed would be infinitely large in the direction of B_1B_2.

If cams were used, all that would be necessary would be to have a part of the A cam made with a dwell, while a part of the B cam makes the piece travel from B_1 to B_2. Similarly, it is not possible to have a screw produce the movements in the B direction because in that case there would have to be an infinite speed in the A direction while the contour is made between C_1 and C_2. Generally speaking, an ordinary feed such as the screw feed can be used in combination with a cam feed when there is never a large ratio between ordinates and abcissae, such as is the case with the contour shown in Fig. 196, but it becomes impossible when this ratio becomes large. Even if the branch B_1B_2 in Fig. 197 had not been vertical but merely a steep slope, a screw could not have been used in combination with a cam.

Making a piece to an irregular contour is generally accomplished by the process of milling though, in a few cases, it is done by slotting, shaping or planing. When an irregular piece is produced by milling, the size of cutter which is to be used should be considered in the laying out of templet or cam. Referring again to Fig. 197 it will be seen that if the cutter which is actually used should be smaller than the cutter which was considered when the cam were laid out, then the branch B_1B_2 would come too far to the left, and the other vertical branch too far to the right; whereas the horizontal branches would also have been spread apart. Altogether, the piece would have been distorted. As a rule the desired accuracy in a piece is not so great but that a small variation in the size of the cutter can be allowed.

Generally speaking, in automatic contour milling we will meet the same conditions as in profiling on a hand operated machine. In the latter type of machines the trouble is sometimes overcome by making the guide pin or tracer taper, so that it is always possible to have such a diameter of the tracer bear against the templet as corresponds to the diameter of the cutter used. This method could not be followed in automatic profiling, because there is no tracer in this case.

When disk cams are used and the roller is always held against the cam, say, by a weight, we might make the roller taper, but then it would bear against an edge of the cam only, and this would not be practical except for the lightest kind of work. Another method is also

sometimes followed in profiling, and that is that two cutters are used to make the piece, one for roughing, the other for finishing. Wear in the roughing cutter is compensated for by the finishing cut, and wear in the finishing cutter is, of course, very small. Thus, a great many pieces can be made with this finishing cutter before it will be necessary to re-sharpen it. A small amount of variation in this finishing cutter is, of course, permissible, let us say a few thousandths, and after it has become too small to be of further use as a finishing cutter, it can be used as a roughing cutter. This method can be employed with automatic milling, but, naturally, only when two cuts are taken.

Advantages and Disadvantages of Cams

Cams offer unlimited possibilities as to the nature and combinations of motions of machine elements. It would be perfectly possible, for instance, to have one's signature produced by a pen by the movement of two slides guided by two cams. There is hardly any kind of movement imaginable, either in one plane or in space, which cannot be produced by cams, and when once the cams are designed the simplest kind of mechanism is, as a rule, sufficient to drive them. Other advantages have already been mentioned, such as the fact that they provide a definite limit of stroke without danger of over-run, that they will give variable speed or motion in opposite directions without complicated mechanism or without reversal of parts, in fact, the advantages of cams are so many and so well recognized that they are often used where other mechanism might have been employed to better advantage.

Like everything else, a cam has its disadvantages as well as its good points. There is, in the first place, its limited capacity as to power or pressure. Generally speaking, cams are not well adapted to heavy duty machines. In the second place, they take large dimensions as a rule and are not easy to place in a covered mechanism. Another disadvantage is that they are limited in their scope. It is easy enough to construct a cam to give a movement of 6 in. but not of 6 ft. Not only that, but it is not possible to produce anything else but 6 in. unless additional mechanism, such as levers, etc., are introduced. Finally, there is the difficulty of making the cam. There is, at the present time, no means of generating a cam, though there is no reason why a generating machine could not be made for certain classes of cams.

Economy Justifies Making of Tracings

By S. N. Bacon

The writer has often observed the almost universal practice followed in small shops and factories where only one or two draftsmen are employed, of using the heavy or "cream" drawing paper for the drafting of patterns, punches, dies, miscellaneous tools and sometimes parts for manufacture. Most draftsmen and tool designers agree that practically the only advantage of this material over the bond and vellum papers is its erasing qualities, the medium grade being about the same in price. The idea of saving the cost of the blueprint, the writer believes to be mistaken economy.

Its disadvantages are several. In making the drawing, quite frequently time could be saved if partial views were traced from other drawings, or the outline of the work were traced as is usually done in jig and fixture design. Then again, it is sometimes convenient to trace a part from the reverse side to change it from right-hand to left-hand. Another disadvantage is the necessity of sending the original drawing to the pattern shop or toolroom, which leaves the designer without a copy for reference; this procedure is especially inconvenient when the work is done by outside shops.

Dirt May Be Dangerous

It is not easy to keep these cream-colored drawings clean in the factory, and the danger of mistakes arising from thumb-printed dimensions is not an imaginary one. It is disagreeable to handle these drawings after they return from the shop, not because the designer is so adverse to getting his hands soiled, but because the sheets are usually very much soiled on the reserve side with black grease due to laying the drawings on the work bench. Thus, when referring to the old drawings, new drawings in the course of preparation are soiled.

Manufacturers of drafting supplies have been furnishing for some years a fairly tough grade of vellum or tracing paper which is equally as transparent as linen tracing cloth and much lower in price. Erasing pencil marks from this material is not difficult if the designs are made with a pencil not harder than 4H. Ink should seldom be used on vellum, as a satisfactory blueprint can be made from the pencil tracing.

Drawings requiring more than two or three days to complete should be traced on linen and blueprints of them, especially from tracings of parts to be manufactured, should be filed in a fireproof vault so that in case of fire no time would be lost in replacing tools and equipment, and the expense of designing all over again would be eliminated. The above economies will more than pay for the cost of blueprinting.

Personality and Pessimism

By Charles W. Lee

I was once severely criticized by a professional optimist. He said that I was a pessimist, that pessimists were all wrong, and that I was harming not only myself but the world at large. After much more in the same strain he demanded to know how I happened to be a pessimist anyhow.

My reply was that if I were a pessimist it was probably because I had designed so much machinery—although possibly it was the other way around—and that no one not a pessimist could be a good machine designer because the first thing necessary after completing a design was to say (quoting good old John Fritz): "Now let's go and find out what's the matter with it."

And that goes!

The most ingenious machine designer I ever knew was also the greatest optimist. He never could see anything the matter with his designs, so it always fell to me to go through the drawings and pick out the "bugs" that were always there, I being only a poor pessimist who could see a bug across the room.

Incidentally the optimist received a much larger salary than the pessimist, which leads me to believe that my critic was right when he said I was harming myself, but I still contend that I was not harming the world.

And anyhow I claim to be neither an optimist nor a pessimist but a rationalist, because I picked only the bugs out of the optimist's drawings, seeing the good and letting it remain. After all, a pessimist is only "one who has to live with optimists."

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Errors in Checking Cylindrical Work in V-Blocks

By A. H. Frauenthal

The writer was recently in discussion with the manufacturer of a rather well-known amplifying gage concerning the application of the V-block in measuring

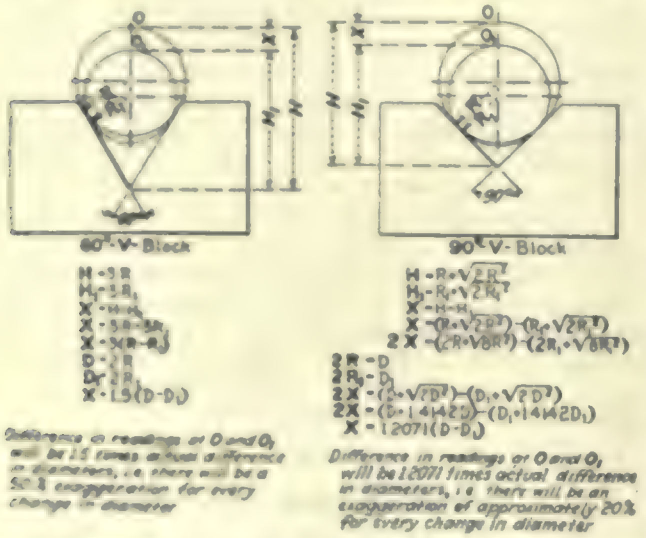


FIG. 1—HOW VARIATIONS IN DIAMETER ARE EXAGGERATED ON WORK CHECKED IN V-BLOCKS

size variation and roundness of cylindrical objects, and was very much surprised to note that the gentleman in question was not conversant with the fact that the ordinary V-blocks in general use, and similar to the V-blocks on some of his own machines, greatly exaggerate both variation of size and amount of out-of-roundness, particularly on centerless-grinding work. I am, therefore, sending you this article which may be of help to others who have never considered the error in this method of checking.

Herewith, in Fig. 1, is a sketch, also figures showing

FIG. 2—ANALYZING TRIANGULAR OUT OF ROUNDNESS

the error of exaggeration in both 60- and 90-deg. angle V-blocks. This explanation shows the magnification of variation in diameter and it can readily be seen by the sketches of triangularly out of round cylinders in V-blocks in Fig. 2 that the measuring of out-of-roundness of a triangularly shaped piece is nothing more or less than the comparison of size of the inscribed and circumscribed circles of the triangle.

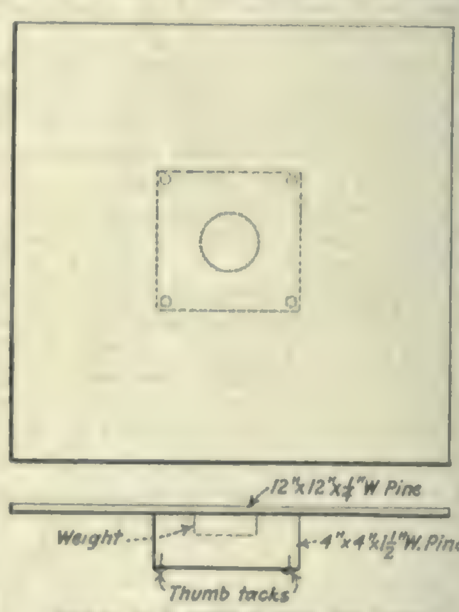
It is, of course, understood that the out-of-roundness produced on a centerless-grinding machine is generally triangular and always a multiple of three.

Drafting Room Kink

By H. R. Bowman

When working on a drawing table where no shelves are available, the drawing instruments are usually spread all over the board, either out of reach or in the way of the T-square and triangles.

I made a portable shelf by fastening a piece of board to a block of wood as shown in the sketch herewith. The instruments are placed upon it and it can be moved to any position on the board on which the draftsman is working. An iron weight may be inserted to give stability but is not absolutely necessary. The thumbtacks on which it rests keep the wood from soiling the paper. If the table is slanting, the block may be cut at a corresponding angle so that the shelf will be level.



PORTABLE SHELF FOR DRAWING INSTRUMENTS

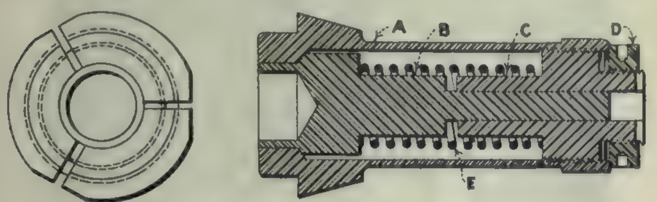
Finishing Spring Collet for Screw Machine

By I. Bernard Black

In the following article is described and illustrated a finishing spring collet designed for use in a No. 0, B. & S. automatic screw machine for finishing the inside diameter of gold rings after they had been blanked out by a punch press. In this particular design the spring collet takes rings from 1/16 to ¼ in. in width. The outside diameter of the rings is 0.700 in. and the inside diameter when finished 0.550 inch.

A noval feature of this spring collet is the ejecting principle. The rings are fed into the spring collet by means of a magazine attached to the front cross-slide of the machine, and a push finger in the turret head. The machine is so set that when the inside diameter of the

ring has been finished by the tool in the turret head, the chucking mechanism will cause the collet sleeve (which is tapered and slides over the collet in the spindle) to draw back, thus opening the spring collet. The grip on the ring being released, the spring plunger *B* will eject the ring and so be ready to take the next ring fed to it by the magazine and turret. For each ring width, however, the spring collet has to be set, that



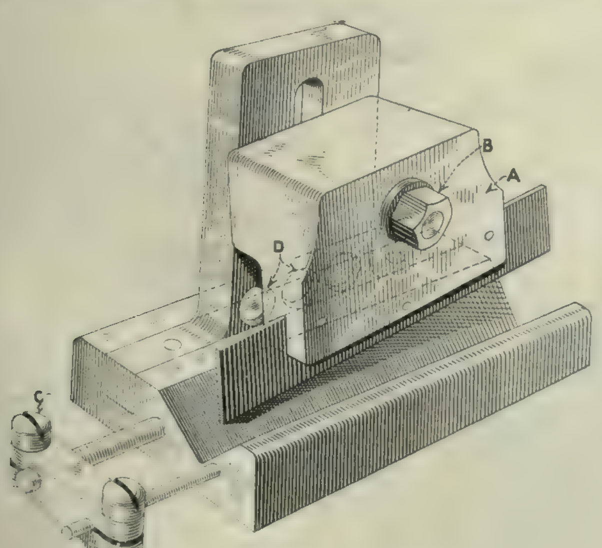
SPRING COLLET FOR HOLDING RINGS

is, the part *C* must either be screwed in or out and then locked in place by the part *D*, so that the distance between parts *B* and *C* will be the same as the ring width. In the illustration, part *A* is a standard single-angle spring collet for No. 0, B. & S. automatic screw machine and is made of tool steel, hardened and tempered. The part *B* is made of tool steel, hardened, and made a sliding fit in parts *A* and *C*. Part *C* is made of tool steel, hardened and has a slot machined on the end as shown to assist in adjusting. Part *D* is a nut made of tool steel and hardened. Part *E* is a steel spring made to suit.

Adjustable Taper Testing Fixture

By Edward J. Rantsch

The accompanying sketch shows an adjustable taper testing fixture in which the important points are: the three-point contact with the work, the adjustment covering a great range of sizes, and the adjustable gage



TAPER TESTING FIXTURE

which can be set at one end of the sample to be reproduced.

All that is necessary when setting the fixture to a given taper is to lay a taper gage or a sample of the taper to be gaged in the V-block, bring down the adjustable head *A* against the sample and secure it in position by tightening the nut *B*. Then the gage *C* should be brought against the end of the taper gage or sample, the taper of which is to be reproduced.

The fixture once adjusted, may be kept at the lathe where the taper is being turned and no time need be lost in going back and forth to try the taper in the spindle of the machine it is to fit. Neither will it be necessary to keep a valuable machine idle while a taper is being turned and fitted to its spindle.

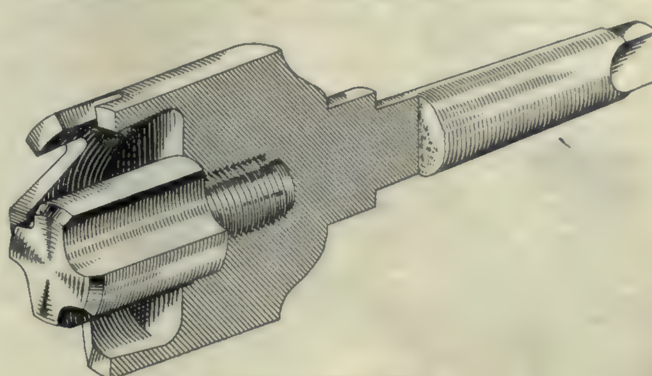
The holes *D* in the standard are for the purpose of letting in light, so as to see that the edge of the adjustable head makes proper contact with the sample or work.

Trepanning Tool for Flue Sheet

By Louis E. Reibel

In applying superheaters to locomotives it is necessary to change the flue sheets. In making the new sheets, the $4\frac{21}{32}$-in. holes for the superheater flues were put in by first punching 1-in. holes, then enlarging them to $2\frac{1}{2}$ in. by drilling and finally bringing them to size in a horizontal boring mill.

As the time required for doing the work in the above



TREPANNING TOOL

manner was excessive, I made the trepanning tool shown in the sketch herewith and its use reduced the time fully 70 per cent.

The tool is $4\frac{1}{2}$ in. in diameter and has six cutting teeth, each $\frac{5}{16}$ in. thick. The 2-in. pilot is in the form of a reamer and is screwed into the shank of the tool as shown.

Limitation of Piston Aligning Gages —Discussion

By Charles G. Liendecker

Referring to page 659, Vol. 57, of the *American Machinist*, I note an article under the above title by J. T. Towlson, London, England. I have been experimenting with such a ball and socket piston head as described by Mr. Towlson for the last six months, having made up four pistons and tried them out in a Ford. I was under the impression that crystallization would take place where the ball joins the connecting rod,

I made one ball-connected piston and connecting rod complete about sixteen months ago and sent them to the Chandler Motor Car Co. for its engineers to pass judgment upon. They corroborated my opinion that the connecting rod would probably crystallize back of the ball. However, I determined to try out a piston and rod of such construction and they are still running and the ball and socket joint does not seem to be worn to any great extent. I have $\frac{1}{16}$ in. of laminations of 0.002 in. thickness between the bronze socket and

cap for adjustment, which a piston of the cross head-pin type does not have. Neither is there any way to take up wear on the present type of gas engine piston-head and pin.

It would seem as though the gas engine manufacturers, especially the makers of stationary gas engines, ought to look into this construction as it is a great improvement, as I know after seeing the many scored cylinders caused by the piston pins coming out against the walls. In my opinion, it is the proper connection for the piston and a connecting rod of a gas engine.

Special Hobbing Attachment

By O. S. Marshall

The special fixture here described is one recently devised and applied to a Gould & Eberhardt hobbing machine in the works of the Jones & Lamson Machine Company. Its purpose is for effecting an angular movement of the cutter-spindle head during cutting operation on certain jobs.

One particular job for which this attachment is used is a worm-wheel that is hobbed for both a right and a left hand worm, half the tooth-width being for right hand, and half for left hand. The worm for this wheel to be seen with the gear in Fig. 1 has right and left hand threads cut on opposite ends. When it is desired to shift from right to left hand feed or vice versa, the worm is moved longitudinally from one position to the other and held in either position by a controlling lever.

FIG. 1—RIGHT AND LEFT HAND WORM AND WHEEL.

The production method for this worm-wheel had been to hob all the blanks in the lot with a hob of one hand and then run the lot through again, using a hob of the opposite hand in the second operation. A little experimenting revealed that both operations could be performed with the same hob without materially affecting the tooth-form and merely required rotating the cutter-spindle head angularly until the correct lead angle was obtained. The time was greatly reduced also. The machine could be set up for either a right or a left hand hob, the work, of course, rotating in accordance with the lead of the hob to be used. The cutting operation consists in feeding the blank into the hob the required depth in the regular manner. When the wheel has been hobbed to suit a worm having a lead in one direction, the cutter-spindle head is given the required angular movement to hob the wheel to suit a worm having a lead in the opposite direction. Both hobbings are done without stopping the machine or backing the work away until the two operations are completed, or both right and left tooth forms are cut.

The parts in Figs. 2 and 3 have the same reference letters. The worm-wheel segment A is attached to the cutter-spindle head, B, by means of supports as at C and so that its pitch line is coincident with the central pivot of the cutter-spindle head B. The worm D is carried by the housing-block E, firmly attached to the vertical slide G, which carries the cutter-spindle head. A stop, set in the segment A (in conjunction with adjustable stop screws), limits the amount of angular movement of the cutter-spindle head.

It will be observed that the worm-wheel segment A moves with the cutter-spindle head and is necessarily limited in the amount of possible travel, but this

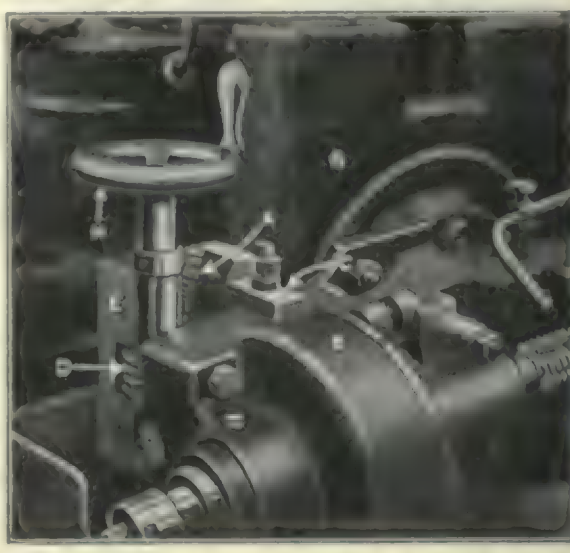


FIG. 2—THE ATTACHMENT ON THE MACHINE

amount is sufficient for all ordinary uses. The worm is carefully seated to avoid backlash. The device is manipulated by means of the handwheel H, the proper amount of angular rotation being governed by adjustable stop-screws. It is necessary to free the clamping bolts of the cutter-spindle head slightly to permit its responding to the action of the worm, the practice be-

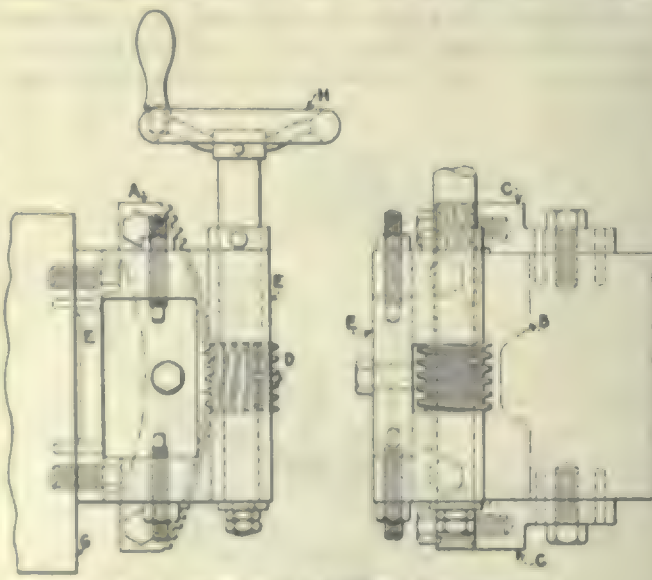


FIG. 3—DETAILS OF THE ATTACHMENT

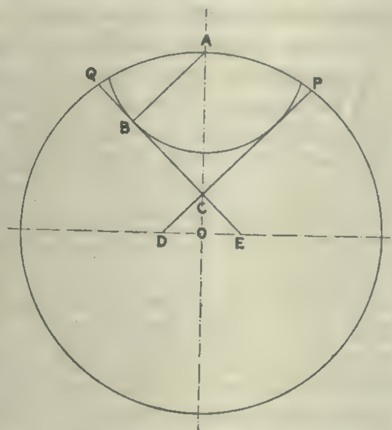
ing to leave one bolt at the top tightened during the in-feed, releasing it slightly while the operator manipulates the attachment.

The fixture has proved its value in repeated production jobs. When spiral gears of extreme angle come to the machine for generating, the attachment is removed. It can readily be attached or detached at any time and as the parts to be fitted to the machine are fitted with dowel pins, their proper location is easily determined.

A Problem in Shop Trigonometry

By M. Tolliver

The problem given and solved by J. Rantsch, which appeared on page 733 of *American Machinist*, is —. That's it. What is it? What does he want to find? When I went to school I was taught that the first step in solving a problem was stating it. So far I have not been able to find what Mr. Rantsch wanted to do, and not knowing this I am not able to say whether the solution fits it or not. Supposing, however, that he wants to cut the right-angle groove, and its outline must be marked off on the piece, it seems to me that he does a whole lot of things which might be left undone, and this is a sin second only to not doing the things which should be done.



A PROBLEM IN SHOP TRIGONOMETRY

If the problem is merely that of scribing the outline of the groove I would work it out as follows:

As $AB = \frac{15}{32}$ and the angle $ACB = 45$ deg., the line $AC = \frac{15}{32} \times 1.4142 = 0.663$. Subtracting this from the radius AO, we find

$$CO = 0.9375 - 0.663 = 0.2745$$

As OD and OE are both equal to OC, we can lay out the three points C, D and E and draw the lines DCP and ECQ, which winds up our problem.

A Large Repair Job in a Small Lathe

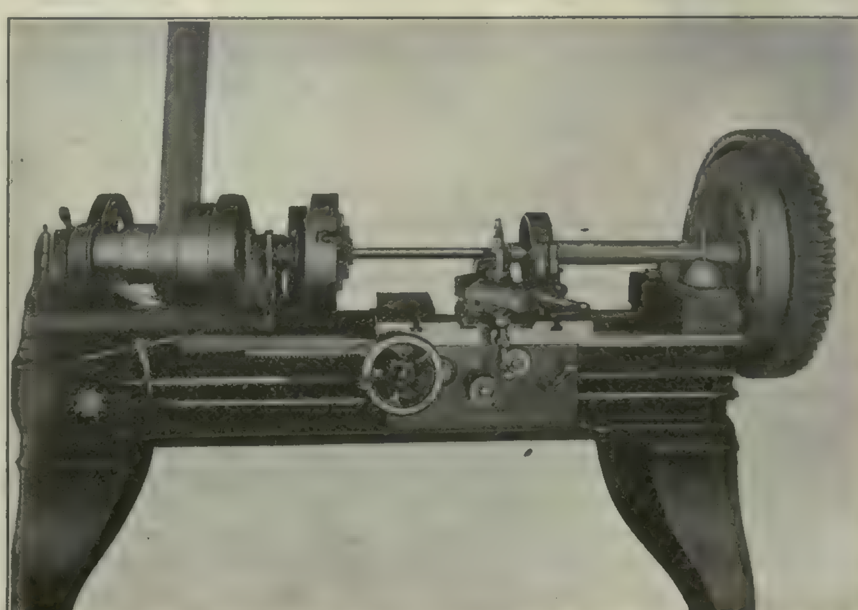
By George Wilson

The drum shaft, clutch, and gear from a hoisting engine were in the shop for repairs, having become damaged by an accident to the clutch mechanism. The repair involved the turning of a shoulder and cutting a new thread on the end of the shaft opposite the gear.

The first thought was, as a matter of course, to get the gear and clutch ring off so that the shaft could be placed between centers, but these parts were keyed very solidly in place and, as we learned that a similar shaft had been ruined beyond repair in an attempt to remove the gear, we changed our minds and decided to devise a way to do the work without taking the gear off. The illustrations show how the work was done.

There was an axial hole in the small end of the shaft about $\frac{7}{8}$ in. in diameter and 5 in. deep, and this circumstance aided us materially in the set-up. A bar of machine steel was first put on centers in the lathe and shouldered down at one end to a drive fit in this hole. The shaft was then placed in the lathe with the gear overhanging the bed—the tailstock having been removed for the purpose—the end of the extension caught in the lathe chuck and the weight of the gear supported by a large V-block carefully packed up to the right height.

The steady rest of the lathe furnished a support for the shaft close to where the cuts were being taken. We were thus able to complete the turning and threading almost as readily as if the gear had been removed.



LARGE REPAIR JOB IN SMALL LATHE

Locating Cutters in a Boring Bar

By William J. Thirkettle

Some time ago I had occasion to bore a number of holes in a rather awkward set of castings and the only machine available for the boring was a radial drilling machine. Owing to the peculiar shape of the castings, the position of the holes and the absence of several movements that would be found in any standard boring mill, it was necessary to leave the bar in place after a casting was set up until all the holes in that casting had been bored.

As it would have been difficult indeed to obtain a measurement of any kind to assist in resetting the cutters with the bar in place I was obliged to devise some way to return them to exact position after each resetting.

The cutters were round pieces of tool steel fitted to transverse holes in the bar and held in place by setscrews. In making up these cutters I first drilled and countersunk a conical cavity—like a center hole—in one side of each cutter midway of its length. Setting them in place with the cavities opposite the respective setscrew holes in the bar, I dropped a small steel ball in each and followed it with a cup-pointed screw.

Thus held, I put the bar on centers in a lathe, turned the cutters to their respective diameters, removed and hardened them and returned them to place for grinding and relieving. I could now take out the cutters at any time for sharpening and return them to their respective places with assurance that the little ball would locate them accurately to cut the correct diameters.

Boring bars, fitted with interchangeable cutters as described in the preceding paragraphs, will always be found useful in shops where much boring is to be done.

Editorial

THE OLD IDEA of putting all the best furniture in the parlor, protecting it with slip covers and locking the door to open it only in case of a funeral, is pretty nearly obsolete at this date. But to buy nice machinery and then pamper it for fear it may wear out is still quite common. What is the good of chairs except to sit on them, and what is the use of machinery except to produce with it?

The Honor and Responsibility of Being an American

AT THE TIME of year when sentiment is uppermost in the hearts of men it is a gratifying feeling to know that you are respected, trusted and loved by some at least of the people in this unhappy world. One of the best features of this feeling of gratification is that it stimulates one to be worthy of the gratitude and to strive to earn more of it. There is also a responsibility to remain true to the ideals that have led one on which has a sobering influence.

We have recently had the pleasure of hearing from an American Relief Association officer what the Russian thinks of the American, from an eminent mining engineer formerly employed by the Turkish government what the Turk thinks of the American, from a Chinese merchant and from an American worker in a Chinese school what the Chinese thinks of the American, and from the secretary of the A.S.M.E. what the South American thinks of the North American engineer.

In Russia, we learn, the A.R.A. has not only filled the stomachs of the people and broken the famine but has helped these desperate people to regain their grip. They look on Americans as a people apart, a people to be trusted and to be emulated.

To the Turk we appear as the only Christian nation that does not have a feverish desire to exploit him or his country. He has had rather unpleasant experiences with his European neighbors and while he may not have been all that could be desired in his dealings with subject peoples he is not worse than most of the rest of us.

China looks upon us as a friend without an ax to grind, a pleasant contrast to other ostensible friends with concessionary bees buzzing in their bonnets. Our medical missionaries, our educators and our financial advisers have paved the way for friendship which the square dealing of our statesmen has helped to confirm.

The South Americans are sending more of their boys to the United States each year to learn something of our ideals of integrity, efficiency and right living.

What a grave responsibility rests on our shoulders to live up to this admiration and respect. But what a wonderful opportunity it presents to carry on the good work and help those less fortunate than ourselves to help themselves to their place in the sun. That we may be able to realize on this friendship by establishing commercial relations should be a minor consideration. If we take care of the moral responsibility that faces us, in the true Christmas spirit, we need have no fear that our reward will not come along in due course.

Ship Subsidy Bill Threatened by Dog-in-the-Manger Opposition

A REGRETTABLE SPIRIT of envy, a mean dog-in-the-manger attitude, has been responsible lately for holding back the fulfillment of many worth-while projects. There was a time when success and progress in men and nations was a matter of admiration. So long as their prosperity was not secured at the expense of others it was considered commendable.

But recently there has been a change of face. It has reached its most absurd expression in the opposition to the Ship Subsidy Bill. The argument is not that the United States will suffer loss of money or prestige because of its enactment, nor that other nations will suffer, but that certain individuals may benefit.

It is not claimed that the country will lose, but the fact that some people may gain—legitimately—rankles in the minds of the envious. The knowledge that their stubbornness may work havoc to the country means nothing to them.

A certain amount of perversity and blindness on any large issue is to be expected, but when a bushel of coin is refused because some one else may get a grain or two, it is time to do something strenuous. There is little doubt that the United States will benefit by the bill. Then by all means consider the good of the nation! If certain individuals also benefit, so much the better.

It Pays to Keep Up With the Procession

A RECENT BULLETIN from the general manager of the National Machine Tool Builders' Association called attention to a situation that has serious possibilities. It has to do with the standardization movement.

The bulletin discusses a communication from the Chief of Ordnance to the American Engineering Standards Committee recommending that steps be taken to standardize certain machine tool parts and accessories. The letter incloses a list of standards as adopted at the Watertown Arsenal.

Here is the point. If the builders of machine tools do not take an active interest in standardization and present their side of the case in committee meetings that may be called, it is a certainty that the big users will go ahead without them and lay down certain specifications that may be embarrassing to meet.

Another possibility is that the users of machine tools in various important industries may not be able to get together but may go ahead on independent lines, each establishing standards of its own that differ from those of all the rest. For instance, the General Electric Co. might decide that T-slots of certain dimensions should be used on all milling machines of a certain size throughout its several plants. General Motors might take a similar position and say that a standard T-slot of a different size should be used on the milling machines in the Cadillac, Buick, Oldsmobile, Oakland and Chevrolet plants. The Singer Mfg. Co. might es-

tablish still a third standard for its Bridgeport, Elizabethport and South Bend shops. Any one or all three of these standards might require extensive re-designing and re-tooling on the part of every machine tool builder who wanted to bid for business from these companies. And all because the builder refused to sit in and meet the ideas of the customer half-way.

It is a footless argument to contend that the customer must take what the manufacturer chooses to offer him. In the first place there would probably be some manufacturer hungry enough for the business of such big houses to build a product to meet their specifications. In the second place organizations like the ones mentioned could build their own tools to their own standards if they had to. The extra cost would be counterbalanced by the savings due to the standardization of small tools thus made possible.

As a matter of fact the question never would have come up at all if the builders had got together and established standards of their own for the work and tool holding elements of their machines. In that case the users could have used one expensive cutter on each of several milling machines of different makes as the occasion arose, instead of being forced to buy a different cutter for each machine.

All this is very unpleasant to think about and quite unnecessary if the men concerned will only recognize that a real procession has started and go with it. It is a procession that will lead to economic and scientific improvement for every one. Why not join in and help a good thing along?

Vindication of Langley's Airplane Design

TWENTY-SIX years ago Prof. Langley made the second successful flight with his steam driven "aerodrome" model which flew for nearly two minutes and covered about three-quarters of a mile. The trial of the full sized machine in 1903 and its failure due to the landing device, stopped the funds from the War Department and experiments ceased. Three years later Prof. Langley died, largely as the result of hostile criticism and ridicule at this failure.

Yet, perhaps more than anyone else, Langley had worked out the correct theory for planes. His critics and defamers who are still alive must be chagrined to find that the winning glider in the recent competition in England, built by Peyret, is very similar to the monoplane designed by Langley and is credited to him by Peyret himself.

It is to be regretted that Prof. Langley could not have lived to see the airplane of today and to see his own machine flown by Glenn Curtiss in 1914 with its original engine (built largely by Manly), even with the addition of 300 pounds of weight in the shape of pontoons.

All this goes to show how thoroughly American the airplane really is and should inspire us all to aid in its development in the country of its inception. It has long since passed the experimental stage—it now needs to be encouraged by the establishment of landing fields in every city and town and by its use for commercial purposes whenever possible. The growth of the aircraft industry depends largely on popular interest in aviation and each one can help in his own community.

Airplanes are mechanical devices and require machine tools and machinists for their construction and maintenance.

The Trend Toward Simple Machines

THERE SEEMS to be little doubt that the demand, we might almost say craze, for strictly single-purpose machine tools is decidedly on the wane. Just how much of it was justified and how much was a total economic waste, we shall never know. But it is good to know that we are getting back on a more rational basis.

There is, however, a decided tendency on the part of large users of machine tools, such as the automobile builders, to demand *simple* machine tools. Not for machining a single piece, but to perform a simple operation, such as gear cutting, on a simple machine.

Taking gear cutting as an example we find this simplification being forced on the builders instead of being inaugurated by them. The demand for quiet gears in automobile transmissions has led to exhaustive study and experiment in the endeavor to secure gears which are concentric and with correct spacing and tooth form. It has been shown that gears vary slightly from time to time on the same machine. This has been traced in some cases to slight defects in the gears in the machine itself.

Realizing more and more the impossibility of securing perfection in gearing one of the large motor companies built a gear-cutting machine with only four gears in the whole machine. The bearings are large and rigid and the whole machine is as free from spring and vibration as they could possibly make it. It is not a universal machine but it will handle such gears as are found in automobile transmissions, and is not in any sense a single piece machine. The four gears in the machine are made as accurately as possible and the results have been very gratifying. The four gears replace from twenty-seven to thirty-five gears in the commercial machines, these being used to give the machine a wider range of work.

The automobile builder in question has no desire to go into the building of machine tools, and has commissioned several builders of gear-cutting machines to build machines of this simple design. The simplification of machine tools for manufacturing shops is a step in the right direction. There will, of course, always be a demand for a more universal machine for shops doing work in smaller quantities. But the eliminations of gears and bearings must have an effect on securing more accurate work and the first cost of the machine may be somewhat lower.

Just Suppose

JUST suppose that you hired a staff of engineers to travel about the country—or even abroad occasionally—so that they could study the latest methods of doing machine work in the most economical manner.

Suppose they sent you a weekly report, illustrated with photographs or drawings that showed just how the other fellow did it? You'd be pretty sure to find some interesting and valuable information in these reports, information that would save you dollars and dollars every year.

Just suppose you let these reports stay unopened on your desk as you sometimes do copies of the best technical papers, because you thought you didn't have time to read them. *You* probably don't neglect any opportunity to secure new and worth while data, but—

Just suppose.

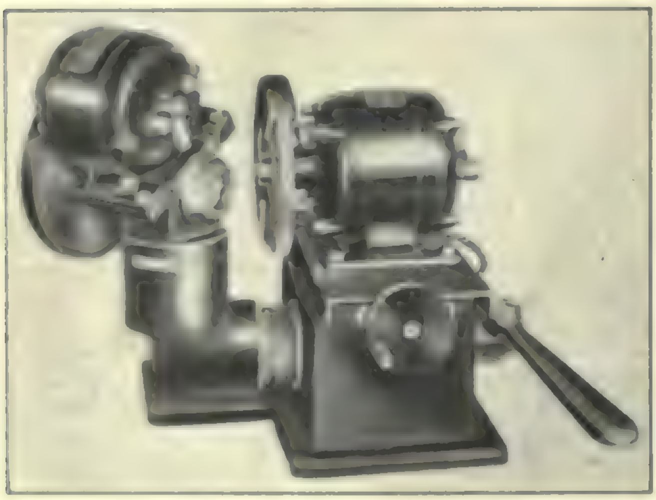
Shop Equipment News

Fleming Valve and Reamer Grinding Machine

The Fleming Machine Co., Springfield, Mass., has placed upon the market the electrically driven machine herewith illustrated for grinding the valves of automotive engines, and also for grinding the valve seating reamers used in connection with them. The device needs but to be connected with any convenient lamp socket to be ready for service.

A $\frac{1}{4}$-hp. ball-bearing motor, mounted upon a slide rest that has screw-adjusted movement in one direction and a hand-lever-operated movement in the other, drives a 6-in. diameter, $\frac{1}{2}$-in. face grinding wheel at a peripheral speed of 5,200 ft. per minute. A 1/20-hp. motor upon the swiveling work head drives the work spindle through speed-reduction gearing. The work is held in spring collets having a maximum capacity of $\frac{3}{4}$ in. round.

The swivelling work head adapts the device to grind



FLEMING VALVE GRINDING MACHINE

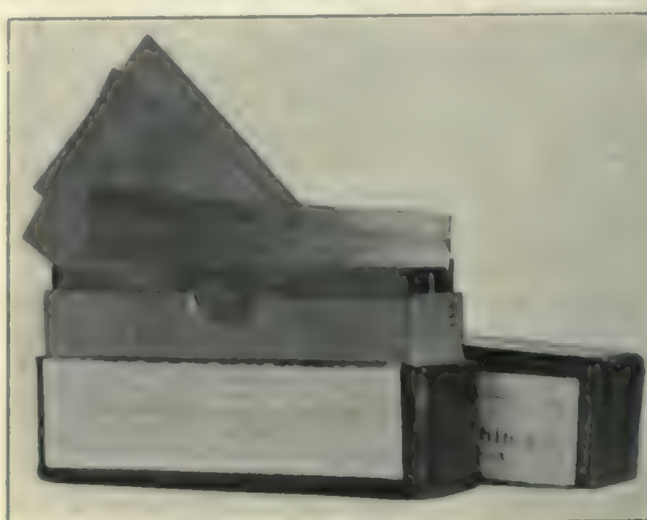
any angle with which the valves of commercial engines are made, and it is easily and quickly adjusted to the desired angle by means of a sector graduated in degrees. Valve seating reamers and the corresponding valves may be ground without disturbing the setting, so that the correct seating of the valve is assured.

Boxed for shipment the device weighs approximately 100 pounds.

Thinsheet Brass Shims

In order to provide the utmost in convenience and economy where small brass shims are required, the Thinsheet Metals Co., Waterbury, Conn., has just placed on the market boxes of brass shims such as illustrated herewith. Each box contains 150 sheets 2 x 4 in. in size, with three thicknesses of 0.001, 0.002 and 0.003 in. The different sizes are kept separate in the box, so that they can be easily reached. The size of the box makes it suitable for use both at the bench or in a tool kit to be carried to the job.

The small sheets are more convenient to use than where it is necessary to cut shims from a large sheet. The waste is reduced, it is stated, as this factor is very often large when shims are cut from a sheet, even



THINSHEET BRASS SHIMS

though care be taken. Strip metal, although economical to use, is not always convenient for the reason that rolls of brass of various thickness are not generally available at each bench and cannot well be carried to repair jobs away from the shop.

"Boyer Superior" Pneumatic Rivet Cutter

Working on the principle that when cutting rivets, a number of comparatively light, rapid blows cause more vibration and therefore more distortion of steel plates than a few intermittent, heavy blows, the Chicago Pneumatic Tool Co., New York, N. Y., has recently designed and placed on the market a type of pneumatically

"BOYER SUPERIOR" PNEUMATIC RIVET CUTTER

operated rivet cutter designated as the "Boyer Superior."

The construction of the device is shown in the accompanying illustration. The tool consists of a dead handle for holding the machine, a throttle handle of the crank design, a throttle valve of the taper type, a back head

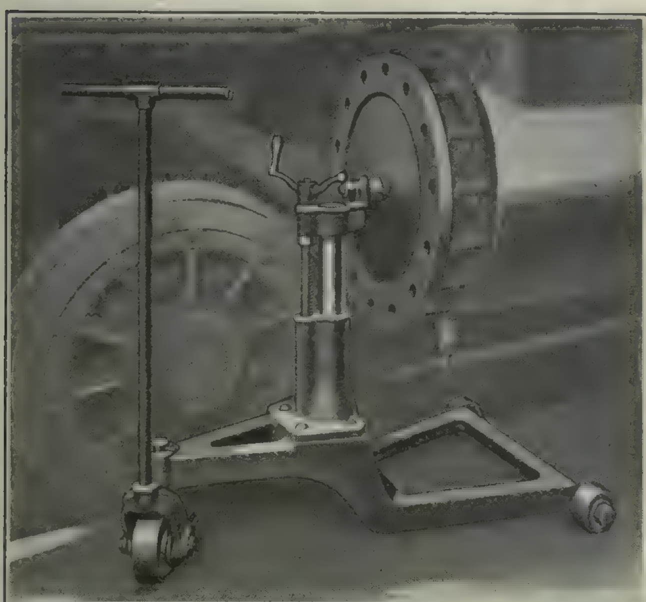
screwed onto the cylinder and secured by a locking device, a cushion chamber in the rear end of the cylinder, a cylinder of seamless steel tubing, a bypass from back to front head, a non-removable electrically welded front head, square coiled spring buffer, adjustable chisel lock, hand hold of the spade handle type, and a chisel.

To operate the cutter, the throttle handle is moved in a line parallel with the cylinder. Each forward and return stroke of the piston is hand controlled. About four blows, requiring approximately 10 to 15 sec., are said to be required to cut off the head of a $\frac{3}{4}$-in. rivet. Two men are needed to operate the machine.

"Viloco" Portable Cylinder-Head Crane

A portable crane or truck for use in the removal and replacement of locomotive cylinder heads and crossheads has recently been placed on the market by Harry Vissering & Co., Chicago and Benton Harbor, Ill., under the trade name of "Viloco." The accompanying illustration shows the device, which is suitable for all classes of locomotives and can be employed for moving the cylinder head to any part of the shop desired.

The frame of the truck, which provides a center distance of $32\frac{1}{4}$ in. between the front and the rear wheels and of 21 in. between the two rear wheels, carries a vertical steel column to which the cylinder heads can be



"VILOCO" PORTABLE CYLINDER-HEAD CRANE

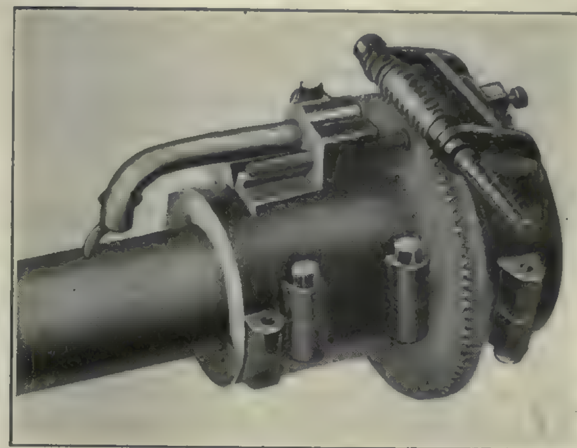
secured. The column is $2\frac{3}{8}$ in. in diameter, and can be adjusted by means of a screw having a pitch of 7 threads per inch. By means of the lever at the top of the column, the screw can be turned to vary the height of the head, the maximum height of the bolt carrying the work being 36 in. above the floor.

The handle for pulling and steering the truck is made of pipe and is connected to the front wheel in such a manner that the weight of the truck keeps the handle in a vertical position when the truck is not being pulled. Lowering the handle causes a slight raising of the truck frame, so that a quick adjustment of the height of the work can be easily obtained. The advantage of this construction is that the cylinder head can be easily raised or lowered to the level required to clear the studs when placing it on the cylinder.

Device for Truing Journals on Locomotive Axles

C. E. Marsh, 324 Hemphill Ave., Atlanta, Ga., has recently brought out the device for truing journals on locomotive axles shown in the accompanying illustration.

The device, including the worm wheel, is made in halves so it can be clamped about the axle. At one



MARSH'S AXLE TRUING DEVICE

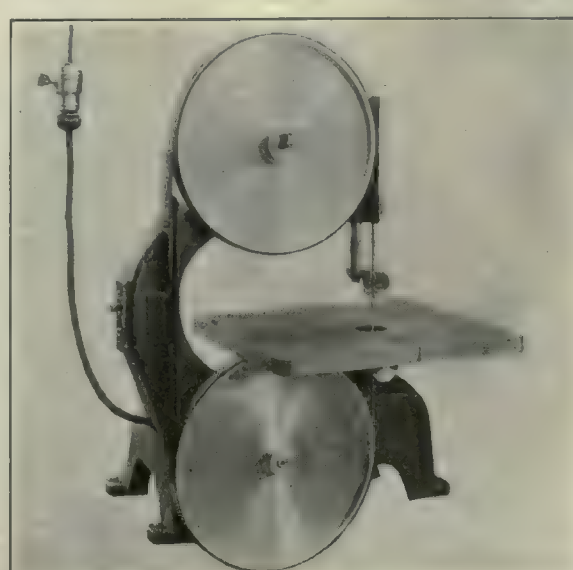
end of the worm shaft is a standard taper shank by which the device may be driven from an air drill or electric motor fitted with a taper socket.

The cutting tool is inserted in the tool arm as shown and may be made of any kind of steel or of any shape desired. The block carrying the tool arm is fitted to a dovetail slide and the feed is by a screw. Three changes of feed in either direction are provided.

The device is portable and its use obviates the necessity of swinging an axle with its wheels into a driving wheel lathe to true the journals.

Jarvis Electric Bench Band Sawing Machine

The accompanying illustration shows an electric-driven band sawing machine for general use such as encountered in a pattern shop, that is being manufac-



JARVIS ELECTRIC BENCH BAND SAWING MACHINE

tured by Benjamin E. Jarvis, Inc., Newark, N. J. The machine is intended for bench mounting. It is of a portable type that can be installed by attaching to any lamp socket, thus eliminating the necessity of countershafts and belting.

The saw bands are of a flexible, Swedish steel of a nature to resist crystallization. The wheels are 12 in. in diameter, 1-in. face, made of steel and mounted on ball bearings. The upper and lower guides are of the roller type and the rolls revolve on hardened centers. The capacity of the machine is for 2-in. wood, either hard or soft. Saw bands can be supplied for cutting thin brass and soft metals.

Current for driving the ⅓-hp. motor may be supplied from a lighting circuit. The motor is controlled by means of a pushbutton switch located on the frame of the machine. The table is 13½ x 15 in. in size and may be tilted to any angle. The machine is 28 in. high and weighs 120 pounds.

Selling Machine Tools

By Albert Clegg

What are the most essential qualities for the successful selling of machine tools? Is a knowledge of men more desirable than a knowledge of things? In other words, is the jolly good fellow with the pleasing and agreeable personality but with very little technical knowledge likely to make a more successful salesman than the chap who knows the subject from A to Z, but who has not had either the time or the inclination to develop the social side of his being?

We all know that the man who combines a thorough knowledge of his goods with a sound study of human nature and psychology is the man most likely to get there. He is quite ready to agree, when out to sell us something, that our Ford is equal to a Rolls-Royce, that our local football team is almost sure to win the cup, and so on, until we begin to believe that after all our judgment must be sound.

From the salesman's point of view, the study of human nature is all too often a study as to how to sell something to a man who doesn't want it, and who, when he gets it, frequently does not and cannot make the best use of it. Someone has said that the best salesman is a combination of satisfactory product and satisfied customer.

From this point of view the purely psychologist type of salesman is more likely to come a nasty cropper than the purely technical type. The latter, by his very ignorance of human nature, would be protected from the risk of selling a machine or appliance which the purchaser had no use for; in fact, his technical knowledge would prevent him from even trying. On the other hand, his failure to be agreeable might prevent him from convincing a prospective client that he was losing money by not purchasing a certain machine.

The technician is more likely to err by sins of omission, while the psychologist will usually suffer from the results of sins of commission. One will sell more and give less satisfaction per sale and the other will sell less and give more satisfaction per sale. The former might eventually build up a business or connection while the latter would run a grave risk of losing an already established connection. Both men would be learning by bitter experience all the time. The final result would resolve itself into a question as to which man could learn his business the sooner. Is the study of human nature more difficult than the study of machine tool construction, design and operation?

What, then, are the basic principles of salesmanship as particularly applied to machine tools? In the first place it is to establish some definite, sentient connection between the prospective user and the manufacturer with a view to effecting a deal that will be to the mutual benefit of the two parties. Note the word *mutual*; the day is gone by when one confers a favor by purchasing from another. Second, salesmanship should assist the manufacturer in keeping abreast, or ahead, of the times, by indicating the lines successful competitors are following. Third, salesmanship should concern itself with striving to achieve the very widest publicity for the goods.

The day is past when machine tools can be sold by making wild and extravagant statements as to what they can do. An incident which occurred some years ago will serve to illustrate the dangers of such a course. A representative of one of the biggest merchants in the country called on one of his customers to discuss an inquiry for a cutter grinder. The merchant handled one of the leading American makes of cutter grinder, a machine that was almost, but not quite, universal in its capacity. The customer wanted the machine for general cutter grinding work but particularly for a certain special job that was rather outside the usual scope of such a machine. When the representative called he was asked if the machine offered by his firm would be suitable for the special work. In reply he gave a long dissertation as to the capabilities of the machine on every class of cutter grinding and wound up by suggesting that the machine would play the Halleluiah chorus if set up properly. On the strength of his assertions and assurance, the order was placed, the total value being something under £100. Now for the sequel. While the machine was a good one in every way and quite satisfactory on all the ordinary classes of cutter grinding, it was an absolute failure on the job for which it had been particularly bought, and no amount of argument could convince the customer that it was at all suitable. The machine was finally taken back and the representative, by bitter experience, was taught never to make extravagant claims for his machine. For years afterward neither the representative nor his firm sold a penny's worth to the disappointed customer, the loss involved amounting to thousands a year.

To return to our original query, is a knowledge of men more desirable than a knowledge of things? Would we as business men be more likely to give an order to a nice, agreeable sort of chap who knew very little about the subject, than to a directly opposite type of man who knew the whole business thoroughly and could discuss all the pros and cons relating thereto? Of course we all like to meet the smart, incisive fellow, whose personality is such a refreshing tonic in the ordinary, everyday routine of business, but nevertheless very few of us would be prepared to admit (even to ourselves) that our decisions had in any way been influenced by the man's personality alone. In selling machine tools the object is to prove that the tools offered will pay a good return and be entirely satisfactory in the prospective client's works, and the only man qualified to judge that is the one who is thoroughly grounded in the operation of the machine. His personality merely enables him to present his argument in the most agreeable manner, and if he is lacking in a knowledge of the subject his arguments will carry very little weight.

News Section

Air-Cooled Motor Meeting of S.A.E.

The Metropolitan Section of the S. A. E. held its December meeting at the Automobile Club of America on the 14th. The paper was on Air-Cooled Motors by Charles Grimes, research engineer of the H. H. Franklin Co., in which he gave the results of their twenty two years of experience with air cooling. An interesting feature of the paper, and one which shows the broad policy of the Franklin Company, was the pains taken to point out the details to avoid in building a successful motor. The results of their years of experience were laid bare for the benefit of any builder who may be working toward air cooling, and there are many. This is in such marked contrast to the older and, we believe short sighted policy more prevalent in other lines, that it stands out as a shining example of co-operation.

The paper was very complete and showed great care in the development of both the mechanical and the combustion features of the new motor. The small amount of power consumed in cooling was rather astonishing to many and the care with which the details have been worked out is of unusual interest. There was some discussion and numerous questions, all of which were answered very satisfactorily.

Power Exposition Very Successful

The National Exposition of Power and Mechanical Engineering, following as it did the forty-third annual meeting of the American Society of Mechanical Engineers, attracted a large number of engineers from all parts of the country. It was held in the Grand Central Palace, New York, N. Y., from December 7 to 13.

Although there were some exhibits by machine tool and engine builders, the majority of the displays were devoted to equipment for boiler room and power plant use. Firebrick, condenser, stoker, tank, boiler tube and such manufacturers had large exhibits, of a heavy nature in many cases. Valves, meters and a variety of measuring and recording instruments were shown in considerable numbers. The scope of the exposition is attested by the fact that there were about 150 exhibitors. Full size units and working models served to show the practicability of the products exhibited, and added life and interest to the exposition.

A.E.S.C. to Study Steel Numbering Problem

After extended discussion of the problem involved in the numbering of steels, the conference called by the American Engineering Standards Committee, at the request of the Bureau of Standards, decided the matter could be handled better by a sectional committee of the American Engineering Standards Committee. For that reason no plan or program was adopted so that the sectional committee could consider the matter without limitations as to whether the classification be based on chemical analysis, heat treatment or physical tests.

Machinery Exports Show Slight Decrease

Exports of metal-working machinery during October were slightly less than in September although considerably above the value of the exports in October, 1921. October exports were valued at $902,188, as compared with $1,093,381 in September of this year and $1,032,483 in August. The detailed figures, of the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS METAL-WORKING MACHINERY

	September 1922	October 1922
Lathes	$54,874	$57,161
Boring and drilling machines	40,628	34,262
Planers, sharpeners and slotters	15,758	38,256
Bending and power presses	11,085	7,179
Gear cutters	14,667	983
Milling Machines	29,662	69,389
Sawing machines	5,041	1,800
Thread cutting and screw machines	22,924	7,464
Punching and shearing machines	7,171	14,977
Power hammers	20,886	10,386
Rolling machines	3,897	786
Wire-drawing machines	81	935
Polishing and burnishing machines	1,265	1,248
Sharpening and grinding machines	56,468	78,044
Chucks, centering; lathe, drill and other	18,676	19,102
Reamers, cutters, drills and other parts for machine tools	114,475	121,944
Pneumatic portable tools	35,389	26,550
Foundry and moulding machinery	44,436	41,314
Other metal-working machinery and parts of	596,508	370,408
Total metal-working machinery	$1,093,381	$902,188

Navy Funds Increased

The Navy appropriation bill reported to the House last week carried appropriations totaling approximately $53,000,000 for continuing construction work on the ships permitted to be completed under the five-power treaty.

This is an increase of $12,000,000 in round numbers over the estimates submitted in the budget, which provided for $29,000,000 in cash and $12,000,000 in indirect appropriations. The increase made by the Appropriations Committee mainly is in the indirect allowances.

Foreign Trade Convention

The Tenth National Foreign Trade Convention of the National Foreign Trade Council will be held in New Orleans on April 25, 26, 27, 1923, according to announcement made last week by O. K. Davis, secretary of the council, India House, New York City.

Domestic Business Shows Further Improvement

Further improvement in the general business situation is shown by November figures so far received by the Department of Commerce. Marked increases have again occurred in the production of pig iron and steel making the output of these industries much the largest for any month in two years. Unfilled orders of the Steel Corporation declined slightly, but this may be due in part to better transportation, which has made it possible to catch up on deliveries. Building contracts in November totaled $248,000,000, or only $5,000.000 less than in October and 30 per cent above November, 1921. Further increases in employment have taken place. The U. S. Employment Service reports that expansion in employment throughout the country has been the greatest since January.

Provides for Increase in Naval Aircraft

A bill, authorizing the Secretary of the Navy, during the fiscal year 1924, to procure, purchase, manufacture, or construct additional aircraft as may be required for the Naval Establishment, including the necessary spare parts and equipment therefor, at a total cost not exceeding $5,798,950, has just been introduced in the House and referred to the Committee on Naval Affairs.

Willard Defends Esch-Cummins Law

To keep the Esch-Cummins Transportation law intact would be the best policy for the Government to pursue with respect to the railroads, according to Daniel Willard, President of the Baltimore & Ohio Railroad, who spoke last week at a luncheon of the Advertising Club, 47 East Twenty-fifth Street.

Although the roads are not yet earning what Mr. Willard considers a fair return on the value of their property, he is confident that a gradual reduction of freight rates may be looked for, providing the Federal rail law in its present form gets a fair and sympathetic trial.

British Industries Fair

The Board of Trade of Great Britain issued during the past week a booklet on the forthcoming British Industries Fair which is to take place concurrently in London and Birmingham from February 19 to March 2, 1923.

The Fair, it is announced, is not an exhibition but essentially a trade fair to which only buyers will be admitted. Americans desiring to attend the Fair, while visiting England, may obtain tickets of admission on application to the British Consulate General, 37 West Van Buren St., Chicago, Ill.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Director, Commerce and Finance, New York

THE advance in sterling exchange and the growing shortage of labor are the two most important developments of the week. Bills on London sold at 4.69 last Wednesday and although the market reacted somewhat and stands at 4.65 as this is written it is plain that the masterful financiers of the British Empire are determined to provide the merchants of the realm with a medium of exchange that is as good as the best.

Although it is variously explained, the immediate cause of the advance is not apparent, but it is fundamentally due to the exhibition of financial courage that the English government has given in handling its debt to our government as well as its persistence in attempting to untangle the reparation snarl in which France and Germany are involved.

Mr. Morgan's call upon Secretary Hughes, the ensuing talk of a loan of 1½ billion dollars to Germany, and a statement from the White House indicating that the President would be glad to find a way to aid Europe in settling her economic problems, have also helped the market for foreign exchange. Francs have advanced sharply and even German marks are up to 145 despite the latest statement of the Reichsbank which shows a total of over 753 billion paper marks outstanding as of Nov. 20.

The effect of the advance in exchange has been to lift commodities like wheat and cotton whose value is largely determined by the price obtained for our exportable surplus, but as sterling is now within 4 or 5 per cent of par there is not much room for a further rise and it is quite possible that the Bank of England will soon attempt to strengthen its position by taking gold from us in quantity, even at a small loss.

Should any such movement develop it is almost certain our commodity markets would be chilled, for the analysis published weekly by the Federal Reserve Board shows that the total of the loans, discounts and security holdings of the 784 more important member banks on November 29 was 416 millions greater than on May 25, 1921, when liquidation was being insisted upon as essential. Since that date the gold held by the Federal Reserve Banks (which gained nearly $15,000,000 last week) has increased by over 669 millions, while the Federal Reserves notes in circulation have decreased some 488 millions. The result is that the reserve ratio has risen from 56.8 per cent to 75.1 per cent, but all this would be speedily changed if we commenced to export gold in important amounts.

Our dependence upon a continued abundance of credit for the moderate degree of business activity and prosperity now reported, and in some cases exaggerated, is also emphasized by the labor shortage.

The Department of Labor says that the shortage is acute and this statement is confirmed by employers all over the country. The scarcity is attributed to the restrictions upon immigration. One result of it has been an abnormal exodus from the farms to the cities. The negroes are leaving the South in such numbers that organized efforts to check the hegira are being made in some states, but the railroad passenger agents report that the movement continues nevertheless.

Wages in many industries are already advancing as an inevitable consequence of the competition for labor and the sequence is certain to be a decreased production at an increased cost. This may for a time create an illusion of good times but it will limit consumption, tie up credit and must ultimately restrict activity. The existing railway congestion adds to the difficulties of a difficult situation.

In a recent address President Markham of the Illinois Central Railroad pointed out that in the five years ending with June 30, 1907, the number of freight cars in service increased more than 480,000. In the next five years it increased less than 230,000; in the next four and a half years it increased only 114,000, and in the five years ended with 1921 the number of freight cars in service actually declined more than 13,000.

During the same period the number of locomotives in service varied as follows:

5 years ending June 30, 1907	increased	18,160
5 years ending June 30, 1912	increased	8,447
4½ years ending Dec. 31, 1916	increased	4,558
5 years ending Dec. 31, 1921	decreased	664

These figures explain the present inability of the railroads to handle the traffic that is the economic life blood of the nation. They make it clear that a business boom is impossible because an abnormal increase in distributive trade would be almost certain to result in strangulation and until our railway facilities are increased the check rein of inadequate transportation will probably continue to hold us back.

A year ago when trade was subnormal and well below the capacity of our facilities for production and distribution it was safe to predict an improvement, but the shortage of both labor and transportation seems to make any further expansion presently impossible and this view of the case suggests caution in accepting the many highly optimistic predictions that are now being made.

A mild prosperity is indicated, but no wild outburst of speculation and advancing prices appears to be possible. The Christmas trade is good. The postal receipts swelled by the increased use of the parcels post show a gain of about 20 per cent. The steel mills are fairly busy and copper is at last a little above 14 cents. Sugar is slightly easier as the weight of the new and abundant Cuban crop commences to be felt, and cotton and wheat are somewhat higher because of the advance in foreign exchange as already explained.

The stock market is steadier. The fear of political radicalism appears to be at least temporarily allayed. The year-end selling to reduce income taxes is nearly finished and the reinvestment demand has absorbed several large issues of new bonds.

The purchase of the International & Great Northern by the St. Louis & San Francisco Railway has attracted not a little attention as foreshadowing other transactions of the same character that are inevitable if the consolidations provided for in the Esch-Cummins bill are to become realities. Inasmuch as it is only through such consolidations or government ownership that it will be possible to rehabilitate our transportation service and as either alternative is almost certain to increase the value of railway securities I continue to believe that the greatest bargains of the investment market are to be found among them.

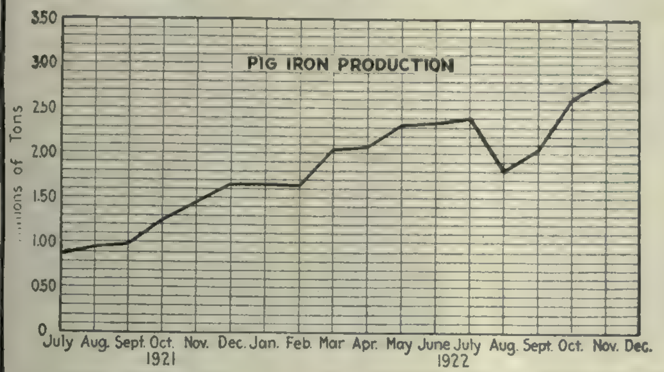
Southern Industries See Prosperity Ahead

A thorough investigation of general conditions prevalent in the metal trades industries over the South, conducted the fore part of this month by William E. Dunn, Jr., secretary of the Southern Metal Trades Association, shows the industry to be in better shape than it has been at any time within the past three years, with every promise that 1923 will prove a prosperous year. Most manufacturers seem to be expecting an inflation period similar to that of 1918 and 1919, but look for it to be on a more stable basis and not followed by so long a period of depression, if any at all.

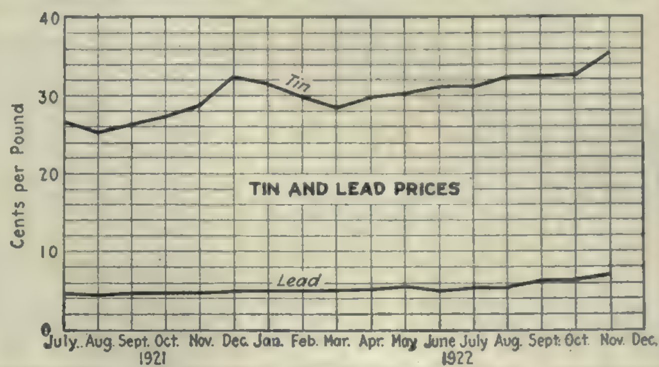
More furnaces, foundries and machine shops are operating in the South now than at any time in several months, and a majority of them are well sold ahead into 1923. The pig iron melt in the whole district, principally in Alabama, is at the highest mark since the flush times during the War. The usual Christmas holiday will, for the most part, be confined to a day or two this year because of the rush of business.

The association advises pig iron quotations for the first quarter of 1923 as somewhat weak, the price on some sales being as low as $23 for No. 2 foundry, with heavier tonnages selling in some cases for as low as $22.50. The prevailing price, however, appears to be around $25 with inquiries very numerous from substantial buyers.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



PIG iron production registered another advance in November over the month previous, although the increase was not so marked as in the case of the October output as compared with that of September. Coke and anthracite pig iron tonnage during the month totaled 2,849,703 tons or an average of 94,990 tons per day as against the October total of 2,637,844 or 85,092 tons per day. November, 1920, output totaled 2,934,908 tons or 97,830 per day. The number of blast furnaces in operation increased during the month 242 being in blast on Dec. 1 as against 218 on Nov. 1.

Tin and lead prices were stronger and higher during the month. The average November price for the former was 35.911 cents as against 33.935 in October, while lead reached 7.047 cents, an increase of over a half cent during the thirty-day period. While the demand for both metals for home and foreign consumption has not been of an active nature, a better tone has been in evidence with excellent prospects for a strong market during the first quarter of the coming year.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0378	0.0373
Brass rods.....	per lb........	0.171	0.1700	0.15
Solder (½ and ½)	per lb........	0.24	0.23	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.59	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list........	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

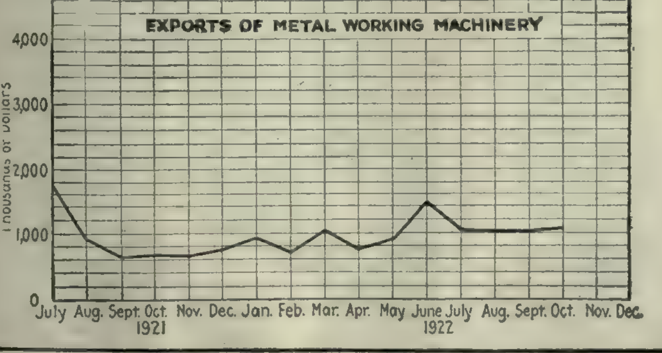
Automobile share markets declined slightly during the month, ten representative issues showing an average price of $44.20 per share as against the October average of $46.52. No special significance is attached to the decline, the entire New York market showing a softening of prices with but little interest and that chiefly of a professional character in evidence. Automobile production continues heavy with an excellent demand for closed cars and a shortage of bodies.

Metal working machinery exports held up well during October, considering the European situation, although there was a drop in value as compared with September totals. The value of machinery exports during the month totaled $902,188 against that of the previous month of $1,093,891 and the August total of $1,032,483. As compared with the month of October, 1921, there is shown an increase of over $200,000, the total in that month being $680,931.

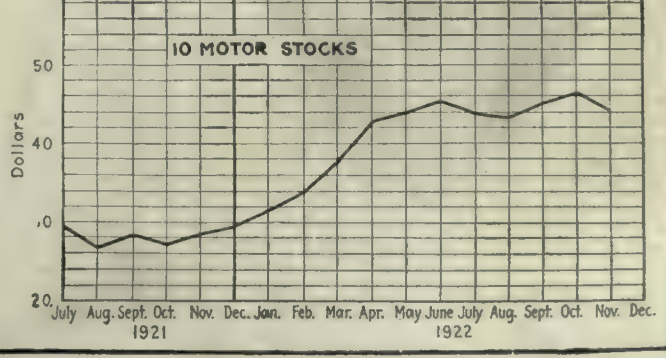
American foreign trade for October shows exports of merchandise totaling $372 millions, a total greater than in any other month since March(1921, and 19 per cent higher than September exports. Import totals for the month have been delayed due to changes in classifications and rates under the new tariff. A review of foreign trade changes during the fiscal year ending June 30, 1922, by the Department of Commerce, recently made public, shows a decline in the value of imports amounting to 28.6 per cent and a decline in the value of exports amounting to 42.1 per cent as compared with 1921.

Financial conditions as reflected in the statement of the Federal Reserve System, at the close of business Dec. 13, 1922, shows gains of $15,400,000 in gold reserve as against a decrease of $3,500,000 in other cash reserves.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp. Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White Willys.



Business Conditions in Germany

Machine Tool Exports Decline—Unemployment Still a Serious Factor—Industry Burdened by Taxation

By OUR BERLIN CORRESPONDENT

RECENT political developments, namely the problem of the stabilization of the mark, have a decided influence upon the course of events. The possibility that the mark will be stabilized in the neighborhood of 3,000 marks to the dollar, has met with considerable skepticism in the business world which has been disappointed too often to put much faith in such announcements.

As a matter of the simplest precaution, buyers are awaiting further developments. The same applies to export sales, which have to be contracted in foreign money. It is clear that under the present uncertain conditions, all purchases not for immediate demand are in abeyance. The business world is receiving an inkling of what will happen, when the stabilization problem is really taken up seriously.

The conviction, that an improvement of conditions cannot be brought about by financial manipulation alone, is spreading and taking deeper root. With the reparation problem in the background for the time being, the public interest is absorbed almost completely by the two great factors, viz., economy and increase of production. Behind these problems is looming up largely and gloomily the huge conflict between the industry and labor, employers and employees.

Machinery Exports Decline

The actual employment of the machine building industry has not receded perceptibly. Reports of shortening of working time are becoming more frequent, but are caused rather by shortage of material and fuel, than by actual lack of orders in hand. The number of new contracts concluded are, however, becoming more and more unsatisfactory. The tendency to retract on orders already booked is also becoming more marked with buyers, and in a number of cases also with sellers. Generally speaking it may be said, that the standard of employment is gradually sinking, but that a fair level can be maintained during the next two or three months. In the machine building industry the ratio of unemployment from August to September decreased slightly from 3 per 1,000 to 2 per 1,000. This is, however, entirely an exception. In all other trades unemployment has increased.

The decline of foreign business found expression in the September returns of exports. Machinery exported has dropped from 42,800 tons in August to 31,000 tons in September. Nearly all classes of machinery are affected by this drop. Machine tool exports for instance, of which, in August, 10.127 single units weighing 3,881 tons were exported, dropped to 7,183 units or 2,412 tons, which is considerably less than in any of the previous months of the year. The total export of machiney and that of machine tools in the first three quarters of the year can be seen by the figures in the accompanying table. As an item of interest, the price per ton realized is added in paper marks and in corresponding gold marks computed at the prevailing rate of exchange.

TOTAL EXPORTS OF MACHINERY FROM GERMANY DURING 1922

1922	Tons	Value Million Marks	Price per Ton Paper Marks	Price per Ton Gold Marks
1. quarter	112,199	3,644	32,500	600
2. quarter	116,715	4,898	42,000	590
3. quarter	110,243	10,571	95,800	390

MACHINE TOOL EXPORTS

1922	Tons	Value Million Marks	Price per Ton Paper Marks	Price per Ton Gold Marks
1. quarter	16,593	....	25,400	470
2. quarter	11,900		47,800	670
3. quarter	9,276	....	108,000	440

From these figures it can be seen, that the exports in the third quarter fall short of both previous quarters. This is solely due to the bad returns of September, the returns of July and August being in keeping with the previous months. The September exports of machine tools represent a value of 1,440 million paper marks. The price per ton is 172,000 paper marks or 490 gold marks. Nearly all foreign markets have contributed to this decline. It is interesting to note, that machine tool imports in September have kept at the level of August as regards weight, while the number of single tools has increased.

In view of the still continuing business depression in most of the German markets considerable disappointment is also felt that, after a promising start, the Russian market is again closing up. This is explained by the Russian Government to be due to the fact, that the Russian works are now in such a state, that they can largely satisfy the demand. From various reports this appears to be gross exaggeration and is only barely veiling the real reasons, which no doubt are to be found in the realm of finance. This is a hard blow, especially to the locomotive industry, which has been figuring on large business for Russia, especially as the German railroads have considerably reduced their annual requirements. An order for 60 locomotives for Rumania, which it is reported has recently been given, is of course only a small compensation.

Fluctuating Tool Prices

It is illustrative of the rapid movement of prices, that the price directions issued by the Machine Tool Builders' Association are now issued in intervals of 10 days. While the increase of the price over the previous month was in September 45 per cent, it was in October 87 per cent and for the first 10 days of November 93 per cent. At the time of writing prices of machine tools average from 1,000 to 1,500 marks per kg. compared with approximately 1 mark in pre-war times. This is the price for standard tools. Specialities command a considerably higher price. A case your correspondent heard quoted today seems to be about the highest that prices have climbed up to. For a gear cutting machine of the old Gleason type (templet) of 3,000 kg. weight a price of 10 million marks or somewhat over 3,000 marks per kg. is being asked. This is considerably above pre-war standard, even in goldmarks.

Greatly divergent and frequently erroneous opinions prevail in foreign countries with regard to taxation, the German industrial establishments are subjected to. This taxation is threefold:

1. The trade tax, which is levied in progressive proportion of the income. The lowest percentage is 1½ per cent for gross revenues from 15-20,000 marks, rising to 27 per cent for a gross revenue above 3 million marks,

2. The company tax, which is 10 per cent of the net revenues,

3. The capital transfer tax, raised on all capital transactions, like new floatations, loans issued, bonds and the like. This tax is 7½ per cent.

Heavy Taxation Burden

In the case of a company, for instance, which has earned a revenue of 1 million marks per year, after paying all expenses, such as salaries, wages and sundries, and which has raised a loan of 1 million marks, the taxation would be as follows:

First, 20 per cent on the revenue plus such expenditure, which remains subject to the taxation under the law, like rents, interest on loans and mortgages, cost of repair of premises and 40 per cent of new equipment. This taxible expenditure frequently equals and even exceeds the revenue.

Second, the company tax of 10 per cent payable on the amount of revenue remaining after paying the trade tax.

Third, the capital transfer tax of 7½ per cent on the loan of 1 million marks, allowed to be put under deductible expenditure.

In the average the taxes amount to from 35 to 60 per cent of the revenue. The turn-over tax, which is raised on the transfer of any property from one hand to the other by sale, is not included, as it is an indirect tax, which is burdened upon the buyer.

As has already been mentioned in these columns, the credit situation of the industry in this country has somewhat eased in consequence of the huge sums of German money in foreign hands flowing back into the country in the shape of investments in industrial securities. A further source is domestic capital, which, the buying craze having ceased, is again taking notice of the low price of industrial stock. Helped by such conditions, many manufacturing companies again come on the money market with capital and bond issues. The fresh capital obsorbed by the industry in October amounted to 5,374 million marks, which is a record figure in paper marks. In gold marks it is, however, only 5,300,000 marks, a ridiculously low sum in comparison to previous months and years. The total fresh capital the industry received in the first 9 months of the current year by increase of capital stock, bond issues, and the like, is only 309 million gold marks compared with 814 million gold marks last year. This explains perhaps better than words could do, the financial straits, into which the industry has dropped through the depreciation of the money with little relief in sight through adjustment of reparations question.

George Richards Dies in England

GEORGE RICHARDS, formerly of George Richards & Co., Ltd., Broadheath, near Manchester, England, and later of the Richards Thread Milling Machine Co., London, England, died on Nov. 17. Mr. Richards was a well known designer of machine tools of advanced type and though he lived in England for many years, never relinquished his American citizenship. He was impoverished by the late war and his financial condition became so low that, pending an appeal to his many friends for assistance, he was forced to become an inmate of the London County House, where he died.

GEORGE RICHARDS

Trade Trip to Cuba

A group of manufacturers from Atlanta and Chattanooga, many of them connected with the metal trades industries, will make a trade trip to Cuba some time during February under the auspices of the Atlanta and Chattanooga Chambers of Commerce, and the Southern Railway System. The purpose of the tour will be to further expand trade relations between Southern manufacturers and the island of Cuba. Within the past few years Atlanta manufacturers and jobbers have built up from practically nothing an export trade with Cuba now in excess of $1,000,000 per year, and there is still room for great improvement. A large part of this export business is in machinery and machinery supplies, machine tools, railroad equipment, and other metal products.

New Worthington Heads

E. T. Fishwick and William Goodman have been appointed vice presidents of the Worthington Pump and Machinery Corporation, 115 Broadway, to fill vacancies made by the resignation of Frank H. Jones and James E. Sague.

Mr. Fishwick was formerly general sales manager and now takes the title of vice president in charge of sales. Mr. Goodman, previously in the executive engineering department, is now vice president in charge of engineering and manufacturing.

Although both Messrs. Jones and Sague have resigned as titled officers they will both remain with the corporation in an advisory capacity.

Business Items

The Goss & DeLeeuw Machine Co., of New Britain, Conn., has incorporated under the laws of Connecticut, with a capital stock of $100,000 to manufacture machinery, tools, etc., operating a plant at New Britain. The incorporators of the company are: Stanley T. Goss, of New Britain, Conn.; John S. Black, New Britain; and Adolph L. DeLeeuw, of Plainfield, N. J.

The Nashville Bridge Co., of Nashville, Tenn., according to officials of the company, is planning the immediate establishment at Bessemer, Ala., of a branch plant to include general shops and units for the production of heavier structural steel. The principal bridge department of the company will remain at Nashville.

The Anderson Tractor Co., recently noted incorporated at Anderson, S. C., proposes the establishment there of a large plant for the manufacture of tractors and sprays for use in cotton fields of the South, according to W. S. Anderson, president of the company. The capital stock of the concern is $200,000.

The Atlantic Coast Line Railroad Co., advises that it is planning the early construction of machine and engine shops and a roundhouse at Port Tampa, Fla., to entail a total investment of approximately $150,000. The work is in charge of the engineering office of the railroad at Wilmington, N. C.

The Crane Co., of Chicago, has established an additional southern branch at 738 West Bay Street, Jacksonville, Fla., this branch to serve the company's trade in South Georgia and all of Florida. The Atlanta branch serves the rest of Georgia and nearby states. P. Z. Huddleston is named manager of the Jacksonville branch.

The National Cast Iron Pipe Co., of Tarrant City and Birmingham, Ala., at the annual meeting of the stockholders and officers to be held the latter part of December, will consider a plan to increase the capital stock from $500,000 to $1,000,000 and favorable action is expected. A larger production during 1923 through the establishment of additional units, and a further expansion of its export facilities is the plan of the company.

Lorne Tractors, Ltd., which has been incorporated for $300,000 at Tillsonburg, Ont., and is erecting a new factory there to build a gasoline equipment, including fire engines, has elected the following officers: L. Carmichael, president; J. M. Clark, vice-president; and L. C. Vangeel, secretary-treasurer.

The Fleming Machine Co., formerly located at 172 Chestnut St., Springfield, Mass., has removed its office to 41 Mercantile St., Worcester, Mass.

The North & Judd Manufacturing Co. in order to keep up with the demand for "Anchor Brand" hardware products has reopened its New Haven plant which was purchased in 1919. The foundry department is now in operation with a large number of moulders.

The Terry Steam Turbine Co., manufacturer of turbines, blowers, etc., of Hartford, Conn., with branches in Chicago, New York, Philadelphia and Pittsburgh, has recently increased its capital stock from $700,000 to $800,000. The number of shares was also increased from 7,000 common to 4,000 of common and 4,000 of preferred stock.

The Pequennock Foundry, Inc., 5th St. Extension, Bridgeport, Conn., has recently increased its capital stock from $10,000 to $50,000.

The Hartford Tool Works, Inc., maker of tools, etc., Hartford, Conn., has filed a preliminary certificate of dissolution with the Secretary of the State of Connecticut. All claims against the company should be mailed to Richard H. Deming, 36 Pearl Street, Hartford, Conn.

The Precision Instrument Co., Inc., has acquired control of the Precision Instrument Co. of Newark, N. J., well known for its line of "3 in 1" draft gauges, pressure recording instruments, CO_2 recorders, specific gravity recorders, laboratory gas meters, gas calorimeters, and other lines. The present executive officers, who have been so successful, will retain their connection with the company. It is expected to enlarge the business considerably, with new capital, adding other specialties, besides staple lines of gauges, valves and fittings. The company's New York office will be in the Engineering Building, 114 Liberty St. The factory will later be moved to New York.

The Kemp Machinery Co., 215 N. Calvert St., Baltimore, Md., has been appointed exclusive representative by the Diamant Tool and Manufacturing Co., 91 Runyon St., Newark, N. J., in connection with the sale of Diamant standard punch and die sets, in the territory covered by the states of Maryland, Virginia, District of Columbia and West Virginia consisting of Jefferson, Berkley, Morgan, Hampshire, Mineral Hardy, Grant, Pendleton, Randolph, Pocahontas, Green Brier, Monroe and Mercer Counties.

The R. S. Leafless Spring Co., of Fresno, Cal., has been organized with Frank Waterfield, Mason Building, in that city, at its head and will engage in the manufacture of a new spring for motor vehicles to eliminate the necessity of shock absorbers. The new company is capitalized at $150,000.

The National Iron Works, San Diego, Cal., has filed articles of incorporation, to establish and operate foundries, with capitalization of $100,000. The incorporators are James R. Russell, C. H. Martin and Leo G. Moore.

The Missouri Boiler Works Co. of Kansas, has been incorporated to do business in Missouri with headquarters in Kansas City. The company will manufacture and sell boilers, engines, smoke stacks and all other machinery used in boiler shops and factories. The incorporators are I. H. Darby, E. D. Proudfit and F. I. Darby.

The North Missouri Power Co. of Excelsior Springs, Mo., has filed articles of incorporation with Secretary of State at Jefferson City, showing a capitalization of $1,700,000. The company will carry on an electric power, light, gas, waterworks, hot water and steam heating business. The incorporators are S. W. Henderson, H. L. Moore, C. W. Fish, W. E. Crawford and F. A. Boys.

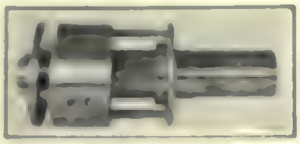
The Spencer Turbine Co., manufacturer of turbines, etc., Hartford, Conn., has recently increased its authorized capital stock from $300,000 to $600,000.

The North & Judd Manufacturing Co., manufacturer of hardware and

Condensed-Clipping Index of Equipment

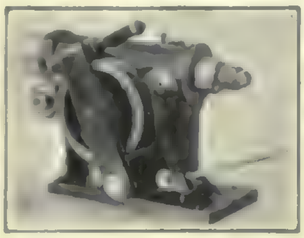
Patented Aug. 20, 1918

Taps, Pipe, Collapsible, Receding-Chaser
Victor Tool Co., Waynesboro, Pa.
"American Machinist," October 26, 1922



The stationary lever-operated [illegible] and the rotary type of tap have been redesigned. The chaser [illegible] are made to recede as the tap enters the work. In the stationary type two cam blocks work in conjunction to give a positive control to the receding chasers. In the rotary type a ring is used for setting the collars and chasers in position for cutting, which can be accomplished without stopping the machine. Both styles have a means for adjusting the diameter with a range of $\frac{1}{16}$ in. over or under size. By adjusting the trip collar, any length of thread can be cut. Interrupted thread chasers are used for tapping steel. The tap is furnished in sizes from 1½ to 12 in. in diameter.

Drilling Machine, Sensitive, Automatic, Horizontal, No. 8
Kingsbury Manufacturing Co., Keene, N. H.
"American Machinist," October 26, 1922



The machine head has a fully automatic feed and control similar to that on the vertical model. The cam gives a stroke of 1 in. to the spindle with a maximum feed of 0.011 in. per revolution. The head can be mounted on the base in multiple and supplied with automatically operated work-holding fixtures for high production on special work. It can be driven by either a countershaft or ½-hp. motor. Capacity, drills from No. 60 to ¼ in. in diameter. Spindle adjustment, 3 in.; travel, 1 in.; height above the base, 6¾ in. Height, 9½ in. Weight, 50 pounds.

Hoist, Chain, Electrically Operated, "Motorbloc"
Motorbloc Corporation, Summerdale, Philadelphia, Pa.
"American Machinist," October 26, 1922

The device can be installed by [illegible] attachment to lighting or power circuits. It consists of a standardized steel chain hoist, electrified by the combination of a heavy-duty motor, reduction gearing and a slip friction clutch, all mounted on a supporting bracket to form a self-contained electrifying unit, to which the pendant controller is attached. The electrifying unit can be applied to standard chain hoists already in service. Where electric current is not available the hand chain can be quickly applied. The mechanism is for use on chain hoists having capacities from ½ to 10 tons. Provision is made for adequate automatic lubrication of the armature shaft and worm. The pendant controller can be easily operated by one hand. Weight of 1-ton size, 168 pounds.

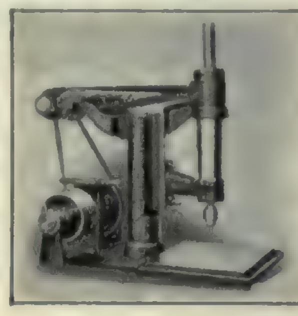
Surface Plates, Steel, Hardened, Lapped
Van Keuren Co., 362 Cambridge St., Boston 34, Mass.
"American Machinist," October 26, 1922

The plates are suitable for general use, as well as for the tool-room. They are free from [illegible] and [illegible] [illegible] warping and have been [illegible] waves for [illegible] manufacture. The plates are furnished in 5-, 8- and 10-in. diameters and are made with two handles [illegible] [illegible] of each plate. [illegible] the surface [illegible] [illegible]. The plates may be used with a [illegible] for the [illegible] of small parts and for [illegible]. [illegible] directly on the surface plates.

Wheel-Truing Device, Angular
Wilmarth & Morman Co., Grand Rapids, Mich.
"American Machinist," October 26, 1922

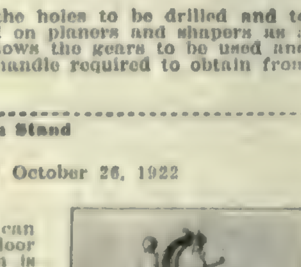
The device is intended for use in shops salvaging and reclaiming worn-out milling machine cutters, reamers and drills, as well as those making a specialty of cast stellite cutters and tools. With the device, the wheel can be easily formed to correspond to the outline to be ground. The diamond is fed to the wheel by means of the knurled knob at the top, while the crank is employed to feed the diamond across the face of the wheel. By means of the graduated dial, the device can be set at the desired angle, the diamond carrying member being tilted to either side for dressing the wheel face at an angle. The wheel can be properly dressed without disturbing the set-up of the work.

Drilling Machine, High-Speed, Bench, No. 0
Sigourney Tool Co., Hartford, Conn.
"American Machinist," October 26, 1922



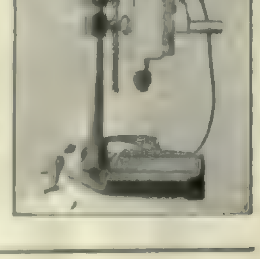
The machine is of the belt-driven type with two countershafts adjustably mounted on the frame. The tension of the belt is adjusted by changing the distance between the countershafts. There is no center hole in the spindle, but the lower end is fitted to the taper socket of a No. 1 Jacobs drill chuck with a capacity for drills from 0 to $\frac{5}{32}$ in. in diameter. Spindle speeds of 2,000, 4,000 and 8,000 r.p.m. are furnished, but by increasing the speed of the first countershaft higher speeds may be obtained. Spindle movement, 1½ in. Table surface, 7½ x 8 in. Vertical adjustment of head, 2½ in. Maximum height, table to chuck, 3½ in. Bench space, 12 x 20 in. Weight, 50 pounds.

Milling Attachment, Multi-Purpose, "Millerette"
Production Machine Tool Co., 629 E. Pearl St., Cincinnati, O.
"American Machinist," October 26, 1922



The device can be set at any angle and is built in three sizes for lathes with from 12- to 24-in. swing. It converts a lathe into a milling machine for cutting spur and bevel gears, for surface milling, angle cutting and spline and keyway cutting. The attachment fits the toolpost slot in the top slide of the compound rest of the lathe. The lathe supplies the power, carries the cutter on an arbor between centers and gives both longitudinal and cross feeds. The down slide of the Millerette can be operated by a handle. The Millerette can be used upon a drilling machine to accurately space the holes to be drilled and to hold work requiring indexing; and on planers and shapers as a dividing head. The index plate shows the gears to be used and the number of turns of the index handle required to obtain from 2 to 360 divisions.

Drill, Electric, Portable, with Bench Stand
A. F. Way Co., Hartford, Conn.
"American Machinist," October 26, 1922



With the portable stand the tool can be converted into a bench or floor drilling machine. The drill, which is complete without the stand, may be used as a hand tool. The breast plate and handle are instantly attachable to the drill by the same "union" couplings holding the drill to the stand. The screw feeding mechanism is separate from both drill and stand. Because of the right-angle mounting of the handwheel, the feed may be used in very close quarters. The special motor is of universal type either d.c. or a.c. and can be furnished for 110 or 220 volts. Capacity of chuck, ½ in. Mounted upon stand: maximum distance chuck to base, 14 in.; vertical adjustment, 6 in.; weight, 115 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

tools, New Britain, Conn., announces the re-opening of its New Haven, Conn., plant, and the foundry is now in operation with a large number of workers. The plant was formerly owned by the W. & E. T. Fitch Co., New Haven.

The Brooks Machine Works, 225 West Lewis St., Wichita, Kan., is installing some new machinery. The new equipment, according to J. M. Hackney, president of the company, will make it one of the best equipped shops in that city.

The Frasse Steel Works, Inc., Hartford, Conn., has been appointed the exclusive New England distributor for the Sizer Steel Corporation with plants at Buffalo and Solvay (Syracuse), manufacturer of electric carbon alloy and tool steels, bars, billets and forgings.

The Brown & Zortman Machinery Co. has been appointed exclusive agent in the territory of West Virginia, the western part of Pennsylvania and the southeastern part of Ohio, by the Wilmarth & Morman Co., Grand Rapids, Mich., for its complete line of grinding machines.

The Carpenter Steel Co. of Reading, Pa., has announced officially that reports recently circulated regarding the merger of the company with some other steel concern are entirely erroneous. No such negotiations, it is announced, are pending and the Carpenter company contemplates no change in ownership or management.

Manning, Maxwell & Moore, Inc., has been appointed exclusive agent in the states of New York, New Jersey, Delaware, Maryland and Pennsylvania east of Altoona, by the Wilmarth & Morman Co., Grand Rapids, Mich., for its complete line of grinding machinery.

The St. John Shipbuilding and Dry Dock Co., Ltd., has nearly completed the construction work on its machine shops at St. John, New Brunswick. The shops, which are of modern type, will be opened in the spring in connection with the dry dock now being built at St. John, N. B.

The T. McAvity and Sons, Limited, of St. John, New Brunswick, manufacturer of hydrants, gages, valves, steel and copper pipe, boilers, etc., is gradually moving its machine shops to the new plant of the company near the city limits of St. John. There are three new buildings of steel, concrete and glass.

The Lunenburg Machine Works and Foundry Co., operating a plant at Lunenburg, Nova Scotia, has been operating steadily, and indications are that the company will keep the plant in operation on full time through the winter.

The Canada Car Co. plant at Amherst, Nova Scotia, is expected to start work on a big car order soon after Christmas. The Canadian National Railways' management intends to order several thousands of new freight cars in order to cope with the demand for cars. The machine shops of the car company are being made ready in anticipation of a big order.

The Canadian Pacific Railway machine shops at McAdam, New Brunswick, are working on full time and report is current regarding the possibility of a new machine shop building being erected at McAdam early in the spring to be ready for next fall.

Personals

ARTHUR L. COLLINS, for the past six months associated with the Standard Steel and Bearings, Inc., has entered the tool and alloy steel department of Horace T. Potts & Co., Philadelphia, as sales metallurgist. His work will be with the various mills turning out the Potts' brands of steels and with the users of these steels in advising on applications and heat treatments.

ALFRED B. CARHART has resigned his position as vice-president and sales manager of the Crosby Steam Gage and Valve Co., to become president and general manager of the Precision Instrument Company, Inc., 21 Halsey St., Newark, N. J.

MARK L. SPERRY, JR., assistant to the superintendent of the Scovill Manufacturing Co., Waterbury, Conn., has been appointed Naval Aide on the Staff of Governor-elect Charles A. Templeton, of Connecticut. Mr. Sperry is a lieutenant-commander, resigning from the Navy in 1921.

MITCHELL S. LITTLE, president of the M. S. Little Manufacturing Co., plumbers' goods manufacturer, Hartford, Conn., and also president of the Sigourney Tool Co., tool maker, Hartford, Conn., has recently been elected a director of the Hartford-Aetna National Bank, of that city.

COLTON D. NOBLE, formerly sales manager of the North & Judd Manufacturing Co., hardware and tool manufacturer, New Britain, Conn., will return to the company shortly. Mr. Noble left the concern back in 1918, to associate himself with the M. S. Brooks Co., maker of brackets, hooks, hardware, etc., of Chester, Conn.

MAJOR EMIL MANWEILER, general manager and secretary of the various plants of the Eastern Malleable Iron Co., with headquarters at Naugatuck, Conn., has been appointed aide-de-camp on the staff of Governor-elect Charles A. Templeton, of Connecticut.

JOHN M. BURRALL, secretary and general manager of the American Ring Co., manufacturer of castings, holders, stampings, etc., of Waterbury, Conn., has been appointed an aide-de-camp on the staff of Governor-elect Charles A. Templeton, of Connecticut.

Obituary

W. B. EVERETS, general traffic manager, Westinghouse Electric and Manufacturing Co., died Dec. 5 at his home 328 Emerson Ave., Pittsburgh, where he had been confined for one week with pneumonia. Mr. Everest was born July 3, 1868, at Newark, N. J.

MISS IRENE PECK SCHOFIELD, for about 15 years secretary of the Universal Boring Machine Co., Hudson, Mass., died at her home in that city Dec. 3. Miss Schofield was a native of Hudson, active in social and political work and was a candidate for local office at the recent election.

JOHN HERGET, since 1904, treasurer of the Century Electric Co., St. Louis, Mo., died at his home in that city, Nov. 14, 1922.

Book Reviews

Production Grinding. By Fred B. Jacobs. Two hundred eighteen 6x9 in. pages, illustrated. Cloth boards. Published by the Penton Publishing Co., Cleveland, Ohio. Price $3.00.

A book describing the grinding operations performed in a number of plants engaged on large-scale production work. A number of the chapters have appeared from time to time as articles in *Abrasive Industry* of which the author is editor. No attempts are made to explain theories of grinding nor to assemble data for the selection of types of machines and grit and grade of wheels for various kinds of work, but perhaps it is just as well that a book on production grinding was confined to a recounting of how individual operations are actually being done. For almost all operations specifications are furnished as to kind of machine, material and wheel; in some cases, further information is given, such as speeds of wheel and work, amount of stock removed, and production per hour. From a literary viewpoint no great praise can be given, a characteristic of too many technical books. Illustrations for the most part are good.

Included in the contents are chapters on grinding parts of the Marmon, Packard, Oakland, Chevrolet and Ford automobiles, tractor parts, chilled iron cams, ball and roller bearings, dental parts, paper mill and chilled iron rolls, milling cutters and dies, and regrinding automobile parts.

The Control of Quality in Manufacturing. By G. S. Radford, Consulting Engineer. Three hundred ninety-one 6x9 in. pages illustrated. Cloth boards. Published by the Ronald Press Co., 20 Vesey St., New York, N. Y. Price $5.00.

An unusual book, carefully planned and well written. It points out, what so many times is overlooked, that quality in manufacturing is essential, not only as such, but as a determining factor in quantity production. Much of the book is devoted to the subject of inspection, and very properly so. Had it not been for the war, the vital importance of thorough inspection in all manufacture would probably not have been realized for many years. Necessity to live up to the letter of specifications compelled many manufacturers to discover methods of maintaining quality, methods that have since been adopted as indispensable. It is an attempt to show the true relation of quality to quantity, sales and cost, that the book was written.

Chapter I consists of an introduction which is a logical plea for quality in all manufacture. The second chapter leads up to the subject of inspection, to which the third to eleventh chapters, inclusive, are devoted. The remaining chapters deal with quality control in practice, measurement and errors, quality defined, working standards, repetition manufacturing, the dimensional control laboratory, gages and gage-checking, thread gaging, the precise control of processes, the control of color, the scientific attitude of mind and its methods, the method of attack to control quality.

Dyke's Automobile and Gasoline Engine Encyclopaedia. By A. L. Dyke. Thirteenth Edition, enlarged and entirely rewritten. 1,238 pages, 7 x 10, illustrated. Published by Goodheart-Wilcox Co., 2009 South Michigan Blvd., Chicago. Price $6.

It is a pleasure to review an old friend such as this book which has gone through twelve successful editions and now appears in its thirteenth. The reviewer found an earlier edition an invaluable aid in his work with aviation cadets during the war and is well acquainted with its merits.

In rearranging the text and illustrations for the current edition, the author has wisely eliminated the chart pages made up of groups of illustrations and inserted the several sketches in the body of the text so that it is unnecessary to hunt around for an illustration when one is referred to.

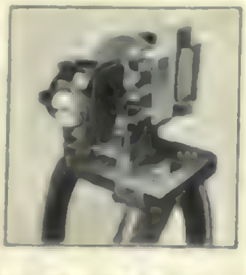
At the beginning of each chapter the fundamental principles underlying the subject under discussion are outlined and the details are worked in afterward. Not only is the function of every part of an automobile completely covered, but its maintenance and repair as well. The book should be quite as valuable to the garage repairman as to the car owner.

Thirteen principal sections are embodied in the book as follows: I, Assembly of the Automobile; II, Automobile Electric Systems; III, The Storage Battery; IV, Wiring Diagrams; V, Ignition and Carburetion; VI, Tires; VII, Garage and Shop Equip-

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Punch, Combination Foot and Power
A. F. Way Co., Hartford, Conn.
"American Machinist," October 26, 1922

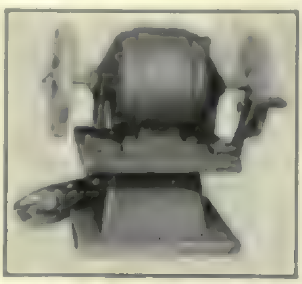


As a foot press the machine is of the [illegible] type, actuated by a swinging [illegible] of [illegible], which is [illegible] attached to the [illegible]. A positive stop limits the downward movement of the ram. Changing the position of the bolt attaching the pendulum to the upper lever, converts the tool into a strongly driven power press, actuated by an eccentric and the toggle levers at the rear. A 2½ in. square hole through the bed allows for the passage of blanks through the dies. A 5 x 12-in. surface is available for attaching the dies. Vertical adjustment of the ram is [illegible] by placing [illegible] above and [illegible] the [illegible] end of the actuating [illegible]. A slotted disk at the end of the shaft provides for the attachment of roll or other automatic feeds. Stroke of press, 1 in. Weight, [illegible] pounds.

Metal, Bearing
[illegible] Manufacturing Corporation, 4535 Fullerton Ave., Chicago, Ill.
"American Machinist," October 26, 1922

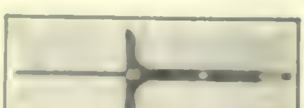
This bearing metal is an inseparable composition of copper and lead which can be remelted and cast any number of times under ordinary foundry conditions without segregation. It is especially adaptable for bearings where lubrication sometimes fails. Above 680 deg. F. the metal sweats lead and lubricates itself, and 1,700 deg. F. is the melting point. The metal is made in four degrees of hardness, to suit all operations and requirements. Grades B, C, D and E vary in Brinell hardness from 25 to 80, the latter being intended for heavy service. Standard bushings of the metal are made in 316 sizes, this range being calculated to meet nearly all ordinary requirements. The metal is furnished in the form of tubes, which are finished all over and made in 13-in. length instead of the 12-in. length.

Grinder and Buffer, Bench, Portable, "Special"
J. G. Blount Co., Everett, Mass.
"American Machinist," November 2, 1922



The machine is a plain bearing, motor-driven combination grinder and buffer and is suitable for light work in garages and repair shops. It is driven by a single-phase motor giving [illegible] hp. at [illegible] r.p.m. and supplied for either single-phase a.c. of 110 or 220 volts and 60 cycles or d.c of 32, 110 or 220 volts. The ground spindle runs in wick-oiled bronze bearings and carries a 6 x [illegible]-in. grinding wheel and a 7 x [illegible]-in. [illegible] buffing wheel. The base of the machine carries a cast iron [illegible] and is [illegible] so that [illegible] can be [illegible] for the [illegible]. If it is desired to use the machine as a small power unit, a 2-in. V-belt pulley can be [illegible] on the spindle between the flange and the motor bearing. Weight, 42 pounds.

Gage, Depth, Spring
L. S. Starrett Co., Athol, Mass.
"American Machinist," November 2, 1922

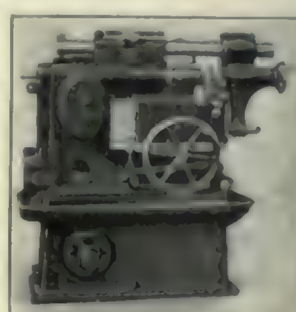


[illegible]

Chuck, Collet, Quick-Change, Improved, "Wizard"
McCrosky Tool Corporation, Meadville, Pa.
"American Machinist," October 26, 1922

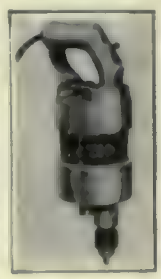
The device is simpler and sturdier than the original model. The chuck consists of two main parts, a driving body having a Morse taper shank to fit the spindle of the drilling machine, and a hardened slotted collar to hold the collet in the driving body. The bayonet locking slots in the collar admit the driving lugs of the collet. The construction permits the operator to insert or release the collet with one hand without slowing or stopping the machine. The tool is inserted by merely pushing the collet up into the revolving chuck, where the automatic latch instantly locks it. The tool is released by pressing the knurled collar of the chuck so as to retard it. The chuck holds the same sizes and styles of collets employed on the former model.

Lathe, Stub, "Sundstrand"
Rockford Tool Co., 2400 Eleventh St., Rockford, Ill.
"American Machinist," November 2, 1922



The machine is intended especially for turning automotive pistons. The carriage ways and headstock are one casting. The heavy tailstock is clamped to a large overhanging arm supported on a stud protruding from the bed. The 18-in. carriage has bearing for its full length both on the face on the front side of the bed and on an angular surface on the top. The front toolslide is wide enough for several tools to be clamped on at one setting. The rear tool is mounted on a slide having a cross travel of 4 in. A 5-hp. motor running at 1,800 r.p.m. is fastened on a pivoted frame inside the bed. Capacity between centers, 12 in. Spindle speeds, 40, 50, 65, 85, 110 and 145 r.p.m. Feeds: Six, from 0.020 to 0.090 in. per rev. Weight, 3,000 pounds.

Drills, Electric, Portable, ¼- and ⅜-Inch
C. L. P. Electric Co., 62 Dey St., New York, N. Y.
"American Machinist," November 2, 1922



Both machines are driven by universal motors furnished for either 110 or 220 volt current. The armature runs on ball bearings and a fan is provided for air-cooling the motor. The table can be removed without disturbing any inside connections of the drill. The drill is equipped with a three-jaw Jacobs chuck, threaded to the end of the spindle. Extension spindles can be supplied. The large handle on the ¼-in. drill at the rear of the motor is equipped with a switch that stays in either the on or off position. A stand can be furnished for precision drilling. The ⅜-in. drill is equipped with a grip handle and two side handles in one of which a switch is placed. Each machine is furnished with a plug and a 10-ft. cable.

Drilling Machine, Bench, with Plain Bearings, No. 1
Sigourney Tool Co., Hartford, Conn.
"American Machinist," November 2, 1922

This machine is similar in design to the ball-bearing, high-speed drilling machine, but is intended for slower speeds. Except for a ball thrust bearing to take the drilling pressure, the parts run upon plain bronze bearings. A chuck holds drills up to $\frac{5}{16}$ in. in diameter, although for larger sizes taper-shank drills are used. The spindle has a taper hole to take a No. 1 Morse taper shank, and a vertical movement of 2¼ in. It is balanced by a coil spring concealed in the case of the spindle bracket. A clamp stop is provided to regulate the depth of the hole drilled. The head may be adjusted vertically upon the face of the column through a distance of 6 in. Three changes of speed are available. An overhead countershaft can be furnished. Table, 10½ x 14 in. Weight, 170 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

ment; VIII, Repairing and Overhauling Engine and Car; IX, Oxy-Acetylene Welding; X, Commercial Cars; XI, Tractors; XII, Ford Car, Tractor, etc.; XIII, Data, Specifications, Horsepower, Useful Information.

A dictionary of motor terms is included in this edition and an elaborate index in which each subject treated is indexed in three ways: In its relation to parts; in its relation to the operation of the car; in connection with the make of the car.

Technical Procedure in Exporting and Importing. By Morris Rosenthal. 312 pages with index. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $3.00.

In this handy little volume on foreign trade the author has described in detail the mechanics of exporting merchandise from, and importing merchandise into the United States.

The general arrangement of the book is good. It is divided into five main subdivisions or parts, each of which contains short, easy-to-read chapters. The simplicity of the scheme is commendable in that it enables the reader to follow an incoming or an outgoing shipment through the successive steps taken by an overseas shipment with the shipment itself constantly before his eye.

In Part I, the author devotes the opening chapter to defining, in simple language, the terms continually met with in inland and overseas shipment. The export sales contract is then discussed, following which, the matter of routing shipments, ocean bills of lading and commercial invoices are taken up in regular order with a simple treatment of each.

Part II treats of the technique of customs procedure both in the United States and abroad with useful notes to guide the shipper on what to do and what not to do in clearing his incoming or outgoing shipments.

The technique of export packing is covered in Part III with numerous examples illustrative of proper methods to be pursued and dangerous pitfalls to be avoided. Marine insurance and the important question of Financing Export and Import Shipments are treated in Parts IV and V.

In short, the volume furnishes to one interested in foreign trade a picture of the actual handling of export and import shipments in that it clarifies the steps required to be taken after a sale has been made to a foreign customer, or an order has been placed for the purchase of goods abroad. Examples of actual shipments are cited in the book with fac-similie documents met with in ordinary overseas business.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering equipment and supplies, factory furnishings, refrigerator equipment, power transmissions, driving belts, lubricating oils, pipe coverings, etc.—Switzerland. Purchase and agency desired. Reference No. 4510.

Iron sheets for dynamos, iron sheet for transformers, and galvanized-iron sheets—Hungary. Purchase desired. Quotations, c.i.f. Hamburg. Terms: Cash against documents in New York. Reference No. 4512.

Direct connected generator for plant to develop 350 to 500 horsepower, 20 motors from 10 to 75 horsepower, transmission machinery for lumber, a large number of live rolls, a number of trucks, and material for 3 kilns, 20 by 150 feet, inside measurements —Canada. Purchase desired. Quotations, f.o.b. point of shipment. Reference No. 4527.

Woodworking machinery used in the manufacture of umbrellas and parasols—France. Purchase desired. Quotations, c.i.f. French port, in francs. Terms: Cash against documents. Reference No. 4530.

Small tools, steel and copper wire, barbed wire, and general hardware—Australia. Agency desired. Reference No. 4455.

Agricultural machinery of all kinds—Spain. Agency desired. Reference No. 4461.

Machinery for extracting the fiber from flax—Mexico. Agency desired. Correspondence, Spanish. Reference No. 4463.

Machinery specialties, patented metallurgical processes, and metallurgical products—France. Engineer desires representation. Reference No. 4470.

Machinery of all kinds pertaining to the manufacture of linen—Australia. Agency desired. Quotations, f.o.b. New York. Terms: Cash against documents. Reference No. 4473.

Hardware, machinery, and tools—Sweden. Purchase desired. Quotations, c.i.f. Maems or Goteborg. Terms: Cash against documents. Reference No. 4482.

Corrugated iron, structural steel material, wire nails, screws, barbed wire, woven-wire fencing, and automobile accessories—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Reference No. 4483.

Any articles used by construction engineers, machine makers, rolling mills, iron founders, and others—England. Agency desired. Reference No. 4486.

Wrought iron and steel pipes and malleable fittings for gas, water and steam pumps and plumbing supplies, such as baths, sinks and lavatories—Norway. Purchase and agency desired. Reference No. 4589.

Hinges, 95 x 55, 110 x 70, 116 x 55, 140 x 70, 160 x 80 and 190 x 80 mm., in packages of 10 or 12—Italy. Purchase desired. Quotations, c.i.f. Palermo. Terms: Cash against documents. Correspondence, Italian or French. Reference No. 4592.

Machinery for a small biscuit making plant and for a soap manufacturing plant —Spain. Purchase desired. Quotations, c.i.f. Spanish port. Terms: Cash against documents. Reference No. 4593.

Machinery for the making of bread, pastry, etc.—Venezuela. Purchase desired. Quotations, c.i.f. Venezuelan port. Correspondence, Spanish or French. Catalogues are requested. Reference No. 4596.

High-speed tool steel, files and drills, to be used in factories, smelters and mines—Poland. Agency desired. Quotations, c.i.f. Danzig. Reference No. 4618.

Machinery to equip a factory for the manufacture of wooden bobbins for textile mills—France. Purchase desired. Reference No. 4607.

Trade Catalogs

Horning and Wiring Presses. The Adriance Machine Works, Inc., 88 Richards St., Brooklyn, N. Y. This company has just issued a new publication of 19 pages, known as Catalog No. 6, illustrating and describing in detail its comprehensive line of horning and wiring presses suitable for manufacturers of tinware, cars, etc. The publication also gives details and illustrations of the company's duplex folding and seaming presses for lock-seamed tinware and for grooving or closing the side seams of round, oval or square cans.

Vanadium Tool Steel. The Colonial Steel Co., Pittsburgh, Pa. The company has just issued a booklet telling the uses, the methods of heat treating, and describing the character of Colonial No. 7 Vanadium tool steel.

Gears. The Boston Gear Works, Norfolk Downs, Quincy, Mass. The company has just issued Catalog No. 41 of 128 pages giving prices, specifications and other information regarding its comprehensive line of gears of all styles carried in stock.

Forges, Blowers, Furnaces, etc. The Buffalo Forge Co., Buffalo, N. Y. A new general catalog (Catalog No. 800) of 180 pages with a complete index has just been issued by this company. The catalog is extensively illustrated with an excellent arrangement and features in detail the company's broad line of forges, hand blowers, post drills, drilling machines, punches and shears—bar cutters, heating furnaces, heating and ventilating apparatus and universal wood cutters.

Power Rotary Shears. The Niagara Machine and Tool Works, Buffalo, N. Y. This company has just issued a new publication known as Bulletin No. 70, covering its line of power rotary shears. It is a twenty-page publication in which are described in detail the various styles of rotary shears with general and detail illustrations, as well as the company's other machinery and tools for sheet metal working. Each machine is accompanied by complete specifications.

Technical Information on Micarta Gears. The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. In order to acquaint the industrial gear user with the advantages of Micarta gears, the Westinghouse Electric and Manufacturing Co. has issued a 20 page booklet, Folder 4506, entitled "Salient Facts on Silent Gears." The booklet describes the advantages of the use of Micarta gears and pinions and gives photographs and data describing some of their applications, tables of gear data, etc., enabling the gear user to judge whether or not they are applicable to his machinery.

Metropolitan Subway and Elevated Systems. The General Electric Co., Schenectady, N. Y. The principal characteristics of several great rapid transit systems from an electrical engineering viewpoint are presented in Bulletin 44018 just issued by the General Electric Co. The facilities for power production, transformation, transmission and utilization are outlined briefly for each of the systems in the cities of Boston, Chicago, New York and Philadelphia. The company has taken an important part in the manufacture of various types of apparatus for use on all of these systems. Exhaustive engineering studies and tests have been conducted by engineers to insure to each railway company the selection of exactly the proper equipment for the most reliable and efficient operation.

Modern Piston Specifications. The Modern Electric and Machine Co., Indianapolis, Ind. This company has just issued a publication of 45 pages on modern piston specifications, known as Issue B, in which are given in tabular form, the complete specifications on the company's pistons of all sizes and types for pleasure cars, trucks and tractors.

Borolon. The Abrasive Co., Philadelphia, Pa. The company has just issued a small booklet describing its product "Borolon," a polishing grain for use in all work where emery is now applied. The properties of the article, its method of application and grain size suggestions are embodied in the booklet.

Modern Machine Tools. The Becker Milling Machine Co., Hyde Park, Boston, Mass., and the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass. The companies named have just issued a catalog listing the land, buildings, modern machine tools, miscellaneous plant equipment, raw materials and supplies which they are offering for immediate sale as a result of the purchase by the Reed-Prentice Co. of the good-will and business of both companies.

Forthcoming Meetings

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923. Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Centering Machine, Hand, Duplex
Pratt & Whitney Co., 111 Broadway, New York, N. Y.
"American Machinist," November 2, 1922

[illegible] is equipped with opposed drill heads for centering both ends of the work in one operation, but can be equipped with only one head. Both heads are operated together by a hand [illegible] on the right-hand head. The drill spindles are each driven by a [illegible] constant-speed motor at speeds of [illegible] r.p.m. Adjustable stops determine the depth of drilling. Two [illegible] self-centering vises take all sizes of work up to 2 in. in diameter, and from 3 to 18 in. long. After the work has been centered it is dropped in a tote box at the rear. Floor space, 4 ft. 6 in. x 2 ft. 6 in. Weight, 600 pounds.

Milling Cutters, Interlocking, "Wizard"
American Standard Tool Works, 402 Owen Bldg., Detroit, Mich.
"American Machinist," November 2, 1922

The cutters are so constructed that they can be used singly or in sets. When more than one is employed, the sides of the teeth of one cutter fit into corresponding grooves in the side of the mating cutter. Cutters can thus be ground in pairs, and when the sides of the teeth become dull the [illegible] of the cutters can be [illegible] to bring the opposite sides into play. As the cutters become narrowed by grinding a pair can be spread apart so as to maintain a given dimension. Individual sections can be used as ordinary milling cutters. The cutters are made in standard sizes for diameter, and of such widths that any standard or special size can be obtained by using the cutters in combination.

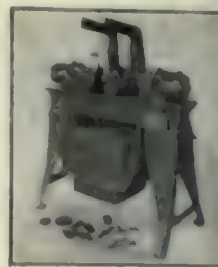
Hoist, Electric, "Load Lifter"
Alfred Box & Co., Inc., Philadelphia, Pa.
"American Machinist," November 2, 1922

Although the hoist is only 11 in. wide and 23 in. long, it is made for heavy duty. It can be turned through 90 deg. so as to hang parallel with the rail. The trolley is adjustable to run on I-beams from [illegible] in. in size. Hook suspension may be used when the trolley is not required. The hoist is built in one size only, to lift 1,000 lb. on a two-part line at 20 ft. per min., and has a drum which will accommodate [illegible] ft. of rope. Self-aligning [illegible] bearings are used in the motor, and Hyatt flexible roller bearings [illegible]. A [illegible] brake and a [illegible] brake on the [illegible] shaft are both provided for [illegible] the load in position. All parts [illegible].

Chucking Machine, Six-Spindle, Horizontal
Baird Machine Co., Bridgeport, Conn.
"American Machinist," November 9, 1922

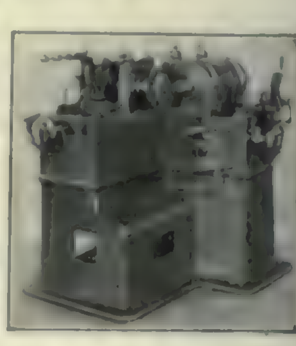
The machine is virtually an [illegible] can be used simultaneously. [illegible] are supplied [illegible] gears, and three quick [illegible] of speed, so that twenty-four speeds are available for each spindle. The [illegible] of feed. [illegible] 110 r.p.m. Floor space, [illegible] pounds.

Centering Machine, Automatic, Duplex
Pratt & Whitney Co., 111 Broadway, New York, N. Y.
"American Machinist," November 2, 1922



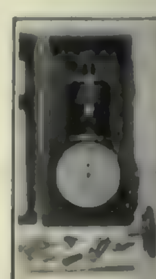
In this machine, an automatically operated feeding mechanism works in conjunction with a magazine. The work is removed from the magazine by transfer slides, placed in the vise, clamped, centered and then released into the work box. The machine is equipped with opposed drill heads for centering both ends of the work in one operation. The feed of the spindles is operated by the cam operating the transfer slides, and driven by a small motor. Each spindle has a feed movement of from ⅛ to ⅞ in. Work from ⅜ to 1½ in. in diameter and from 2½ to 18 in. long can be held. Oil is supplied to the drills by a geared pump running at a constant speed. Floor space, 4 ft. 6 in. x 2 ft. 6 in. Weight, 1,020 pounds.

Gear-Testing Machine, Bevel
Davenport Machine Tool Co., Inc., Rochester, N. Y.
"American Machinist," November 2, 1922



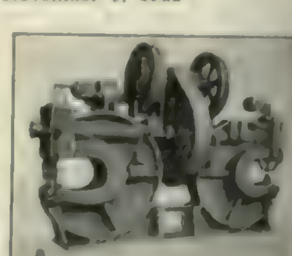
The machine is for subjecting to a running test spiral bevel gears and pinions, tests being made for bearing on the teeth, quietness of running and the center distance at which the best bearing and the least noise occur. One headstock holds the gear and the other the pinion. The pinion is rotated by power and a brake is incorporated to retard the speed of the gear, so that load can be applied. The right-hand headstock is moved back and forth, clamped in position, and the pinion clamped in the spindle by compressed air. The position of the right-hand headstock can be adjusted by the handwheel with a graduated dial located underneath it. Floor space, 4 ft. square. Weight, 1,500 pounds.

Tachometer, Hand
Coats Machine Tool Co., Inc., New York, N. Y.
"American Machinist," November 2, 1922



The hand tachometer is for obtaining a reading directly in revolutions per minute. It is arranged for either three or four ranges of speed for speeds from 30 to 1,600 r.p.m. and can be operated in either direction. Various types of couplings for contact with the shaft, and an extension spindle are provided. A "cutmeter" wheel 6 in. in circumference is employed for obtaining surface speeds. It can be held in contact with a moving surface so that the number of lineal feet of travel per minute can be read on the dial. When the center of the shaft is inaccessible, a thread can be run over a pulley and through the groove on the cutmeter wheel to obtain the circumferential speed. Weight, 1 pound.

Punching and Shearing Machines, Electric-Control, Vertical
Chambersburg Engineering Co., Chambersburg, Pa.
"American Machinist," November 9, 1922



With the electrical control mechanism, the length of stroke and the action of the machine is governed electrically. The mechanism by which the stroke adjustment is made is mounted on the front of the head, and the point at which the stroke will end can be easily predetermined. Depression of the push-button causes the clutch to engage and the head to descend. Two press units can be mounted end to end so that the same motive power can be employed for each. Belt-driven machines without electric control can be furnished. Eight sizes of the machine are made. Smallest size: punching capacity, ⅞-in. hole through a ½-in. steel plate; throat dimensions, 6, 12, 18 and 24 in. Largest size: capacity, 2½-in. hole through a 1-in. plate; throat depth, 15, 24, 36 and 48 inches.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Ala., Dothan—Dothan Machine Shop—machine shop equipment.

Calif., San Francisco—Continental Furniture Co., 1636 Bryant St.—double spindle boring machine.

Conn., Bridgeport—J. L. Lucas & Son, Inc., 3 Fox St, (machinery)—four Garvan No. 3 duplex milling machines with 40 in. feed.

Ill., Chicago—Reynolds Equipment Co., Lumber Exch. Bldg.—one 36 in. lathe, bed not less than 14 ft.; one radial drill, 5 to 6 ft.; one planer, 48 in. open sides; one 24 in. shaper; one 100 lb. press.

Ill., Chicago—J. Sidor, 5521 Leland Ave. —one engine lathe, 8 to 11 in. swing.

Mass., Lawrence—Champion-International Co., 38 Prospect St., (paper makers)—equipment for proposed machine shop.

Mass., Roxbury (Boston P. O.)—M. Wolbarst, 77 Waumbeck St.—tools and equipment for garage at 143 Washington St.

Mass., Winthrop—J. C. Murray, 15 Putnam St.—equipment for automobile repair shop.

Minn., Minneapolis—Rohne Electric Co., 2434 25th Ave., S., E. J. Rohne, Purch. Agt.—screw machine and spinning lathe.

Mo., St. Louis — H. B. Schwarz, 3926 Washington Ave.—equipment for automobile repair shop.

Neb., Fairbury—Traum & Lien—machine shop equipment.

N. Y., Brooklyn—B. F. Stephens, 1274 Flatbush Ave. (automobile service station) —screw cutting lathe about 8 in. center, between 6 or 7 ft. bed; also drill press suitable for auto work.

N. Y., Buffalo—J. Myers, 258 Bway.—equipment for service station and automobile repair shop.

N. Y., New York—Delaware, Lackawanna & Western R.R., 90 West St., C. C. Hubbell, Purch. Agt.—one 500 ton single-end car wheel press; two 20 in. heavy duty vertical drilling machines; one Whiton 6 in., 2 spindle centering machine; one Whiton, 4 in. 2 spindle centering machine; one duplex control, motor driven, horizontal-boring, drilling and milling machine, spindle 4 in. diameter; one 48 x 48 in. x 10 ft. planer; two 30 in. x 8 ft. heavy-duty engine lathes; two portable belt lathes, 18 in. swing, 4 ft. between centers; one Warner & Swasey No. 2 universal hexagon turret lathe; one 36 in. Morton draw-cut pillar shaper; two motor driven, double spindle floor grinders, wheel 18 in., 3 in. face; two double spindle sensitive drilling machines, ¼ to ¾ in.; one No. 5 Cincinnati plain milling machine; one double end punch and shear, 40 in. throat; two Chicago steel power bending brakes; three 20 in. engine lathes, two for Buffalo and one for Kingston; one 32 in. shaper; for shops at Kingston, Pa.

O., Youngstown—Federal Iron Wks., 70 Prospect St.—machine to bend angles ¼ x 2 x 2 in.

Okla., Okmulgee — Philips Hi-grade Petroleum Co.—machine shop equipment.

Ore., Portland—J. Neelay, 187½ Chester St.—machinist's lathe.

Pa., Boyertown—Eastern Fdry. Co.—machine shop equipment.

Pa., Moores—W. Bozzelle, (contractor and carpenter)—hollow chisel mortiser.

Pa., Pittsburgh—Dusquesne Light Co., 435 6th Ave.—machine tools.

Pa., Pittsburgh—Western Penitentiary, Riverside St., N. S.—list of machine tools.

Tex., Van Alstyne—J. H. Elliott, (repair shop)—electric power lathe and work bench.

W. Va., Logan—Guyan Machine Shops—24 in. shaper vise, 3 to 5 ton trailer, chucks for 22 in. lathes and cylinder grinder for automobile cylinders.

Wis., Cambridge—A. Kiavick—repair machinery, storage tanks and pumps for proposed $45,000 garage on Main St.

Wis., Janesville—W. Alderman, 219 East Milwaukee St.—automobile repair machinery, including drill press.

Wis., Milwaukee—E. Todd, 1117 Kinniekinnie Ave.—drill press and lathe for automobile repair shop.

Wis., Milwaukee—C. W. Valencourt Auto Co., 172 12th St.—electric drilling machine for automobile repair work.

B. C., North Vancouver—J. Crane, 309 East Esplanada St.—machine shop equipment.

Ont., Sarnia—C. McPhee—equipment for garage, to replace that which was destroyed by fire.

Que., Montreal—Quebec, Montreal & Southern Ry. Co., 286 St. James St., N. J. Ferguson, Purch. Agt.—machine and blacksmith shop equipment to replace that which was destroyed by fire, at Sorel.

Machinery Wanted

Ark., Fort Smith—E. Roberts—sausage grinder, cutter, stuffer and lard agitator for power equipment.

Ark., Rumley—Printer—job power printing press, power paper cutter and newspaper cutter (new).

Calif., Fresno—Exide Battery Co., 1347 Van Ness Ave.—additional equipment for battery station.

Calif., Monolith—Monolith Portland Cement Co.—machinery and equipment for the manufacture of portland cement.

Colo., Stonington—News—cylinder newspaper press.

Conn., East Lyme — Niantic Mfg. Co. (manufacturer of cotton goods)—machinery for addition to mill.

Conn., South Norwalk—H. Jacobs & Sons, Day St.—machinery for proposed addition to shoe factory.

Del., Wilmington—J. A. Bader & Co., 923 Market St.—refrigerating machinery for proposed ice manufacturing plant at Clayton.

Fla., Daytona—W. A. Hoffman, Genl. Mgr.—electrically operated machinery and equipment for the manufacture of doors, sash, etc.

Ga., Atlanta — W. H Bradley, Grant Bldg.—one 15 to 25 ton, 8 wheel locomotive crane.

Ga., Brunswick — Overstreet & Son, A. Overstreet, Purch. Agt.—26 x 34 in. job press with power equipment.

Ga., Columbus — The Ricco Co. of America, 938 Bar St.—one syrup agitator, one syrup pasteurizer and two or more storage tanks.

Ill., Chicago—Advance Wood Turning Co., 1345 Rawson St.—8 in. ring machine, also a twisting machine.

Ill., Chicago—Alto Mfg. Co., 180 North Cornelia Ave.—36 in. square shear.

Ill., Chicago—E. M. Heller & Co., 144 West Kinzie St.—saw table, good for 10 in. saw, iron top.

Ill., Kewanee—M. L. Koch, 208 Maple Ave.—complete newspaper and job printing equipment.

Ill., Waukegan—Butler Candy Co., 213 South Sheridan Rd.—power operated candy making machinery.

Kan., Wichita—Stevens & Michels, South Water St., (machinery), P. J. Michels, Purch. Agt. — power combination saw (used).

Kan., Wichita — H. J. Underhill, 131 North Emporia St. (planing mill)—woodworking machinery, planer, saw, sander and belting (used preferred).

Ky., Ludlow—Post-Glover Electric Co.—machinery and equipment for the manufacture of electrical devices, to replace that which was destroyed by fire.

Ky., Murray—Johnson & Adams Furniture Co., R. Maddox, Purch. Agt.—complete machinery and equipment for manufacturing, upholstering and repairing furniture for small plant.

Mass., Boston—H. S. Dow, Inc., 35 Newland St.—machinery for new laundry at 70 West Dedham St.

Mass., Conway—Tucker & Cook Woolen Mill, J. F. McDonald, owner—additional machinery for mill.

Mass., Marlboro—Marlboro Dairy Co.—equipment for proposed dairy.

Mass., South Boston (Boston P. O.) — Liberty Marble Co., 80 Granite St.—tools and equipment for the manufacture of marble for new plant at 42 Dillingham St., Boston.

Mass., Waltham—New England Coal Co., Newton St.—elevating and conveying machinery for coaling plant.

Mich., Birmingham—Inter City Bus Line, 207-209 South Woodward Ave.—electric drill; jack shaft and belting; 2 ton chain falls.

Mich., Detroit—Lanza Printing Co., 3133 Rivard St.—pony cylinder press (used).

Mich., Detroit—Michigan Steel Corp., 1708 1st Natl. Bldg.—heavy rolling mills and equipment for proposed steel plant at Ecorse.

Mich., Highland Park (Branch of Detroit)—Ford Motor Co.—coal grinding mills, one kiln with provision for another, slurry tank equipment, 18 in. stocking conveyor, two reclaiming conveyors, slurry pump and rotary coolers for proposed cement factory at River Rouge.

Minn., Wolverton—Hendrickson Bros.—catalogues and prices on machinery for the manufacture of clay brick, blocks and tile. Will be on market about April 1.

Mo., Kansas City—Decker Tin Shop, 111 North Denver St., A. Decker, Purch. Agt.—tinner's press.

Mo., Kirksville—C. C. Howard—complete newspaper equipment.

Mo., Maplewood (St. Louis P. O.)—O. E. Morton, 7421 Manchester Ave.—linotype machine.

Mo., St. Louis—C. A. Axtell, 4400 Easton Ave.—equipment for gasoline filling station on Newstead and Easton Aves.

Mo., St. Louis—St. Louis Southwestern R.R., Railway Exch. Bldg., E. O. Griffin, Asst. to Pres.—machinery for shops at Pine Bluff, Ark. and Tyler, Tex.

Mo., St. Louis—L. Spelbrink, 1321 Franklin Ave., (undertaker)—550 gal. gasoline tank and pump.

Mo., Springfield—North Side Motor Co., 1640 Booneville Ave.—15 to 20 Singer, single needle power sewing machines.

N. Y., Angola—L. L. Brown—ice manufacturing machinery.

N. Y., Buffalo — Central Star Laundry Inc., Main and Northland Ave.—equipment, including one 1,000 gal. gas tank and pump for proposed service station on Northland Ave. and Master St.

N. Y., Buffalo—Holmwood & Holmwood, 328 White Bldg.—equipment, including one 1,000 gal. gas tank and pump for proposed service station on Delaware Ave. and Olive St.

N. Y., Buffalo—C. Johndahl, 169 Allen St.—plumbing shop equipment.

N. Y., Buffalo — W. H. Linford, 2082 Niagara St.—equipment for service station, including one 1,000 gal. gas tank and pump.

N. Y., Buffalo—M. E. Mussen, 10 Fisher St.—equipment for service station, including one 1,000 gal. gas tank and pump.

N. Y., Buffalo — Prene Mfg Co., River Road—machinery and equipment for plant for the manufacture of skid chains.

N. Y., Dundee—W. Fox—machinery for flour and feed mill, to replace that which was destroyed by fire.

N. Y., Hornell—Elmhurst Dairy Co.—pasteurization and milk plant machinery, including machinery for sterilization of bottles.

N. Y., Mayville—Chautauqua Cabinet Co. —woodworking machinery for proposed addition to factory.

N. Y., New York—R. Grant, Woolworth Bldg., (iron and steel broker)—air compressor.

N. Y., New York—Muller MacLean & Co., 195 West St. (machinery agency)—friction saw for cutting pipe.

N. Y., Niagara Falls—Gay Bros.—equipment for bakeshop at LaSalle.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Pig iron firmer in Birmingham and Youngstown districts; slight declines, however, reported in No. 2 foundry iron at Philadelphia, Cincinnati and Chicago. Steel prices, for first quarter, inclined upward; with show of better stability. Bars firm at $2 per 100 lb., Pittsburgh. Improvement in inquiry for structural shapes; $2, uniformly and quite firmly, quoted on all new business. Quotations of $1.90@$1.95, however, frequently apply on large tonnages. Attractive tonnages on new plate business placed at minimum of $1.90@$1.95, with maximum at $2. Demand moderate; confined mostly to car builders.

Electrolytic copper, 14⅞c. as against 14⅝c. per lb. in New York warehouses, one week ago. Coke plates up ¼c. per lb. in Cleveland. Babbitt metal, best grade, advanced 7c. per lb.; roll sulphur, 5c. per 100 lb. and raw linseed oil 3c. per gal., in New York.

Declines—Downward tendency in black and galvanized steel sheets in Pittsburgh and New York. Tin down ½c.; zinc ¼c. in New York warehouses, during week. Chinese antimony cheaper in Cleveland.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.05
Northern Basic	29.27
Southern Ohio No. 2	28.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.44
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.14
Virginia No. 2	34.17
Basic	27.50
Grey Forge	28.64
CHICAGO	
No. 2 Foundry local	28.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	29.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	27.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cincinnati	4.5@6
New York	5.5
Chicago	4@5
Cleveland	5½@6

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	4.19	3.70	4.00
No. 12	2.60	4.24	3.75	4.05
No. 14	2.70	4.29	3.80	4.10
No. 16	2.90	4.39	3.90	4.20
Black				
Nos. 17 and 21	3.20	4.30	4.20	4.70
Nos. 22 and 24	3.25	4.35	4.25	4.70
Nos. 25 and 26	3.30	4.40	4.30	4.75
No. 28	3.35	4.50	4.40	4.85
Galvanized				
Nos. 10 and 11	3.35	4.50	4.40	4.85
Nos. 12 and 14	3.45	4.60	4.50	4.95
Nos. 17 and 21	3.75	4.90	4.80	....
Nos. 22 and 24	3.90	5.05	4.95	5.40
No. 26	4.05	5.20	5.10	5.55
No. 28	4.35	5.50	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
⅛	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.87½
Tin, 5-ton lots, New York	37.50
Lead (up to carlots), St. Louis 6.90;	New York 7.45
Zinc (up to carlots), St. Louis 7.20@7.25;	New York 7.87½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7@7.25	8.37½	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.75	20.00
Babbitt metal (83% tin)	42.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	6.50	7.00
Zinc	3 00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.00	11.50	14.50
IC,		112 sheets	12.30	11.90	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.90	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville....per net ton		$6.50@7.00	
Coke, prompt foundry, Connellsville...per net ton		7.50@8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in, per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.50	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2 67	3.20

N. Y., Niagara Falls — A. S. Gilman [illegible], Inc., 623 St. Clair Ave.—printing and [illegible] machinery.

N. Y., Poughkeepsie—[illegible] Eng. Co., [illegible] St.—shear to cut light sheets.

N. Y., Rochester—Consolidated Milk Co., [illegible] Ave.—pasteurization equipment.

N. Y., Rochester—C. Hans, 111 1st Ave.—[illegible] scales.

N. Y., Rochester — West Side Pattern Wks., [illegible] Ave.—one small size [illegible] machine.

N. Y., Syracuse—New Process Gear Co., [illegible] St., C. R. [illegible], Mgr.—about $[illegible] worth of gear cutting machinery of all kinds.

N. C., Cary — Bd. Educ. — vocational equipment for new school.

N. C., Wilmington—Carter's Production Works, [illegible] Water St., (machinery), [illegible] Carter, Mgr.—one [illegible] in. veneer clipper; 4 ft. stapling machines; rounders for lettuce [illegible] bottoms and heads and potato barrel [illegible], hardware for making strawberry [illegible] and lettuce baskets.

O., Archbold—Archbold Ladder Co.—machinery and equipment for the manufacture of ladders.

O., Cincinnati—J. R. Wolf & Co., 316 East Pearl St.—drug packing machine.

O., Cleveland—Republic Structure Iron Wks., East 53rd St. and Lakeside Ave.—[illegible] 96 in. blade and 36 in. throat gate shear.

O., Columbus—Bd. Educ., Tower and High Sts., E. L. McClure, Clk.—receiving bids until Jan. 12, equipment for manual training and laboratory departments of Joseph Sullivan High School.

O., Columbus—D. Davidson, 548 West [illegible] St. (job printer)—[illegible] x 15 in. press with [illegible] and full equipment.

O., Columbus—Ohio Bishop Co., Inglewood Ave. and [illegible] Lane, (manufacturer of saws and [illegible]), L. W. Seymour, Purch. Agt.—general machinery to enlarge factory.

O., Columbus—Union Oilcloth Co., 7th Ave., along tracks of Cleveland, Cincinnati, Chicago & St. Louis Ry., R. H. Wilcox, Purch. Agt.—large generator set and special oil cloth machinery.

O., Dayton—[illegible] Boiler Co., 954 Richard [illegible]—punch, shear, air compressor and bar shear (new or used).

O., Marion—Marion Shovel Co. (steam shovels)—motor driven shear for cutting bars.

O., Portsmouth—W. J. Collum Co.—circular shear.

O., Sandusky—Webster Printing Co.—[illegible] machine.

O., Toledo—E. N. Riddle Co., Bway. and Ottawa St. (manufacturer of lighting fixtures, etc.)—[illegible] equipment.

O., Wellston—Wellston Mfg. Co. (manufacturer of heating furnaces and specialties), I. Warden, Pres.—machinery and equipment for addition to plant.

Okla., Yahola—[illegible] Sand & Gravel Co.—washing and screening machinery.

Ore., Portland—I. Flint, 365 Union Ave. N. (job printing)—12 x 19 in. press for power attachment (used preferred).

Ore., Portland—[illegible] McDonald, Supt. [illegible] Lumber & Door Co., 215 Falling [illegible]—complete line of sash and door machinery for [illegible] mill at Vancouver, Wash.

Pa., Burnesboro—Bd. Educ., Dr. G. F. [illegible], Pres.—equipment for vocational department of new school.

Pa., East Pittsburgh—Westinghouse Elec. & Mfg. Co.—one [illegible] ton crane for Homewood plant.

Pa., Franklin—[illegible]—machinery and equipment for the manufacture of [illegible] products.

Pa., Hazelton—[illegible] machinery and equipment.

Pa., Manayunk (Phila. P. O.)—[illegible] (manufacturer of [illegible] and [illegible])—[illegible] rotary [illegible].

Pa., Meyersdale—H. W. Keith—machinery and equipment for 500 ton coal washery at [illegible].

Pa., Mount Jewett—[illegible]—machinery and equipment for the manufacture of [illegible], to replace that which was destroyed by fire.

Pa., New Castle — Universal Sanitary Mfg. Co., [illegible], Pres.—special machinery and equipment for pottery manufacturing plant at Cambridge, O.

Pa., Phila.—[illegible] Bros., 12th and [illegible] Sts. (knit goods, etc.)—doubling and wrapping machine, lightweight type, for folding 50 in. fabrics.

Pa., Phila.—J. J. Brooks, 63rd and Mt. Moriah Ave., (contractor and stone mason)—3 ton traveling crane (power).

Pa., Phila.—Bureau of Water, 792 City Hall—receiving bids until Dec. 29, one 8 wheel locomotive crane, steam operated, 46 ft. steel boom, 1 cu.yd. clamshell bucket, 5,800 lb. capacity.

Pa., Phila.—The city, City Hall, C. E. Davis, Purch. Agt.—two sand filtering, washing and conveying machines, self propelled, electrical, to remove, wash and replace sand in filter beds.

Pa., Phila.—E. Clinton & Co., 2113 Arch St. (manufacturers of brushes)—woodworking machines, drills, sanders, planers, etc., for new factory.

Pa., Phila.—M. Colter, 1220 North 42nd St. (laundry)—extractors, mangles, tubs, etc.

Pa., Phila. — Ellis Glautz & Co., 1216 Race St.—stitcher, pressers and miscellaneous tools for leather working.

Pa., Phila.—Gladstone Knitting Mills, 44 North 3rd St., (knit goods)—latch needle machines and other equipment.

Pa., Phila.—R. M. Greene & Co., 1413 Vine St. (manufacturer of cabinets and soda fixtures), R. M. Greene, Jr., Purch. Agt.—additional woodworking machinery, radial drills, presses, etc., for new factory.

Pa., Phila.—Penn Seaboard Steel Corp., 1417 Sansom St., (castings), G. A. Pedrick, Purch. Agt.—one 9 to 12 ton capacity, double frame steam hammer with pressure of 150 lb. per sq.in.

Pa., Phila.—H. M. and E. B. Siner, Church St. and Tacony Ave., (textiles and dyers)—dyeing machines, dryers, etc., for new plant.

Pa., Phila. — J. M. Tompkins, Belgrade and Orthodox Sts., (manufacturer of small machine parts and talking machines) — additional equipment and small tools for new plant.

Pa., Phila.—A. Wackerman, 859 Church Lane, (sheet metal works)—brakes and other metal working machines.

Pa., Phila.—J. J. Wilson, 2927 Ellsworth St.—additional equipment for woodworking plant, including planers, tenons, saws and drills.

Pa., Pittsburgh—Guibert Steel Co., 703 Diamond Bank Bldg., S. E. Bachtel, Purch. Agt.—air compressor for steel fabricating work.

Pa., Pittsburgh—Hanlon Gregory Galvanizing Co., 24th St.—monorail system for new plant at 54th and Butler Sts.

Pa., Pittsburgh—Jones & Laughlin Steel Co., 3rd Ave. and Ross St., A. Ochsenhirt, Purch. Agt.—one 15 ton crane for Aliquippa works.

Pa., Pittsburgh—Pittsburgh Steel Co., Frick Bldg., H. Llewellyn, Purch. Agt.—tube piercing machinery.

Pa., Reading—R. McCain, Green and Cedar Sts. (hosiery)—several ribbers, Huse or Wildman (used).

Pa., Saint Marys—Elk Graphite Milling Co.—machinery and equipment for the manufacture of graphite products.

Pa., Wampum—Crescent Portland Cement Co.—air compressor.

Pa., Warren—Crew-Levick Co.—oil filter station equipment to replace that which was destroyed by fire.

R. I., Providence—W. B. Dunn Co., Industrial Trust Bldg., (textile spinning)—two twisters, double roll with 2½ or 2¾ in. rings (used).

Tenn., Chattanooga—G. G. Raoul, Pres., West 1st St.—enameling machinery and equipment.

Tenn., Knoxville — Knox Porcelain Co. (manufacturer of porcelain specialties), J. House, Pres.—complete machinery and equipment for plant.

Tenn., Nashville—Federal Can Co., 500 Benton Ave.—machinery and equipment for $20,000 addition to plant.

Tex., Dallas—J. Kirby, 1007 Dale St., (newspaper)—8 x 9 in. power job press.

Tex., Dallas—Paternostro Mfg. Co., 205 South Ervay St., (machine shop)—oxyacetylene welding outfit complete.

Tex., Pioneer—Amer. Oil Co., T. Ryan, Pres., machinery and equipment for proposed refinery.

Tex., Sherman—E. C. Hunter, (newspaper)—4 quarto or 7 folio news press.

Va., Martinsville—Amer. Furniture Co., (manufacturer of bedroom and dining room furniture), A. D. Witten, Pres.—
Jointer.
Clamps, two 36 in. sections.
Two joint glue spreaders.
Two 250 lb. glue kettles.
One vegetable glue spreader.
One 76 in. hydraulic press.
One rip saw with motor.
One 84 in. veneer jointer.
One 80 in. clipper.
One 86 in. x 64 in. dryer.
Two planers (one 36 in. round head), (one 30 in.—3 knife sq. head).
Jointer, 18 in.
Three No. 5 cutoff saws.
Four dry kilns, 110 ft. long, 80 ft. wide, end piling.
Lumber lifts.
Rip saws, No. 15.
Molders, No. 35 (one No. 6 and one No. 12).
Tenon machine, double end.
Tenon machine, single end.
Endless bed sander, triple drum.
Band saw, 25 N. P. motor.
Filing room equipment, including tension roll for 6 in. band saw, grinder and knife grinder.
Sidney lathe, 20 in. swing.
Jointer, 12 in.
Double trim saw.
Dovetail machine.
Dovetail machine, 12 spindle.
Two 42 in. band saws.
One jig saw.
Mitre saw.
Lathe.
One shaper.
Two buss shapers.
Variety saw.
Six-spindle boring machine.
Mortice machine, 5 spindle.
Sander, (disc and jig).
Sander, variety.
All belt sanders, including oscillating, No. 274, 3 overhead and 1 underneath.
6 in. jointer.
Double drum sander.
Cabinet benches.
Bow end bed clamp.
One No. 273 sander.
One case clamp.
One handy end clamp.
Electric glue pots.

Va., Richmond—Hackley Morrison Co., Inc., 1708-22 Lewis St., (machinery), G. W. Booth, Purch. Agt.—one 100 ton track scale, standard gauge; one ⅝ yd. caterpillar tread steam shovel; two 8 $\frac{1}{16}$ x 16 x 52 in. cast split pulleys, extra heavy, with key way and set screws.

Va., Wytheville—R. P. Johnson (machinery dealer), O. M. Johnson, Purch. Agt.—portable gasoline engine drive air compressor outfit, about 100 cu.ft. free air per minute (used); ⅝ yd. steam shovel, caterpillar tread.

Wash., College Place—Walla Walla College—power press for printing college paper.

W. Va., Charleston—Tire Gauge Valve Co., H. D. Everett, Pres.—machinery and equipment for the manufacture of tire valves.

W. Va., Clifton—Clifton Coal Co.—coal tipple machinery, also conveying and handling equipment.

W. Va., New Cumberland — Hancock County Bd. Educ.—vocational equipment for $180,000 school at Weirton.

W. Va., Parkersburg—Blackwood Electric Steel Corp.—annealing furnaces, traveling crane, electric welders, air compressors, acetylene generator and grinders.

Wis., Chippewa Falls—Northern Supply Co. (telegraph and telephone supplies), J. M. Bischell, Mgr.—woodworking machinery and special machinery for the manufacture of poles, brackets, etc.

Wis., Green Bay — Fildex Corp. of America (manufacturer of filing cabinet devices), J. Kabat, Secy.—special equipment and machinery, including precision tools.

Wis., Green Bay—Press Gazette, 316 Cherry St.—steel equipment and new press for proposed newspaper plant.

Wis., Madison—Piper Bros., 31 North Pinckney St.—refrigeration machinery.

Wis., Madison—M. Sommers, 512 West Wilson St.—refrigeration machinery.

Wis., Milwaukee—Luxknit Sweater Mills Co., 685 3rd St., P. E. Yolles, Purch. Agt.—power knitting machines.

Wis., Milwaukee—O. F. Pfeil, 2017 Clybourn St., (metal specialties)—nickle plating equipment and shafting.

Wis., Milwaukee—South Side Buick Co., 916 Forest Home Ave., J. A. Piszczek, Purch. Agt.—presses, gas storage tank and pump.

Wis., Racine—B. R. Adams, 1010 13th St. (dairy)—ice making machinery, approximately 40 ton capacity.

Wis., Ripon—A. E. Wells—creamery equipment, including power churns, belting and shafting.

Wis., St. Francis—J. Handle, Station D, Route 1, (carpentry and millwork)—mortiser (used preferred).

Wis., Whitehall—E. F. Rotering (quarry)—crushing machinery.

Wis., Wisconsin Rapids—Arpin Process Coke Co., c/o J. B. Arpin—special machinery and equipment for the manufacture of coke.

B. C., Prince George—Aleza Lake Sawmill Co.—sawmill equipment.

N. S., Windsor—Nova Scotia Textiles, Ltd., (knit goods) — calender machine (used).

Ont., Alexandria — Alexandria Woolen Mills, Ltd., D. A. MacDonald, Pres.—two 108 in. blanket looms; one fancy loom with 25 sets harners or more; one automatic spinning mule; one bobbin winder to wind from the small bobbins as they come from the mule on to the bobbins to be used in the shuttles for the looms.

Ont., Arnprior—E. McKinney—cold storage and refrigeration machinery and equipment.

Ont., Hamilton — Ontario Shale Brick Co., Sun Life Bldg.—equipment for proposed plant.

Ont., Hamilton—Zimmerman Reliance Knitting Co.—$30,000 worth of additional equipment.

Ont., Milverton—West Window Regulator Co., E. H. Gropp, Mgr.—special metal working tools and machinery for the manufacture of patent auto window regulator.

Ont., Petrolea—Canadian Oil Co., C. A. Hale, Mgr.—equipment to replace that which was destroyed by fire.

Que., Montreal—Acme Trading Co., 205 St. James St., (pulp and paper), A. Ellison, Purch. Agt.—machinery for ground wood mill.

Que., Terrebonne — Limoge & Co., W. Limoge, Purch. Agt.—sash and door factory equipment, also woodworking and sawmill machinery.

Metal Working Shops

Calif., Berkeley—J. Havens, c/o J. W. Plachek, Archt., 2014 Shattuck Ave., is having plans prepared for the construction of a 1 story garage on Shattuck Ave. Cost will exceed $50,000.

Calif., Fresno—U. G. Hayden, Rowell Bldg., plans to build a 2 story battery station on Van Ness Ave. Estimated cost $20,000. Exide Battery Co., 1347 Van Ness Ave., lessee.

Calif., Fresno—The Herminghaus Estate plans to build a 1 story, 125 x 150 ft. garage on L St. between Merced and Tuolumne Sts. Estimated cost $40,000. Architect not selected. Waterman Bros., Tulare and L Sts., lessees.

Calif., San Francisco—G. Hackett, 247 Powell St., is having plans prepared for the construction of a 2 story (ultimately 6 story) garage and store building, on Ellis St., near Taylor St. Estimated cost $50,000. O'Brien Bros., Inc., 240 Montgomery St., Archts.

Calif., San Francisco — The Stevenson Garage, Inc., c/o A. S. Bugbee, Archt., 26 Montgomery St., is having plans prepared for the construction of a 2 story, 130 x 150 ft. garage on Stevenson St.

Ill., Chicago—R. F. France, Archt., 155 North Clark St., is receiving bids for the construction of a 1 story, 106 x 135 ft. garage on Juneway Terrace near Clark St., for F. J. Fadner, c/o Architect. Estimated cost $125,000.

Ky., Louisville—The Louisville Garage is having plans prepared for the construction of a 2 story, 150 x 200 ft. garage on 5th Ave. Estimated cost $225,000. Murphy & Bros., Louisville Trust Bldg., Archts. Noted Dec. 14.

Ky., Ludlow—The Post-Glover Electric Co. plans to rebuild its factory for the manufacture of electrical devices, which was destroyed by fire. Estimated cost $25,000. Architect not announced.

Mass., Cambridge—The Ford Motor Co., Highland Park, Detroit, Mich., is having preliminary sketches made for the construction of a 3 story assembly plant with power house, here. Estimated cost $300,000. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Mass., Holyoke—P. F. Donaghue, Walnut St., awarded the contract for the construction of a 2 story garage. Estimated cost $75,000.

Mass., Lawrence — The Champion-International Co., 38 Prospect St., paper makers, will build a 1 story, 65 x 115 ft. machine shop on Canal and Gorden Sts. Estimated cost $30,000. Noted Oct. 19.

Mich., Ecorse—The Michigan Steel Corp., 1708 1st Natl. Bldg., Detroit, has had plans prepared for the construction of six 1 story mills for the manufacture of sheet steel, on Rouge River, here. Estimated cost $1,000,000. Private plans.

Mo., Kansas City—Holbert & Perrin, 23rd and Grand Sts., awarded the contract for the construction of a 2 story, 75 x 100 ft. garage on Armour Blvd. Estimated cost $42,000.

Mo., St. Louis—The Haynes-Langenberg Mfg. Co., 4045 Forest Park Blvd., awarded the contract for concrete work of 3 story, 150 x 200 ft. furnace factory on Bircher St. near Euclid Ave. Estimated cost $100,000. Noted Dec. 7.

Mo., St. Louis—The United Shoe Mchy. Corp., Albany Bldg., Boston, Mass., is having plans prepared for the construction of a 3 story, 125 x 190 ft. addition to its factory, for the manufacture of tacks and nails, at 4045 Forest Park Blvd., here. Architect not announced.

N. Y., New York—R. Jacobs, c/o R. H. Almiroty, Archt., 48 West 46th St., will soon receive bids for the construction of a 2 story, 100 x 100 ft. garage at 31 West 65th St. Estimated cost $50,000.

N. Y., Rochester — The Rochester Vulcanite Pavement Co., Sherman Pl., plans to build an addition to its plant, for the repair of machinery. Estimated cost $5,000. Architect not announced.

N. Y., Syracuse—Mills, Rhines, Bellman & Nordhoff, Archts., 1234 Ohio Bldg., Toledo, Ohio, are receiving bids for the construction of a 2 story, 100 x 250 ft. factory for the manufacture of gears for the New Process Gear Co., 500 Plum St., here. Estimated cost $150,000. C. R. Burt, Mgr.

O., Chillicothe—The Quartermaster General, Office War Dept., Wash. ,D. C., awarded the contract for the construction of a U. S. Veteran's Hospital, including garage and shop, and vocational shop, here. Estimated cost $1,497,000.

O., Cleveland—L. A. Lux Co., 2183 Scranton Rd. (boiler compound), awarded the contract for the construction of a 1 story, 40 x 80 ft. factory. Estimated cost $10,000. L. A. Lux, Pres.

O., Youngstown—The Brier Hill Steel Co., Stambaugh Bldg., plans to build a strip steel mill. Architect not announced.

Pa., Aspinwall (Pittsburgh P. O.)—Humes Bros., Brilliant St., awarded the contract for the construction of a 1 story addition to garage. Estimated cost $40,000.

Pa., Freedom — Freedom Oil Wks. awarded the contract for the construction of a 2 story, 48 x 75 ft. garage and repair shop addition to its plant. Estimated cost $40,000. Noted Aug. 3.

Pa., Lancaster—The Champion Blower & Forge Co. plans to build a 1 story, 60 x 145 ft. addition to its plant, to be used as an assembling department. Estimated cost $25,000. Architect not announced.

Pa., Leechburg—The West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, awarded the contract for the construction of a 1 story, 120 x 700 ft. addition to its strip mill, here. Estimated cost $1,500,000.

Pa., Phila.—S. B. and B. W. Fletcher, 25th and Reed Sts., plan to build a 1 story, 60 x 160 ft. garage on 26th and Wharton Sts. Estimated cost $70,000. Stuckert & Co., Crozier Bldg., Archts.

Pa., Phila.—W. Smedley, Archt., Stephen Girard Bldg., is receiving bids for the construction of a 3 story, 102 x 104 ft. garage and repair shop at 223-27 Lombard St., for the Abbotts Dairy Co., c/o E. R. Linebach, 31st and Chestnut Sts. Estimated cost $150,000.

Pa., Pittsburgh—The Chatham Land Co., c/o H. D. Shawkey Motor Co., 5526 Penn Ave., awarded the contract for the construction of a 1 story, 100 x 200 ft. service and repair station on Penn Ave. and Pacific St. Estimated cost $60,000.

Pa., Pittsburgh—The Metal & Thermite Corp., 1201 Bway., New York City, awarded the contract for the construction of a 2 story, 40 x 100 ft. shop and storage building on Fayette St., here. Estimated cost $60,000. Noted Nov. 23.

Pa., Pittsburgh—The Natl. Metal Products Co., Erie and Diamond Sts., will build a 1 story, 68 x 138 ft. factory on Chateau and Fayette Sts. Estimated cost $60,000.

Pa., Pittsburgh — The Studebaker Sales Co., 4724 Baum Blvd., awarded the contract for the construction of a 2 story, 87 x 112 ft. addition to its garage and sales room. Estimated cost $65,000. Noted Nov. 16.

Pa., Pittsburgh—The Van Vleck Motor Car Co., 420 North Craig St., will soon award the contract for the construction of a 3 story, 91 x 115 ft. automobile sales and service station on Baum Blvd. and Commerce Way. Estimated cost $125,000. E. P. Mellon, 350 Madison Ave., New York City, Archt.

Pa., Wilkinsburg (Pittsburgh P. O.)—C. C. McKallip, Magee Bldg., Pittsburgh, is receiving bids for the construction of a 2 story, 50 x 90 ft. sales room and garage on Penn Ave., here. Estimated cost $50,000. Private plans.

R. I., East Providence—The United Electric Rys. Co., Providence, is receiving bids for the construction of a 1 and 2 story, 170 x 535 ft. car house and repair shop on North Bway, here. Estimated cost $400,000. Private plans.

W. Va., Warwood (Wheeling P. O.)—The Centre Fdry. and Machine Co. awarded the contract for the construction of a 1 story, 100 x 320 ft. foundry and machine shop. Cost will exceed $60,000.

Wis., Cambridge—A. Klavick plans to build a 1 and 2 story, 50 x 90 ft. garage, repair shop and filling station on Main St. Estimated cost $45,000. Architect not selected.

Wis., Sheboygan Falls—The Falls Motor Corp. is receiving bids for the construction of a 1 story, 50 x 60 ft. factory for the manufacture of motors.

Wis., Stratford—G. Chrouser plans to build a 2 story, 60 x 100 ft. garage and repair shop. Estimated cost $40,000. Architect not selected.

Wis., Waukesha—The Spring City Auto Co., 220 West Main St., awarded the contract for the construction of a 1 story, 65 x 190 ft. garage. Estimated cost $40,000. Noted Dec. 7.

Ont., Mount Dennis — The Electroplax Mfg. Co. plans to rebuild its electro plating factory which was recently destroyed by fire. Estimated cost $100,000.

Ont., Toronto—C. Pearce, 100 Inglewood Dr., plans to build a 1 story, 40 x 120 ft. garage. Estimated cost $25,000.

General Manufacturing

Ala., Montgomery—The Atlantic Ice & Coal Co., Perry St., awarded the contract for the construction of a 101 x 220 ft. ice and cold storage plant. Estimated cost $300,000.

Calif., Berkeley—L. W. Hink, 2226 Atherton St., is having plans prepared for the construction of a 2 story garage and printing plant. Estimated cost $15,000. J. W. Plachek, 2014 Shattuck Ave., Archt.

Calif., Emeryville—The Paraffine Co.'s, Inc., 34 1st St., San Francisco, manufacturer of box board, roofing, wall board and floor coverings, has purchased a 40 acre site, here, and plans to build extensions to its plant.

Calif., San Francisco — The California Shade Cloth Co., Inc., 2183 Bryant St., has had plans prepared for the construction of a 2 story, 40 x 200 ft. factory on San Bruno Ave. near Costa St. Estimated cost $35,000. Private plans.

Calif., San Francisco—Roth, Winter & Walsh, 1271 Mission St., pork packers, have had plans prepared for the construction of a 2 story, 92 x 120 ft. packing plant on Townsend St. near 5th St. Ward & Blohme, 454 California St., Archts.

Calif., Stockton—The Natl. Paper Products Co., Church St., between McDougall and Stockton Sts., awarded the contract for the construction of an addition to its paper mill. Cost between $100,000 and $150,000.

Conn., South Norwalk—H. Jacobs & Sons, Day St., are receiving bids for the construction of a 2 story, 60 x 120 ft. addition to shoe factory. Estimated cost $40,000. A. S. Meloy, 2965 Main St., Stratford, Archt.

Conn., Waterbury—R. F. Worden & Sons, Cherry St., awarded the contract for the construction of a 3 story, 40 x 45 ft. addition to their factory, for the manufacture of novelties. Estimated cost $25,000.

Conn., Westport — Lees Mfg. Co., 320 Bway., New York City, awarded the contract for the construction of a 3 story, 50 x 150 ft. addition to its cordage and twine factory, here. Estimated cost $75,000. Noted Dec. 14.

Del., Clayton—J. A. Bader & Co., 923 Market St., Wilmington, awarded the contract for the construction of a 1 story, 75 x 100 ft. ice manufacturing plant, here. Estimated cost $30,000.

Idaho, Weippe—[illegible] T. Chapin Co., [illegible] Bldg., Spokane, Wash., manufacturer of [illegible] will receive bids in the spring for the construction of a sawmill, here. Estimated cost [illegible].

Ill., Chicago—The Advertising Art Bulletin Co., [illegible] North State St., is having plans prepared for the construction of a 1 and 2 story, [illegible] x [illegible] ft. factory on Ravenswood St. near [illegible] St. Estimated cost [illegible]. A. H. Knox, [illegible] West Madison St., Archt.

Ill., Chicago—The Evans Fibre Box Co., [illegible] West [illegible] St., awarded the contract for the construction of a 1 and 2 story, [illegible] x [illegible] ft. factory at [illegible] South [illegible] Ave. Estimated cost $150,000.

Ill., Chicago — The E. L. Mansure Co., [illegible] Ave., manufacturer of draperies and trimmings, plans to build an 8 story factory and office building. Estimated cost [illegible]. Architect's name withheld.

Ill., Dixon—O. Beyer, Hennepin and 1st Sts., will soon receive bids for the construction of a 1 and 2 story, [illegible] x 140 ft. factory. Estimated cost [illegible]. R. Griesser, [illegible] West Randolph St., Archt.

Ill., Taylorville—The Hopper Paper Co. is receiving bids during December for the construction of a 2 story, 50 x 160 ft. addition to its factory. Estimated cost [illegible]. [illegible] & Cobb, 404 Press Bldg., Kalamazoo, Mich., Archts.

Ind., Fort Wayne — The Fort Wayne [illegible] Co., 449 Baker St., awarded the contract for the construction of a 2 story dairy. Estimated cost [illegible].

Ind., Fort Wayne—The Standard Lumber & [illegible] Co., Leesburg Rd., is having plans prepared for the construction of a 2 story, 50 x 100 ft. planing mill and garage. Estimated cost $35,000. Private plans.

Kan., Wichita—The Jacob Dodd Packing Co., 21st St. and Lawrence Ave., awarded the contract for the construction of a refrigeration plant. Estimated cost $100,000.

Kan., Wichita — L. A. Watkins, North [illegible] St., will soon receive bids for the construction of a 1 story, 50 x 140 ft. planing mill. Estimated cost $12,000. U. G. Charles, 2601 Schweiter Bldg., Engr. and Archt.

Ky., Louisville — A. Loomis, Archt., 51 Todd Bldg., will receive bids in the spring for the construction of a 3 story, 100 x 220 ft. printing plant on 5th St. and Bway, for the [illegible] Co., 425 West Bway. Estimated cost $100,000.

Mass., Bridgewater—L. Q. White Shoe Co. is having plans prepared for the construction of a 5 story, 40 x 200 ft. factory. Estimated cost $50,000. Architect not announced.

Mass., Clinton—Roubaix Mills, Inc., 792 Main St., awarded the contract for the construction of a 2 and 3 story dyehouse, to contain 15,000 sq.ft. of floor space on Main St. Estimated cost $50,000.

Mass., Great Barrington — The Dairymen's League Co-operative Association plans to build a 2 story dairy. Estimated cost $50,000. Architect not announced.

Mass., Marlboro — The Marlboro Dairy Co. awarded the contract for the construction of a 2 story, 50 x 60 ft. dairy on East Main St. Estimated cost $50,000.

Mass., Quincy (Boston P. O.)—Brooks-Skinner Co., Inc., Quincy Point, will build a 1 story, 100 x 242 ft. factory for the manufacture of portable buildings, here. Estimated cost $50,000.

Mass., Roxbury (Boston P. O.) — The [illegible] Mills, 99 Chauncy St., awarded the contract for the construction of a 2 story, 40 x 60 ft. addition to knitting mill, here. Estimated cost $15,000.

Mass., South Boston — The New York, New Haven & Hartford R.R. Co., South Station, Boston, awarded the contract for the construction of a 1 story [illegible] on [illegible] Ave., here. Estimated cost [illegible].

Mass., Spencer—The Spencer Gas Co., 110 Main St., will [illegible] build a 1 story addition to its gas plant on [illegible] St. Cost between [illegible] and [illegible].

Mass., Stoneham—The [illegible] Sons Co., Main St., will build a 1 story, [illegible] ft. addition to its shoe factory. Estimated cost [illegible].

Mass., Waltham—The New England [illegible] Co., [illegible] St., will build a [illegible] plant. Estimated cost [illegible].

Mich., Petoskey—The Petoskey Portland Cement Co. is having preliminary plans prepared for extending factory, stock house and power plant. Estimated cost $100,000. J. C. [illegible], 1st Natl. Bank Bldg., Chicago, Engr. This corrects report in Dec. 7 issue.

Mich., River Rouge—Ford Motor Co., Highland Park, awarded the contract for the construction of a 260 x 365 ft. plate glass and gas producer plant, here. Estimated cost $1,500,000.

Mich., River Rouge (Branch of Detroit) —A. Kahn, Engr. and Archt., 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Dec. 22 for the construction of a 1 and 2 story, 150 x 300 ft. cement plant, including conveyor runway in open clinker storage adjoining coal grinding and calcining building, and 10 silo storage bins for bulk cement, 24 ft. in diameter, here, for the Ford Motor Co., Highland Park. (Branch of Detroit).

Minn., Hibbing—The Members of Village Council will soon award the contract for the construction of a 1 story, 65 x 65 ft. gas works. Estimated cost $30,000. C. Foster, 512 Sellwood Bldg., Duluth, Engr. and Archt.

Mo., Kansas City—Hall Bros. Co., 1114 Grand Ave., manufacturer of stationery, etc., awarded the contract for the construction of a 5 story, 100 x 115 ft. plant on 26th and Walnut Sts. Estimated cost $1,250,000.

Mo., Kansas City—The Kansas City Oxygen Gas Co., 1805 Grand Ave., is having plans prepared for the construction of a 2 story, 18 x 48 ft. factory on 13th and Easton Sts. Estimated cost $25,000. Private plans.

Mo., St. Louis—The Grace Sign Mfg. Co., 425 South Main St., awarded the contract for the construction of a 1 story, 162 x 260 ft. sign factory on President and 2nd Sts. Estimated cost $100,000. Noted Dec. 14.

N. J., Camden—H. Kohnstamm & Co., Cleveland and Lois Sts., plan to build a 1 story, 65 x 74 ft. factory for the manufacture of laundry supplies. Estimated cost $18,000. Private plans.

N. J., Trenton—The New Jersey Porcelain Co., New York Ave. and Mulberry St., plans to build a plant. Architect not selected.

N. J., Trenton — The Trenton Potteries Co. will build a 1 story, 50 x 150 ft. kiln building at the Equitable Pottery plant on Lalor and Hancock Sts. Estimated cost $10,000.

N. J., West Berlin—Baccellieri Bros., 924 South 11th St., is receiving bids for the construction of a 1 story, 50 x 150 ft. furniture factory. Estimated cost $35,000. Private plans.

N. Y., Buffalo—The Culliton Ice Cream Co., 172 Guilford St., has had plans prepared for the construction of a 20 x 65 x 80 ft. ice plant, a 15 x 30 x 65 ft. engine room and a 12 x 30 x 60 ft. ice storage building on East Jewett Ave. Cost will exceed $25,000. Architect's name withheld.

N. Y., Buffalo—Kittinger Bros., 1893 Elmwood Ave., plans to build a large addition to furniture factory. Estimated cost $40,000. Architect not announced.

N. Y., Buffalo—The Quality Damp Wash Co., Inc., Northland Ave. and Chelsea St., plans to build a 1 story, 80 x 100 ft. laundry. Architect not announced.

N. Y., Buffalo—The Sinclair Oil Co., Washington St., plans to rebuild major portion of its gasoline and oil plant on Alabama St., which was destroyed by fire. Estimated cost $100,000. Architect not announced.

N. Y., Coberton—The Wetmiller Dairy & Farm Products Co. awarded the contract for the construction of a 2 story, 44 x 44 ft. dairy.

N. Y., Dundee—W. Fox plans to rebuild flour and feed mill on Vine St. which was destroyed by fire. Estimated cost $5,000. Architect not announced.

N. Y., Hornell—The Elmhurst Dairy Co. plans to build a creamery on Erie Ave. Estimated cost $10,000. Architect not announced.

N. Y., Jamestown — The Jamestown Worsted Mills Co. awarded the contract for the construction of factory No. 16, 4 story, 70 x 180 ft. Estimated cost $250,000. Noted Nov. 16.

N. Y., Mayville—The Chautauqua Cabinet Co. plans to build an addition to its factory for the manufacture of wooden cabinets. Cost will exceed $6,000. Architect not announced.

N. Y., Niagara Falls—The A. S. Gilman Printing Co., 623 St. Clair Ave., awarded the contract for the construction of a 1 story, 100 x 200 ft. printing plant.

N. Y., Rochester—The Empire State Ice Co., 76 West Monroe St., Chicago, has had plans prepared for the construction of a 48 x 182 ft. and 67 x 132 ft. ice plant on Atlantic Ave., here. Estimated cost $200,000. Private plans.

N. Y., Tonawanda—The American Kardex Co., Main St., is having plans prepared for the construction of a 2 story, 50 x 160 ft. addition to its plant. Estimated cost $70,000. L. Eggert, 35 Elmwood Ave., Archt.

N. C., Gastonia—H. H. Groves will soon award the contract for the construction of a cotton mill for the manufacture of fine combed yarns, capacity 15,000 spindles.

N. C., Whitnel—The Nelson Cotton Mill Co., Lenoir, plans to build a 6,000 spindle cotton mill, here.

O., Cleveland—Donley Bros., Co., East 74th St. and Aetna Rd., (building specialties) plans to build a 1 story factory on East 138th St. and Miles Ave. Estimated cost $50,000. G. Donley, Mgr. Architect not selected.

O., Cleveland—The Double Eagle Bottling Co., 6517 St. Clair Ave., awarded the contract for the construction of a 2 story, 30 x 60 ft. bottling works. Estimated cost $40,000. J. Potokar, Mgr. Noted Nov. 16.

O., Cleveland—Fischer & Jirouch, 4821 Superior Ave., awarded the contract for the construction of a 3 story, 60 x 73 ft. addition to plastic works. Estimated cost $40,000.

Ore., Medford — W. E. Sterns plans to build a cold storage plant.

Ore., Portland—The See-Der Mfg. Co., Larabee and Delay Sts., plans to build a factory for the manufacture of cedar chests, furniture and wood novelties. Estimated cost $25,000.

Pa., Allentown—The Independent Oil Co., Inc., Rialto Bldg., plans to rebuild its oil plant on 12th St., which was destroyed by fire. Cost between $60,000 and $75,000. Architect not announced.

Pa., Johnstown — The Edward Hahn Packing Co., Hickory St., awarded the contract for the construction of a 3 story, 48 x 108 ft. and 24 x 112 ft. addition to its packing plant. Estimated cost $65,000. Noted Dec. 7.

Pa., Pittsburgh—The Ward Baking Co., Southern Blvd. and St. Marys St., New York City, will soon award the contract for the construction of a 1 story, 141 x 194 ft. addition to its bakery on Penn Ave., Beechwood Blvd. and Shakespeare Alley, here. Estimated cost $100,000. C. B. Comstock, 110-112 West 40th St., New York City, Archt.

Pa., Tullytown — The Megargee Paper Mills, 16 South 6th St., Phila., will not build a paper plant, here, as stated in issue of Dec. 7.

Pa., Wilkes-Barre — A. Hildebrand, 91 Wood St., plans to rebuild planing and lumber mill which was destroyed by fire. Estimated cost $45,000. Architect not announced.

Wash., Hoquiam — The Grays Harbor Home Building Corp. is building a plant for the manufacture of ready cut homes and buildings. C. Kane, Secy.

Wis., Cedar Grove — The Cedar Grove Shoe Mfg. Co. plans to build a 2 story, 50 x 95 ft. shoe factory. M. J. De Master, Pres. Architect not selected.

Wis., Green Bay—The Northern Paper Mills, Day St., manufacturer of machinery to bark logs, will build a 1 story, 40 x 100 ft. barker room. Estimated cost $12,000.

Wis., La Crosse—The Art Glass Co., 125 South Front St., awarded the contract for the construction of a 1 story, 40 x 100 ft. factory for the manufacture of art glass, on South 3rd St. Estimated cost $25,000. F. H. Flemmer, Mgr.

Wis., Madison — Heilprin & Co., West Mifflin St., is having plans prepared for the construction of a 2 story, 75 x 150 ft. cold storage warehouse on Bedford St. Estimated cost $90,000. J. Heilprin, Pres. E. A. Tough, Conklin Bldg., Archt. Noted Nov. 30.

Wis., Milwaukee—H. J. Esser, Archt., 82 Wisconsin St., is receiving bids for the construction of a 2 story, 85 x 150 ft. dairy on 11th St. for the Cedarburg Dairy Co., c/o H. Berns, 1586 Prospect Ave. Estimated cost $75,000. Noted Nov. 30.

Wis., Milwaukee—The Harsh & Chapline Shoe Co., 694 Hanover St., awarded the contract for the construction of a 3 story, 60 x 210 ft. factory. Estimated cost $110,000. Noted Nov. 30.

Wis., Sheboygan—The city is receiving bids for the construction of a 2 story, 76 x 108 ft. tool, carpenter and woodworking shop, on South Water St. Estimated cost $40,000. J. Steimle, Clk. A. A. Nack, City Hall, Archt.

Wis., Sturgeon Bay—The Door County Fruit Growers Union plans to build a cold storage plant and a dehydrating plant for drying apples. Estimated cost $50,000. E. L. Johnson, Mgr. Architect not selected.

Vol. 57, No. 26 December 28, 1922 25 cents a copy

American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
L. C. MORROW, *Managing Editor* A. L. DE LEEUW, *Consulting Editor*
Associate Editors—S. ASHTON HAND C. J. PRIEBE ELLSWORTH SHELDON, *New England Editor*
HOWARD CAMPBELL, *Western Editor, Chicago* ETHAN VIALL, *Ohio Editor, Cincinnati*
MASON BRITTON, *Manager*

CONTENTS

Coming Features

Management of the Machine Jobbing Shop
Organization and Management of a Medium Sized Plant
What's Wrong With the Railroad Shops?
And Other Management Articles

In the first issue of 1923

JAMES H. McGRAW, President — ARTHUR J. BALDWIN, Vice-President — MALCOLM MUIR, Vice-President — EDWARD D. CONKLIN, Vice-President — JAMES H. McGRAW, JR., Secretary and Treasurer

McGRAW-HILL COMPANY, INC., Tenth Ave. at 36th St., NEW YORK

WASHINGTON, Colorado Building
CHICAGO, Old Colony Building
PHILADELPHIA, Real Estate Trust Building
CLEVELAND, Leader-News Building
ST. LOUIS, Star Building
SAN FRANCISCO, Rialto Building
LONDON, 6 Bouverie St., London, E. C. 4

Published weekly.
Entered as second-class matter, June 23, 1879, at the Post Office at New York, under the Act of March 3, 1879.
Printed in U. S. A.
Member Associated Business Papers, Inc.
Member Audit Bureau of Circulations.

Cable Address: "Machinist, N. Y."

Publishers of

Engineering News-Record American Machinist
Power Chemical and Metallurgical Engineering
Coal Age Engineering and Mining Journal-Press
Ingenieria Internacional
Bus Transportation Electric Railway Journal
Electrical World Electrical Merchandising
Journal of Electricity and Western Industry
(Published in San Francisco)
Industrial Engineer
(Published in Chicago)
American Machinist—European Edition
(Published in London)

Circulation of this Issue 19,138

Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.
Annual subscription rate, $5 in any part of the United States, Canada, Mexico, Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba, Panama, Dominican Republic, Honduras, Salvador, Nicaragua, Peru, Colombia, Bolivia, Ecuador, Argentina, Spain and Shanghai, China. Extra postage on American Edition in other countries except Europe and British possessions in Eastern Hemisphere, $4 (total, $9 or 38 shillings). Single copy 25 cents. McGraw-Hill Publishing Co., Ltd., 6 Bouverie St., London, E. C. 4, England, will serve with the European Edition all subscribers in Europe and British possessions in Eastern Hemisphere (35 shillings for England and elsewhere in Eastern Hemisphere.)

Ideals *plus* Ideas

TIME-HONORED custom makes this the open season for new resolutions, when each of us is wont to set a higher goal for next year's achievement.

But a new leaf thus blithely turned over has one fatal fault—it *doesn't always stick*. New Year's ideals, if not sustained by IDEAS, fade soon into the mist of the might-have-beens.

IDEAS—new ideas, better ideas and proved ideas—a wealth of ideas that will help readers of the *American Machinist* carry out their New Year's Ideals—are found each week in the advertising pages of the *American Machinist*.

IDEAS for the executives in every part of the metal-working manufacturing shop—facts about materials and equipment that will make a better product at a lower price—are waiting to be gleaned from the Buying Section. Here machinery executives who have resolved to raise production standards and reduce costs will get the essence of up-to-date practice—for the fact that a method or machine is advertised consistently is the best proof that it has made good.

So, after you have made your New Year's resolutions, make just one more in order to make the other ones stick. Resolve to make full use of the advertising pages of the *American Machinist*, where dependable ideas, proved and vouched for, are yours for the reading—because

Only Reliable Products can be Continuously Advertised

Through such standardization of quality a vast business has been developed, the yearly sales of which total millions of dollars.

Thirty years ago Lodge & Shipley selected as their battle cry "Lathes—Good Lathes Only." The reason for this was two fold. First, a slogan was wanted that would make it plain a specialty was to be made of good lathes only. Secondly, a mark to shoot at was wanted. One that would mean something!

And this one does mean something!

The trade mark chosen has ever been a source of inspiration, making it clear at a glance what would otherwise take paragraphs to explain.

The fact that Lodge & Shipley are today building lathes only, in accordance with their original ideas, means that the vision of thirty years ago, has been realized.

It means that they have made good with the trade mark selected. It means that wherever the Lodge & Shipley product is known, "Lathes—Good Lathes Only" stands for the best.

Ask an operator!

Send now for literature describing

LATHES
Good Lathes Only

Machine Tool Co.
Ohio

OUR WELCOME

Cincinnati No. 4 Vertical High Power Miller. One of 38 Types and Sizes of our Millers.

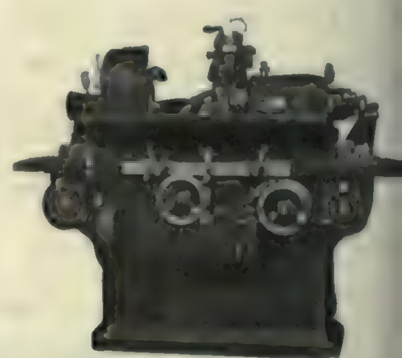
Upon Coming to Cincinnati You Will See In Our Plant

Modern Buildings
Machine Shop equipped for refinements in manufacturing.
Large Engineering and Design Dept.
Machine equipped Foundry with thoroughly tooled Pattern Shop.
Physical and Chemical Laboratories.
Tool Room with modern layout.
Centralized Tool Stores.
Precision Tools and Gauges.
Demonstration Room.
Complete line of our products in a running exhibit.
Operators' Instruction Sheets.

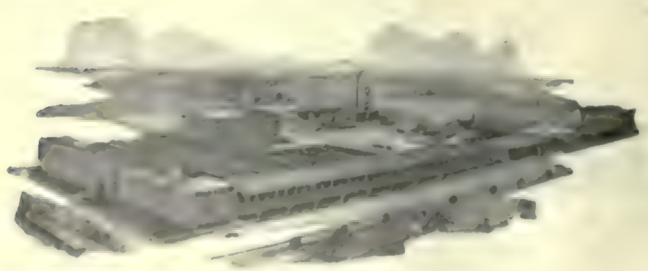
An Employees' Service Department
with
Modern Employment Methods

Careful Medical and Surgical Attendance for employees.
Sanitary and Safety Provisions.
Self-Service Dining Hall.
Co-operative Students of the University of Cincinnati at work.

Cincinnati Grinder Company's line of Cylindrical Grinders; in the process of manufacture and in demonstration.



12" x 24" Plain Cincinnati Cylindrical Grinder.



THE CINCINNATI GRINDER COMPANY

THE CINCINNATI BICKFORD

4, 5 and 6 Foot Regular Plain Radial

One of the many highly desirable features of this machine is the location of its control levers. Maximum efficiency is unattainable without maximum convenience of operation. No back gears can be engaged without shock while the spindle is revolving at high speed. The driving clutch must be released sufficiently to permit slippage while the change is effected. The back gear lever should, therefore, be placed within easy reach of the reverse lever, so that the operator can keep a hand on each as depicted opposite.

The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

Founded 1874

THE CINCINNATI

21-Inch Stationary Head Upright Drilling Machine

This illustration depicts the drill equipped with Back Gearing, Power Feed and Patented Tapping Attachment. The Back Gears increase the number of speeds from four to eight and multiply the pulling power of the spindle nearly five and one-half times. The tapping attachment acts through friction clutches and hence enables the operator to stop, start and reverse the spindle while the machine is running.

MILWAUKEE MILLING MACHINES

Continuous Milling on a Milwaukee Vertical

KEARNEY & TRECKER
MILWAUKEE MILLING MACHINES

Milwaukee Vertical Milling Machines are well adapted for rapidly producing many parts by the continuous milling process, the limiting factors being the ability of the cutter to remove the stock and the operator to change the pieces.

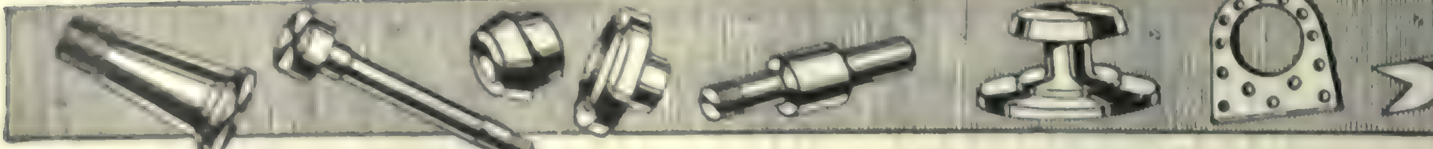
The illustration shows a No. 1½-B Milwaukee Vertical Milling Machine equipped with a cutter 4 in. in diameter and 7/16 in. wide, milling through solid steel, the feed being 5 in. per minute and cutter running 78 r.p.m.,—the operator simply loading and unloading the work.

These machines can also be used on the general run of work suitable to this type, but by the use of simple fixtures the range and production can often be considerably increased.

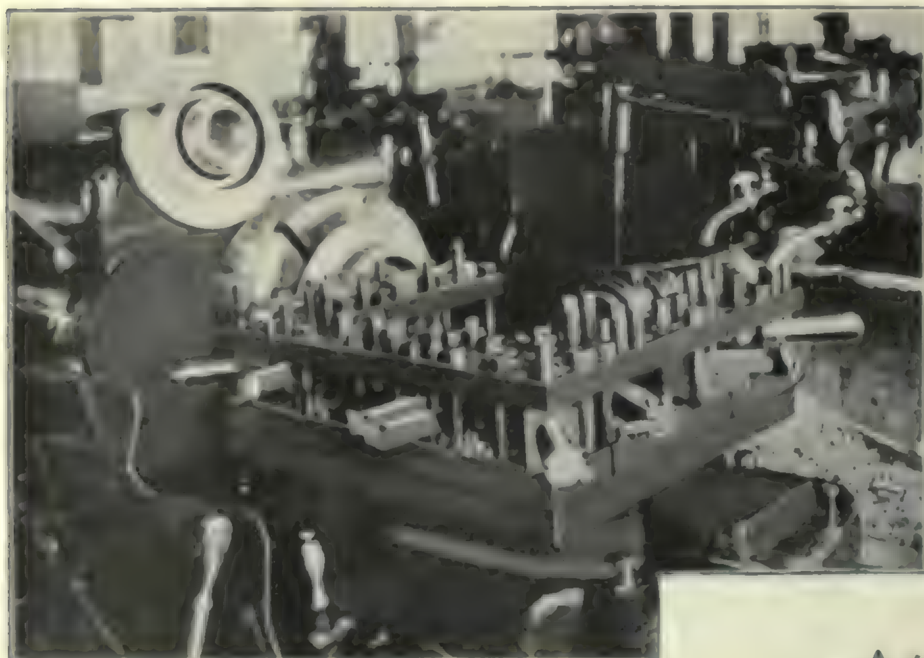
We welcome opportunities to apply our experience to milling problems with a view of reducing production costs.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WIS., U.S.A.

CHICAGO OFFICE 631 WASHINGTON BLVD. | CLEVELAND OFFICE 738 SUPERIOR AVE. N.W. | NEW YORK OFFICE 50 CHURCH STREET



Versatility of the Hart
shown by many examp

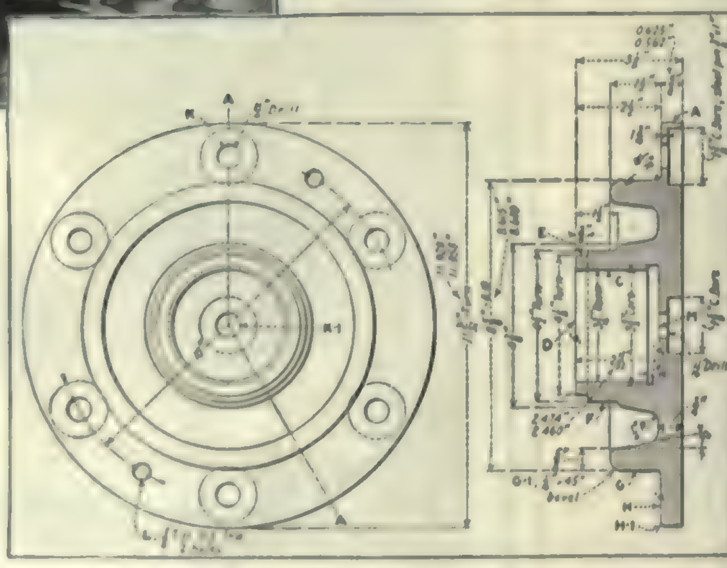


This is one of a series of examples taken from actual practice to illustrate the wide range in character of work of which the Hartness Flat Turret Lathe is capable, and its quick change possibilities from one job to the next. The examples are of parts being made on a commercial basis by a large manufacturer of mining machinery. They have 100 Hartness F. T. Lathes in their plant. Note the tools placed in the corners on this set-up. This gives 8 different positions instead of 4.

Operations on this piece performed on the Hartness

1. Turn A
2. Drill K-1
3. Rough bore C
4. Rough turn E, F and G
5. Rough face H, D and M
6. Finish bore C
7. Finish turn E, F, G and bevel G-1
8. Finish face H and D and bevel H-1.

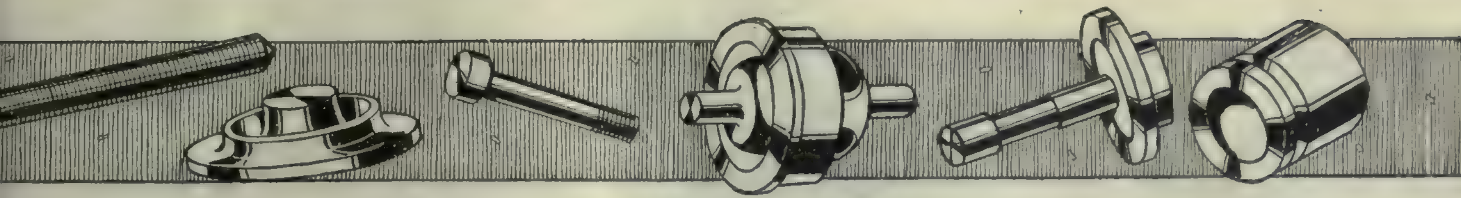
Double Spindle HARTNESS Flat Turret Lathe equipped as a single spindle giving a 17 in. swing and 8 positions of turret.



Branch Office
San Francisco, California
[illegible] Market Street
AGENTS
Japan, Korea, Manchuria, Formosa
Mitsui Co., Ltd., Tokio
France, Spain and Belgium—F. Auberty & Co.
[illegible] Rue Lafayette, Paris
Australasia—McPherson Pty., Ltd.
[illegible] Collins St., Melbourne

JONES & LAMSON

SPRINGFIELD,



ness Flat Turret Lathe
les from actual practice

If your machines lack adaptability you must run the work through your plant in excessively large lots, or else you must have an unnecessarily large number of machines with, practically all the time, a certain percentage standing idle. This ties up a lot of your money where you derive no benefit from it and is a waste all around.

For quick adaptability to a great variety of jobs the Hartness Flat Turret Lathe is unexcelled. It has many exclusive features that contribute toward this result. Among others is the Cross Sliding Head.

The use of the Cross Sliding Head makes every turret tool a cross slide tool if necessary. The same tool can both bore and face, or turn and face.

The same tool can turn and bore two different diameters.

The same tool, if necessary, can face two different shoulders.

The same tool can feed forward or backward.

Nine stops for the cross sliding head, any or all of which may be applied to any one turret position, add to the flexibility of the general scheme.

The Hartness Flat Turret Lathe is the only lathe having a cross sliding head. All others must resort to a toolpost or to mounting the turret on two slides in order to get the same movements. Hence the "Hartness" is the only turret lathe having length and cross-feeds for each tool without resorting to the double-slide turret support.

This gives to the "Hartness" a versatility and adaptability with tool economy on both bar and chuck work that can not be equalled by any other turret lathe on the market.

Investigate this Hartness F. T. Lathe. It gives the largest output per dollar, as well as a low cost of work and an accurate duplication. Write today for complete details.

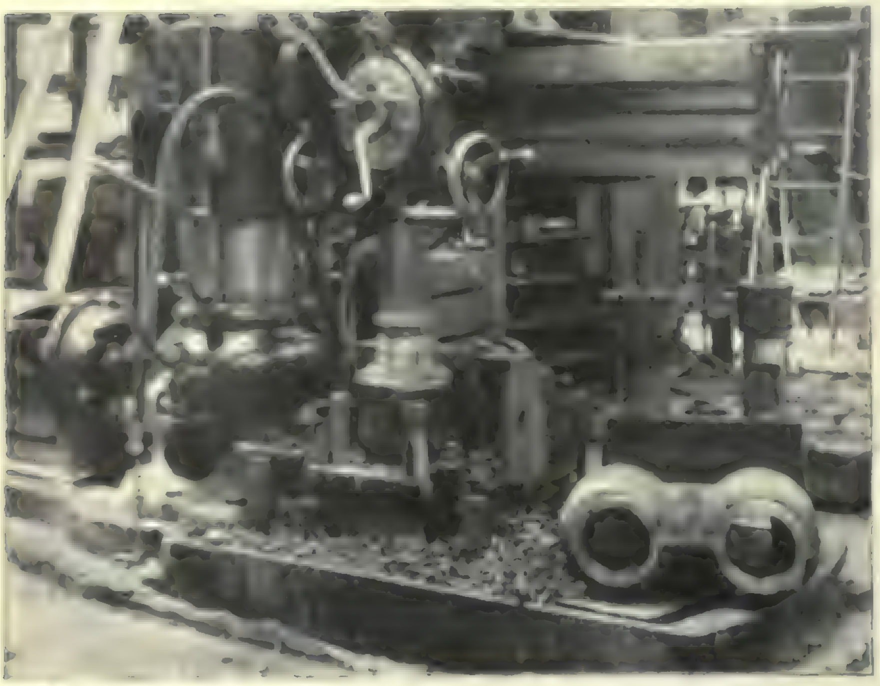
MACHINE COMPANY
VERMONT

Branch Office:
London, England
9-10 Water Lane, Queen Victoria St.

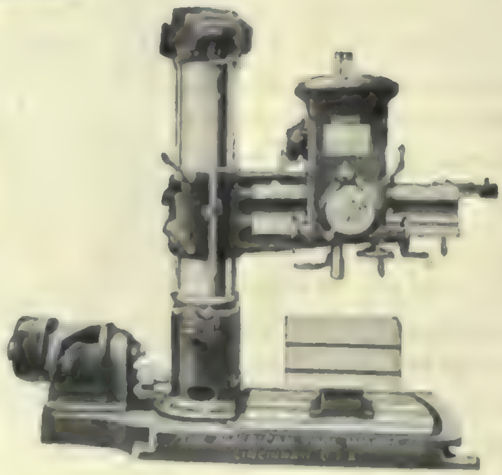
AGENTS:

Holland—Spliethoff, Beeuwkes & Co., Leuvehaven, Wz., 159 Rotterdam

Sweden—A. Bol. Oscar Lindbom, Stockholm—Post Box 420



This Shows thing Behind "DO IT WITH



This 4-foot AMERICAN Radial bores, faces and taps 6 in. holes in close-grained steel Time, 57 minutes

Probably there was some doubt as to results when Superintendent J. E. Dykstra, of the Foos Gas Engine Co., Springfield, Ohio, first put this 4-ft. "AMERICAN" Triple Purpose Radial Drill to the test, pictured above.

But it didn't take long for the wide-awake production executives in this shop to come to the conclusion that here was still another job where it paid to "do it with an AMERICAN."

These castings of close-grained steel, capable of resisting a high pressure test, are rough and finished bored, faced and tapped. The production average, floor to floor, for the two 6-in. holes is 57 minutes. The extreme precision and reliability of the sturdy, adaptable "AMERICAN" eliminates spoilage. Out of 250 castings, 3 only were lost—and these due to a dull tap and hard spots in the castings.

THE AMERICAN TOOL WORKS

Lathes *Planers*

Save Your Original Investment By Buying This

NEW YORK, N. Y., Vandyck Churchill Co. 52 Vesey St.
CHICAGO, ILL., E. L. Essley Machinery Co.
 Washington Blvd
TOLEDO, O., National Supply Co.
PHILADELPHIA, PA., Vandyck Churchill Co.,
 504 Rush Bldg
DETROIT, MICH., Cadillac Machinery Co.
 Cor. Beaubien and E. Lafayette
ST. LOUIS, MO., Bernard E. Mohr Machy. Co.,
 1213 Pine St.
 Fairbanks Co., 7th & Market Sts.
BOSTON, MASS., Taylor Mchy. Co., 78 Batterymarch St.
BALTIMORE, MD., Fairbanks Co.,
 Light & Lombard Sts.
PITTSBURGH, PA., Somers, Fitler & Todd Co.,
 Water St.
LOS ANGELES, CALIF., F. O. Stallman Supply Co.,
 500 East Third St
BUFFALO, N. Y., Crane Mchy. Co., 501 Morgan Bldg.
 Homer Strong & Co., Inc., Ellicott Square
SAN FRANCISCO, CLA., Fred Ward & Son, 171 First St.
MILWAUKEE, WIS., E. L. Essley Machy. Co.
 78 W. Water St.
SEATTLE, WASH., Buckner-Woodard Co.,
 924 First Ave. So.
INDIANAPOLIS, IND., Millholland Sales & Engr. Co.
 1047 Lemcke Annex
ROCHESTER, N. Y., Homer Strong & Co., Inc.
 501 State St.
PROVIDENCE, R. I., Brownell Machy. Co.,
 11 and 13 Eddy St.
COLUMBUS, OHIO, Osborne & Sexton Machy. Co,
SYRACUSE, N. Y. H. A. Smith Machy. Co.,
 501 E. Water St.
RICHMOND, VA., Smith-Courtney Co.,
 7th & Bainbridge St.
NEW HAVEN, CONN., Vandyck Churchill Co
 First National Bank Bldg
GREENVILLE, S. C., Carolina Supply Co.
KANSAS CITY, MO., Faeth Co., 1117 W. 8th St.
LOUISVILLE, KY., Neill-LaVielle Sup. Co.,
 505 W. Main St
ATLANTA, GA., Fulton Supply Co.
OMAHA, NEB., Sunderland Mchy. Co., 21st & Pacific Sts.

CHARLESTON, S. C., Cameron & Barkley Co.
CHATTANOOGA, TENN., James Supply Co., 1104 Market St.
NEW ORLEANS, LA., P. H. McArdle, 633 Carondelet St.

Their Price is *RIGHT*

KEMPSMITH

THE KEMPSMITH MFG·CO
MILWAUKEE U.S.A.

The Maximum in Milling Machines

"tuff stuff"

Here's a job that demands the acme of precision on internal grinding. It is a Universal Joint Body and the material is Hard Steel.

Limits of .001 in. are held to on this piece and the .015-in. stock is removed in finishing. Twenty-five of these bodies are produced hourly. The Universal Products Company, where this work is being done, have 14 Heald Grinders. Such a battery is sufficient evidence of their value as producers, especially on this particular tough material.

Grind with a HEALD and be sure

HEALD

No. 75 Internal Grinder

is extremely rigid, durable and simple in construction. It is easily operated and fully guarded to protect the operator. It is particularly well adapted to handle such work as transmission gears, bevel gears, pinions, bushings, rings, etc., and on this short work will be found fully as rapid as any automatic feed machine.

Let Heald Engineers give you some performance facts and figures

THE HEALD MACHINE COMPANY

35 New Bond St., Worcester, Mass.

The New High-Speed Gear Shaper which is taking the place of Single-purpose Machines in many of the Large Automotive Factories

The Single-Purpose Machine is Taboo

A machine tool designed especially for performing one or more operations on a certain part may produce a greater number of pieces per hour than a so-called standard machine equipped with special fixtures.

But, when a change is made in the design of the part produced, what becomes of the single-purpose machine, unless it can be adapted to the new part?

The new High-speed Gear Shaper is a standard machine having single-purpose possibilities. To handle different pieces of work, it is only necessary to equip it with work arbors or work-holding fixtures suited to the work in hand. The machine in all of its functions and units is a standard product.

Works Managers in general are appreciating the significance of this fact and are adapting standard machines to single-purpose machine work.

Our book, "A New Development in Gear Cutting," explains wherein the new High-Speed Gear Shaper fulfills this important requirement.

Do you want a copy?

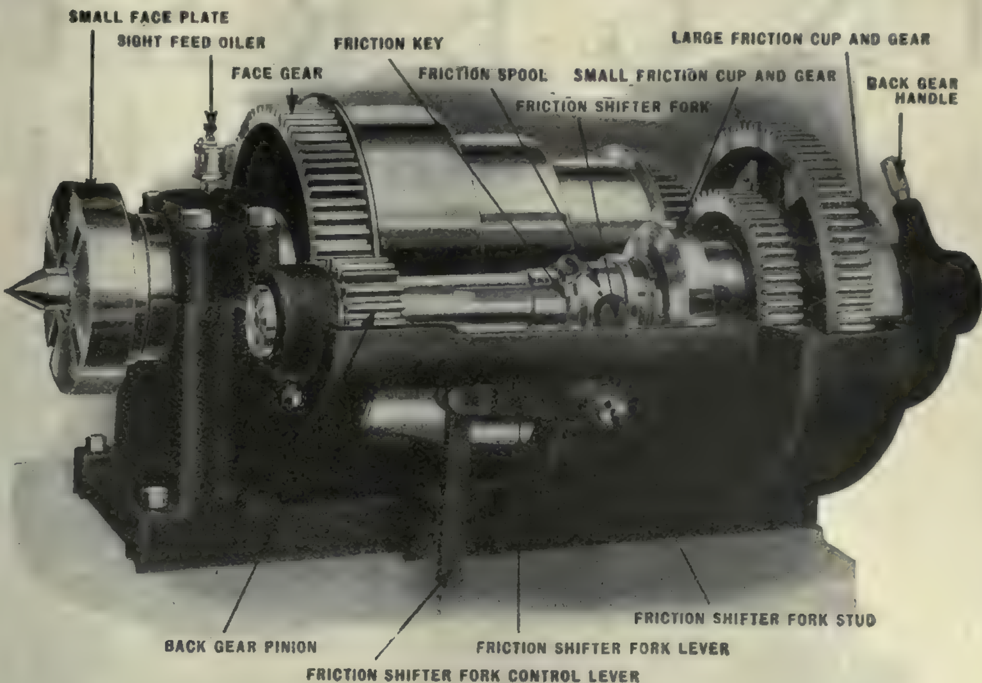
The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

Foreign Agents: [illegible] England; Societe Anonyme Alfred Herbert, Paris, France; [illegible] Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert Ltd. Yokohama, Japan; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd. Head Office Calcutta, India; [illegible] Bohm & Reimann, Berlin, Germany; Werkzeug Und Maschin [illegible]

Pacific Coast Representatives: [illegible] & Smith Company, Portland, Oregon; Seattle, Washington; San Francisco and Los Angeles, [illegible]

Change the Gears While Cut is Under Way

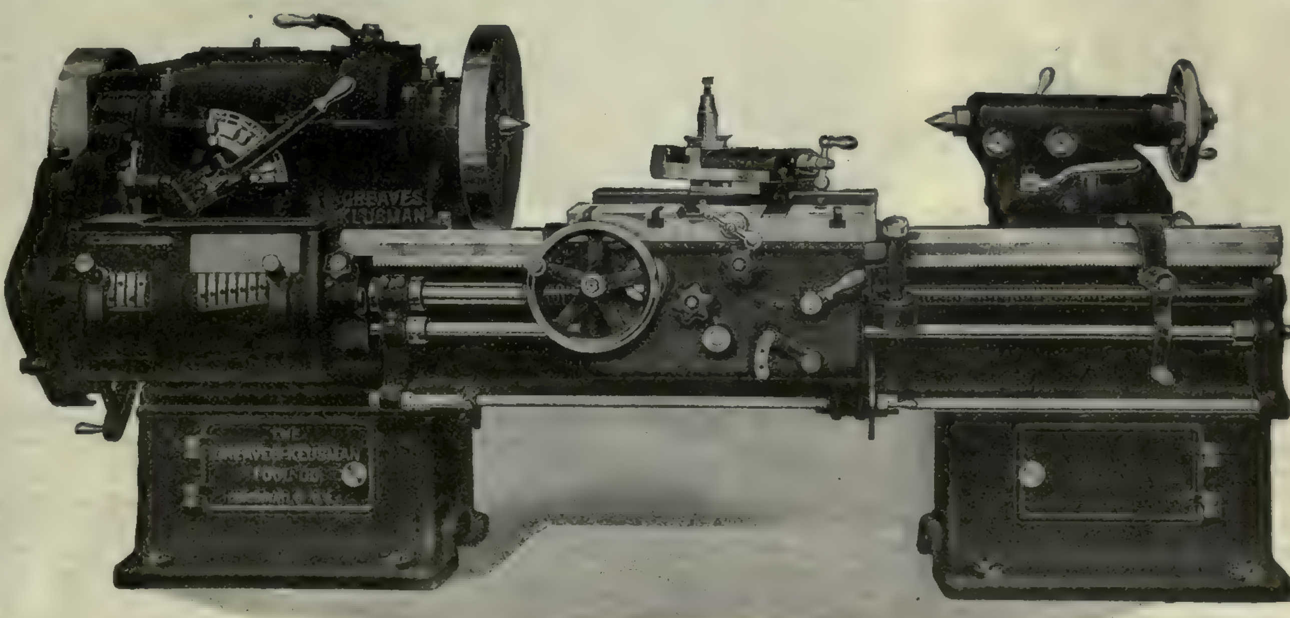


We show, herewith, a G-K feature that raises production figures by allowing the lathe operator to pay closer attention to his work. This Double Friction Back Gear is controlled from the apron and the lathe runner can quickly change the proper speeds while cut is progressing.

This Back Gear is self-adjusting, thus eliminating necessity of tightening it every few days. The ratio between the first and second back gears is the correct ratio between roughing and finishing speeds. This allows the operator to go directly from a roughing to a finishing cut. Six speeds are available without shifting drive belt.

G-K Heavy Duty Lathes are an assembly of features. Every unit entering into their construction is based on two prime factors—*quality* and *output.* The Catalog lists all the features but it will pay you to get it for full details on the

G-K Double Friction Back Gear

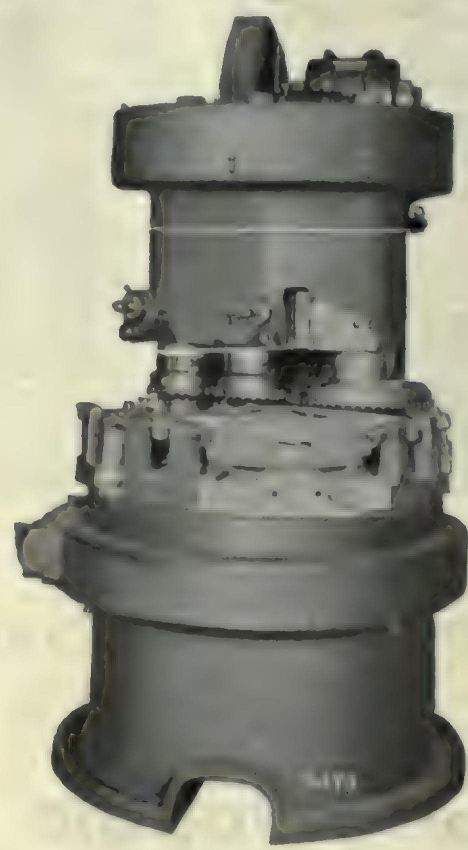


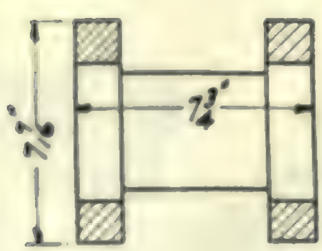
Greaves Klusman Tool Company

Cincinnati, Ohio, U. S. A.

INGERSOLL

Rotary Milling Machines





Milling the feet of General Electric Motor Frames.
A finished casting produced every minute.

Roughing and finishing flywheel housings
for Continental Motors.

The development of the Ingersoll Rotary Continuous Milling Machine can be carried out so as to include a great many castings and forgings where the production requirements warrant continuous milling.

They occupy a very small amount of floor space and require only one operator who merely removes the finished castings and replaces them with rough ones. This work can be done by one man without undue fatigue because the machine operates continuously and without requiring his attention.

The cutters and fixtures with which these machines are equipped were designed and built in our shops and the entire responsibility for the installation was assumed by us.

In addition to building special machines adapted only for quantity production, we are prepared to build machines on which a large number of different operations can be performed, for shops having a diversified line of work going through in small quantities.

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment

Detroit: David Whitney Bldg. ROCKFORD, ILL. 50 Church St., New York

Two Operations at The Same Time

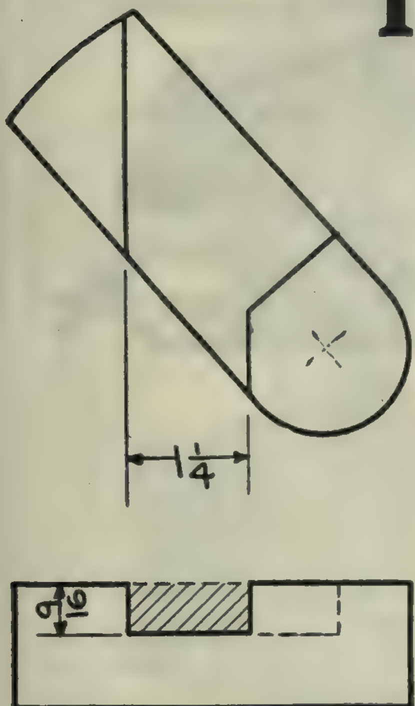


Fig. 1

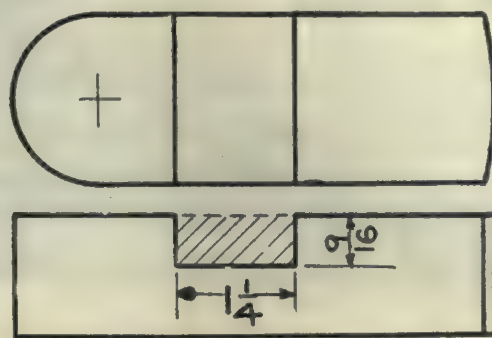
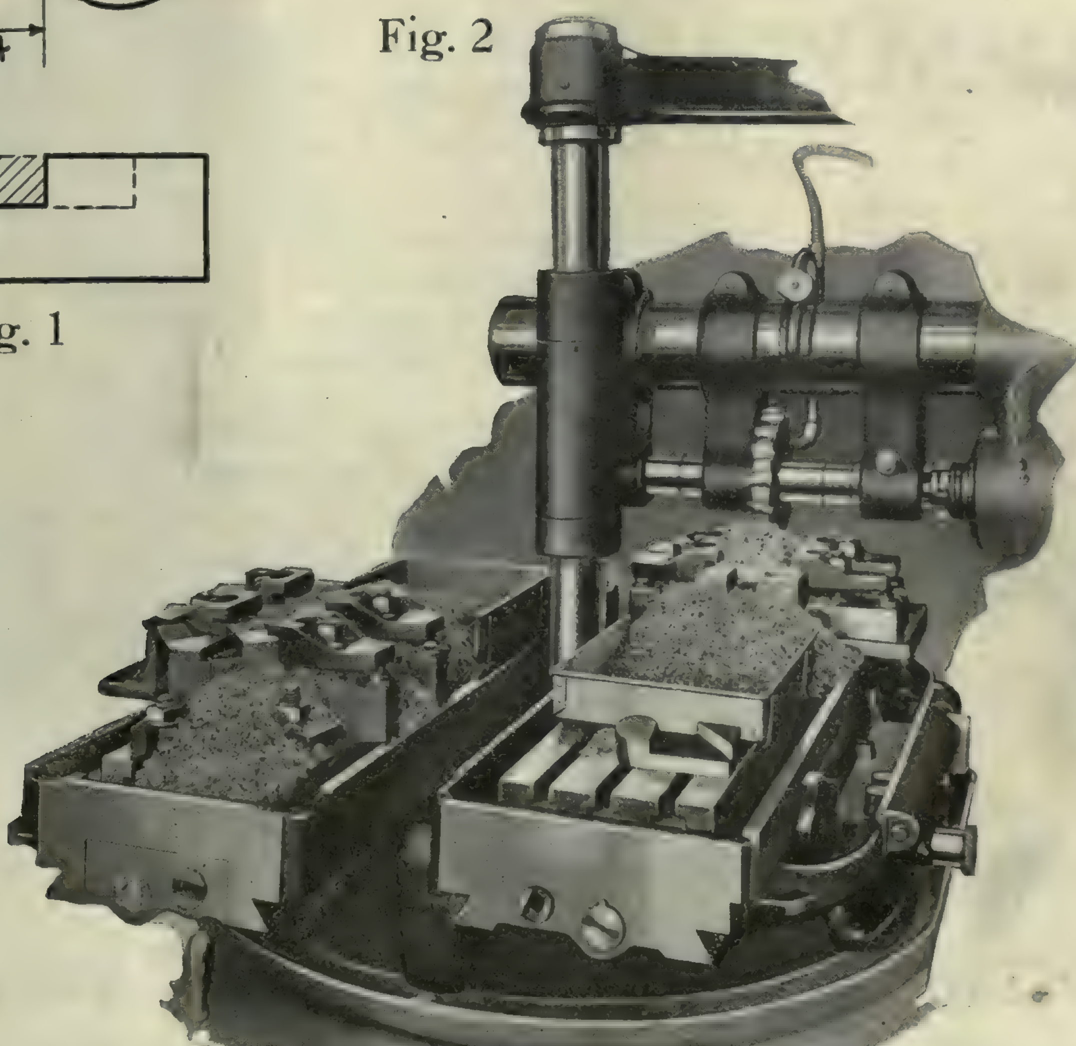
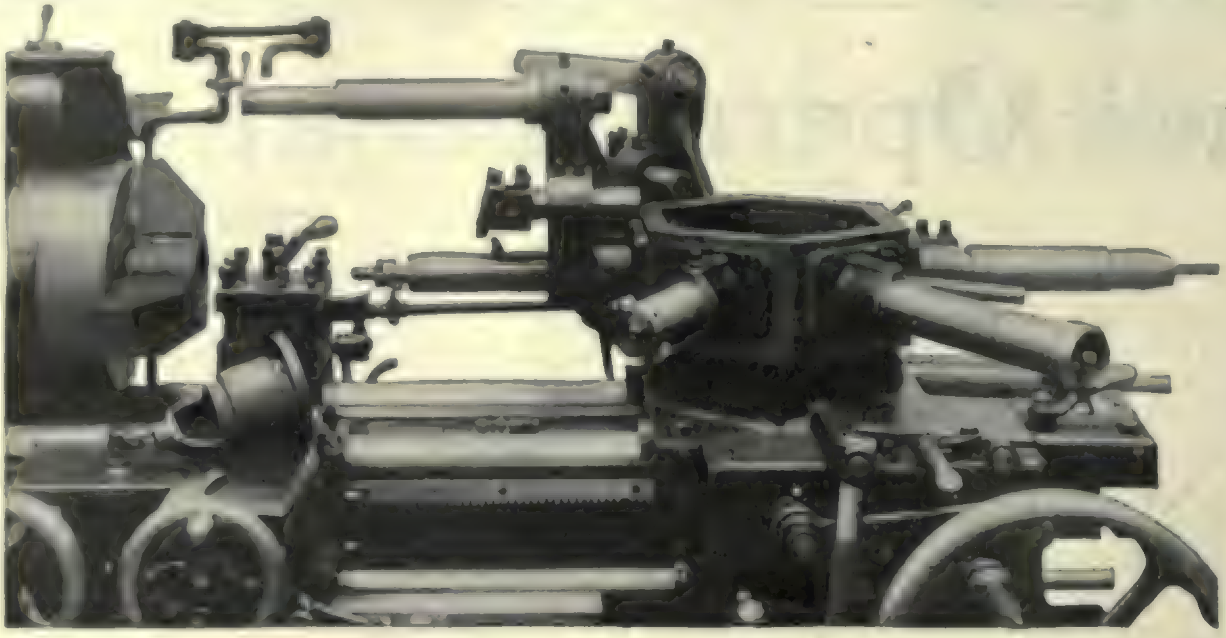


Fig. 2





Bendix Housings
Finished in 3 minutes each
on a W. & S. Turret Lathe

Overhead piloted tools can very often do your work to better advantage in cost, in accuracy and in finish. W. & S. Engineers recommended them in the job pictured above.

The very close accuracy to be obtained in the finish of these bendix housings demanded the use of this type tool, and the resulting time obtained (3 minutes each) quite justified their cost.

Have you some very accurate work you'd like to speed up? Send us blue prints of it.

Turret Lathes and Turret Lathe Tools [illegible] in. x 4 in. to 4½ in. x 44 in. Bar Capacity Up to 21½ in. Swing for Chucking Work.

The Warner & Swasey Company

Cleveland, U. S. A.

NEW YORK: [illegible] Building
CHICAGO: [illegible] Washington Boulevard

BOSTON: Oliver Building
MILWAUKEE: 209 Sycamore Building
DAYTON: 518 Mutual Home Building

BUFFALO: Iroquois Building
DETROIT: 5928 Second Boulevard

BAUSH METAL

DURALUMIN

A Few Advantages

MACHINING

Better than aluminum.

Cost greatly reduced when compared with iron or steel.

Taps and threads well.

RECIPROCATING PARTS

Weight reduced without loss of strength.

Acceleration increased.

Inertia decreased.

Polishes easily.

Resists atmospheric conditions.

No plating required.

Can be rolled, forged, drawn, heat treated and annealed.

Hot and cold worked.

A QUALITY METAL

Duralumin is an alloy produced after years of systematic endeavor to meet the demand for a metal which shall be as light as Aluminum and as strong as mild steel, yet without the many disadvantages of Aluminum in its pure state.

Duralumin is the only light metal that can replace steel in forgings. With a two-thirds saving in weight, heat treated Duralumin Forgings approximate mild steel forgings in strength.

Wherever weight is a deciding factor Duralumin is the most satisfactory metal for most articles made by hot working or forging. Naturally, Duralumin Forgings are especially desirable for reciprocating or moving parts where inertia, due to their own weight, forms a large part of the total stress.

Minimum Physical Properties of Rolled or Sheet Metal (heat treated) and of Forging Metal are:

Tensile	55,000 lbs. per sq. inch
Elastic Limit	30,000 lbs. per sq. inch
Elongation	18%

BAUSH MACHINE TOOL COMPANY

Metals Division

SPRINGFIELD, MASS., U. S. A.

Manufacturers of

BAUSH
DURALUMIN

BLOOMS—SLABS—BILLETS—SHEETS—FORGINGS

BAUSH CASTING METAL INGOTS

Aluminum Alloy of High Tensile Strength

Rolling Mill and Drop Forge Works
SPRINGFIELD, MASS.

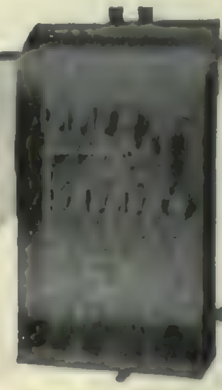
Detroit Office:
1825 Dime Savings Bank Bldg


Strom
Double-row, deep-groove Conrad type, radial bearing
Angular contact bearing, combination radial and thrust
Double-row, maximum type, radial bearing
Single-row, maximum type, radial bearing
Dependability
Under unusual loads and high speeds, bearings will soon reveal whether or not they can be depended upon for satisfactory service.
Strom Bearings have met the demands of the most discriminating engineers. Their confidence is based on performance records, careful design, high-grade materials, and accurate workmanship of these bearings.
The Strom catalog contains sizes and load-carrying capacity data covering all standard bearings. You should have it on file.
U. S. BALL BEARING MANUFACTURING CO.
(Conrad Patent Licensee)
4530 Palmer Street
Chicago, Illinois
Strom BEARINGs
Single-acting thrust bearing, flat seats (grooved races) 1100-F Series
Single-acting, self-aligning thrust bearing 1100 Series
Single-acting, self-aligning thrust bearing, leveling washer 1100-U Series
Double-acting, self-aligning thrust bearing, leveling washers 2100 U Series

Automatic Starting Compensators for Squirrel Cage Induction Motors up to 600 Volts

G-E CR 7852 Automatic Starting Compensator—for floor mounting. For 3-phase 50- and 60-cycle motors 60 HP and larger, 220 V.; 125 HP and larger, 440 V.; 150 HP and larger, 550 V. For 3-phase 25-cycle motors 60 HP and larger, 220 V.; 100 HP and larger, 440 and 550 V. Minimum 2-phase ratings are somewhat different.

G-E Ammeter and Disconnecting Switch Attachments, and separable conduit wiring box of wall-type Compensator are designed with small knockout holes for convenient installation of either or both Attachments. These Attachments are for wall-type Compensators only.



G-E CR 7052 Automatic Starting Compensator—for wallmounting. For 3-phase 50- and 60-cycle motors up to 50 HP, 220 V.; 100 HP, 440 V.; 125 HP, 550 V. For 3-phase 25-cycle motors up to 50 HP, 220 V.; 75 HP, 440 and 550 V. Maximum 2-phase ratings are somewhat different. Equipped with separable conduit wiring box designed to be used with or without Ammeter Attachment or Disconnecting Switch.

Thousands of G-E Automatic Starting Compensators are used today because of their incomparable performance—and their flexibility of application for Industry's needs.

Their construction is such that they can be installed easily, inspected readily, and operated with convenience and economy. Enclosing cases for all live parts provide safety for operators, and prevent tampering by others.

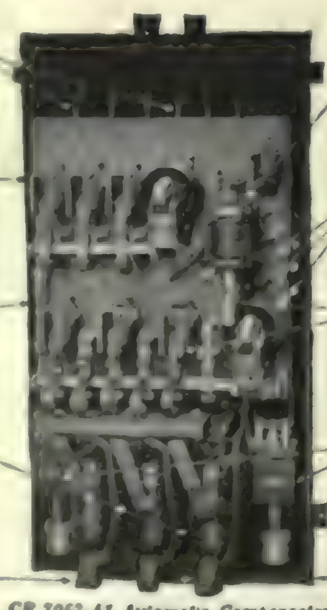
Terminals for motor and line leads. Liberal space for connections.

Contactors are suitable for severe service. They have solid copper tips, magnetic blowouts and moisture resisting coils, all accessible for easy inspection.

Fuse protects control circuit against accidental short-circuits when inspecting the equipment.

Three compensator coils for three phase give balanced starting conditions and maximum torque per ampere line current.

Accessible taps for selecting the most desirable starting voltage for any particular starting condition.



CR 7052-A1 Automatic Compensator with cover removed

Current limit relay automatically opens starting contactor and closes running contactor immediatly upon proper acceleration of the motor.

Terminals for control leads. Liberal space for running wires along edge of base to conduit wiring box.

Starting and running contactors open all lines to three-phase or two-phase three-wire motors.

Two inverse-time overload relays.

Padlock may be attached here to lock cover on.

General Electric Company

General Office Schenectady, N.Y.

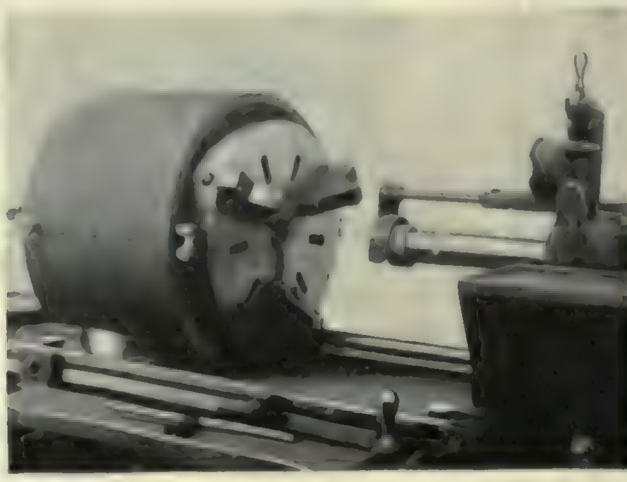
Sales Offices in all large cities

43A-75

Little Stories of Real Production

Grinding Manganese Steel with "HYDROIL"

No. 52 "HYDROIL" equipped to grind 20-in. manganese steel sheaves.



Showing heavy chuck, blocked up work head and arrangement of wheel slide and water guard.

This was a job they all said was "wicked"

Sheaves for carrying mine cables must be made of the toughest material, to resist the eternal wear of grease and grit-coated cables. Manganese steel is used extensively because of its extreme toughness.

Once the center hole was finished in a lathe, and it was not uncommon to spend a whole day on one large sheave. "*Hydroil*" has taken hold of the job and put it on a production basis. They figure time in minutes instead of hours now.

A No. 52 "*Hydroil*" was provided with a raising block and special wheel slide to care for the large sheaves. (They are 20 in. in diameter.) The center hole is 3½ in. diameter and 4 in. deep and the average stock removed is .060 in.

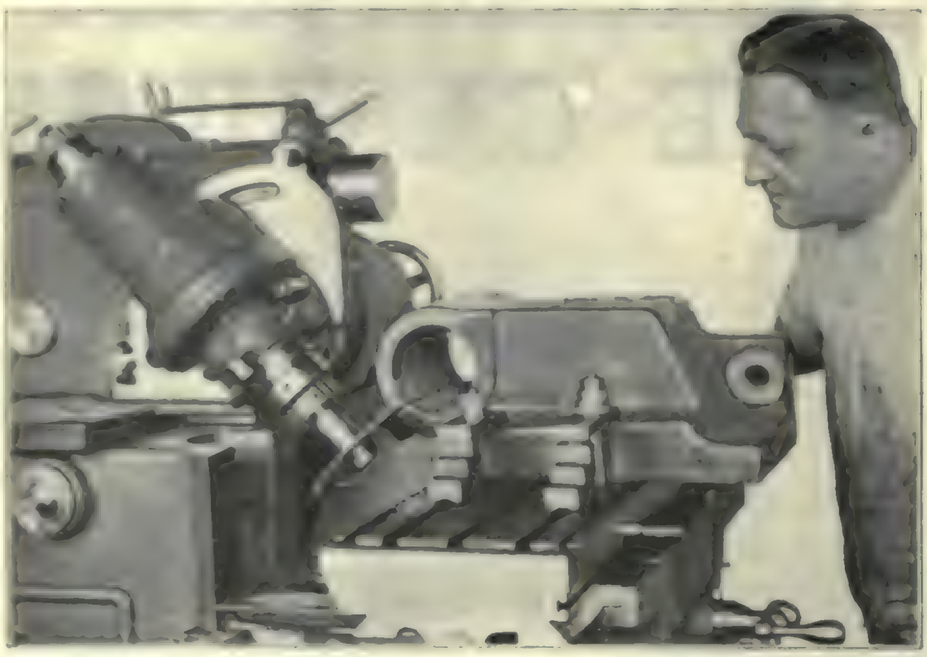
Have you a tough job? The "*Hydroil*" Grinder may be just what you are looking for. Write for description and data covering this machine.

12 in. and 20 in. O.D. manganese steel sheaves internally ground on No. 52 "HYDROIL" Grinder.

The "HYDROIL" will be shown in action at the New York Auto Show, January 6-13 inclusive. Call at Booth No. C-5D Grand Central Palace

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

This Job Will Be All Finished on a VAN NORMAN "DUPLEX" While You Are Rigging-It-Up on Another Miller



No Special Fixtures Required

Just Clamp It Flat on the Table

Universal in Range

Requires Minimum Equipment

Van Norman Machine Tool Co.
160 Wilbraham Avenue
Springfield, Mass., U. S. A.

Machine Finish Insures Precision

Hand work seldom results in rigid duplication. In finishing cams by hand, the slight variations from limits cause irregular machine movements.

Rowbottom Cams are a machine made product in their entirety. Every cam produced is an exact duplicate of the master.

The **Rowbottom Universal Cam Milling Machine** was developed to produce cams of every required type on a commercial basis. It produces with the acme of precision at low cost.

If your needs do not warrant the installation of a **Rowbottom** machine, we can cut your cams for you.

In either case you get the peak in cam performance.

The Rowbottom Machine Co.
Waterbury, Conn.
Factory: Waterville, Conn.

Rowbottom *for* Cams

FROM GILBERT'S  *DE MAGNETE —*

"WORD MONGERS" *and* "CHATTERING BARBERS"

"Word mongers" and "chattering barbers," Gilbert called those of his predecessors who asserted that a wound made by a magnetized needle was painless, that a magnet will attract silver, that the diamond will draw iron, that the magnet thirsts and dies in the absence of iron, that a magnet, pulverized and taken with sweetened water, will cure headaches and prevent fat.

Before Gilbert died in 1603, he had done much to explain magnetism and electricity through experiment. He found that by hammering iron held in a magnetic meridian it can be magnetized. He discovered that the compass needle is controlled by the earth's magnetism and that one magnet can remagnetize another that has lost its power. He noted the common electrical attraction of rubbed bodies, among them diamonds, as well as glass, crystals, and stones, and was the first to study electricity as a distinct force.

"Not in books, but in things themselves, look for knowledge," he shouted. This man helped to revolutionize methods of thinking—helped to make electricity what it has become. His fellow men were little concerned with him and his experiments. "Will Queen Elizabeth marry—and whom?" they were asking.

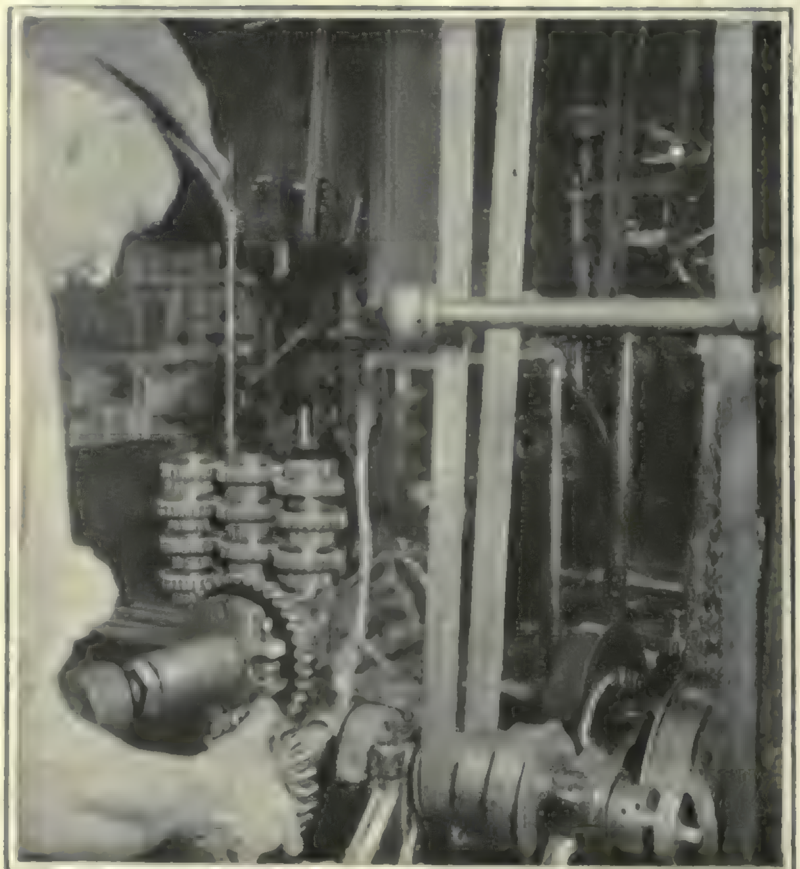
Elizabeth's flirtations mean little to us. Gilbert's method means much. It is the method that has made modern electricity what it has become, the method which enabled the Research Laboratories of the General Electric Company to discover new electrical principles now applied in transmitting power for hundreds of miles, in lighting homes electrically, in aiding physicians with the X-rays, in freeing civilization from drudgery.

General Electric Company

General Office *Schenectady, N.Y.*

ROCHESTER

Gear Tooth Rounding Machine



A finished gear every 3 minutes

The Hudson Motor Car Company's gear generating department is equipped with Rochester Gear Tooth Rounding Machines for rounding the teeth on transmission gears used in Hudson cars.

The photograph shows one of a battery of Rochester Machines rounding the teeth of 18-tooth, 6-pitch steel gears at the rate of 20 per hour.

Rochester Gear Tooth Rounding Machines will round the teeth of any type gear from 1½ in. to 30 in. diameter and practically any pitch, and do not require skilled help to operate.

When you buy a Rochester Machine you are not experimenting—you are confirming the judgment of the world's largest gear manufacturers, machine tool builders, automobile manufacturers, etc., in whose plants these machines are performing efficiently.

May we send you a catalog?

BETTS MACHINE PLANT

of

CONSOLIDATED MACHINE

of

BETTS MACHINE PLANT, Rochester, N. Y. MODERN TOOL PLANT, Erie, Pa. HILLES & JONES PLANT, Wilmington,

GENERAL OFFICE:

District Sales Offices: New York,

Making Big Advances in Boring Mill Practice

CINCINNATI
Boring Mill

Boring mills are today being called upon to produce a class of work heretofore believed impossible with a machine of this class.

We are not backward in stating that **Cincinnti Boring Mills** have been a prime factor in this advance.

They possess the power and stamina to back the coarsest feeds at high speeds; control, centralized, minimizes operating error and thus practically prevents work spoilage; close and simple adjustments hold to the finest tolerance limits.

Our 42-in. and 48-in. Mills—Bevel Gear Type—have a capacity of 39 in. under tool-holder—bed heavily ribbed—housings box form construction—Rapid Power Traverse to heads—Forced Lubrication.

Show the other fellow your heels with a **Cincinnati.**

The Cincinnati Planer Co., - Cincinnati, Ohio

Price Plays No Part In Performance

Because we can produce and market Standard Gauge Machine Rack at a more reasonable figure than other rack of similar grade does not infer that its quality is lower.

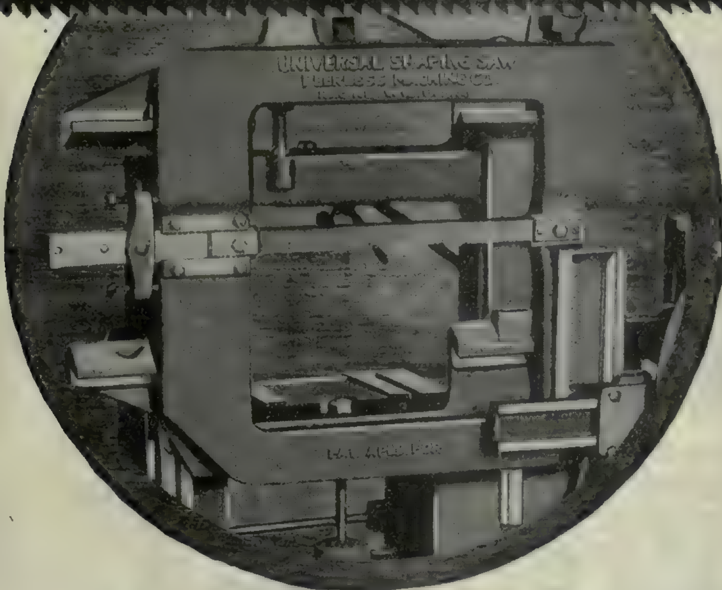
Our experience in producing the special analysis O.H. steel itself, and in machining and straightening, cannot be duplicated elsewhere. There is *one* national headquarters for MACHINE RACK—regardless of pitch or size. Try us and see.

Our line includes turned and cold drawn steel shafting, finished common and special shapes. Compressed steel elevator guides, connecting rods and crank shafts. Screw stock, feed screws, lead screws and worm. Send for list.

Standard Gauge Machine Rack

Standard Gauge Steel Co., Beaver Falls, Pa.

[illegible] Ave., New York. [illegible] Bldg., Boston. 1240 Old [illegible] 505 Capital Theatre Bldg., [illegible] Abbott & [illegible] Mill & Co. [illegible] New Orleans, [illegible]



A Toolroom Conversation

Stockroom Man: "You will have to use 4 in. x 4 in. stock and shape off ½ in. on one side."

Tool Maker: "That's easy. I won't shape off that half inch; I'll *saw* it off. Then I'll use the strip I saw off for a plate or a strap part."

Stockroom Man: "Is that right? I can see where we won't need to carry so much stock, and there won't be so much scraps going out of the toolroom at only scrap prices. We will save both ways."

THINK IT OVER

Write today for information

PEERLESS MACHINE COMPANY
1360 Clark St.
Racine **Wisconsin**

Peerless

Still Faster
UNIVERSAL
SHAPING SAW

BARBER-COLMAN

HEAVY DUTY CUTTERS FOR STRADDLE MILLING

Notice the spiral undercut teeth on the face and deeply cut side teeth. They combine to give maximum production, longer wearing life and smoother cutting.

Write for our pamphlet.

BARBER-COLMAN COMPANY

BRANCH OFFICES
BOSTON, MASS CHICAGO, ILL
CLEVELAND, O DAYTON, OHIO.
DETROIT MICH MILWAUKEE WIS.
NEW YORK, NY ROCHESTER, NY

MAIN OFFICE & PLANT
ROCKFORD·ILL·U·S·A·

AMERICAN MACHY. CORP. MINNEAPOLIS, MINN.
F. O. STALLMAN SUP. CO. SAN FRANCISCO, CAL.
EUROPEAN REPRESENTATIVES
BARBER & COLMAN, LTD.
BROOKLANDS NEAR MANCHESTER ENGLAND

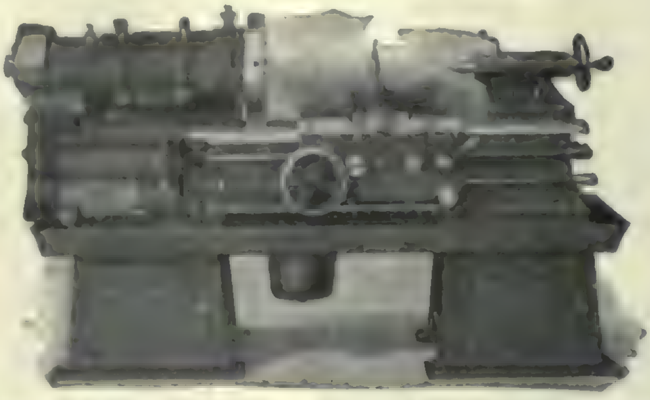
ACCURATE

DEPENDABLE

51

A New Standard in Geared Head Lathe Construction

This REED-PRENTICE GEARED HEAD LATHE embodies all the modern practical developments that have proven their merits in actual service.



It is a powerful production lathe that assures an increase in the quantity and accuracy of the work, besides exceedingly low operating and maintenance costs.

A thorough investigation will convince you of its merits. Do you want complete information?

Reed-Prentice Co.

BECKER MILLING MACHINES
LATHES—RADIAL DRILLS
PRODUCTION LATHES

WHITCOMB SECOND BELT DRIVE PLANERS—
MILLING CUTTERS—
SPECIAL MACHINERY—

DETROIT — WORCESTER, MASS. — NEW YORK

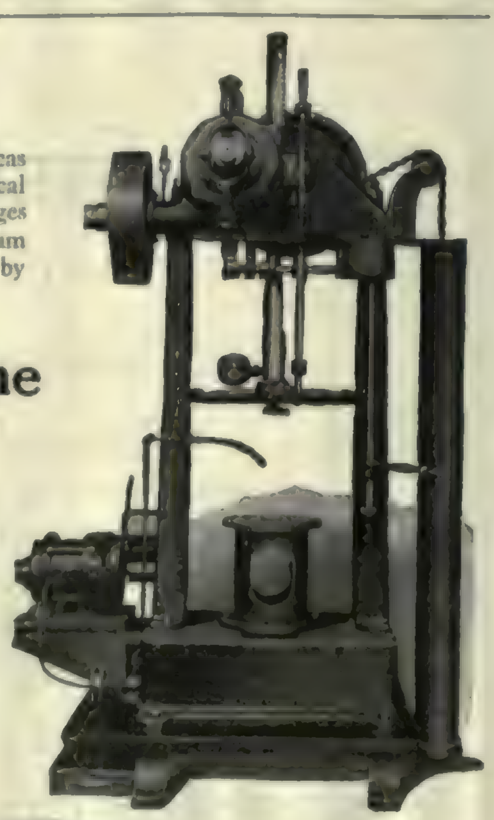
677 CAMBRIDGE ST.

Agents throughout the world

Proven in Service

The **Lucas Push Broaching Machine**—a modification of the Lucas Power Forcing Press—has started a highly successful career in vertical push broaching and production assembling. It possesses many advantages over the horizontal type of machine and will enter your economic program from a dozen angles. Let us tell you some of the ways you save by using the

Lucas Push-Broaching Machine



WE ALSO MAKE THE

"PRECISION"

BORING, DRILLING AND MILLING MACHINE

Lucas Machine Tool Co.

AGENTS

[illegible] Alfred Herbert, Brus[illegible] Copenhagen, [illegible] & George Co., Tokyo.

NOW AND ALWAYS OF

Cleveland
Ohio, U. S. A.

Gray Planers

CAN'T-SLIP FEED

(Patented)

Instantly set—one motion does it.

Simply turn the knob until the desired feed is indicated on the dial. The dial is automatically locked where set. A partial turn of the wrist gives any feed from .01 in. to 1 in. The feed is positively driven—we do not rely on a friction drive.

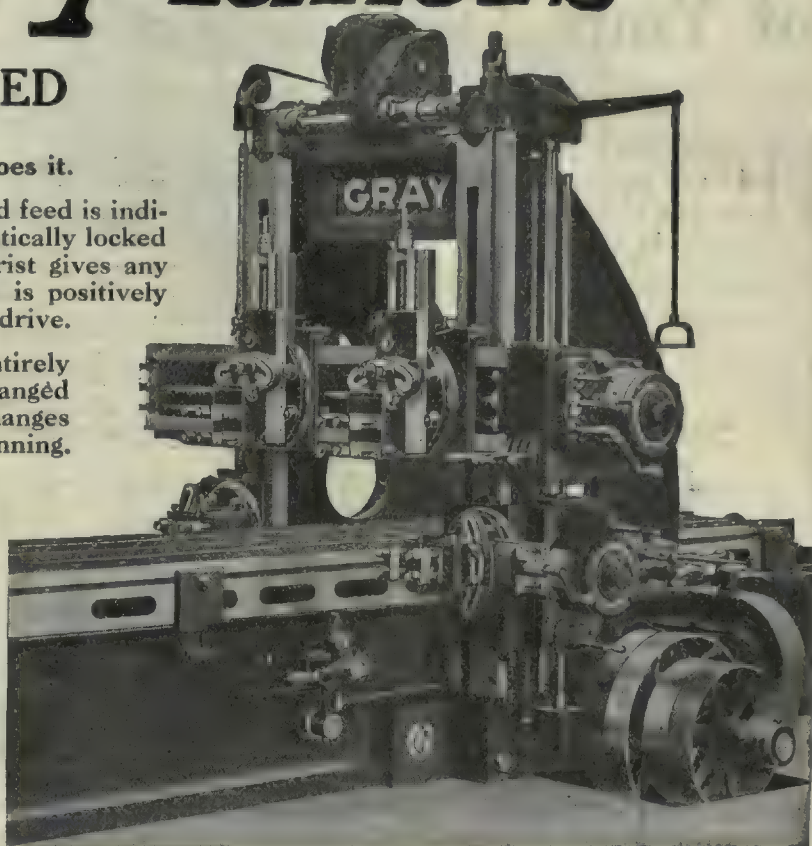
Rail head and side head feeds are entirely independent so that one can be changed without affecting the other. Feed changes can be made while the planer is running.

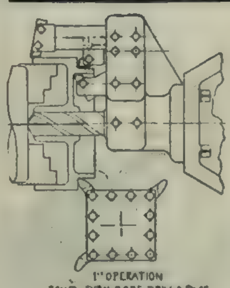
This is one of

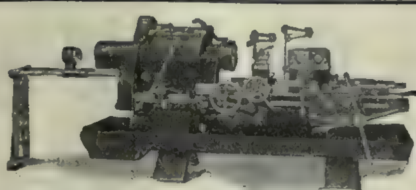
12 EXCLUSIVE FEATURES

Send for Our New Catalog

THE G. A. GRAY CO.
CINCINNATI, OHIO

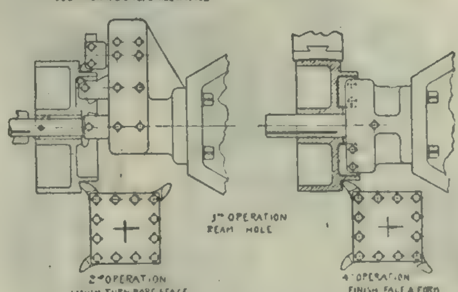






Universal Turret Lathes—3 Sizes

Multiple Turning Tools on the I-B FOSTER Sets the Pace



The W. A. Barker Wrenchless Chuck

W. A. Barker Wrenchless Chucks quickly pay their cost by increased production. They reduce the chucking time.

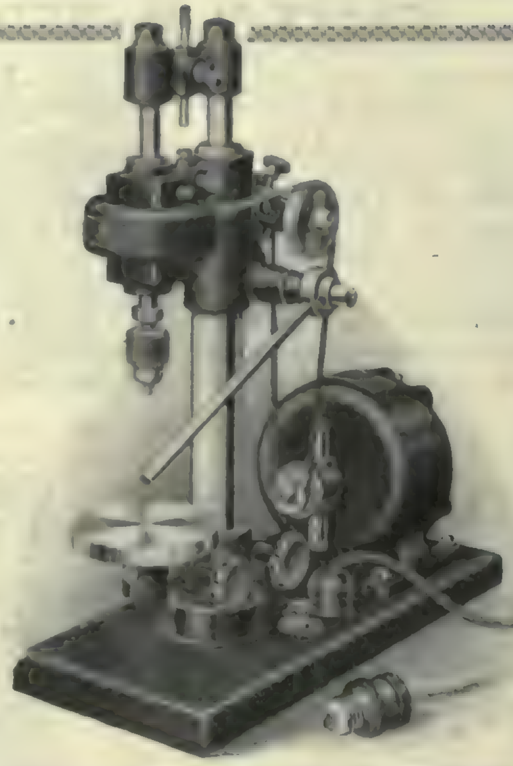
The power rigidity and adaptability of every Foster makes the use of multiple tooling possible and the complete finishing of parts in the time required for the longest cut.

Note in the 1-B operation diagram for clutch pulleys—five cutters working simultaneously in the first and second operation, four in the fourth. The pulley is entirely finished in the time required to turn the outside diameter, except reaming the hole.

Send us your blue prints, let our engineers show you what multiple tooling will do for you.

THE FOSTER MACHINE CO. **Elkhart, Ind.**

Greatly Prolongs the Life of Your Twist Drills



EXTREME sensitiveness coupled with the closest accuracy are the two prime factors in the **A. M. Sensitive Drilling Machine** that minimize twist drill breakage and thus lower producing costs. It possesses the "feel" required for drilling holes as small as ten one-thousandths yet is sturdy enough to make high producing records. Every mechanic will appreciate the qualities found in the

A. M. Sensitive Drilling Machine

We have been building Sensitive Drilling Machines for over 30 years and our books contain the names of the most particular users.

The "A. M." is a complete unit in itself and will fit admirably in your experimental department, tool room or in general manufacturing.

A copy of the Circular will convince you of its quality

ADOLPH MUEHLMATT
5th and Elm Sts., Cincinnati, O.

Free your shop from the shackles of old-style planers and planing

In many shops improvements have been made in all departments but the planing department. The efficiency in such shops is greatly hampered by their old-style planers.

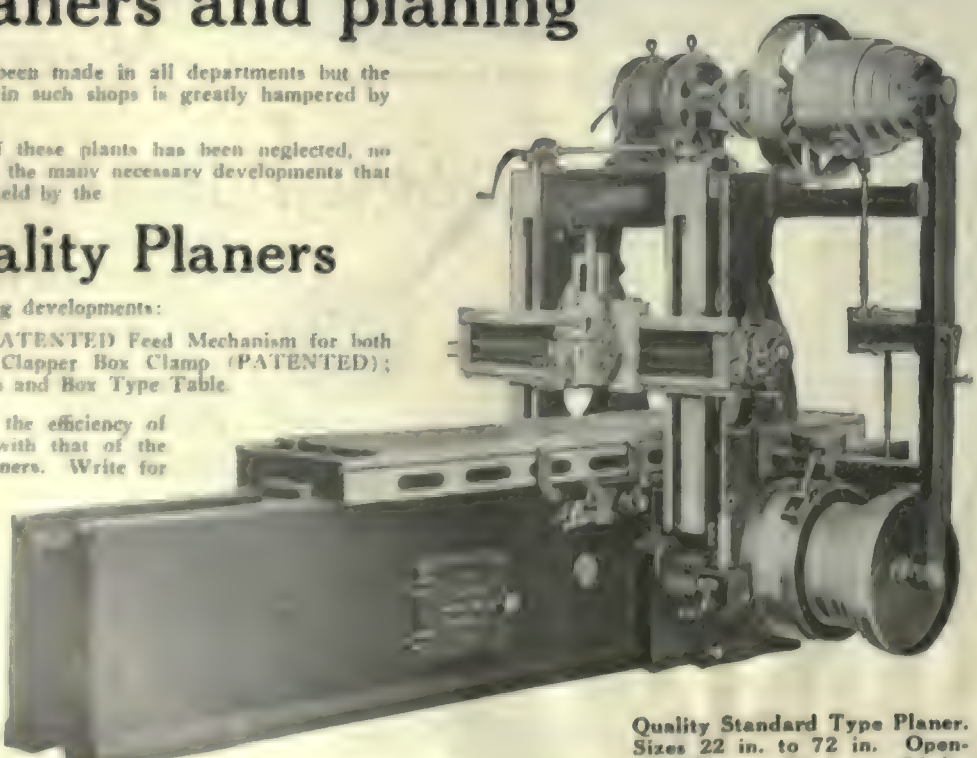
The planing department in most of these plants has been neglected, no doubt, due to a failure to appreciate the many necessary developments that have been introduced in the planer field by the

Liberty Quality Planers

Here are a few of these profit-making developments:

PATENTED 4-speed Belt Drive; PATENTED Feed Mechanism for both rail and side heads; forced feed; Clapper Box Clamp (PATENTED); Tool Box in bed, Micrometer Collars and Box Type Table.

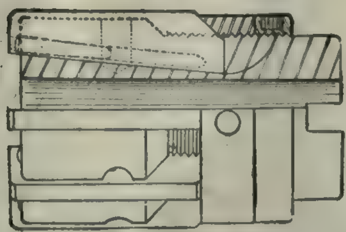
Look into this question of bringing the efficiency of your planer department on a par with that of the rest of your plant with Liberty Planers. Write for full details today.



Quality Standard Type Planer. Sizes 22 in. to 72 in. Open-side Planers 24 in. to 84 in.

The Liberty Machine Tool Company
Hamilton, Ohio

Sectional View.
Shell Type



Group II No. 550.

One of the three distinct types designed to meet all requirements

Davis
Expansion Reamers

(Patented 1912)

Simplicity—
the keynote of efficiency

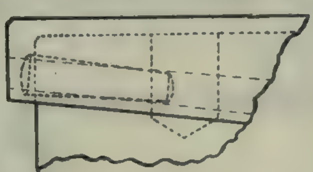
In the simple design, is found the principal factor of Davis Expansion Reamer efficiency. Here, numerous features and advantages are embodied that simplify the operator's responsibility to such extent, as to insure definite results with minimum effort.

The unique engineering principle involved in the method of holding blades (with hardened and ground taper pins), is the most singular feature of Davis Expansion Reamers. Taper pins, fitted as shown in illustration, have 100 times the holding power of separate blade screws.

Expansion of blades is uniformly forward on taper—thus eliminating circular grinding when adjusting; while the ends of blades project and cut in advance of reamer body for perfect bottoming.

Many other distinctive features, including liberal range of expansion with blades interchangeable in various size reamers, will interest those who are anxious to realize the full possibilities in their reaming production.

Reamer Catalog No. 540 tells the full story in an interesting manner. Send for it today.



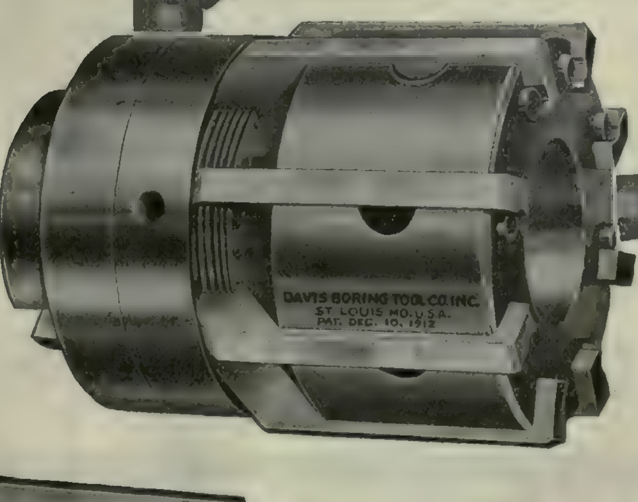
The taper pin is fitted almost entirely in the reamer body, at special angles, so that entire length of taper pin has perfect bearing in blade groove. Line contact only, in blade groove, results in a constant downward and lateral thrust that does not interfere with free movement of blades in adjustment.

Davis Boring Tool Company

Incorporated

3706-30 Forest Park Boulevard
St. Louis, Mo., U. S. A.

We Supply the World with Expansion Boring Tools and Expansion Reamers.

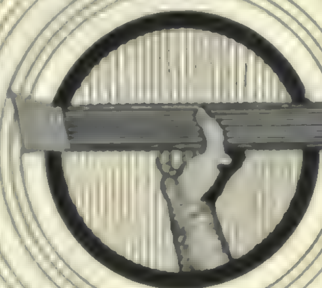


Shell Type.
Group II No. 550

Note how contact of taper pin in blade groove exerts a downward and lateral thrust.

LARGEST EXCLUSIVE MANUFACTURERS OF EXPANSION BORING TOOLS AND EXPANSION REAMERS

"Red Cut Cobalt" High Speed STEEL



75% More Pieces Per Grind

"RED CUT COBALT" Treated Bits were recently introduced at the plant of the American Bearing and Die Casting Company by one of their lathe operators. In a short time he was turning out three bearings to every one by other operators with the result that Red Cut Cobalt Tool Bits were immediately adopted for all heavy turning, forming and boring work. Today this company is obtaining at least 75% more pieces per grind with a 25% increase in production over that received when numerous other brands were used.

This wonderful efficiency is just as evident when tools are made of Red Cut Cobalt Bar Stock.

You, too, can effect the same savings in your plant by standardizing on "Red Cut Cobalt" for your severe cutting operations.

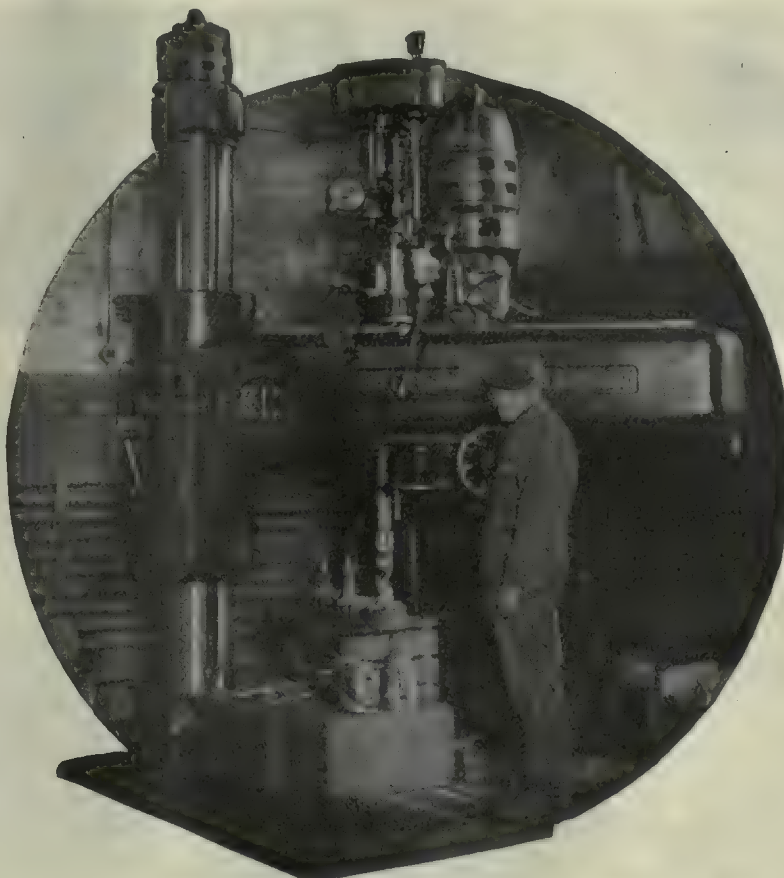
Ask our Engineering Department for complete information and recommendations

VANADIUM-ALLOYS STEEL CO.

MAIN OFFICE & WORKS: LATROBE, PA.

BRANCH OFFICES:

New York, Chicago, Pittsburgh, Cleveland, Buffalo, Cincinnati, Boston, Detroit, Philadelphia, Indianapolis, Dayton, St. Louis



The Gage Method of Screw Thread Inspection

The Hartness Comparator Method

Cut the cost of your screw thread inspection and make it infallible during the new year

The HARTNESS Screw Thread Comparator offers you the opportunity to do just that.

Look at the old method on the left. Note the size of the force you have to maintain for screw thread inspection with the gage method.

Then see how one man with the Hartness Screw Thread Comparator handles the same job.

But that isn't all. The gage method REJECTS some of the BEST screws and ACCEPTS some of the WORST. The Hartness method rejects only those that are actually bad and accepts only those that are actually good.

You can readily appreciate the truth of this when you stop to consider that with the ring gage method the threads fit or they don't fit. Your inspector cannot tell just what the trouble is. With the Comparator, however, the character of every feature of the thread, such as size, lead, surface, etc., is made clearly visible to the eye. When you can see just what your thread troubles are you can soon eliminate them and cut down your rejections to practically nil.

From whatever point you look at it the Hartness Comparator Method is considerably less costly and productive of better results than any other method of inspecting screw threads.

It is not a hard task to prove it to you conclusively. May we do so?

Jones & Lamson Machine Co., Springfield, Vt., U. S. A.

This Bowling Ball Is Being Turned With A **DIAMOND**

Send for Free Booklet, "Diamonds Used in Tools."

ARTHUR A. CRAFTS & CO.
128 Summer St., Boston, Mass.

Electric Industrial Crane Truck

Ready to Save the Cost of Wasteful Hand Trucking

Request Catalog 811.

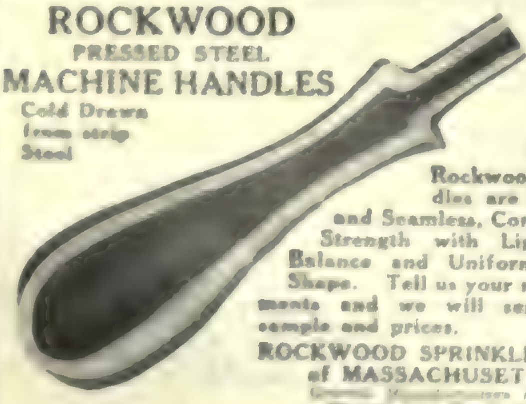
The Elwell-Parker Electric Co.
Cleveland, Ohio

DIAMOND TOOLS

hold their cutting edges for months. Can easily be sharpened and will last for years. Leave a smooth, true and finished surface. These special shaped carbon, black diamond pointed tools are best for turning paper, cotton, corn husk, rag, fibre, hard rubber, etc. They turn out a large number of pieces of exact uniform size.

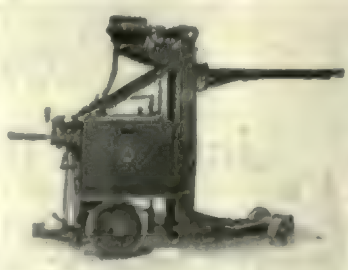
THOS. L. DICKINSON
38 Gold Street New York
Successor to John Dickinson. Estab. 1796

ROCKWOOD
PRESSED STEEL
MACHINE HANDLES
Cold Drawn from strip Steel



Rockwood Handles are Hollow and Seamless, Combining Strength with Lightness, Balance and Uniformity of Shape. Tell us your requirements and we will send you sample and prices.

ROCKWOOD SPRINKLER CO. of MASSACHUSETTS
[illegible]
Worcester, Mass.



Pick-up, Carry and Elevate 4000 lb. loads

A new series of installation folders showing users of the LAKEWOOD TIER-LIFT TRUCK in different industries may offer suggestions for similar economies in your plant.

Ask for Series A

Lakewood Engineering Co., Cleveland, O.

American Machinist

Volume 57 NEW YORK, DECEMBER 28, 1922 Number 26

Assembling, Testing and Storing Motors

Using Small Trucks or Casters, Elevated Tracks, Roll-over Frames, Transfer Tables, Overhead Carriers and Elevators for Storing in Tiers

By FRED H. COLVIN
Editor, *American Machinist*

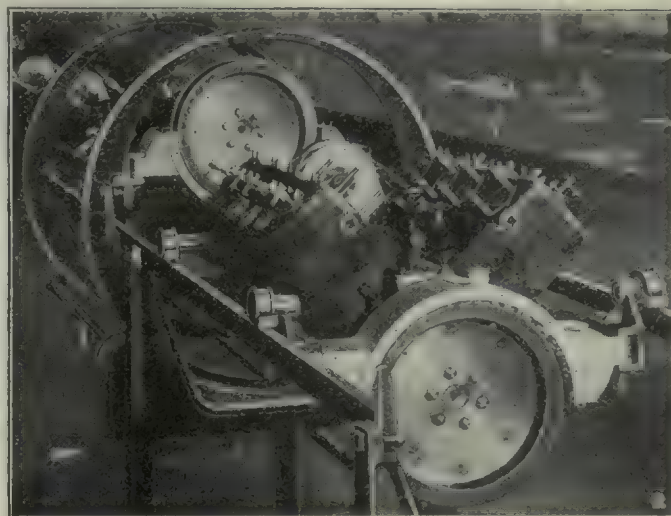
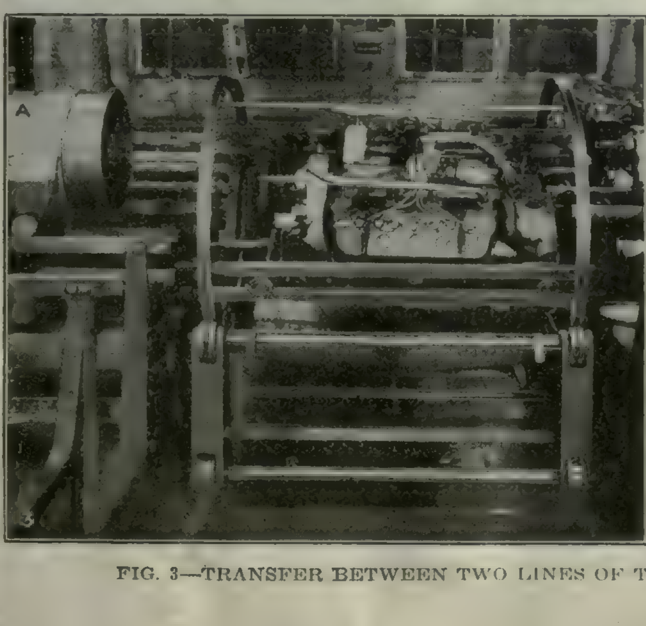


FIG. 1—ASSEMBLING TRACK FOR MOTORS. FIG. 2—ROLL-OVER FRAME AND TRANSFER TABLE

THE way in which the Peerless Motor Car Co. handles its motors, both in assembling, in testing and in storing for future demand, presents a number of problems and their solution. The various methods used are well worth studying from a number of different angles, as parts if not all of the system can be used in many places.

In Fig. 1 is shown a portion of the line of elevated track on which the motors are, for the most part, assembled. It will be noted that each crankcase has four small caster or truck wheels. Two wheels as at *A* are bolted to the case, utilizing the same bolt holes as for fastening the motor to the frame. The other two wheels, as at *B*, are mounted on a frame which bolts to the front of the case. When the front cover is put on, the frame carrying the wheels at *B* is removed and wheels, as at *A*, are bolted to the case. The track holds the motor at a convenient working height and permits it to be easily moved down the line as the assembling progresses. As shown, the crankshaft and connecting



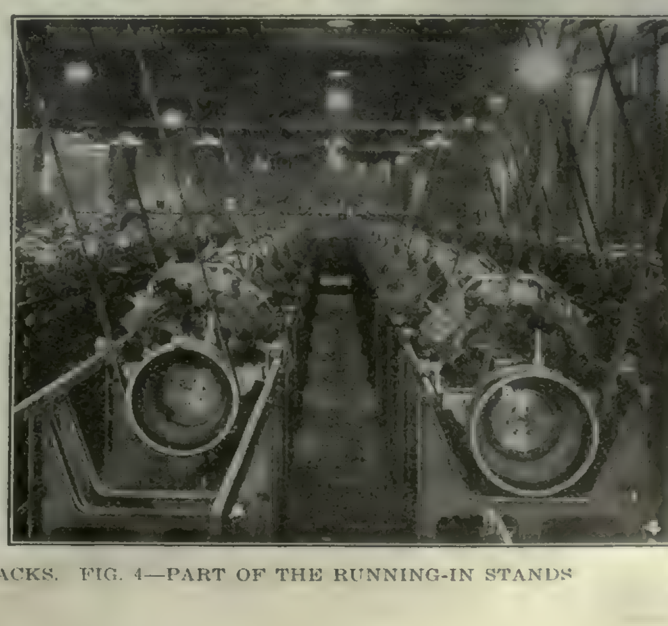


FIG. 3—TRANSFER BETWEEN TWO LINES OF TRACKS. FIG. 4—PART OF THE RUNNING-IN STANDS

FIG. 5—THE TRANSMISSION ASSEMBLY

FIG. 6—BRINGING THE TRANSMISSION TO THE MOTORS

rods are in place and the case is ready for the cylinders, manifolds, and other parts.

A motor, practically completed, is shown in Fig. 2, and immediately ahead of it is a roll-over frame for turning the motor upside down or putting on the lower crankcase as well as inspection or adjustments. This frame is shown in detail in Fig. 3. It will be seen in this illustration that the roll-over frame is mounted on small wheels on a cross track so that it acts as a transfer table by which a motor can be taken from any one of the assembly lines and transferred to any other line on either side of the transfer track. A motor is shown upside down at *A*.

There are also plain transfer trucks, as at *A* Fig. 4, which are used when it is not necessary to turn a motor over. This view also shows part of the running-in stands. The capacity of this department, however, can hardly be judged from the illustration. The motors are run in by belts from the overhead countershafts, each countershaft being supplied with a friction clutch. It will be noted that each motor is provided with a suitable pan, drawn deep in the center, for catching any oil drip which may work out of the motor during the running-in process. A special, light pulley is bolted to the flywheel, as shown at *B*, and is used for running-in the required 20 hr. at 250 r.p.m. The motor is then torn down and all wearing parts inspected. After reassembly it is run 10 hr. at the same speed as before and then goes to final test under its own power.

Assembling the Transmission

In the meantime, the transmission units are being assembled, a portion of this department being shown in Fig. 5. Special frames are provided as at *A*, mounted on small wheels which fit the tracks at the top of the assembling benches. The clamps, shown at *B*, hold the transmission case in place during assembly. As the transmissions are completed they are suspended from a series of overhead carriers, as shown in Fig. 6. Each of these carriers consists of a bar carrying four flanged wheels and these fit over and run on a T-shaped runway suspended from the roof girder. These wheels come up

FIG. 7—FITTING TRANSMISSIONS ON MOTORS

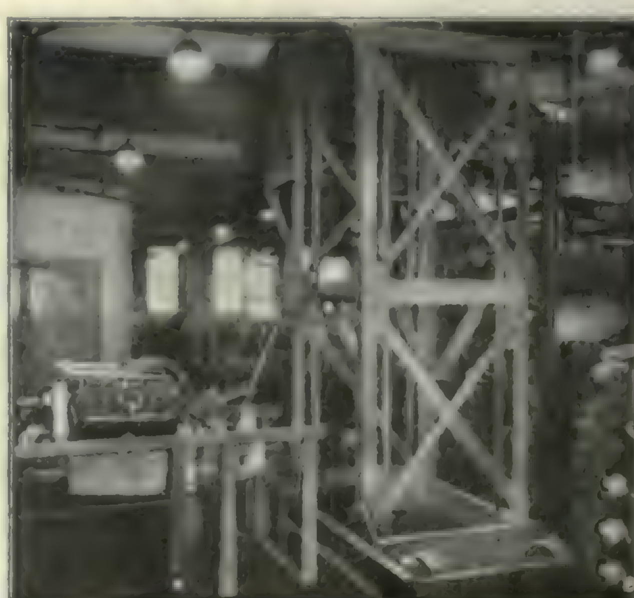


FIG. 8—ELEVATOR FOR TIERING MOTORS

on each side of the rail and rest on the T-head, being spaced far enough apart to clear the supporting hangers.

Each carrier bar *A* has a long rod through the center, fitted with a four spoked right and left nut which acts as a turnbuckle as at *B*. Below the turnbuckle is a short rod and suitable hooks for lifting the transmission and suspending it during transit from the assembling department. One of these carriers is shown more clearly in Fig. 7 where the transmission has reached the motor for assembly, after the running-in has been completed. This view shows both the carrier *A* and turnbuckle *B* quite plainly and gives a better appreciation of the convenience of the arrangement. The turnbuckle facilitates raising the transmission to line up with the motor. At *C* is a motor which still has the running-in pulley in place, at *D* the transmisson is swung into place for final assembly. Here we see the assembly tracks, showing where the transmissions come into the progressive assembly, and the roll-over frame at *E*. At *F* is a battery and ammeter for testing starting motors.

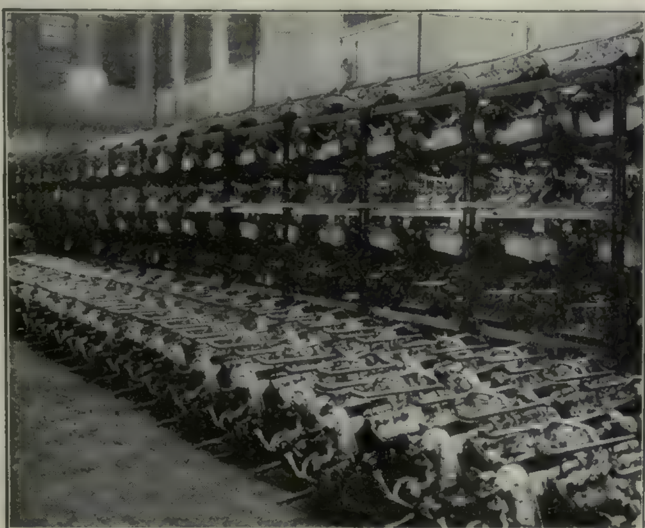


FIG. 9—COMPLETED MOTOR STORAGE

It runs on a small track to reach every line of the assembly tracks.

Storing Completed Motors

Motors are usually made up in advance of assembly into the chassis and it is necessary to store them safely and compactly. For this purpose, a sort of elevator known as a tiering machine is used and is shown in Fig. 8. This is a self-contained elevator built with a steel frame and mounted on fair-sized, flanged wheels which fit on a track running crosswise of the storage tracks. In other words, it is a combined elevator and transfer table. The elevator car is merely a pair of rails which correspond to the assembling tracks already shown, and the completed motor can be run on the elevator, hoisted to the desired level, the whole elevator moved sideways if necessary, and the motor run to any storage track desired.

The motor storage racks, which consist of three tiers of tracks, are shown in Fig. 9. This view also shows the racks full and a fair sized surplus on the floor beside them. This condition, however, is not general, the racks being built to accommodate the usual number of motors stored. These racks keep the motors safely and out of the way but readily available for assembly whenever needed. With minor modifications, such a system can be adapted to many other kinds of manufacturing.

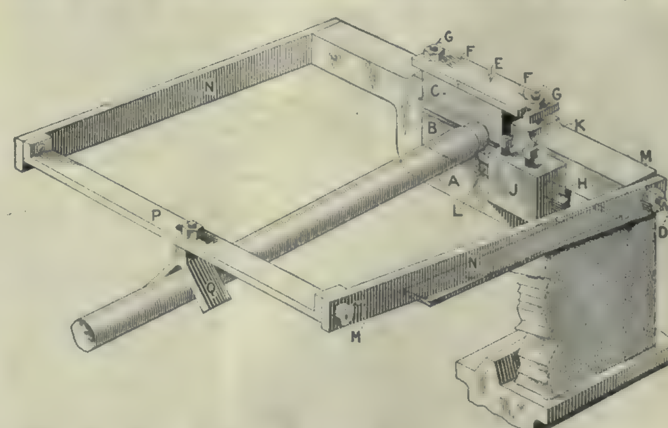
Turning Long Shafts in a Short Lathe

By Edward Heller

Mr. E. W. Tate's article, Re-Echoes from the Oil Country, in the *American Machinist*, Vol. 56, No. 26, reminds me of a method we used for turning long shafts in a famous textile town in Russia. While Mr. Tate's description is of a stunt used in an exceptional case, the method and tools that will be described here are of a kind that were used every day as a regular feature.

The shop where this method was employed had a gap lathe that swung about 14 in. over the carriage and about 3 ft. in the gap but would take only about 6 ft. between centers and that, of course, would not do for 20 ft. or longer shafts. Now, at that time and in that part of the world, we did not know anything about cold rolled shafting as it is manufactured now in all sizes coming within a few thousandths on the diameter and running pretty true in general. The material we got there was black hot-rolled stuff, not very close to any standard size, with bends and kinks that took quite a bit of ingenuity to take out. When a shaft like this was to be used for a transmission shaft, it had to be turned the whole length to a size in order to fit pulleys. And here is how it was done on that short lathe.

The lathe had a wooden bed extension that was as long as our shop permitted. This bed was securely bolted to the lathe bed and lined up nicely with the real lathe. When a long shaft had to be turned the tail stock was moved out on the extension as far as necessary and clamped down with a special bolt and strap. The shaft was then centered with a punch, tried on the centers for accuracy, and when everything looked O. K. it was drilled and countersunk with a home-made drill and countersink held in a peculiar sort of breast drill that must have been brought over on the Ark. As soon as the shaft had substantial centers, it was put in the lathe with a dog on one end and was given a general survey to



DEVICE FOR TURNING LONG SHAFTS IN A SHORT LATHE

see how many "cranks" and kinks it possessed. All the big kinks were then hammered out with a sledge on an anvil that was brought to the lathe, while the minor bends were sprung out straight with a bar, right in the centers.

When the shaft was straight enough to clean up with the cut, it was blocked up in the middle to take the sag out, the dog was fastened as close as possible to the driving end and a piece four or five inches long was turned to size with a tool that left *good sharp tool marks.*

The shaft was now turned, end for end, so that the finished piece was at the tail stock and the device shown in the accompanying illustration was used to turn the rest of the shaft.

This turning device consisted of a cast iron saddle *A*, with studs *D* and *G* screwed in at the places shown and carrying hardwood blocks *B* and *C*. These blocks had a hole bored out to suit the finished size of the shaft and it was so located as to leave not more than one quarter of an inch wall on the front side of the blocks. In other words, the hole was off center in all cases excepting when a shaft of the full capacity of the fixture was turned. The lower block *B* was lined with tin for reasons that will be explained later. On one side of the saddle *A* was a box affair *J* which was provided with stout set screws *K* and *H*, the former for holding the tool *L* down in place and the latter for holding it in and adjusting the cut.

The saddle *A* holding the lower block *B* was placed under the shaft, the upper block *C* was then put in and the whole thing clamped by means of the nuts *F* clamping down the latch bar *E*. The links *N*, *N*, carrying the cross bar *P* and the V-block *Q* were then added, the front end of the saddle *A* was blocked up to prevent it from turning and the lathe was started. As soon as the lathe was in motion the nuts *F* were pulled up snugly so that the shaft could just go around without undue friction and the tool *L* was brought to the work and made fast. The wooden blocks would immediately wear themselves into the tool marks made on the finished piece on the shaft and begin to feed the whole business toward the head stock. The cutting point on tool *L* would usually be an exact duplicate of the tool used in the tool post in the carriage, so that there would be no perceptible stop between the two finishes and it would provide its own means of feeding as it went along.

Making the Job Run Itself

After the outfit moved over its own length the nuts *M*, *M*, *M*, *M*, were released and the links *N*, *N*, and cross bar *P* with V-block *Q* would be thrown over to the back. Then the V-block running over the finished shaft would take off some of the strain from the comparatively short blocks *B* and *C*, and the job went merrily along until the tool box *J* reached the dog at the head end of the lathe. While this turning operation did not complete the job it certainly did most of the work and with very little attention.

A can full of oil with a dripping arrangement was kept over the tool point and the excess oil went to the wooden feed bearing. One of the apprentice boys (and the writer was one of them) was generally delegated to keep the can full, and occasionally tighten the nuts *F* to take up the wear on the upper block *C*. The lower one being lined with tin would usually last throughout the whole trip. The reason for the tin lining was to preserve as much as possible the setting, since the cutting tool *L* was practically integral with the lower block while it did not matter how much the upper block wore out.

Keeping the wooden block at the right pressure was comparatively easy. All that was necessary to do was to watch the "motor." In our case it consisted of a human being turning a crank somewhere in a corner of the shop from which emerged a belt to an overhead shaft carrying the cone pulley for our lathe. As it was the duty of the apprentice boy to help the "motor" along occasionally he could feel very quickly when the feed mechanism was getting loose, while, on the other hand, a grunt issuing from the power plant would be evidence that the wrench was pulled a little too far.

To finish the shaft the carriage was dismantled, the apron and gibs taken off and what was left was put on the wooden bed close to the tail stock and fastened down with special clamps. The work was then finished by using the compound rest. After the ends were turned and fitted to couplings, the shaft while running at high speed (i.e. at as high a speed as could be drawn out from our "motor") was first filed to size to a ring, then the couplings were driven on, keyed and faced in the centers on the shaft. When all this was done the shaft was polished with oil and emery and was ready to be "hung."

A Peculiar Water Tank

By A. B. Seaman

The water tank shown supported on brick work and surrounding the chimney base in the accompanying illustration is built of cast-iron segments bolted together. The tank was built in 1858 and has never been known to leak. The original purpose of the tank was to supply water to the Savannah shops of the Central of Georgia Railway. The brickwork supporting

TANK SURROUNDING A CHIMNEY

the tank originally inclosed the shop toilets, but the space under the tank is now used for storage.

The chimney, built at the same time as the tank, is about 150 ft. high, and is lined with fire brick the entire height. The foundation of brick and mortar is laid to a depth of 15 ft. below the ground level. The chimney is bell-mouthed at the top and the thickness of the brickwork at that point is almost 6 feet.

The chimney has been struck by lightning many times without further damage than having a few bricks knocked off. Owing to its age and possible deterioration it was banded at intervals of about 15 ft. ten years ago. One of the lower bands can be seen just above the top of the tank.

Making Steel Balls

Conclusion of Article on Atlas Ball Company Methods—Methods of Hardening Large and Small Balls—Lapping, Finish Grinding and Polishing

By A. L. De Leeuw
Consulting Editor, *American Machinist*

After soft grinding the balls are hardened. This is done in an automatic furnace which is shown in Fig. 10. A few shovelfuls of balls are thrown in the front end of the furnace which, as will be noticed, rotates around its axis. The interior of this furnace is provided with a helical pathway which extends the entire length with the exception of the front end where the loading is done. A scoop or projection of the rotating compartment gathers up a few of the balls and when the rotation of the machine has brought the scoop to the proper position it discharges these balls into the helical groove which they must follow from then on.

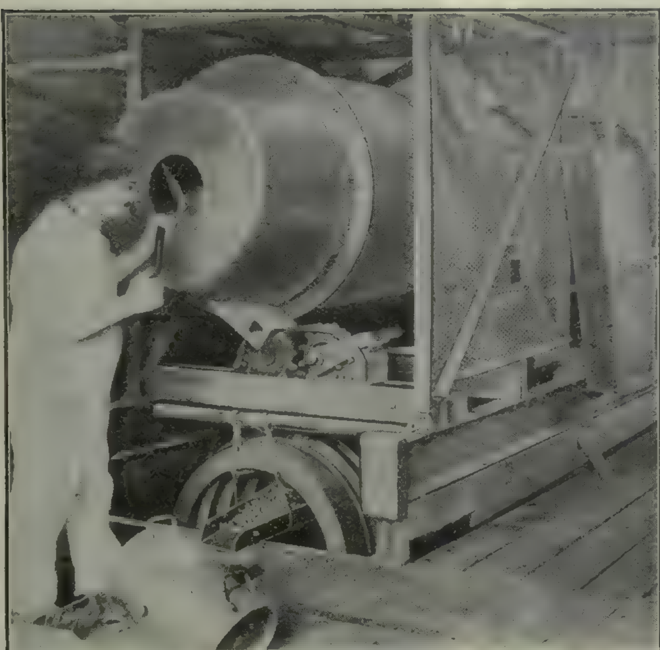


FIG. 10—ROTATING HARDENING FURNACE, AND ROTATING QUENCHING DRUM

The furnace is centrally heated at the far end and the speed is so arranged that the balls are brought to the proper hardening temperature when they have reached that end. They are then automatically discharged through a pipe into the center of another barrel shaped piece of apparatus which may be seen in the illustration, half-way projecting above the floor. The lower barrel is submerged in a large body of water which is constantly renewed by a pump so that its temperature remains practically constant throughout the day. It also has a helical pathway which brings the balls back to the loading side.

The illustration shows clearly how the balls are discharged into a tray, where they are prevented from rolling out by a block of wood. The operator picks one of these balls up every so often and cracks it to observe the fracture. A secondary operation which may be considered properly to belong to the hardening is the tempering. Balls are tempered at a very low temperature, never exceeding 300 degrees F. The smaller balls are tempered in hot water, the larger ones in hot oil. This system of hardening produces very uniform results.

The very largest balls, however, are hardened in a furnace with proper temperature control. The main things to observe with the system of hardening in the rotary furnace are the time and temperature, and both these items are of equal importance. Time is regulated by varying the speed of the driving motors while temperature is controlled by the Leeds & Northrup system. The very small balls are hardened in the little furnace shown in Fig. 11. This furnace also rotates but it is heated from the outside, in other words, the rotating barrel is surrounded by the furnace. The balls are discharged through a pipe into the same cooling barrel which receives the balls from the larger furnace.

The second rough grinding of the larger balls does not differ in any respect from the first. The oil lapping process, however, which follows is of an entirely different nature and presents many points of interest. Fig. 12 shows the machine used for this purpose. In this machine also there are two spindles which, however, in this case are in line with each other. Each spindle carries a metal plate with a number of concentric grooves. The grooves are made V-shaped and the balls rest between them, as shown in Fig. 13, where each of the grooves envelopes the ball for about ⅓ of its diameter or perhaps somewhat less. Very shortly after a new plate has been put in service, the abrasive action of the ball changes the contour of the groove so that it will actually fit the ball. It will be noticed that there is a relief at the bottom of the V-groove which is made this way because it has been found that no satisfactory results can be obtained when the balls bear at the bottom of the groove. The grinding in this case is done by means of oil and an abrasive which constantly floods the plates. From a description of the grooves one can readily see that the ball can only travel in a circle and not in a radial direction as was the case with the rough grinding. In other words, it travels around one axis only, a motion which would cause the balls to assume an entirely different shape from what is desired. Right here we find how the proper method can overcome difficulties which could not be met by mere skill.

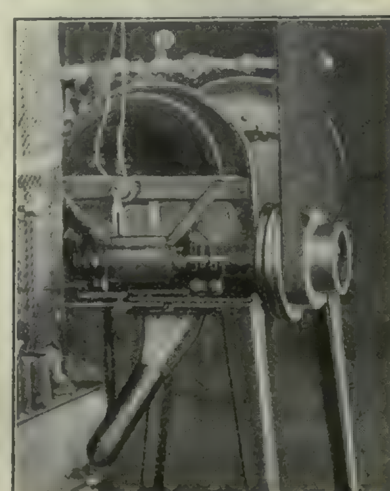


FIG. 11—SMALL ROTATING FURNACE FOR SMALL BALLS

Somewhere in the upper plate there is a large open-

ing in which fits a device which catches the balls and compels them to follow grooves made in that device. There are really two sets of grooves, one set coming from the outside of the plates, the other coming from the inside. The balls are compelled to follow the grooves which are so constructed that those which catch the outside balls deliver them back to the inside grooves and vice versa.

As the balls have been traveling around a certain axis

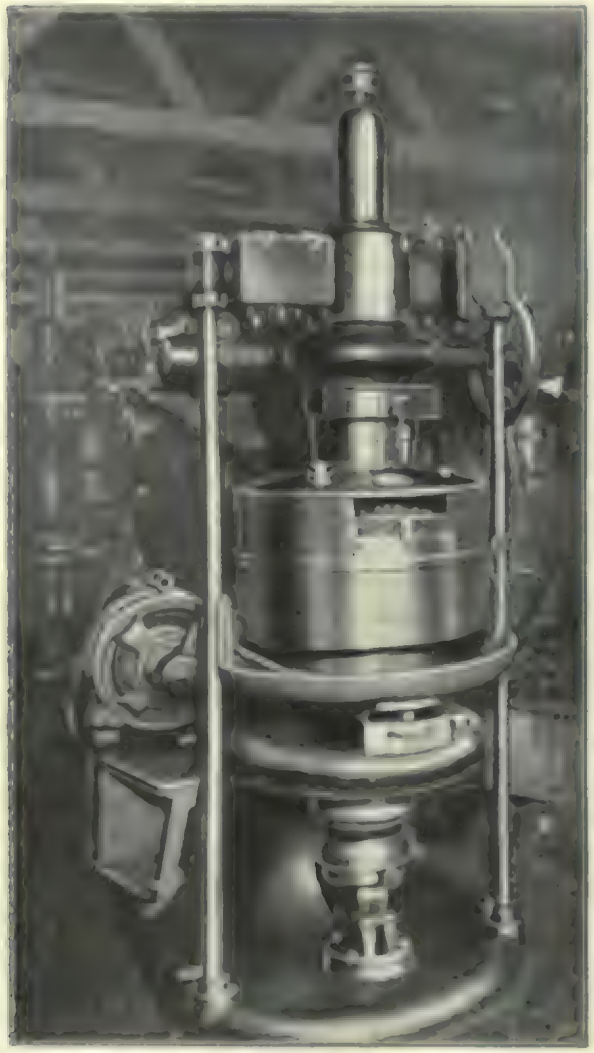


FIG. 12—OIL LAPPING MACHINE

while they were being ground it is almost absolutely sure that when they are delivered again to the plate they will not be in exactly the same position in which they were when they started, so that on their second trip they will be rotated around some other axis and every time they are returned to the plate a new axis of rotation is provided. The balls are in the machine about 40 minutes and the time required to make one complete revolution with the plate is only one or two seconds so that they are picked up and placed again on the plate several thousand times. As a result every part of every ball receives the same treatment.

It might be asked why the balls which come from the outside should be delivered to the inside and vice versa. A moment's thought will show that if this were not done the balls on the outside of the plate would receive a greater amount of grinding than those on the inside because they travel around a larger circle. The redistribution of the balls insures uniform grinding.

The principle embodied in this operation becomes clear when we consider that when there is a snow storm without wind, the snow will fall evenly over a large area notwithstanding that there is never a time when every square inch receives the same number of snow flakes. It is a fact that every operation does very little but the operations are repeated so many times without being controlled in any way that there is a 100 per cent chance that every point of every ball will receive the same treatment.

It was said that the balls after rough grinding presented the appearance of a great number of facets, each one with parallel scratches. As they come from the oil grinding machine the appearance is entirely different. Viewed under the magnifying glass they show an enormously large number of very fine pits or impressions, indicating that under the pressure of the plates the little grains of abrasive were pressed into the metal so that the balls had to roll over them with the result that a very small amount of metal was removed.

After oil grinding the balls are finish ground in a horizontal machine, shown in Fig. 14. In this machine there is a grinding wheel opposite the plate. The plate is grooved and soon after the wheel is set to work, it also will be grooved by the action of the balls. Here again the balls are caught, as in the oil lapping machine, but now they are not immediately returned to the plate but are brought to a contrivance which is called the magazine and which is located at the rear end of the machine.

The balls enter the magazine at its lower end, are elevated, mixed in a large chamber and then returned to the active part of the machine. This method also produces very fine impressions rather than scratches, but the impressions are so small that they can hardly be seen with a strong magnifying glass. The speed at which the grinding takes place is very low, being only about 300 ft. per minute, while the pressure under which they are held against the grinding wheel is very great, from 5,000 to 7,000 lb. in all. The balls remain in this machine from 8 to 10 hours. The time cannot be determined beforehand and is dependent on the rapidity with which the particular wheel acts on these particular balls. The operator has ample time to remove a ball every so often and test it on a minimeter and return it to the magazine.

FIG. 13—DIAGRAM OF GROOVES IN PLATES OF OIL LAPPING MACHINE

When the balls are not more than $\frac{1}{10}$ of a thousandth over-size the machine is stopped and the balls removed. About 240 lb. of balls are charged in the machine at one time and it should be noted that this quantity of balls remains intact through the following operations. Not only must the balls be hard and strong but they must be of great uniformity not only of size but also of quality. Such uniformity cannot be obtained without having an almost absolute uniformity of material and methods of hardening, tempering, annealing, etc.

The Atlas Ball Company does not use the same specifications for all of its balls. The analysis of the steel varies with the size of the balls and, as a general rule, it may be said that the carbon contents go down and

the chrome percentage goes up with the increase of size of the balls. Chrome, by the way, is the constituent which permits of even hardening to a great depth. At the same time, no higher percentage of chrome should be permitted than what is absolutely necessary in order not to weaken the other desirable qualities of the ball.

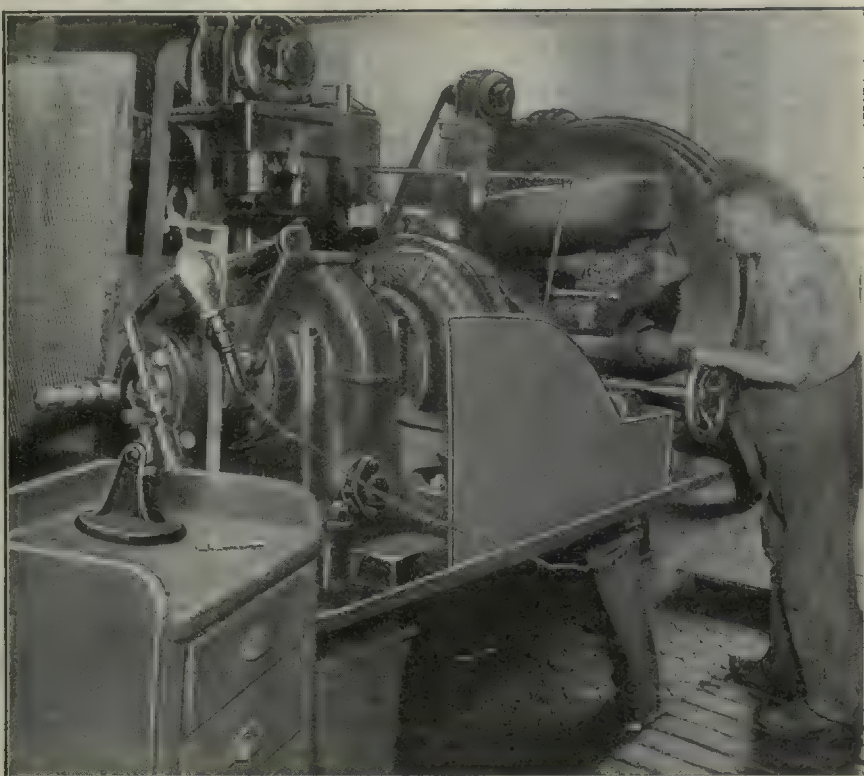


FIG. 14—HOFFMAN MACHINE IN WHICH BALLS ARE GROUND TO WITHIN 0.0002 IN. OF THEIR SIZE

The specifications of the steel range from 1.15 carbon and 0.00 chrome to 0.95 carbon and 1.75 chrome.

It is, of course, of importance to have the correct temperature for hardening but with the instruments obtainable at the present time this is no longer a problem. Of equal importance is the time during which the balls are in the furnace and it was pointed out how this time is regulated for the Atlas balls. For the tempering, low temperatures are used which will relieve the balls of unequal strains caused by the hardening but will not reduce their hardness.

In order to be sure that there shall be uniformity in the steel, the Atlas Ball Company makes it a practice to purchase all the steel of one heat, regardless of whether this amount is too much for their present requirements or not. Even then, the steel is carefully analyzed and followed up through the shop. In no case are two heats mixed in the manufacturing operations so that the mere date of the shipment of a set of balls permits the company to locate the steel from which these balls were made.

Among the shop problems peculiar to the making of Atlas balls and which are not found in most other shops, is the selection of the abrasives for grinding and polishing. Much harder steels are used and much finer grit than in ordinary practice. For instance, for rough grinding Aloxite wheels are used, 40 grit and 848 grade, or Alundum wheels of 60 grit and 848 or 846 grade, while for the Hoffman grinding, which, in a way, is a polishing operation, a flour of extreme fineness is used which is built up into a wheel of extraordinary hardness. It should be remembered that this wheel does not act like an abrasive wheel in ordinary cylindrical grinding machines, that is, the particles of abrasive do not cut as they pass the work and are finally broken out of the matrix, but the protruding fine particles of the abrasive roll over the ball and have a kind of generating action.

Another peculiarity which cannot be lost sight of in the making of balls is the fact that the size of the ball increases during the process of hardening and decreases during tempering. The change is great enough to be taken into consideration as it affects the amount of metal which must be removed by a slow process. A ½-in. ball increases in size practically 0.0015 in. by hardening and decreases again 0.0003 in. when it is tempered at a temperature of 300 deg. The roundness, smoothness and size of the ball can be appreciated by the eye and can be inspected and measured. Defects can be eliminated. There are, however, other qualities of the ball which do not show themselves, which cannot be detected without breaking the product, and yet are of at least as great importance as either of the other qualities.

In order to be of first quality a ball must be extremely hard and strong. Great hardness and strength do not, as a rule, go together. It is customary where these two qualities are required to make the outer surface hard and treat the steel in such a way that the inner metal is tough and will resist heavy strains without breaking. This method of combining strength and hardness cannot be followed with steel balls. A steel ball, in order to be useful for a ball bearing, must deflect or compress exceedingly little under heavy load. If the ball should compress to any appreciable extent its cross-section would become elliptical and it would offer relatively large surface to the ball race. As a result the ball would have

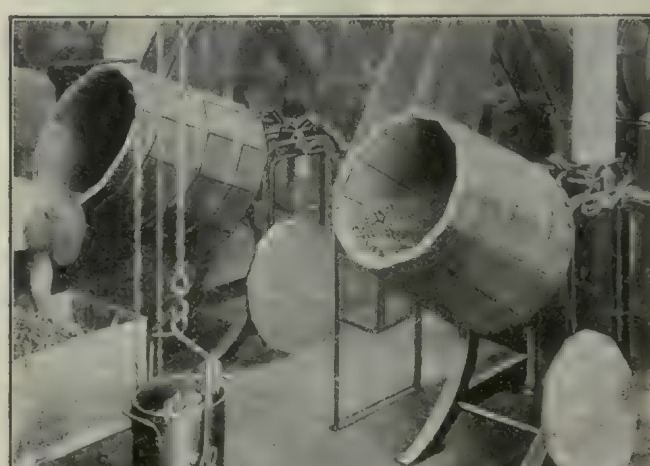


FIG. 15—TUMBLING BARREL USED FOR ROUGH AND FINISH POLISHING

to climb from its minor to its major axis when it revolves in the bearing and appreciable power would be consumed. The proper functioning of a ball bearing is based on the fact that a ball changes its shape very little and in order to be sure that such shall be the case the ball must be of extreme hardness throughout.

The next operation is the polishing which is done in two stages. All polishing is done in inclined barrels such as shown in Fig. 15. The first or rough polishing is done by means of Vienna lime. Four hundred and fifty pounds of balls are loaded in a barrel with the proper amount of lime and are slowly revolved for about 25 hours. This 450 lb. of balls is made up out of two or three sizes, the idea being that the smaller sizes will locate themselves between the larger ones thus causing more points of contact than if there were only one size of balls. The amount of 450 lb. should not be considered as the exact figure. It is made up of two batches of balls, each one coming from a Hoffman machine and, as the theoretical amount of balls given to such a machine is 240 lb., the total amount which is being polished at one time may be as high as 480 lb.

The rough polishing takes practically all of the 0.0002 in. which was left by the Hoffman machine. The final polishing is done by means of scraps of soft leather. The illustration shows this clearly. This last polishing operation removes practically no metal and is more in the nature of a burnishing than a polishing operation. Its duration is about 2 hours.

The subsequent operations of measuring and inspecting have already been described.

The Passing of Craftsmanship —Discussion

By S. N. Bacon

In the article under the above title which appeared on page 648 of *American Machinist*, Entropy expresses regret at the passing of craftsmanship. The writer does not agree that craftsmanship is passing but thinks it is merely shifting from actual skilled work performed upon the product to an even higher grade of work required in making tools of great accuracy that are capable of producing parts in large quantities. Forming and embossing dies for silverware and other ornamental work are good examples. It requires a high grade of craftsmanship to construct such dies properly, perhaps even more so than in the olden days. Then the parts which had been made by hand, although they were beautiful in ornamentation were not all of that same accurate detail which characterizes the present-day manufacturing methods and clever ideas in designing tools.

Another requirement of the present methods for interchangeable manufacture is the extreme accuracy of inspection gages. These gages are often the highest form of the craftman's art although they are not ornamental. It is regrettable that these wonderful tools are never exhibited, but the craftsman must surely derive considerable satisfaction in exhibiting the final product as for instance the metal pencils, mechanically engraved and such wonderful products as the radio, telephone, fire-arms and adding machines. The writer always has a wonderful sense of satisfaction when he sees a certain rifle or typewriter displayed for many of their principal parts are manufactured by the tools he has designed.

Standard Numbers for Steel

At a conference held in Washington, D. C., December 6, 1922, Lawford H. Fry reported a resume of European practice in the numbering of steel, based upon replies to a circular request for information sent by Dr. Agnew to the standardizing bodies of Great Britain, the Netherlands, Germany, France, Austria, Sweden, Belgium and Switzerland. Canada, Norway, Italy, Czecho-Slovakia and Japan made no reply.

Great Britain has done practically nothing since its adoption during the war, of the symbols of the Air Ministry. There is, however, a strong desire to adopt some other form of symbol for automobile steel. No system has been adopted in the Netherlands, although the Royal Institution of Engineers has standard specifications which were issued March 4, 1911. In these, the specified grades are designated by arbitrary letters. The Austrian Industrial and Trade Standards Committee has done nothing since the publication of a tabulated nomenclature of iron and steel on September 30, 1921.

Recent Action of Swiss Engine Builders

The Standards Committee of the Swiss Association of Engine Builders has just issued a series of tentative standard sheets covering carbon, nickel chrome and nickel steel. The principle of the system of symbols is to show the content of the carbon and of the principal alloys by using the standard chemical symbol of the element in question, and adding to it a figure showing the mean percentage of this element. Thus, a carbon steel with 0.25 to 0.35 per cent carbon is symbolized as C2n. The C indicates carbon and the amount is given by the figure 2, representing a mean content of 2/10 per cent. The "n" shows a maximum allowable content of 0.07 per cent phosphorus and 0.06 per cent sulphur. If the symbol is C2s, the maximum allowable phosphorus is 0.04 per cent, and the sulphur 0.03 per cent. If the symbol is written C2, then neither phosphorus nor sulphur is permitted to exceed 0.02 per cent.

The German Industrial Standards Committee has issued a tentative standard under date of August 12, 1922, covering steels without alloys, and untreated. This covers seven grades, for which the tensile strength and elongation in the annealed condition are certified. The grades are designated by arbitrary numbers, with the prefix St.

French Standardization Specifications

In France, the Permanent Commission for Standardization is issuing a series of standard French specifications for various materials. Five specifications are given, and the steels meeting these specifications are to be marked to indicate the material as follows: The number of the specification, a letter indicating the method of manufacture, and a number showing the minimum tensile strength specified. The French Commission points out that this system of marking gives a compact symbol which, by referring to a definite specification, leaves no room for misunderstanding. It also takes account of the principles laid down by the Consulting Committee of Manufacturers, which recommended that designations of material should be given in full and not in codes. As shown, the Swiss and the French systems are directly opposed to each other, and Mr. Fry seems to feel that the French plan is to be preferred in every way.

Single Hole Drilling on a Multiple-Spindle Machine

A Three Station Fixture—Work-Holding Jaws Closed by Weights—Carriers Adapted to Various Sizes of Work by Changing Jaws

BY W. F. SANDMANN

A FEW years ago the multiple drilling machine was brought into use only when large numbers of parts having ten to twenty or more holes in the same plane were to be drilled. It would have been con-

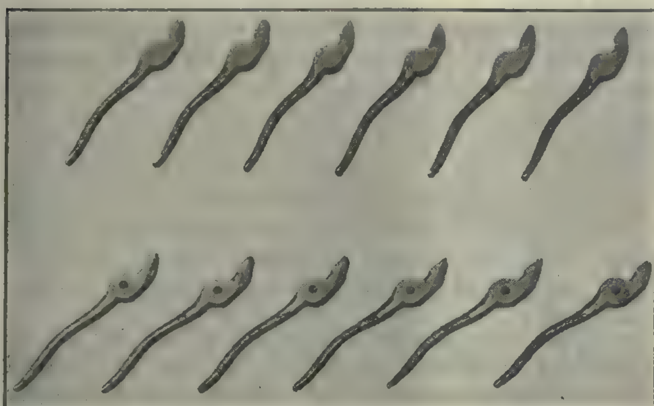


FIG. 1—THE WORK BEFORE AND AFTER DRILLING AND REAMING

sidered absurd to even entertain the thought of using the multiple-spindle machine for parts having but a single hole to be drilled. Now the field of its usefulness

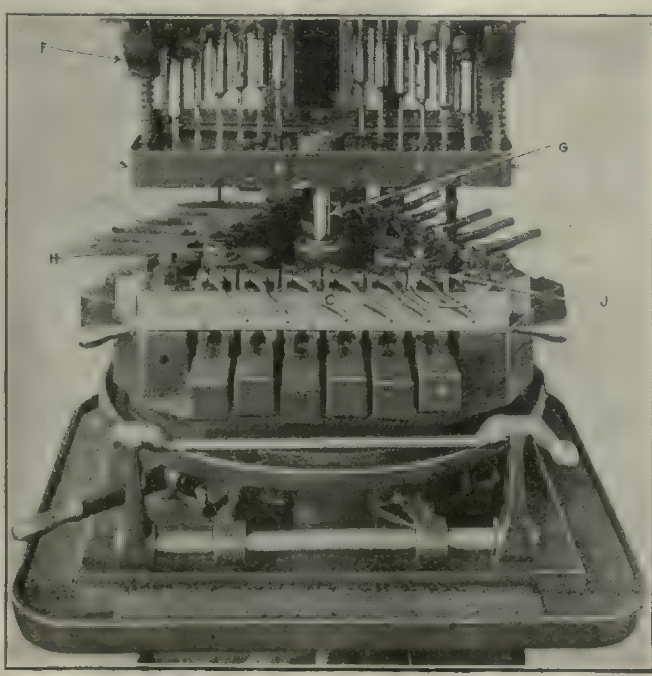


FIG. 2—THE DRILLING MACHINE WITH FIXTURE AND WORK IN PLACE

has broadened until there is no such a thing as too few holes in a piece for it to be a multiple drilling proposition, so long as there is to be quantity production.

The success of single hole drilling on the multiple-spindle machine depends almost entirely upon the type of fixture that is used for securing the work while the operation is being performed. An example of an interchangeable fixture and machine set-up for single hole work is that used for the drilling and reaming of drop-forged plier halves. The plier halves are shown in Fig. 1, both before and after drilling and reaming the $\frac{3}{8}$-in. hole through the boss. A half dozen or more different sizes of these pliers are manufactured so the fixture had to be arranged to accommodate them all with the minimum of time for changing from one size to another.

A Natco Type 80, automatic cam-feed multiple-

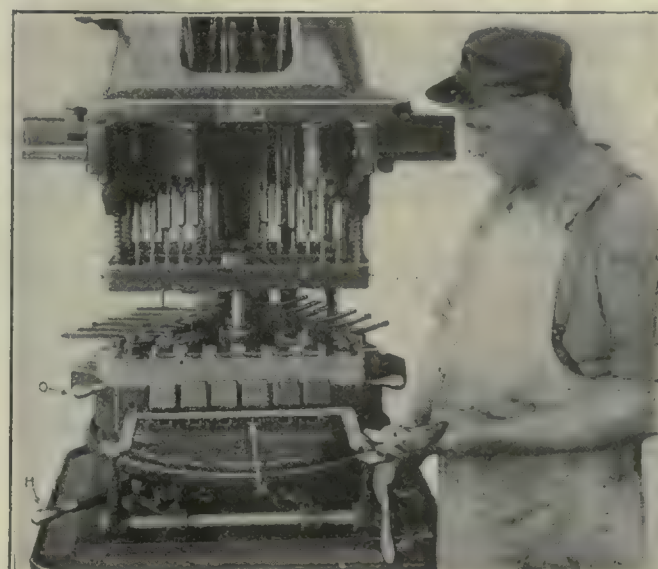


FIG. 3—REMOVING FINISHED WORK

spindle drilling machine is shown in Fig. 2, with a three-station plier fixture in place on a rotating table approximately 2 ft. in diameter. At *A* six plier halves are shown in the drilling position, at *B* six more are in the reaming position after having been drilled at *A*, and out in front and from under the head of the machine at *C* are six plier halves drilled and reamed and ready to be removed from the fixture. The drills and reamers can be seen in their respective spindles and the construction of the machine allows each of these spindles to revolve at the proper speed for the tool it contains, making possible the simultaneous drilling and reaming operations.

The guide bushings for the drills and reamers are carried in the plate *D*, suspended from the head of the machine by four spring suspension arms *F*. The guide bushings are slip bushings within a liner bushing so that they can be easily changed to suit the size hole to be drilled or reamed. Around the edge of the suspension plate is a band of sheet metal forming a reservoir into which the cooling compound is pumped.

As the only outlet for the compound is through the bushings, the proper cooling of the tools is assured at all times.

When the head of the machine is fed down to begin the operation, the suspension plate D locates in the proper position on the fixture by means of the center-post G and whichever one of the three short dowels H that happens to be at the rear of the machine. The plate comes to rest on pads when it is 1 in. above the work and the drills and reamers pass on into the work. The suspension springs are compressed tending to hold the plate tightly in position and the suspension rods pass into the opening in the head of the machine.

FIG. 4—ONE OF THE CARRIERS

Each plier half is held between a pair of equalizing V-jaws J which are spread apart at the bottom and forced together at the top on the plier by the action of the weight K. It is necessary that each pair of jaws be an independent clamping device on account of the variations in the diameters and thicknesses of the pliers, the forgings being in the rough at this operation with the exception of a ground side.

The operator is shown unloading a half dozen finished plier halves in Fig. 3. He presses down on handle L and the bar M is thrown up, lifting all six weights at the same time and allowing the jaws to spread open at the top. The six finished plier halves are removed from the fixture by a sweep of the hand and six unfinished halves placed in the jaws. The handle L is lifted, allowing the weights to fall back into place and the loading is completed. The unloading and reloading operations are performed while the machine is in operation, the only idle time being when an operation is completed and while the operator is pushing down lever H releasing the indexing bolt and swinging the fixture a third of a revolution by means of one of the handles O. This places the plier halves that have just been loaded at C, Fig. 2, in drilling position A, those that have been drilled at A in reaming position B and those that have been reamed in position B come around to C completely drilled and reamed. The operations of the cycle are then repeated.

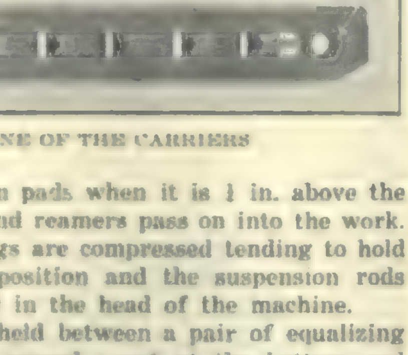


FIG. 5—DETAILS OF JAW CLOSING DEVICE

Two views of the carrier, or jaw holder, containing six pairs of clamping jaws are shown in Fig. 4. The fulcrum pins of the jaws are at A and the weight closes the jaws by spreading their lower ends at B. The spring C pulls the jaws together at the bottom when the weighted spreader is removed, causing them to open at the top and release the work.

The carriers are made sufficiently wide to support the plier halves before the jaws are tightened. The holes in the ends are bushed as at D and fit over studs in the fixture where they are held down by nuts. This construction permits a carrier to be removed and replaced by another, containing jaws for different work by merely taking off two nuts and washers. Several sets of carriers are provided.

Details of the jaw closing device are shown in Fig. 5. The screw A does the actual closing of the jaws and is removable so that different diameters of screws can be inserted for different spreads of jaws that may be required. It should be noted that the screw A comes into contact with only a thin edge of the jaw, as the sides are milled away toward the bottom. The weight fulcrums on the pin B and because of the positions of the fulcrum points in both weight and jaw, a pressure of not less than 70 lb. is exerted at the clamping point. The Vs in the jaws recede toward the bottom to cause a more pronounced holding down effect.

By the use of different carriers containing properly shaped jaws for the part to be held, and by inserting the correct size of pin for the spread required, the same fixture can be made widely interchangeable.

With the arrangement described a production of 720 drilled and reamed plier halves per hour is obtained with one operator against less than a total of 500 per hour by three operators using gang drills.

Effect of a Private Sidetrack on Insurance

An industry in the Middle West raises the question as to the possibility of obtaining insurance against liability for damage caused by a railroad while operating over a private sidetrack.

It appears that the industry, according to the terms of its contract with the railroad, has agreed to assume two distinct liabilities. In the first place, it has contracted to indemnify the railroad company against any legal liability arising in the event that property be damaged by fire caused by locomotives operating on the private sidetrack. This provision applies to the property of the industry or other property on its premises, except that belonging to or in charge of the railroad company. The industry thus agrees that it will not make claim or permit to be made against the railroad company in the event of damage to its property. In case fire insurance is carried, this agreement can be fulfilled by requesting the insurance company to endorse the policy to the effect that subrogation rights will not be exercised. An additional premium is usually charged for this endorsement. If there is other property on the premises which does not belong to the industry, the industry should be sure that it is covered by a fire insurance policy containing a waiver by the insurer of subrogation rights.

In the second place, the industry has agreed to indemnify the railroad company against liability for loss, damage or injury to persons or property while on or about said sidetracks, occasioned by any act or omission of the industry, its employees or agents. As it is customary for casualty companies to assume this contractual liability as a supplement to policies of workmen's compensation and public liability, insurance protection can thus be obtained.

Industrial Cost Accounting for Executives

Fifth Part — Business Functions and Their Organization—Classification of Departments and Designation by Mnemonic Symbols — Typical Organization Chart

By PAUL M. ATKINS

IN THE PREVIOUS articles we have surveyed very briefly the various elements of costs and the accounts and journals by means of which cost elements are recorded. It is now time to turn aside from what may seem to be the direct path of our discussion and spend a little time considering a subject, which, at first glance, may appear to have very little direct connection with our main topic. The subject, as was mentioned in the first article, is the functionalization and organization of a business. It is fundamental to the study of almost any problem concerning a business, and an understanding of it will be found not only helpful at various times in the consideration of our subject, but practically indispensable if the real significance of the method of expense classification which is described later is to be grasped.

Definition of "Functionalization" and "Organization"

Functionalization and organization may, perhaps, seem like long words with rather shadowy meaning. The first often seems to have an academic flavor and the latter is used to mean so many different things that it has lost much of its significance to most business men. They serve to describe certain ideas, however, better than any other words, and though these ideas are rather complex and have been made to seem much more difficult of comprehension than they really are, they are very useful to us in our discussion. Before going any further, therefore, let us see if we cannot agree upon definitions for these words which, while not entirely complete and exact will be sufficiently so to serve our purpose here and which can be improved, if necessary, later.

Functionalization, I think we can say, is the analyzing or breaking up of the business into its functions. Functions, in turn, may be defined as activities, and business functions as the various activities involved in the operation of a business. We speak, for example, of the functions of the purchasing department and mean by that all the various activities which are involved in the making of purchases and which are centered in the purchasing department. When we say the time-study function, we mean ordinarily the operations necessary to make a time-study. The functions of the foreman usually carry the idea of the various tasks which the foreman must perform in supervising the operation of his department. Often the expression is used to mean much larger units when marketing or selling functions are spoken of to indicate all the activities involved in selling the goods which have been produced. We see, then, that the word is employed to mean almost any activity which is involved in the operation of a business and this, in general, is the meaning which we shall attach to it in our discussions.

Organization is used to mean so many different things that no attempt will be made to enumerate them here for they are so varied and diverse that the reader would probably be more confused than helped thereby. The meaning which we wish to give to it here is that of the co-ordination and tying together of the various functions in such a way that they will work most effectively together.

Let us now turn our attention once more to the functionalization of a manufacturing business and study the problem a little more intensively. In the first place we can make one generalization which will hold, practically without an exception. A manufacturing concern can have its functions divided into three main groups. There are those activities which are concerned primarily with the production of the finished merchandise and which we can call the manufacturing functions. There are those which are involved principally in the selling or marketing of the completed goods, and which we can name the selling functions. And then there are those activities which are not directly connected with either manufacturing or selling but serve to aid them, or to co-ordinate or supervise them. Such functions as accounting, filing and general administration are examples of this class which we can probably best call the administration functions.

The particular grouping of functions we have given has considerable importance in cost accounting, as was pointed out in the third article, because it serves as a basis for the classification of expenses, a classification which facilitates both the control of the business and the allocation of overhead to the product. It is a grouping also that can be made for practically any industry no matter what kind of merchandise it produces.

Such a sub-division of a company's activities does not give a very satisfactory basis for their administration or operation. Except in the smallest businesses such units would be much too large and so we find that functions which can be carried on satisfactorily together are gathered together into departments. If departmentalization is done properly we will find that all the detailed functions which make up the three large groups are broken up into departments, and it is with these departments that we shall have to deal.

A Typical Small-Sized Company

Perhaps a simple example will help us to understand the problem which has been outlined. Let us take a moderate sized concern turning out a product made principally of steel and let us see what its functions are likely to be. In the first place there would be the functions involved in producing the finished goods, in this case, let us say, a foundry department, a machine shop and an assembling department. Then there are activities which exist almost solely to aid these operating departments such as the power department, the maintenance department, the planning department, the inspection department and the toolroom, and other departments, such as the engineering department and the purchasing department, the larger part,

---

For the author's forthcoming book.

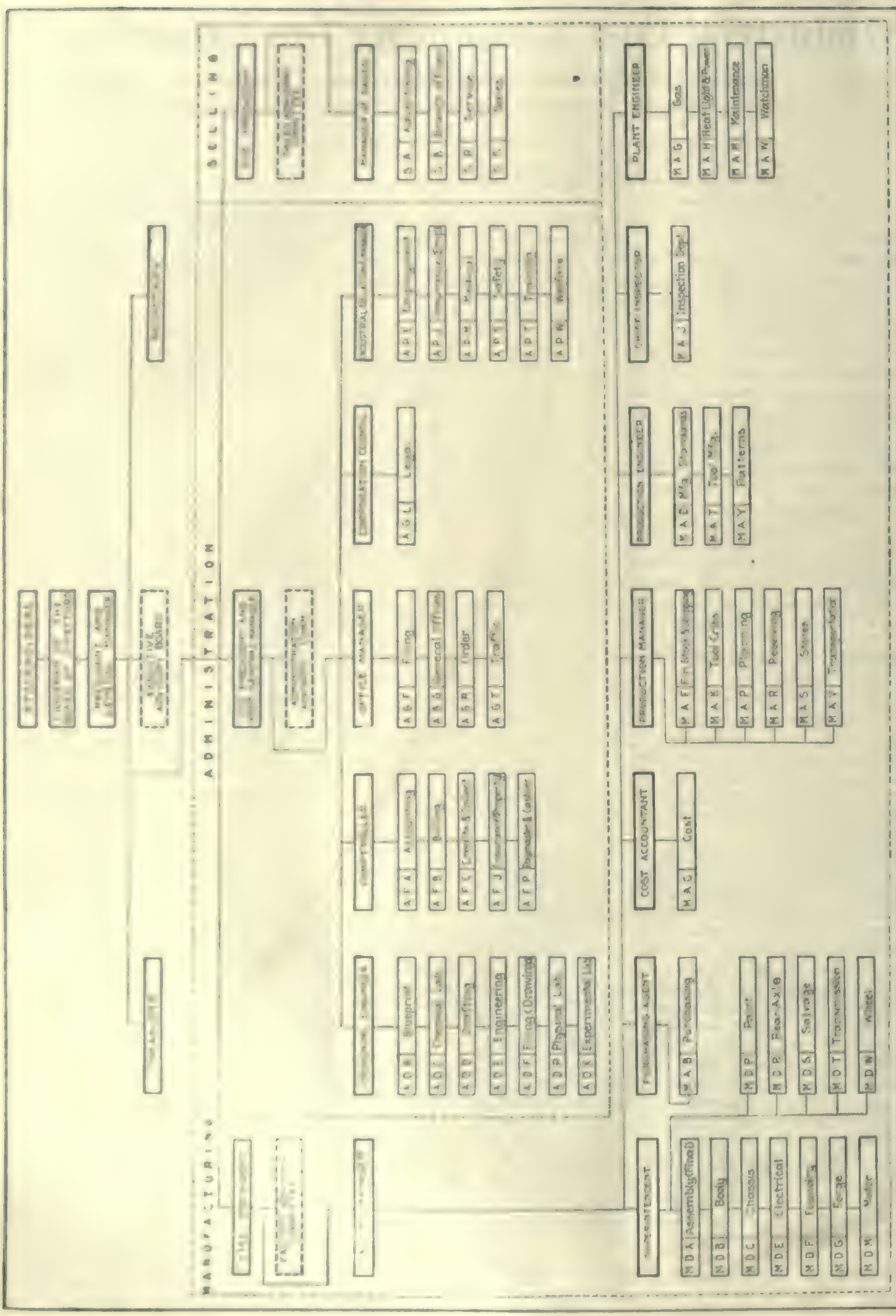


FIG. 3—ORGANIZATION CHART OF A LARGE COMPANY

though not the whole of whose services are to promote the work of the shops.

To handle the selling end of the business, departments like the advertising department and the sales department are necessary, and we can analyze the selling functions into these two groups. The general administration of the business will probably have the record-keeping functions placed by themselves in an accounting department and the writing and filing of letters and general office work can be gathered together into a general office department, while the policy deciding functions can be thus established in an executive department.

So far we have analyzed the functions of the business, but aside from the first division into the three main groups we have not classified them and experience has proved that a heterogenous collection of units is not very useful until it has been classified and symbolized, an act that is different from but closely related to classification. Both terms are subject to long definition, as in the case of functionalization and organization, but we can get along with definitions which are quite simple and at the same time sufficiently exact for our purposes. Classification is essentially the logical, systematic and orderly arrangement of related details, while symbolization is simply the giving of symbols to the details, symbols being nothing more nor less than short convenient names. It is quite possible, of course, to have a classification without having it symbolized and also to have items symbolized without having them classified. To be most satisfactory we must have both together. When we have further classified and symbolized the various departments we obtain something like the following:

THE AMERICAN METAL WORKING COMPANY

- A. Administration functions
  - AA Accounting department
  - AE Executive department
  - AB General offices department
- M. Manufacturing functions
  - MA Auxiliary manufacturing functions
    - MAB Buying or purchasing department
    - MAE Engineering department
    - MAH Heat, light and power department
    - MAJ Inspection department
    - MAM Maintenance department
    - MAN Personnel and employment department
    - MAS Stores, stock receiving and shipping department
    - MAT Tool manufacturing department
  - MD Direct manufacturing functions
    - MDA Assembly department
    - MDF Foundry department
    - MDM Machine shop department

There are probably two features about the above table which will attract the reader's interest first. One of them is the classification of the manufacturing functions into two groups, the first called "auxiliary" indicating that they are an aid to manufacturing though they do not directly have a part in it, and the other "direct" indicating that the departments so classified are the ones in which the actual manufacturing operations are performed. Such a division is most useful when the problem of the distribution to the direct manufacturing departments of the expenses of the other departments is reached.

The second feature is the use of letters, and letters not in their consecutive alphabetical order, to designate the departments. Here we have an illustration of the use of the "mnemonic" system of symbolization, a system which endeavors to aid the memory by employing as far as possible the initial letters of the words which describe the item in hand and its place in the classification, the first letter indicating the principal sub-division, the second the group within that sub-division, etc. Let us take *MDM*, the machine shop department, as an example. The first *M* stands for the manufacturing group of functions, the *D* for the fact that it is the direct manufacturing group, and the second *M* shows that it is the machine shop department within that group. It may be clearly seen here that the position of the letter in the symbol, as well as the letter itself has a significance, a fact that is sometimes overlooked although everyone recognizes that 123 represents an entirely different number from 312.

There is another important advantage, among others, in the mnemonic system of symbolization in addition to the one which has been mentioned above and that is its expandibility. Only 22 letters are used because of the similarity of *Q* to *J* or *I*, of *O* to *Q* or zero, and of *U* to *V*, but even so we have 12 or 13 more than the number of digits available if figures are employed. Hence if only one unit is used in a symbol, 22 of them can be symbolized in a single class if the mnemonic system is used, and only 9 or 10 if numerals are utilized. If a symbol of two units is wanted we have a possible variety of combinations of letters of 484 as against 99 for the numbers, and the difference becomes increasingly marked as the number of units in a symbol is increased.

To offset the advantages there are some disadvantages. It is not so easy to use such symbols with modern tabulating machinery though it is not impossible to do so. Mr. C. M. Ford has described in a very interesting article entitled "Alphabetical and Mnemonic Symbols on Tabulating Machine Cards," in the May, 1921, issue of *Industrial Management* magazine how the problem can be solved. Also, it is not always possible to make the symbols mnemonic, as in the case of the inspection and personnel departments above where *J* and *U* are used instead of *I* and *P*. The *J* is employed because the *I* is never used, and *U* is utilized instead of *P* because the latter is already reserved for another department. In general, however, the advantages outweigh the disadvantages and slowly but surely we are seeing the mnemonic method of symbolization more frequently used.

The case which we have just presented is very simple and there is not likely to be any serious questioning in regard to the details shown therein. Let us, therefore, take up a more complex illustration now, one which is likely to raise a debate concerning some of the details. The following symbolized classification is intended to be typical only. It is the result of extensive study of the problem as it has been worked out for various concerns, especially those engaged in wood and metal working, and may be taken as a general model subject to modification in individual cases.

A TYPICAL SYMBOLIZED CLASSIFICATION OF FUNCTIONS

- A. Administration functions
  - AD Functions involved in designing and developing the product
    - ADB Blueprint and photographic department
    - ADC Chemical laboratory department
    - ADD Drafting department
    - ADE Engineering department
    - ADF Filing (blueprint and drawings) department
    - ADP Physical laboratory department
    - ADX Experimental department

- AF Financial functions
  - AFA Accounting department
  - AFB Billing department
  - AFC Credits and collection department
  - AFJ Insurance (property) department
  - AFP Paymaster and cashier department
- AG General administration functions
  - AGE Executive department
  - AGF Filing (general) department
  - AGB General office department
  - AGL Legal department
  - AGR Order department
  - AGT Traffic department
- AP Personnel functions
  - APE Employment department
  - APJ Insurance (employee) department
  - APM Medical department
  - APS Safety department
  - APT Training department
  - APW Welfare department

M. Manufacturing functions
- MA Auxiliary manufacturing functions
  - MAB Buying or purchasing department
  - MAC Cost department
  - MAD Manufacturing standards department
  - MAF Finished stock and shipping department
  - MAH Heat, light and power department
  - MAJ Inspection department
  - MAK Tool cribs department
  - MAM Maintenance department
  - MAP Planning department
  - MAR Receiving department
  - MAS Stores department
  - MAT Tool manufacturing department
  - MAV Internal transportation department
  - MAW Watchman department
  - MAY Pattern Department
- MD Direct manufacturing departments

These departments are sub-divided usually either according to the kind of product turned out as, for example, engine department, rear axle department and body department of an automobile factory, or according to the kind of work to be performed, such as the lathe department, punch press department and heat-treatment department in a general metal working factory doing work largely or entirely to order.

S Selling functions
- SA Advertising department
- SB Branch offices department
- SS Sales department

An examination of the above classification will show that there are a number of divergencies in it from what is normally found for manufacturing companies. One of the reasons why these differences have been made so apparent is to call them to the attention of the reader and to get him to think about the causes of them. It not infrequently happens that we become so accustomed to doing a thing in a certain manner or to thinking about it in a particular way that we do not realize that there may be better ideas concerning it, or that some of its phases have been overlooked.

As we look at the classification just given, the first section of it—especially if our interests be in the factory—probably seems misplaced. Such functions as those ordinarily carried on by the engineering department, drafting department and experimental department are very frequently operated under the direction of the factory manager as activities which are directly, and practically entirely, connected with the fabrication of the finished product. When they are concerned only with preparing information for the benefit of the shops the classification of such departments, as was indicated in the first classification, is very appropriately under the head of the auxiliary manufacturing functions. It must not be overlooked, however, that sometimes the design and development of the product is affected by and, in turn, influences the marketing policies of the company. Our large electric equipment companies furnish one good illustration. The design of automobile bodies also is quite as much a matter of pleasing the public taste as it is of supplying the factory with information as to how they should be built.

While, therefore, on many occasions the engineering and allied activities are properly grouped under the head of manufacturing functions, there are often times when they serve both marketing and manufacturing and aid in developing general business policies so that they are correctly classed as administrative functions. Of course, such a splitting up of activities, as is shown here, into an engineering department, drafting department, blueprint and photographic (or photostat) department and filing department is only necessary or desirable in the case of large concerns.

Hardly anyone will question the propriety of treating the financial functions as a sub-division of the administration functions. The real head of this group of departments is naturally the treasurer but he is not properly located in any of them but in the executive department (discussed later) with the other executive officers. The departmentalization of these functions is such as is likely to be found in a moderately large concern and the titles are so self-explanatory that no additional explanation is needed except, possibly in one case. The property insurance department is not frequently found, but for large concerns whose inventories are constantly and often rapidly changing, such a department, or, at least, the recognition and organization of the insurance function is necessary if the company's property is to be fully protected at the least expense.

General Administration Functions

The general administration functions can have only brief consideration here though they form a very interesting subject of study. They include in the first place the policy forming activities as represented by the executive officers, principal managers and their personal assistants grouped together into an executive department. In addition, there are other departments whose location in this group is due more, perhaps, to the fact that they do not properly belong to any other group than to any common tie among them. The filing department is to care for all material which is to be filed and which is not better located elsewhere. It may often be conveniently joined with the general offices department whose activities include the stenographic work, telephone and messenger service, internal mail service and care of incoming and outgoing mail. The order department takes the orders received from customers and prepares the necessary papers so that the goods may be shipped at once or that the factory may begin its work upon them. It serves as an operating link between the sales and the shipping or planning departments. The traffic department has the task of controlling the movement of goods, both incoming and outgoing, while they are in the hands of a common carrier, and thus serves both the selling and manufacturing sides of the business.

When we come to the personnel functions gathered together under the general head of administration, we take up another topic which is likely to raise some questions in the mind of the reader. Probably most manufacturing concerns which have organized the activities involved in their relations with their em-

ployees, other than those of supervision, have placed them in the group of manufacturing functions. As in the case of the functions involved in the designing and developing of the product, this is undoubtedly correct under many circumstances, as for example, when the factory is located away from the general offices of the company and hence not in immediate contact with the general administration of the concern. Under such conditions it would be quite appropriate to organize employee relations departments as a separate group co-ordinate with the auxiliary functions, or even, in the case of a small concern, as a single department in the auxiliary group.

Personnel and Purchasing Departments

There are other occasions, however, when such an arrangement is not so sound. If we find, for instance, that many of the employees are in the administration and selling departments so that a considerable part of the service rendered by the personnel departments is to those groups, then the logic of the situation points to the inclusion of the personnel departments in the administration section. We have additional reason for reaching such a conclusion in case a large part of the work of these departments consists of what may be loosely termed "welfare work" whose results are expected to benefit the business as a whole rather than simply the manufacturing departments. What is sought here, however, is to call the possibilities to the reader's attention and not to force upon him any particular conclusions.

When we turn to the departments which have been placed in the auxiliary manufacturing group we find that most of them logically and practically belong there without any serious question. One or two may need some brief explanation, however, and the dividing line between several of them needs classifying for some readers, perhaps.

The desirability of so placing the first department of all on the list may, quite possibly, be questioned by some. Since the purchasing or buying department directs the expenditure of such large amounts of the company's funds, it would seem proper to include it as a financial department. More often, however, the prime function of the buying department is to buy material to meet the needs of the factory. The fact that it causes the disbursement of money and purchases materials and services for other than factory departments is of secondary importance, though often a factor not to be overlooked or left out of consideration. Hence, in most cases, the classification given is best for this department.

The second department in the auxiliary manufacturing group, the cost department, may also appear misplaced, and since it is the department of most interest to us here and as the pros and cons concerning it are pretty well balanced, it may be well to consider it rather carefully. At first glance it might seem as though the logical place for it would be in the same group as the accounting department, provided it did not form a part of that department. This feeling would be still further reinforced when one considers that the work of the department is largely for the benefit of the business as a whole. On the other hand, there are important reasons why the cost department should be classed where it is. A large part of the results of its work is, or should be, for the benefit of the factory and for the control of its operation.

The most important reason, however, is a purely practical one. While the connection between the cost department and the accounting department must necessarily be very close if both are to operate successfully, the number of entries which pass from one to the other is usually comparatively small, especially in relation to the number of entries which the cost department receives from the planning department. In most cases it will be found that about ninety per cent of the material which must be handled by the cost department comes from the production control records. In many instances also, these papers and vouchers, must be utilized with a minimum of delay if the work is to be successfully carried on and mistakes rectified before it is too late to do so.

Most of the other departments mentioned here need little discussion. Their general scope is evident from their titles. The manufacturing standards department is probably the least well-known of all of them and a word of explanation may be in order here. It is the department whose prime function is the establishment of the operation standards—the making of time studies, the routing of work through the factory, the preparation of standard practice instructions and instruction cards, the setting of tolerances on materials and specifications for the product at various stages of its fabrication, etc. In the past, its functions have often been treated as a part of the work of the planning department and the relationship is, of course, very close. It is often better, however, to segregate them as has been done here.

When all the various functions of a business have been analyzed and classified, the next step is to prepare an organization manual in which a concise but accurate description of what each department is to do should be given. There is no space here to discuss it, but in the following article its preparation and use will be explained and an illustrative section describing the functions of a typical cost department will be given.

Organizing a Business

There is one other matter, however, which does deserve consideration now. The process of analyzing a business into its various functions and departments is essentially a "breaking up" process. It is quite essential, but there is a final step which is equally important and that is to combine and co-ordinate the departments into what we call an organization in such a way that the business may operate with the least amount of friction and with the greatest efficiency.

In approaching the study of the organization of a business the first point which needs emphasis is the fundamental necessity of organizing on the basis of functions or departments and not on a basis of individuals. Departments should be co-ordinated because their activities have points of contacts and not because their respective heads have mutual sympathies. If the criticism in many books in regard to certain types of organization are read with this thought in mind, it will be found that many of the troubles complained of are due to the attempt to organize a business on the basis of personalities and their characteristics instead of on the basis of functions.

There are various so-called "types of organization" such as line, line and staff, Taylor and committee; and much has been written about the advantages of each. In actual practice it will usually be found best to combine several of them in co-ordinating the various

departments and in analyzing and organizing the work within the departments. In some situations one form will prove superior to the others, but in all cases the utilization of the various activities as the units of organization should be adhered to without exception. In a later article where a bibliography of cost accounting will be presented, references will be given to works where the different types are described.

Just as the analysis of the business into departments is recorded in a permanent form in an organization manual—a record which provides the material for the construction of an organization—so the organization itself should be given permanence by being recorded in the form of an organization chart an illustration of which is given in Fig. 3. It will be noted that various types of organization find places in different parts of the chart and that the principal groups of departments are set off by themselves. The only relationships between functions and departments are those of authority and responsibility, reciprocal relationships in other words. Many a good chart has been spoiled by having too much recorded on it. The basic chart should be supplemented by others on which the lines of coordination may be shown.

The most satisfactory way is to select a single department and group around it the other departments with which it has contacts and then plot the relationships, using different kinds of lines to show the different ones. It will be found that if this is done for a few principal departments and functions no need will be felt for the same kind of thing for the others for all except a few insignificant relationships will be covered.

System for Locating Reference Prints

By Charles B. Johnson

A source of constant irritation and avoidable delay exists in many drawing offices on account of the inability of designers to secure the necessary blueprints or drawings for reference at the time that they are required. Nothing can be more annoying, nor can more easily take a designer's mind from the design upon which he is working, than the necessity of a protracted search for some print that he wishes to refer to at that time.

The more difficult to find, the more desirable the print seems, and the man determines to have this particular print no matter how much time and energy is expended searching for it. In case he is unable to locate it, his mind is constantly reverting to it and he is continually trying to find it. If it proves absolutely necessary, and the work is indefinitely held up, he, in all probability, calls his superior's attention to the matter, whereupon orders are issued to someone, usually the office boy, to "find that print."

This condition exists in many plants through neglecting to provide a satisfactory system of checking out prints or drawings. In fact, in some organizations it is considered superfluous to have a checking system of any kind. It is needless to say that this is a very undesirable state of affairs, and in such offices efficient work is impossible. The designers and draftsmen are allowed free access to all files, from which they remove drawings or prints as they may require them and then return them at their leisure. This means that they are dumped miscellaneously or carelessly on the top of the filing case, to be refiled later by someone who has a few minutes' spare time and who often is ignorant of the necessity of refiling them correctly. As a result, a great many drawings are misfiled. For all practical purposes, they are lost until someone discovers them while searching for either the particular one or some other.

A system which to a great extent makes it impossible for this condition to exist, is to place someone in direct supervision of the files. Upon a print or drawing being issued, a card is filled out with such information as the name of the person, date and drawing number, and it is filed either alphabetically or numerically. The numerical system has the most to recommend it on account of its ease of installation and the simplicity of maintenance. The party to whom the print or drawing was issued is held responsible for any damage or loss which may occur while it is in his possession.

New Cards Frequently Issued

Periodically, say at least once each week, the person holding the drawing or print should be required to reissue a duplicate card bearing the new date. This system will eliminate the confusion arising from the practice among designers of loaning reference drawings to each other. The one to whom they are loaned neglects returning them or perhaps re-loans them. The result is that where no card is re-issued the files are apt to carry charges against men for several weeks, or possibly months, who have re-loaned the prints.

This condition necessitates an extended search being made, and the party requiring the print usually insists that the searching be done by the party to whom it was originally charged. In either case the resultant loss of time is expensive to the concern, and the designer to whom the print is charged is annoyed by the fact that he must take what he considers valuable time to locate the print—perhaps in the beginning he was forced to find it for himself, and he feels that the one who now requires it should do the same.

If the re-issuance of cards is insisted upon, the files are automatically kept up to date within the time limit set by the issuance of the cards, and thus is eliminated the waste of time which might be more profitably employed. The cards are comparatively inexpensive and may be of any suitable size and design, although it is not recommended that they be so large as to require a bulky filing case. One 2x3 in. should be large enough for all purposes.

Making Expensive Taps in a Railroad Tool Room

By Arthur C. North

The first article on "What's Wrong with the Railroad Shops," reminded me of an experience I had when I was in charge of the small tool room in a railroad shop. This tool room was equipped with a 14-in. x 8-ft. lathe, a 16-in. shaper, a universal milling machine, a small drilling machine and an emery stand.

When I first took charge the general foreman's orders were to make all tools. Not long afterward we needed some regular ½-in. hand taps. I told the foreman that it would be much cheaper to buy them but the only answer I got from him was a gruff "Make everything."

I did, and they cost nearly fifty cents apiece. They could have been bought for fifteen cents each from any local dealer and would have been available sooner.

FIG. 1—GRINDING THE PIERCE-ARROW CYLINDERS

Grinding Data from the Pierce-Arrow Shop

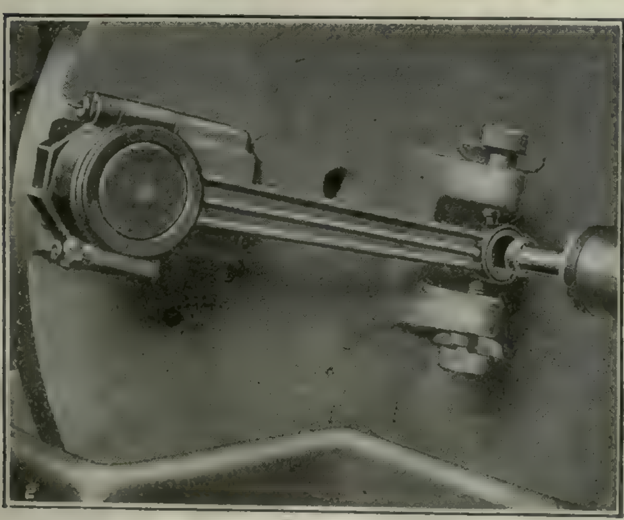
Testing Cylinder Gages—Grinding Bronze Connecting-Rod Bushings—Forming Steering Balls—Grinding Aluminum Transmission Covers

BY FRED H. COLVIN
Editor, *American Machinist*

THE INCREASED use of grinding as a machining method in automobile manufacture is evident in almost every shop one visits. There is also quite a diversity as to the grinding practice, involving wheel speeds, grades of wheels, and similar points. While a wheel surface speed of 6,000 ft. per minute is still considered advisable, there seems to be a tendency in many quarters to reduce this speed to some extent. As one grinding man expressed it, "We talk about 6,000 ft. as a suitable grinding wheel speed. Considering belt slippage and speed variations, however, we are very well satisfied if we get 5,200 ft. in actual practice." In the examples which follow, it will be noted that the wheel speeds vary to some extent, according to the work in hand, as is almost universally the case.

Grinding a Pierce-Arrow cylinder block on a No. 60 Heald machine is shown in Fig. 1. The wheel is 3½ in. in diameter by ¾ in. face, and has a 1¼-in. hole. It is a No. 30 grain and the grade is known as the H-LoTens, by the makers, the Precision Grinding Co. The same wheel is used for both roughing and finishing, the spindle speed being 6,600 r.p.m. The cylinders are bored to allow from 0.015 to 0.018 in. in diameter for grinding. The rough grinding leaves 0.003 in. for finish. The average production is 15 min. for each bore, or 90 min. for the six-cylinder block. This time is from floor to floor, including all handling.

A noticeable feature is the heavy ring gages mounted at *A*, by which the operator tests his inside gages. The ring gages represent the high and low limits. The



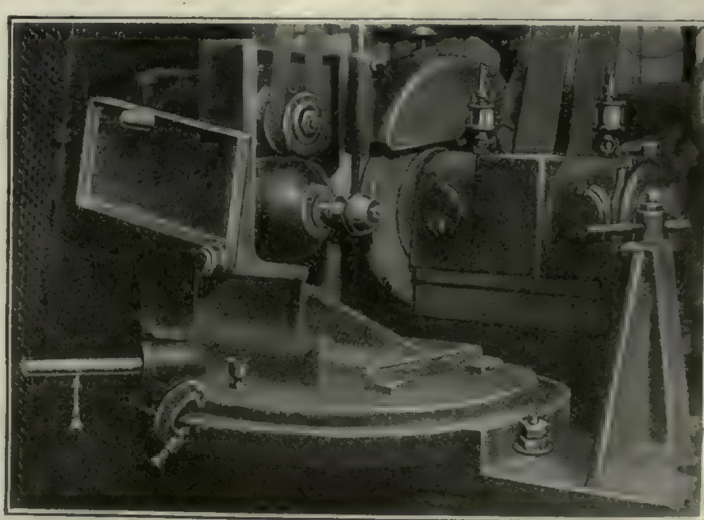


FIG. 2—FIXTURE FOR GRINDING CONNECTING ROD BUSHINGS. FIG. 3—GRINDING STEERING KNUCKLE BALLS

tolerance is 0.0003 in. for both diameter and out of roundness. When the cylinders are inspected, the size of each bore is stamped on the outside of the block as an aid in selecting pistons which shall be just right in every way. This does not mean that the whole dimension is stamped on each cylinder. If the bore is found to be just the nominal size of the cylinder, the block is stamped 0. If it is above or below the nominal size, the exact variation (within the tolerance, of course,) is stamped on the block, with a plus or minus sign before it.

Grinding Bronze Bushings

Another grinding operation is shown in Fig. 2, where the bushing in the small end of the connecting rod is being ground on a Bryant internal grinding machine. The illustration shows very clearly the method of holding the connecting rod. By locating the large end firmly on the pin as shown, and holding the small end lightly between the knurled screws, the hole can be ground not only to the correct center distance from, but also parallel with, the large bearing. Wing lock nuts make it easy to clamp and to release the screws.

The bronze bushing is $1\frac{3}{4}$ in. long and has a hole $1\frac{1}{4}$ in. in diameter. The wheel, an alundum, known as 3,860 K, is 1 in. in diameter with a $\frac{3}{8}$-in. face, and has a $\frac{5}{8}$-in. spindle hole. The production is 15 rods per hour.

Owing to the desire to have a polished surface in the hole, the final finishing is done with a reamer, 0.002 in. being left for this purpose.

Form Grinding a Ball

The method of grinding one of the balls which form part of the steering mechanism is shown in Fig. 3. This work is done with a formed wheel on a Landis machine. The wheel, an American corundum 54-N, is 12 in. in diameter with 1-in. face. In addition to the face of the wheel being concaved, the work table carrying the ball is swung on its central pivot by the handle *A*. The wheel is dressed by a diamond mounted on the work table, so as to be readily swung past the face of the wheel at the correct radius. The wheel speed is 1,800 r.p.m., and the work speed 400 r.p.m. The stock removed is 0.020 in., and tne production is 22 balls per hour.

Still another job, though not illustrated, is grinding the joint face of the aluminum cover for the transmission case. This is done on a Pratt & Whitney vertical-spindle surface grinding machine with a Norton elastic wheel known as No. 46-4. The wheel is of the ring type, 14 in. outside and $10\frac{3}{4}$ in. inside diameter and 4 in. deep. The production is 25 covers per hour.

Unshackle Business

By J. Bainter

It has been said that ours is the most governed and the worst governed nation on earth with the exception of Russia, and possibly of Mexico. The words were spoken with reference to the legislation that hampers our business activities.

The people of our country seem to believe that all big and little defects in our political, social and industrial organizations can be remedied by legislation. The result has been a multitude of laws that are often conflicting and that leave the business man shackled. The type of regulation that he has been subject to is apt to kill his initiative and prevent the proper development of our national resources. As a shining example, the purpose for which the Sherman Anti-Trust Law was made has been perverted. This law was never intended to interfere with private business, although it is now construed in that way.

The details that come up daily in business are so regulated that the business man does not feel free to manage his enterprise in the way in which he would naturally do it. It is not possible for him to be running to a lawyer with details that come up possibly every hour, and yet that is what is required in order to carry on in strict conformity with the law those activities that are necessary in industry and business.

Certainly a law such as the Sherman Law to prevent those things morally wrong in business, particularly with reference to monopolies, is very desirable. But, public opinion was so aroused by the action of the so-called trusts some years ago that it has not yet had the opportunity of cooling off and examining just what sort of co-operation between businesses is beneficial and what is detrimental. There is beginning to crystallize among business men, however, a sentiment that it is hoped will ultimately have an effect on our laws.

The men who control and operate an industry should be more free to care for their interests in the manner that is best for those interests, provided that nothing is done to injure the public. Slowing up the functions of our business eventually must result to the harm of the country. What can be done about it is not now certain, although the first step seems to be to stop promiscuous legislation regarding business and then to relieve business of some shackles now on it.

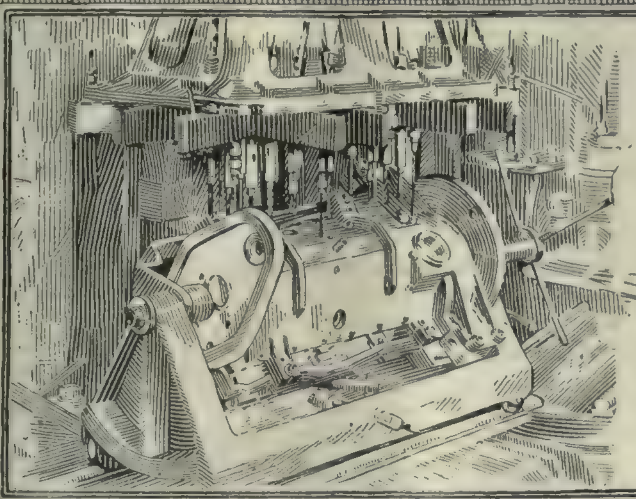
Men Who Make Better Executives

By Frank V. Faulhaber

In selecting employees for promotion in the large machine shop, the man invested with this responsibility may be unduly influenced in his choice by the fact that those he finally picks have shown brilliance in a certain line of work. But, is it wisest to have particular preference for this type of employee? Pay heed to what the superintendent of one large plant has to say on this subject.

"In my many years of experience I have learned that it is not always the best course to place responsibility on the shoulders of what I call the 'special-job men.' The employees I have in mind usually show talent for one line of work and do this very well. I have found that this kind of man does not make the best executive. He is not the man to be chosen because the individual who knows something of the various operations can rightly give better instructions. This being particularly true in the case of the minor operations.

"All due credit to the man who performs one task unusually well. But he is not the man to place in charge of others. It has been found, too, that it is best to keep the man who can do one task well right at his work, for that is his natural bent. His efficiency is otherwise lowered under responsibility. 'Brilliant' men have a tendency to be erratic and that alone is a good reason for selecting for promotion such men as know a little bit of everything and can learn as they go along. In my experience, they have been much more dependable."



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Piercing Dies Concluded—Dies for Formed Work—Multiple Piercing and Perforating Operations—Examples of Dies for Key and Radiator Fin

WHEN work which is to be pierced has been previously drawn or formed, the dies must be constructed so that the work can be located properly and supported so that it will not spring during the operation of piercing. Naturally a great deal depends upon the shape of the work which is to be pierced, but in cases of this kind a nest or seat can be provided in the die into which the work can be fitted. Fig. 486 shows two dies for piercing a piece of formed work. The work *A* shown in the upper example has been formed in a previous operation, and there are eight holes to be pierced in the flange. The construction of the die for this operation is very simple. The shoe *B* has mounted upon it the die *C*, in which the work locates by the outside formed surface in such a way that the flange which is to be pierced lies on the surface of the die.

The punch holder *D* carries eight punches *E*, and these are located and guided in the stripper *F* as shown. The stripper is perfectly held in place by the punches, and its movement is limited by the screw *G*. The required pressure to hold the stripper down is provided through the springs *H*. This example illustrates clearly the action of the stripper plate and punches in connection with a piercing operation of rather simple form. If desired, additional refinement can be obtained by using bushings in the stripper plate.

Another example in the lower part of the illustration shows a die for piercing a hole in the end of the same piece of work. Here the piece is turned over and located on two studs *K* and *L*, which are mounted on a stripper plate *M*. This stripper is so made that it is a sliding fit on the punch *N*, which guides it in its movement up and down. The upper end of the punch locates the work so that as the punch holder *O*, which has the die *P* mounted on it, passes downward, the die *P* strikes against the end of the work and forces the latter down over the punch, thus producing the hole. The pressure pins shown at *R* and *S* are simply used to apply the necessary pressure to support the locating plate. Both of the dies shown in this illustration are used for high production work when progressive operations are performed, yet it may be seen that both operations can be performed simultaneously by making a combination die in which both principles are used at the same time.

When a number of holes are to be pierced in a blank and when these holes are very close together, the method of holding the punches is somewhat different from those which have been previously illustrated. In the example shown at *A* in Fig. 487 there are six oblong slots *B* to

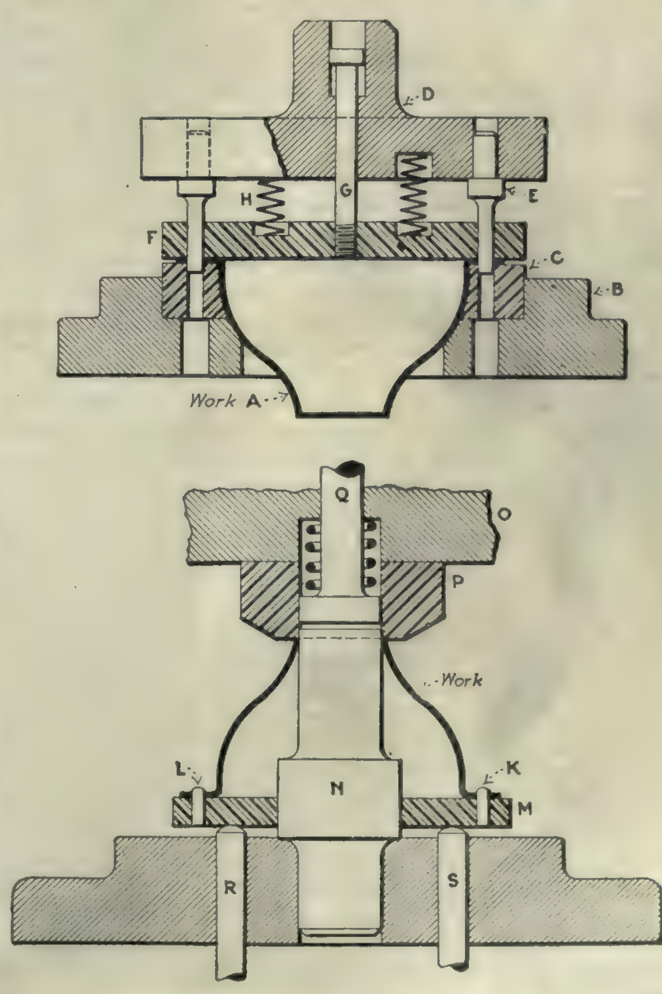


FIG. 486—DIES FOR PIERCING FORMED WORK

be pierced in the strip indicated. One method of holding punches for an operation of this sort is shown at *C*. The piercing punch *D* is held between the plates *E* and *F*, these plates being fitted into a slot *G* in the punch holder *H* and held in place by the pressure of the setscrew at *K*. The construction of the plates *E* and *F* is

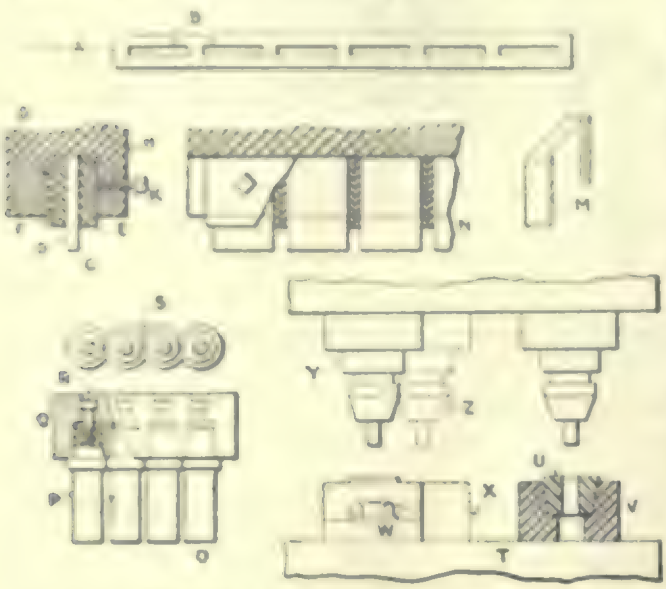


FIG. 487—METHODS OF HOLDING GANG PUNCHES AND ADJUSTABLE PUNCHES AND DIES

clearly shown at *M*, while at *N* is shown the method of setting several of these units in the punch holder.

Round holes which are to be pierced close together may have the punches held in various ways, among which are those shown at *O*. The punches *P* shown here fit into a punch holder *Q* in which they are kept in position by means of the fillister-head screws *R*. The flanges are cut away as shown at *S* to permit the punches to be placed closer together.

Work is occasionally encountered in which the spacing of the holes varies somewhat, yet the piece itself is uniform in size. For cases of this kind it is often satisfactory to design an adjustable punch and die like that shown at *T*. The die *U* is held in a holder *V* which is fastened to the die shoe by means of screws *W*. This unit is so arranged that it can be moved in either direction, as shown by the dotted lines at *X*. The same method of adjustment is applied to the punch and punch holder *Y*, so that it can be set in one direction or the other as indicated at *Z* by the dotted lines.

Perforating Cylindrical Work

Several examples to illustrate the methods of punching various forms of work are shown in Fig. 488. In the example at *A* the work is a silver plate which is to be perforated in order to make a border as indicated at *B*. In punching work of this sort the plate is mounted on an indexing fixture and a section of the border as shown at *B* is punched at each index. At each stroke of the press the indexing mechanism operates so that the plate is turned around and positioned for the next operation. The turning of the work may be done by hand, or it may be operated automatically so that each stroke of the press indexes it. This arrangement would be dependent upon the nature of the work and the number of pieces to be produced. A simple method of indexing can readily be devised for the purpose.

Another example of a piece of work which requires an indexing operation is shown at *C*. This work is an armature disk and the slots to be cut are oblong in shape. When the arrangement of these slots is such that they can be cut in one operation the work is very often done in this manner, although in some cases it is found necessary to punch one or two slots at a time and index the work accordingly. In the example shown the slot *D* is pierced and the work is revolved so that the slot *E* comes under the punch, and the subsequent slots are punched in like manner. The indexing can be done automatically by each stroke of the press or by hand as may be required.

There are special presses on the market for work of this kind so arranged that they can be adjusted to take a considerable range of work within their capacity. When machines of this type are used it is necessary to make up suitable dies and an arbor on which the work can be located. Adjustments are provided so that the center of the arbor can be varied in relation to the ram of the press, thus making it possible to punch work of different diameters without difficulty. The indexing operation is automatically performed at each stroke of the press.

In perforating a cylindrical or formed shape of work like that shown at *F* the method of piercing and the construction of the die are somewhat different from standard practice. The work is slipped over an arbor or a mandrel *G* on which it is free to turn. There is some provision made usually for turning the work, and in the case shown there is a square hole in the end in which the plug locates and turns the work after each

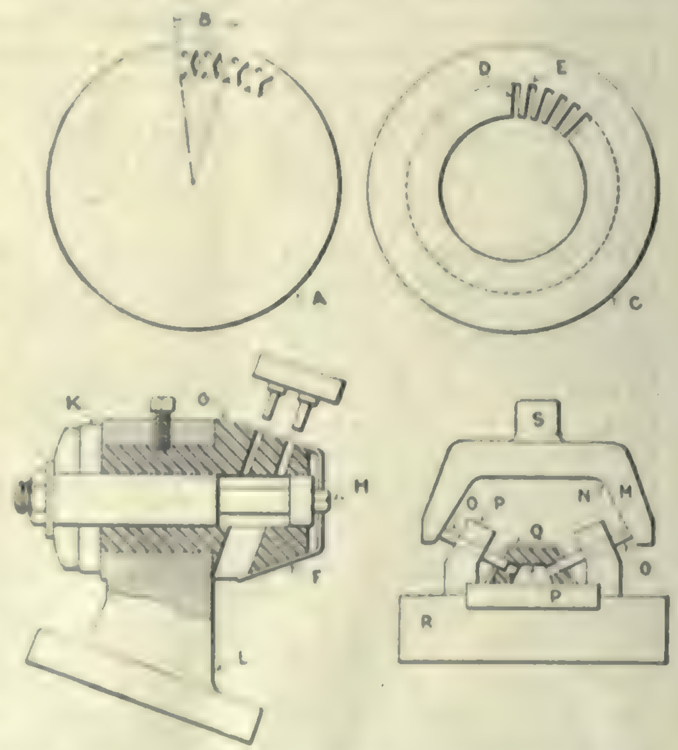


FIG. 488—PIERCING OPERATIONS REQUIRING INDEXING

stroke of the press, by means of the ratchet *K*. The base of the fixture *L* is of cast-iron construction and the illustration clearly shows the operation.

It may be necessary occasionally to provide some means for holding the work on the die so that it will not slip off during the indexing operation. Such an arrange-

ment can easily be made, but it is dependent naturally upon the shape of the work to be punched. There are cases when it is possible to pierce a number of holes in a piece of work with one movement of the punch, but this is not always advisable and a great deal depends upon the nature of the work and the accuracy required.

The punch shown at *M* has an angular face *N*. The punch is made of steel and finished to the angular shape indicated. It is possible on very large work to make a holder of cast iron in which a steel piece of the required shape is inserted. The work *Q* is held on the die as shown, the latter being mounted in the shoe *R*. The punches *O* are located in accordance with the requirements of the holes on the rim of the work, and as the member *M* moves downward the punches are forced in through the sides of the piece, thus completing the operation. Suitable springs can be provided to return the punches to their original position after the piercing operation has taken place. The punch *M* is held in the usual manner by a shank *S* in the ram of the press. All wearing parts in a die of this sort must be very carefully fitted if accurate work is to be obtained. The thickness of the metal limits the use of this die, and it is only possible to utilize an arrangement of this sort on thin stock.

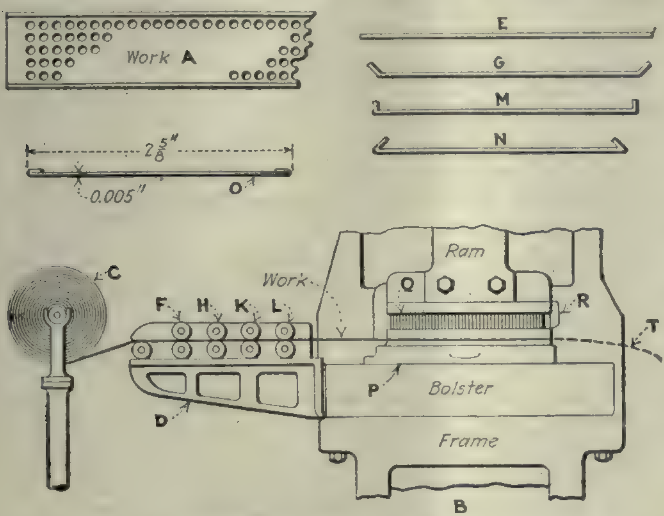


FIG. 489—PIERCING TOOLS FOR RADIATOR FIN

In Fig. 489 is shown in diagrammatic form the method of piercing a radiator fin. The work shown at *A* is made from 0.005 in. thick brass ribbon stock and there are 95 holes punched in it. The width of the finished work is $2\frac{5}{8}$ in., while the length is 19 in. It is necessary to turn over or bead the end of the fin, and the die shown combines this operation with the piercing work and at the same time cuts off the piece to size. The diagram *B* shows the general arrangement of this die. The ribbon stock *C* is held on a reel as shown, and from this it is fed through a series of rolls which are mounted on a bracket *D* of special design, attached to the bolster plate of the press. The appearance of the stock before passing through the rolls is shown at *E*, and after passing between the rolls *F* the two ends are turned up at a 45 deg. angle as indicated at *G*. After this, a continuation of the feeding movement carries the work through the rolls *H*, *K* and *L*, which successively form the material into the shapes shown at *M*, *N* and *O*. In the last roll the shaping is completely finished and the bead turned over, while the stock is reduced to the required width of $2\frac{5}{8}$ in. at the same time.

As the stock continues to move forward it passes over the die *P*, so that it is pierced by the punches at *Q*. The cut-off plate *R* is mounted on the punchholder so that it shears the previously pierced piece of work. The method of feeding the stock through the machine is by an automatic friction feeding device which is not shown in the illustration. In this example the stock moves very rapidly and the production is approximately 90 pieces per minute. The finished work drops off the machine after it has been cut off, as indicated by the dotted line at *T*. A suitable box can be attached to the press in such a way that the work will pile up in it and be ready for any further operation. This is an excellent example of modern piercing die construction.

Among the blanking dies described in a previous article we gave an example of a die for blanking a key and the general method of manufacture was also described. After the blanking is finished the piercing operation is to be done, and Fig. 490 illustrates the dies used for this piercing operation. The construction of

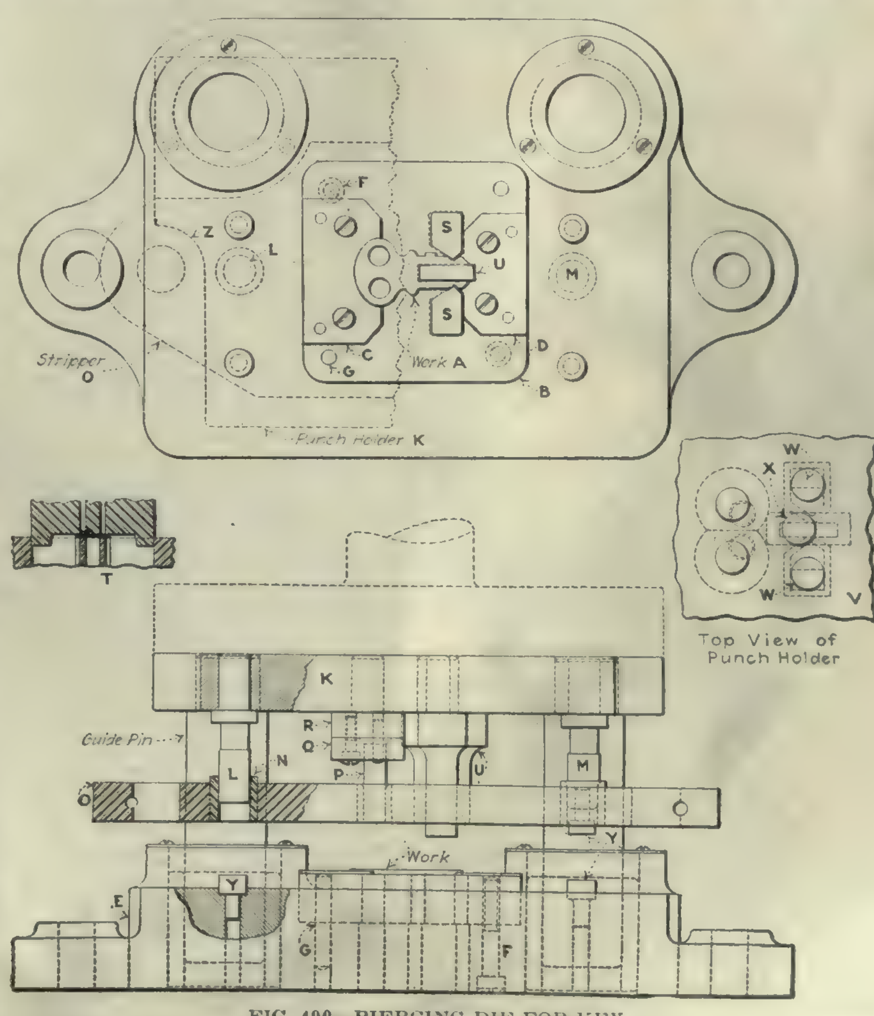


FIG. 490—PIERCING DIE FOR KEY

this die can be very readily understood from the illustration, and several points will be noted in the design which have been spoken of. The work shown at *A* is located on a die block *B* and nested at one end by the set edge *C* and at the other end by the set edge *D*. Button dies cannot be used in this particular case because the holes are too close together. The die block is mounted in a die shoe *E* and held in place by the screws *F*. Location is obtained by means of dowels shown at *G*.

This punch and die are of the sub-press or pillar type and a cam stripper like that previously described is used. The punch holder *K* has two stripper guide pins *L* and *M* which fit into the bushings *N* mounted in the cam stripper *O*. The punches *P* which pierce the two holes are of wire-punch construction, being held by the plate *Q* and holder *R* as indicated. The two punches *S* used for notching the end of the key are backed up in the die block by means of a "heel" which enters the die before the notching operation takes place. The importance of this point has been shown in a previous illustration. The view at *T* shows the construction of the punches more clearly, and illustrates the principle by showing the heel just entering the die block and the notching portion of the punches striking the work. The punch shown at *U* is used for cutting the slot at the center of the key.

Method of Holding Punches and Provisions for Grinding Punches and Dies

At *V* a top view is shown of the punch holder to bring out the general arrangement of holding the punches. The two wire punches used for the holes at one end of the key are off center from the hole. This is often done when holes are close together. The two punches for notching are held in the holder by means of the shank *W* and the punch for the elongated slot is also held by the shank shown at *X*. All these punches are made with flanges, and portions of the flanges are cut away so that the punches interlock each other, thus eliminating the use of locating pins.

One of the features in this die which has not been previously mentioned is the use of leveling studs *Y*, which are mounted on the cam stripper and the die block. The purpose of these leveling studs is to bring up the cam stripper on the downward stroke, so that as the punches descend through it they will be rigidly supported without any chance for them to become forced out of alignment. When the dies become worn so that it is necessary to regrind them the top of the leveling studs must also be reground, and as the studs and die blocks are of the same height it is very easy to place them all on the grinding machine and grind both parts at the same time.

When the punches are to be ground it is unnecessary to grind the leveling studs, as the amount of adjustment necessary to compensate for the stock ground from the punches can be very easily made in the press. The outline of the punch holder in the plan view shows a portion of it cut away at *Z*, which is done to provide ample clearance for the pins which hold the cam stripper. Both cam stripper and punch holder in this view are shown by dotted lines.

It has been our endeavor in this article on piercing dies to illustrate fundamental principles and show graphically the various points of importance in connection with their design.

Ventilation

The report of the New York Commissions on Ventilation, to be published by E. P. Dutton & Co., Jan. 1, 1923, will be in two parts in one volume. The first part will deal with the physiological aspects of ventilation with a review of historical developments in physiological influences of ventilation. The preliminary experiments were conducted in a specially designed laboratory and covered a period extending from December, 1913 to January, 1916 and used 113 persons as subjects.

The second part will deal with the mechanical phases of ventilation, data for which were obtained from work in the period extending from 1915 to early in 1917. Included is a review of historical developments in ventilation and a report on different methods of ventilation of school rooms.

Among the subjects covered are: Effects of overheating, carbon dioxide, exposure to drafts, dry air at moderate temperatures, rooms ventilated by windows supplemented by exhaust flues, fans supplemented by exhaust flues, fans (both supply and exhaust), using the same air over again after re-conditioning, studies of different types of ventilation in schools.

The following is an abstract of the conclusions:

Physical and chemical characterization of air affect health and efficiency, but physical condition of air, particularly as it relates to its temperature, is the factor of prime importance. Moderate and high temperatures (75 and 86 degrees) combined with high humidities, tend to interfere with the normal function of heat loss which gives rise to discomfort. A high moisture content of the air, especially when the air is warm, mitigates against heat loss through the evaporation of water from the skin. A high humidity will therefore reinforce the harmful action of a high temperature.

Vitiated Air To Be Avoided

As compared with fresh air at the same temperature, vitiated air reduced the performance of physical work. The second and more important effect was on the appetite for food. The appetite was found to be measurably and definitely decreased as a result of breathing stale air. The primary essential for good ventilation is the maintenance of a proper air temperature of 68 degrees or below, but without the production of chilling drafts. At the same time, there should be an air change sufficient to avoid the accumulation of odoriferous or other substances arising from human occupancy. The use of windows for ventilating purposes without a suitable means of exhaust for the vitiated air was found wholly impractical. The ventilation of the schoolroom by the use of window inlets and gravity exhaust gave much more satisfactory results. Ventilation by the use of fans and gravity exhaust was found to give better results than any form of window ventilation insofar as the aeration of the room was concerned.

The commission points out that the nature and environment of the enclosure to be ventilated dictate the method of ventilation to be used, and that what is adequate for one type of building may be inadequate for another. Theatres and auditoria, for example, must generally rely on fan systems. Window ventilation would prove inadequate for a school which is overcrowded.

The report states, finally, that the avoidance of overheating is the primary essential of all systems of ventilation and that the most important article of ventilation equipment is the thermometer.

TABLE XII

Switzerland—Imports of Machinery for Working Metal, Wood, Stone, etc.

Country	1909 Quantity q.n.	1909 Value Francs	1910 Quantity q.n.	1910 Value Francs	1911 Quantity q.n.	1911 Value Francs	1912 Quantity q.n.	1912 Value Francs	1913 Quantity q.n.	1913 Value Francs	1914 Quantity q.n.	1914 Value Francs	1915 Quantity q.n.	1915 Value Francs
Germany	27,787	3,708,838	27,825	4,148,354	32,413	4,588,790	35,427	5,116,763	32,834	4,779,723	20,862	3,051,229	8,313	1,259,276
Austria-Hungary	525	57,746	188	19,310	219	22,519	207	27,426	154	18,839	134	18,742	58	5,515
France	587	104,289	871	149,774	1,463	206,408	1,378	265,326	1,097	206,959	2,100	318,928	918	135,166
Italy	258	55,416	208	36,382	257	35,395	171	27,234	125	11,103	39	7,478	41	7,465
Belgium	503	81,223	153	15,825	215	37,950	153	27,460	342	32,170	174	20,272	280	17,630
Netherlands	8	1,040	1	300	44	10,090	2	660	10	2,683	......	....	17	3,744
Great Britain	785	144,007	780	211,496	845	152,261	1,052	201,311	962	245,644	536	111,247	130	34,452
Sweden	88	15,304	22	3,615	186	40,317	190	48,464	54	11,705	96	20,730	10	1,900
Denmark	1	94	......	....	7	1,500	6	1,200	.....	....	38	3,970	......	....
United States of America	1,797	460,858	1,901	479,495	2,450	674,832	4,942	1,218,331	3,092	895,388	2,319	572,486	1,969	631,060
All other countries	......	100	......	25	......	300	4	380	......	....	1	90	2	350
Total	32,339	4,628,915	31,949	5,064,576	38,099	5,770,362	43,532	6,934,555	38,670	6,204,214	26,299	4,125,172	11,738	2,096,558

Country	1916 Quantity q.n.	1916 Value Francs	1917 Quantity q.n.	1917 Value Francs	1918 Quantity q.n.	1918 Value Francs	1919 Quantity q.n.	1919 Value Francs	1920 Quantity q.n.	1920 Value Francs	1921 Quantity q.n.	1921 Value Francs
Germany	19,656	2,958,467	7,999	1,580,130	7,370	1,780,703	54,022	12,336,733	105,457	19,300,232	38,563	7,295,000
Austria-Hungary	218	23,530	51	15,472	......	....	1,059	141,874	686	139,556	922	151,000
France	2,235	470,330	516	199,207	65	47,085	538	200,062	1,272	502,207	932	302,000
Italy	20	6,795	18	7,000	......	....	71	11,420	298	56,740	123	57,000
Belgium	20	1,600	26	5,212	......	....	110	26,550	243	75,274	22	11,000
Netherlands	3	533	......	....	......	....	1	1,000	17	21,245	17	2,000
Great Britain	176	47,141	488	209,013	314	78,210	94	77,317	616	354,966	426	140,000
Sweden	64	15,270	69	38,552	199	137,626	466	253,535	175	62,266	......	....
Denmark	......	....	292	129,275	......	....	9	2,000	4	1,180	......	....
United States of America	4,093	1,465,188	8,447	4,052,082	3,669	1,807,383	3,852	2,074,362	3,080	1,750,717	657	305,000
Czecho-Slovakia	......	....	.....	....	......	....	......	....	19	1,489	44	4,000
All other countries	......	....	3	482	......	....	......	....	7	2,000	15	3,000
Total	26,485	4,988,854	17,909	6,236,425	11,617	3,851,007	60,222	15,124,853	111,874	22,267,872	41,721	8,270,000

Value of Franc at parity is 19.30c
q.n. = net quintals or 109 kilograme = 220.46 lb.

TABLE XIII

Chile—Imports of Machine Lathes

"Tornos Mecanicos, Varios"

Country of Origin	1912 Quantity Number	1912 Value Pesos	1913 Quantity Kilos	1913 Value Pesos	1914 Quantity Kilos	1914 Value Pesos	1915 Quantity Kilos	1915 Value Pesos	1916 Quantity Kilos	1916 Value Pesos	1917 Quantity Kilos	1917 Value Pesos	1918 Quantity Kilos	1918 Value Pesos	1919 Quantity Kilos	1919 Value Pesos	1920 Quantity Kilos	1920 Value Pesos
Great Britain	6	3,811	26,360	10,544	9,585	3,834	930	372	1,770	750	1,513	1,807	392	300	5,689	7,512	51,390	80,989
Germany	3	1,309	26,230	10,492	5,155	2,062	......	......	......	......	......	......	......	......	......	......	6,002	7,593
United States of America	4	1,609	5,450	2,180	7,280	2,912	5,350	2,140	4,208	6,396	68,071	111,556	79,014	157,571	36,349	84,387	65,174	84,566
France	......	......	225	90	40	16	......	......	......	......	97	362	......	......	......	......	2,224	4,201
Belgium	......	......	370	148	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Argentine Republic	......	......	......	......	165	66	......	......	......	......	119	174	10,897	30,727	......	......	100	686
Italy	......	......	......	......	......	......	735	294	......	......	......	......	......	......	......	......	1,400	9,710
Total of Imports	13	6,729	58,635	23,454	22,225	8,890	7,015	2,806	5,978	7,146	69,800	113,899	90,303	188,598	42,038	91,899	126,200	187,745

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Power Required for Shearing Machines

By John S. Watts

The formula given in most textbooks for determining the horsepower required to operate a shearing machine is obtained as follows: First, to determine the force required to shear the maximum size of bar, multiply the sectional area of the bar by its ultimate stress per square inch in shear. For instance, to shear a 4-in. square bar of soft steel having a shearing stress of 50,000 lb. per square inch, will require 50,000 $\times$ 16 = 800,000 lb. This force is assumed to act through a distance equal to the height of the bar, which in this case will be 4 in. or one-third of a foot; and the work performed each stroke will be 800,000 $\times \frac{1}{3}$ = 266,667 ft.-lb. At twenty strokes per minute the horsepower needed is

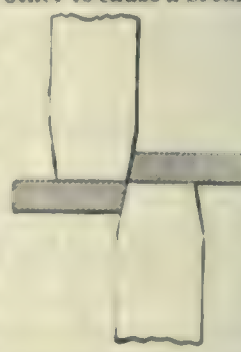
$$HP = \frac{266{,}667 \times 20}{33{,}000} = 162.$$

Experience with actual machines shows that this horsepower is very much in excess of that actually used, a 30-hp. motor being quite capable of running the above-mentioned size of machine, which proves that the calculations are incorrect or are based upon erroneous assumptions. Going over the calculations again, we find that there are only two of the factors which can be incorrect, namely, the shearing stress, and the assumption that the full shearing force has to be exerted through a distance equal to the height of the bar. The shearing strength of soft steel, which is taken at 50,000 lb. per square inch, does not in actual practice vary much from this figure. Therefore, it is clear that the error does not lie with this factor, but that we must look for it in the other one.

Consideration of the action of the shear knives shows us that the shearing force cannot but decrease as the knives cut through the bar; and observation of the shearing of large bars proves that the bar is actually sheared completely off long before the moving knife has traveled to the lower edge of the bar. Unfortunately, the forces exerted in shearing are so high and fluctuate with such rapidity during the stroke that it is impossible to devise any means of accurate measurement of them on an actual machine, and we have to depend upon what information we can gather from analysis of the action of the bar being cut.

Let us see what data we can assemble from such a study. If the shear blades were infinitely thin, and cut off the steel by cutting through it, as we would cut off a slice of bread from a loaf, the amount of force needed would be only that required to force the knife into the bar; but this force would be constant until the knife had passed through the bar. On the contrary, the knives have to be of appreciable thickness to stand up to the work; and if it were not for the bar deforming under the pressure, it would be sheared off completely very soon after the knife had come in contact with the upper side of the bar. That is, if the bar did not become deformed before being completely sheared, the force required would be equal to the area of the bar multiplied by its shearing strength; but this force would be exerted only momentarily, and not for the whole depth of the bar.

Anyone who has seen high-carbon steel being sheared will have noticed that the piece being sheared off flies off almost as soon as the knife touches it, with a sound like that from a cannon being fired. What actually occurs is that the knife first compresses or deforms the bar, until the compression has reached a point where further deformation would require a force greater than that needed to shear the bar. At this stage shearing commences and is continued until the molecules of steel are torn apart, or forced past each other to cause a break.



KNIVES FINISHING SHEARING CUT

The textbooks to the contrary notwithstanding, it needs no more than a look at a bar which has been sheared, to know that the actual shearing has been done in a small fraction of the stroke. For any resistance to shear to last while the knife travels the full depth of the bar, would mean that there was still cohesion between the two sections of the bar when the sheared bar was as shown in the sketch herewith, which is absurd. For the whole shearing force to be required during the full travel of the knife past the bar, as assumed by the textbooks, would require us to believe that the whole sectional area of the bar being sheared still retained its full shearing strength when the knife was in the position shown, which is still more absurd.

It is common practice among those familiar through experience with shearing machines to assume that the full shearing force lasts during a distance of one-half the thickness of the material being sheared. While this may be approximately correct for thin material, it is obviously not so for bars, say, 4 in. thick, as the bar is sheared off long before the knife has passed 2 in. into it. From observation and experiment I find that in shearing or punching soft steel, there is first a certain amount of deformation takes place, which under like conditions varies about as the thickness of the material being sheared. By amount of deformation I mean the distance traveled by the knife from its first contact with the bar until it actually begins to cut. This travel is, of course, greater when cutting large square bars with plain knives, than it will be if the knives are notched to fit the bar. The actual shearing after deformation is completed is done practically instantaneously.

The amount of this deformation can be measured on the sheared bars and is found to be approximately

one-quarter of the height. The force required to produce this deformation is necessarily less than would be needed to shear the piece, but is probably not much below it, and the error will be on the safe side if we assume it to be equal to the shearing stress. The conclusion arrived at is that in the formula for the horsepower given in the beginning of this article we should use one-quarter of the thickness of the bar in feet, instead of the whole thickness, and it will be found that the horsepower so calculated will agree quite closely with that commonly used.

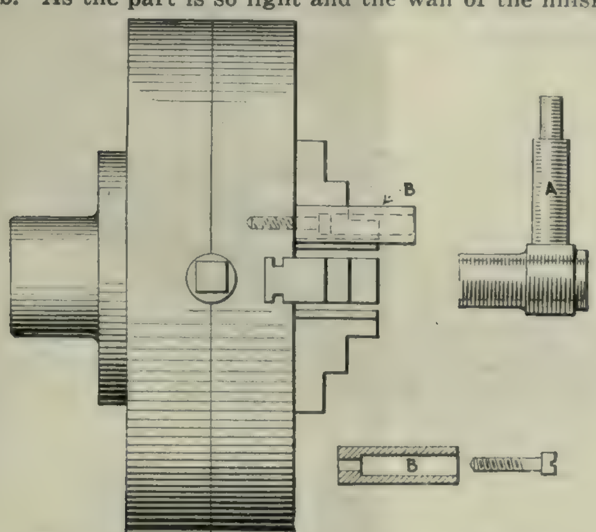
To the horsepower so calculated must be added sufficient to cover the power required to overcome the friction of the machine running idle. This power does not appear to vary in proportion to the capacity of the machine, being very little more for a large machine than it is for a small one, but differing more with the different types of machines. This can be best determined from measurement of the power consumption of a similar machine, but may be taken as around 3 hp. on small machines and up to 5 hp. on the larger ones.

When used for punching there is additional power required in stripping, that is, for pulling the punch out of the hole after punching. This averages about one-half of the power required to punch the hole, if the punches and dies are sharp and in good alignment; if in bad condition the stripping may consume as much power as the punching.

A Lathe Kink

By Walter Kaufman

A simple expedient for driving a piece of work that was difficult to hold is shown in the accompanying sketch. The part A, to be machined, is of brass and requires a hole to be drilled and reamed through the hub. As the part is so light and the wall of the finished



DRIVING STUD ATTACHED TO LATHE CHUCK

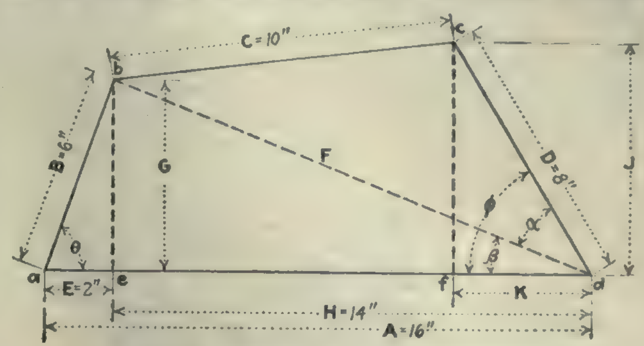
hub so thin, it was impossible to grip it with sufficient force to prevent slippage without distorting it.

To overcome the trouble we drilled out a piece of round cold rolled steel as shown at B and attached it to the face of the chuck by tapping a small hole in the latter between two of the jaws. This "stud" now protrudes beyond the chuck jaws and the arm of the work lies against it, thus furnishing the driving power while the chuck jaws have only to hold the work central.

An Interesting Shop Problem

By H. W. Hardy

Four shafts were to be spaced with their centers at a, b, c and d, as shown in the accompanying illustration. The distances B, C, D, E and A were given, and the distances G and J had to be found. By joining the centers bd, the two triangles abd and bcd are formed, and by dropping perpendiculars from b and c cutting



AN INTERESTING SHOP PROBLEM

the line ad at e and f, three more triangles, abe, bde and cdf are formed. These triangles may be solved by trigonometry for any side or angle.

From the triangle abe we get

$$\frac{E}{B} = \cos\theta \tag{1}$$

$$G = B\sin\theta. \tag{2}$$

From the triangle bde we get

$$\operatorname{Tan}\beta = \frac{H}{G}. \tag{3}$$

From the triangle abd, by using the well-known formula

$$C = \sqrt{a^2 + b^2 - 2ba\cos C},$$

we get $$F = \sqrt{B^2 + A^2 - 2BA\cos\theta}.$$

From (1),

$$\cos\theta = \frac{E}{B}$$

and $$F = \sqrt{B^2 + A^2 - 2EA}. \tag{4}$$

From the triangle bcd, we get, by employing the formula

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}.$$

$$\cos\alpha = \frac{D^2 + F^2 - C^2}{2DF}.$$

Substituting the value for F from (4) we get

$$\operatorname{Cos}\alpha = \frac{D^2 + B^2 + A^2 - 2EA - C^2}{2D\sqrt{B^2 + A^2 - 2EA}}. \tag{5}$$

From the triangle cdf we get

$$\phi = \beta + \alpha \tag{6}$$

$$\frac{K}{D} = \cos\phi;\ K = D\cos\phi \tag{7}$$

$$\frac{J}{D} = \sin\phi;\ J = D\sin\phi \tag{8}$$

Substituting the values given for A, B, C, D and E in the formulas, we get

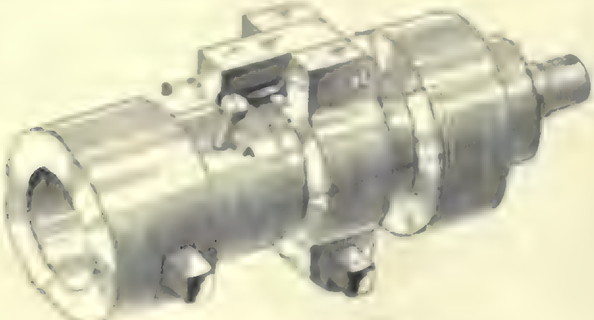
From (1) θ = 70 deg., 32 min.
From (2) G = 5.65698 in.
From (3) β = 22 deg.
From (5) α = 37 deg., 22 min.
From (6) ϕ = 59 deg., 22 min.
From (7) K = 4.07633 in.
From (8) J = 6.88352 inches.

Holding a Drill Chuck in the Tail Spindle of a Lathe

By W. H. Storey

On page 238 of the *American Machinist*, Charles Kaufmann describes a method of preventing a drill chuck from slipping in the tail spindle of the lathe. At the end of his article he cautions the reader to make the head of the clamping screw of the driving ring the same size as the head of the toolpost screw.

It will be obvious from that caution and also from his illustration that the device has to be removed often: i.e. removed each time a tool other than the chuck is used. It would seem to me that the driving ring would



HOLDING A CHUCK IN LATHE SPINDLE

have to be made much wider than he shows it if it is to have a greater driving effect than the long taper shank of the drill chuck.

In the accompanying illustration the writer shows a chuck driver which need never be removed from the tail spindle because the driving tail swings away to the back of the machine. It will be obvious that this device can be operated in a fraction of the time required to pick up a key and loosen a screw and remove a collar. The driving tail is kept in driving position by the T-headed pin *A* which fits in the slots *B* in the tail whilst the chuck is in use. Two slots are provided so that tools with either right or left hand cutting edges can be held.

Valve Grinding—Continuous or Reciprocating

By H. R. Fowler

A discussion recently arose in the shop as to the best method of "grinding in" valves, particularly referring to fairly good sized steam governor valves, which were being ground in by hand. The man was following the traditional way of grinding, which our grandfathers probably used—a reciprocating motion of the valve *less than a full turn*, a certain number of times, which varied at the fancy of the man—lift the valve clear of the seat—revolve a quarter turn—replace on seat and repeat.

What is the theory of these motions? Do we lift the valve clear of the seat, for any reason except to allow the abrasive to get between the surfaces again? And if that is so, why the reciprocating motion—why not keep the valve revolving in a continuous direction, and possibly get just as good a seat, in less time, provided the valve was lifted from the seat for an instant, every 3 or 4 revolutions?

A certain valve shop has a whole battery of "grasshopper" machines, imitating the old hand method of grinding in seats of globe valves. To be sure the seats are right, but that does not necessarily prove that it is the quickest and best way.

Some of the automobile companies in their instruction books, recommend that in regrinding valves the old conventional way be followed. The continuously revolving way is certainly easier, if done right, than the other way. I've tried it, and would like to hear some one else's opinion on the subject.

[The theory is that by the latter method you correct any "out-of-roundness" in a valve or its seat or both. With valves and seats which are really round, as we now produce them, there seems to be little doubt as to the continuous grinding being just as satisfactory. Editor.]

Holding a Drill on the Center

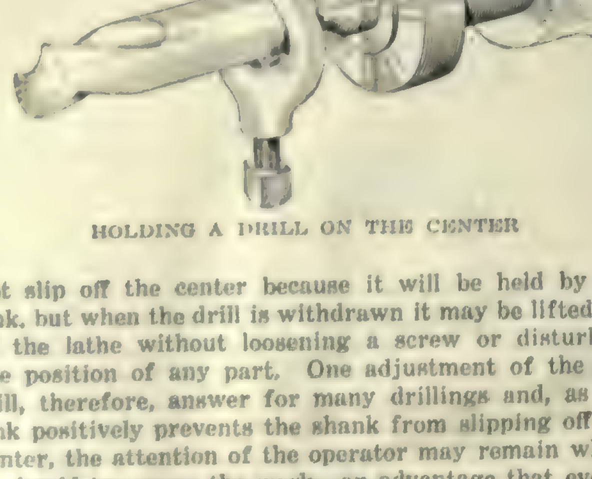
By Harry Moore

A drill hold-back that works very well and does not cost much to make is shown in the accompanying illustration.

The principal part is the collar, which should be fitted nicely upon the end of the tail spindle where it is held by the long screw. A pad or shoe of brass should be placed under the screw to avoid marring the surface of the spindle. The body of the screw acts as the stop against which the tail of the dog rests when the drill is at work.

Slip a lathe dog loosely upon the shank of the drill and put the latter in the lathe with the point against the work and the shank end upon the tail center. Place a link or washer over the body of the long screw and allow it to encircle the tail of the dog also; then move the dog along the drill shank until the "slack" is all taken up and then tighten the dog screw.

As long as the drill is in the work the shank can-



HOLDING A DRILL ON THE CENTER

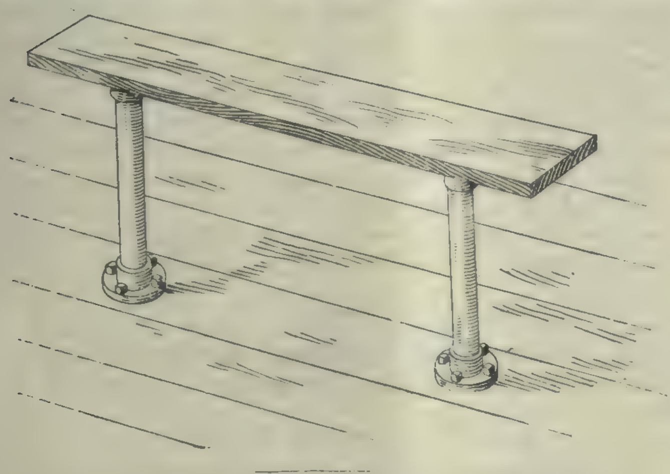
not slip off the center because it will be held by the link, but when the drill is withdrawn it may be lifted out of the lathe without loosening a screw or disturbing the position of any part. One adjustment of the dog will, therefore, answer for many drillings and, as the link positively prevents the shank from slipping off the center, the attention of the operator may remain where it should be—upon the work—an advantage that even a highly skilled man will appreciate.

A Convenient Bench for the Repair Shop

By G. A. Luers

The bench illustrated by the sketch is of a convenient type for the repair shop and is suitable for the heaviest driving and fitting work. It is compact enough not to encroach unduly upon the floor space and it embodies simplicity of construction along with dependable rigidity. Two 3-ft. lengths of 4-in. pipe with flanges at each end form the footing for a 2-in. oak top 14 in. wide and 7 ft. long.

A local shop specializing in the repair and maintenance of heavy trucks uses this type of bench for handling truck parts. Some of these benches are fitted with vises while others are fitted with straightening clamps and gear pullers. The main advantage is that the bench withstands a considerable amount of pounding and driving. The renewal of the top in the event of its breaking is only a matter of obtaining a ready cut section from the nearest lumber yard.

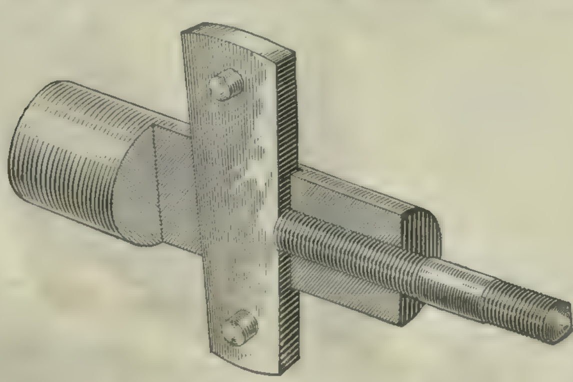


A BENCH FOR THE CENTER OF THE SHOP FLOOR
PORTABLE BENCH MADE FROM SHEET METAL AND PIPE

A Quick Acting Stud Driver

By Lee Jackson

Some machine shop operations have not changed in a good many years. At least, not in some shops. For instance: for the last twenty years I have seen studs inserted with just one kind of a driver. That was a piece of hexagon stock with one end tapped to receive the stud, and the other to receive the locking set screw. This driver was placed on a stud and used as a wrench grip to screw it in place, then it usually required two wrenches to remove the driver from the stud.



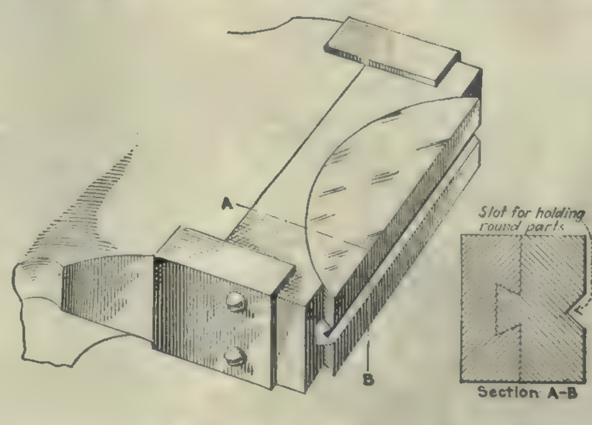
QUICK ACTING STUD DRIVER

But, the other day I saw what to me was a brand new idea in a stud driver. It was made from a piece of round steel about 15 in. long and had a smaller piece of round steel about a foot long through the upper end for a handle. In this respect it resembled a socket wrench. The lower end was tapped to fit a stud and a wedge of hardened steel inset in a rectangular hole through the driver so it would slide endwise freely was used as a lock. But it worked as smoothly as a worn out file. Studs were inserted about as fast as nuts are ordinarily put on as no time was lost in removing the driver. When a stud was tight a tap on the small end of the wedge loosened the driver and the tool was spun off. The accompanying sketch shows the business end of the driver. The shank and handle you can provide to suit your needs.

Self-Aligning Vise Jaw

By G. A. Luers

While the ordinary bench vise is an admirable all-round tool for holding most of the work that comes to it, there are times when tapered keys, shafts or other parts (the opposite sides of which are not parallel) are to be worked upon and then the vise is useless without cobbling it up with loose pieces to make up for the inequality. Machinists who have tried to hold such work in the vise and fervently wished for three hands with which to accomplish the job will appreciate the advantage of the simple auxiliary jaw shown in the appended sketch.



AUXILIARY VISE JAW FOR HOLDING TAPERS

A block of suitable material is clamped to the faceplate of a lathe, the inner face bored to a large radius, and a dovetail groove machined in it. Another block of steel is then so clamped to the faceplate that when turned its convex surface and the tang to fit the groove machined upon its radii will match those of the first block. The flat surface of thesecond block ma be checked if desired to match the face of the movable jaw of the vise, and a V-groove should be planed along it, as shown, to facilitate the holding of round tapered work.

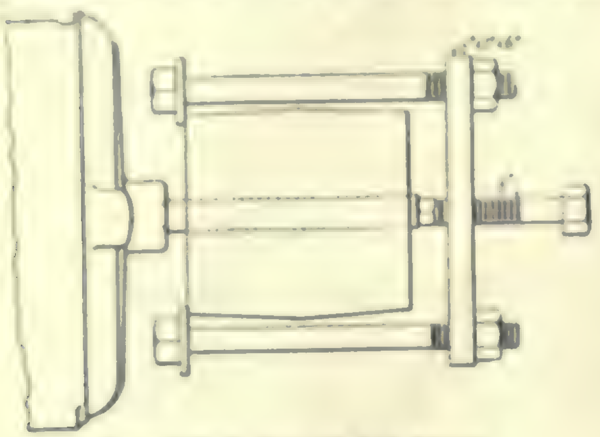
The end pieces to retain the device in position may be made of heavy sheet metal and fastened to the block with countersunk head screws. This little appliance has saved no end of trouble and is one that can be made up in any shop, on account of its simplicity.

Puller for Small Motor Pulleys

By Waller L. Kaufmann

We have several one-quarter horsepower motors in our shops which have small cast-iron pulleys, about 3 in. in diameter. When repairing one of these motors the other day I found the pulley had been put on very tight, and not having a puller I made the little device shown in the sketch in a very few minutes.

I took a piece of steel about $\frac{1}{2}$ in. x 1 in. in section and



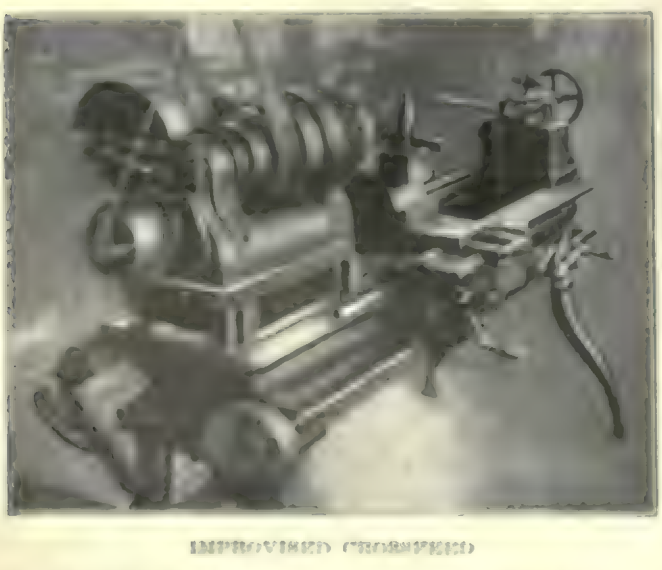
IMPROVISED PULLER FOR SMALL MOTOR PULLEYS

about 5 in. or 6 in. long, and drilled two $\frac{1}{4}$-in. holes far enough apart to span the pulley. I then drilled and tapped a hole between these two for a $\frac{1}{2}$ or $\frac{3}{8}$-in. cap screw. Then by putting two $\frac{1}{4}$-in. bolts in the two outside holes, as shown in the sketch, with washers to hook under the edges of the pulley, it was pulled off quickly and easily. A nut was put between the armature shaft and the cap screw so the center would not be spoiled.

Power Crossfeed for Old Lathe

By William Clancy

The illustration shows an old lathe, resurrected for use in a small garage, that has been fitted with a power



IMPROVISED CROSSFEED

cross feed to enable the garage man to attend to other jobs while the lathe is taking a facing cut.

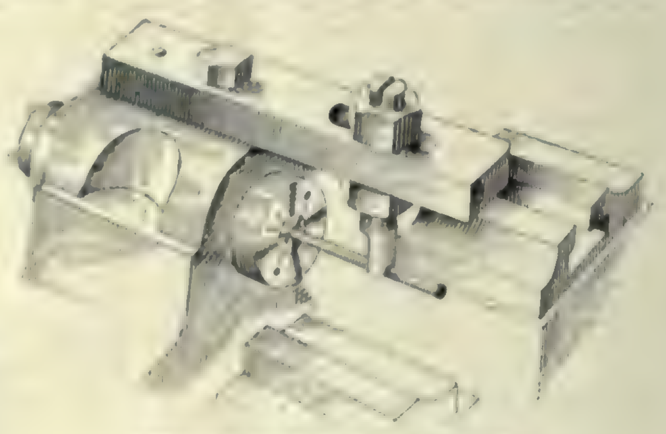
All of the parts used except the chain either came out of the scrap or were parts of the lathe. The bushing through which the crossfeed screw passes was shortened to expose a sufficient length of the screw to allow for keying on one of the change gears and also to make room for the ratchet lever, which is a piece of cold rolled sheet steel, bent to the desired shape.

The end of the ratchet lever is slotted to allow a link of the chain to slip in sidewise, and the effective length of the chain may thus be increased or shortened to meet requirements. Any change gear on the lathe may be used as a ratchet and, as the diameter of the gear is a factor in the resulting movement, the amount of feed per revolution may be graduated to very small increments by using a large gear. The casting upon the change gear stud has a familiar appearance to one who is acquainted with automobile repair shops and is slotted to receive a driving stud. The position of the driving stud may be changed from central to any part of the slot. To reverse the direction of the feed it is necessary only to flop the ratchet lever over to the other side of the gear and turn over the pawl. Except for the odd moments spent in its devising, the whole bill of expense probably did not exceed twenty-five cents.

Steady Rest for Small Automatic Screw Machines

By Edward A. Hazen

In drilling holes in the end of small work made from bar stock in the automatic screw machine, difficulty is often encountered in getting the drill to start centrally owing to the slenderness of the work and its consequent liability to "dodge" when the drill comes into action.



STEADY REST FOR SMALL WORK

The sketch shows a steady rest that I made for the No. 00 Brown & Sharpe automatic to overcome this trouble.

A piece of flat stock is bolted to the main spindle-bearing cap to project over and parallel to the work. An elongated hole near the end of this piece receives the round steady rest, which is threaded nearly its full length and provided with two nuts by which it may be adjusted to and clamped at any desired height. The bar carrying the steady rest must be high enough above the tool blocks on the cross slide that the cross slide tools will pass under it with out interference.

The lower end of this piece is flatted off and a half hole made in it as shown, to match the diameter of the work, or it may be notched to an inverted V-shape to accommodate a range of sizes.

Editorial

THERE ARE FOUR varieties of workers and we find all four kinds in almost every shop. Some are slow and do poor work; some do the work just as poorly but produce more; some are slow but do good work and a few do the work both well and fast. Why should all get the same pay? What incentive is there for the good man to give the world the benefit of his greater capacity if the world gives no more to him than to his poorest brother? Don't forget that, even when a man is paid according to what he produces, he who gets the highest pay will still be the cheapest man.

Investing Money to Improve Machine Work

THE MANUFACTURER who earnestly desires to turn out the very best product in his field, is beset with many difficult problems. The greatest problem is perhaps financial rather than mechanical. A case in point is that of a maker of special cutters of a type that is still far from perfect even though they have been used for many years.

A large user of this particular kind of cutter has made extensive experiments and developed a standard which has given the best results. The standard is not easy to make and most of the makers of this kind of cutter have made no serious attempts to follow it. They make cutters galore to be tried out, but fail to conform to the standard.

One maker, however, and not one of the largest either, has made a careful study of the situation and has spent approximately $50,000 developing a method of making the cutters of the desired standard. And this in spite of the fact that the maximum business of this concern will not exceed $10,000 a year. Here is where the financial problem comes in.

The cutter maker is staking present expense against future orders, not only from the one concern but from others who will probably demand the special type of cutter later on. If the demand for better cutters materializes, as he evidently expects it will, he will be in a most advantageous position to supply them. But on the other hand he is perhaps running the risk that other firms, who have not invested $50,000 in experiment, will profit by his work along this line.

The chances are, however, that the knowledge and experience gained in this development will place him in a position to profit in the years to come. When it becomes known that he can furnish these special cutters with a certainty of their being right, users who are educated to the point of knowing what they require will not bother with experimenters. The man who knows how to make them should get the business—and it is to be hoped that the pioneer along this line will have his business so organized as to cash in on the large investment already made. He deserves a rich reward for his courage and his efforts to better machine production, and there can be no question as to his being in the most advantageous position to secure new business.

The Need of Federal Control of Aircraft

THOSE WHO are doubtful as to the coming of air transportation in the near future will do well to read the reports of the First National Air Institute meeting held in Detroit, Mich., and the proceedings of the Second National Aero Congress which followed it. Both of these documents are extremely interesting and show just where we stand in aviation. They also show where we can stand and ought to stand, if we are alive to the situation as it now exists.

As pointed out by Howard E. Coffin in his foreword, "No comprehensive, definite or continuing policy of aeronautical development can be had by us except through an orderly pressure of national sentiment resulting from an educated public mind. Federal laws, the control and regulation of all aircraft are of immediate and crying need. An authoritative Federal agency must be established to examine and license both pilots and aircraft in any commercial or private service. Federal inspection of all aircraft for airworthiness must be provided."

It is not at all creditable that we, the pioneers of aviation, are the only great nation which has not subscribed to the International Air Code which covers the points made by Mr. Coffin, our lack of participation being entirely due to a partisanship which comes very near being criminal. An American plane landing on Canadian soil or on Canadian waters, is practically an outlaw and has no standing. Nor is it permitted to resume its flight until it has been inspected for airworthiness and the pilot likewise examined. Such lack of co-operation, for which we are solely responsible, does much to hinder aviation along the border.

Progressive cities and towns are providing landing fields at convenient points. These should be near enough together to permit a pilot's reaching one of them in case of motor failure. The time is not far distant when these fields must be illuminated for night landing.

Aviation is here to stay. The rate of its development depends largely upon Federal control and the providing of landing fields. Every community can do its share to help it along—and it all makes business for the country.

Just Suppose

JUST SUPPOSE that you, as the manager of a small jobbing shop, had an emergency job come in that demanded of you certain technical information that you didn't have. Suppose further that you wrote to two concerns from either of which you would have bought the part needed if the case had not been one of emergency, and asked them to give you the information you wanted.

Now suppose that one of them sent it back by return mail while the other one hesitated a while and finally said it couldn't let you have it.

If somebody asked you to recommend one of these concerns, it doesn't take much supposing to guess that you would strain a point to recommend the one that wasn't afraid to come out of its shell, does it?

Shop Equipment News

Kobert Type-NB Dual-Head Electric Riveting Machine

The dual-head electric riveting machine made by the Kobert Machine Co., Inc., 50 Church St., New York, N. Y., has recently been redesigned, so that it appears as in Fig. 1, which gives a view of the Type-NB machine. The new model is, of course, similar to the former one and is distinct in type, since an upper tool of construction peculiar to the Kobert machine is employed.

A copper electrode is placed on the right, and a steel heading set on the left. Heating of the rivet is done by passing a current through it when resting on the horn and held down by the copper electrode. When the heat has progressed sufficiently, the head is moved laterally 1½ in. to bring the steel heading set or ram over the work, which does not change its position. The head of the rivet is then formed under pressure. The machine is motor-driven to provide the necessary pressure on the work, and the control is provided by one pedal, so that the hands of the operator are free to manipulate the work. The machine is adaptable to a wide variety of work, both in its standard form and with special fixtures.

The overhanging column and base are one member, on which all parts of the machine are mounted. The horn or lower electrode is water-cooled, the water being circulated from a pipe line connected to the shop water supply. A screw is provided to vary the height of the horn. The construction is such that the entire front of the machine can be stripped, thus giving room for special fixtures to suit the work.

All rivets are heated in place; that is, they are assembled in the holes in the work and then placed on the horn of the machine. In this way, handling of hot rivets when inserting them in reamed holes is eliminated. By heating the rivet in place, the metal around the hole is expanded; and it contracts upon cooling, so as to make a very tight fit on the rivet. Electric heating does not cause oxidation and scaling of the rivets if proper care is given the process.

The upper electrode also is water-cooled. The material is copper, since it has seven times the conductivity of steel. Both electrodes are connected to the transformer in the machine by means of heavy wire cables to reduce electrical resistance. There is no attempt made to apply pressure by means of the copper upper electrode.

The steel heading set comes down on the rivet in a line parallel with its axis. There is no vibration in the machine, as the blow is not repeated and consists chiefly of the application of a steady pressure. The operation is noiseless; it consists principally of bringing the rivet to a cherry red, and then forming the head immediately. Setting the rivets while hot requires a pressure only one-eighth as large as when done cold. Furthermore, the crystallization of the metal that is apt to occur in cold setting does not take place. The riveting can thus be performed as quickly, and, it is stated, more quickly in some cases than cold riveting can be done.

To operate the machine, the operator places the work with the rivet already assembled in it on the horn of the anvil, and then depresses the pedal. This action causes the copper electrode to descend and make contact with the upper end of the rivet. Further movement of the pedal closes the electric circuit by means of the contact that can be seen on the right of the head.

As soon as the rivet has reached a glowing red, as in Fig. 2, the foot pedal is released. The first action due to this movement occurs in breaking the circuit by means of the spring in the switch mechanism just referred to. It should be noted that this switch is merely a master

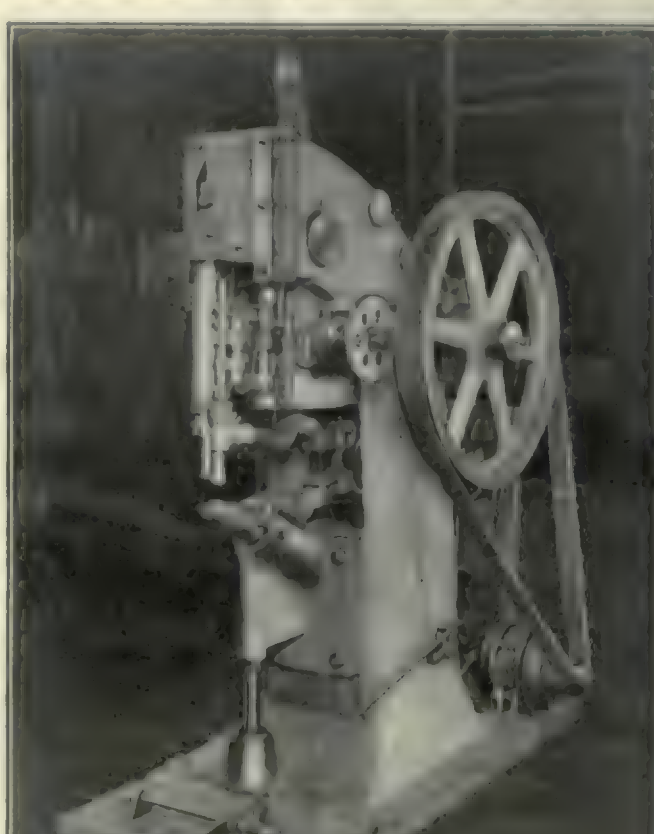


FIG. 1—KOBERT TYPE-NB DUAL-HEAD ELECTRIC RIVETING MACHINE

or controlling switch, and does not itself break the current for the electrode, as this break is made in the primary circuit. The electrode itself then breaks contact with the work. The advantage of this arrangement is that the electrode does not make nor break contact with the work while the current is on, so that no sparking occurs.

When the electrode completes its up-stroke, the clutch in the drive is automatically tripped, thus operating a

cam on the left side of the machine and throwing the heading set into a line directly over the rivet. The head immediately descends, forms the rivet head, and returns to its upward position on the left.

The operation is very rapid, and the average time for heating a $\frac{3}{8}$-in. rivet is stated to be approximately 3 sec. It should be noted that the operation is largely automatic, as the only function of the operator, aside from seeing that the work is properly located, is to

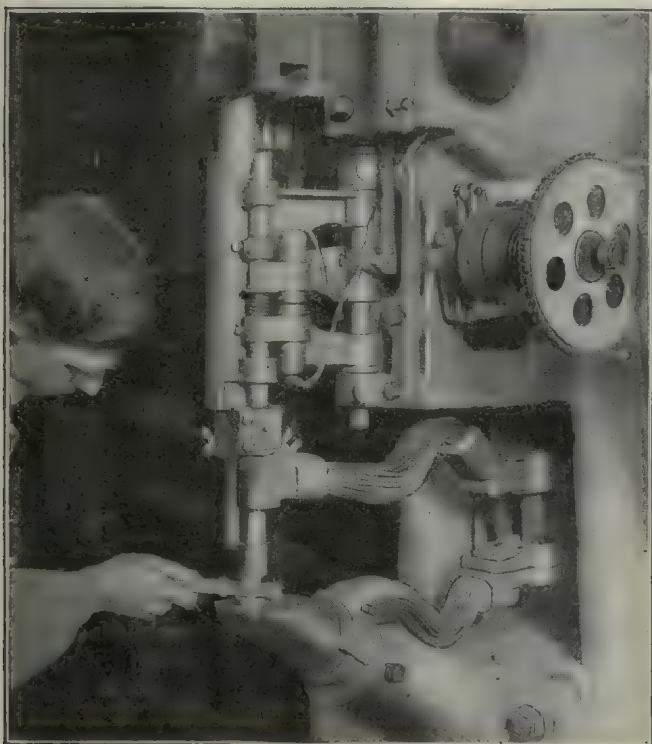


FIG. 2—HEATING RIVET IN KOBERT MACHINE

press on the pedal. The pressure required is only 1 lb., a feature that should tend greatly to eliminate fatigue.

The machine is driven at constant speed, either from a lineshaft or from an individaul motor. By means of the clutch previously mentioned, the power mechanism can be engaged so as to cause the descent of the riveting head. This drive mechanism incorporates a feature worthy of note. By means of this feature both the maximum pressure exerted can be controlled, and a safety device is provided so that nothing in the mechanism will be injured even though the descent of the riveting set is blocked. The drive from the crank on the drive shaft to the ram takes place through a "walking beam" that is so fitted with a spring-loaded toggle mechanism that the ram can be held while the crank turns, without breakage of any parts. The release mechanism does not come into play until the pressure under the heading set exceeds the maximum for which the mechanism has been adjusted.

The advantage of this construction is that the ram is usually so set that when the crank is about 80 per cent through its possible stroke, the rivet is home. Throughout the rest of the travel of the crank the ram dwells on the work so as to press the parts securely together. Should an additional thickness be placed between the riveting points, a longer rivet may be interposed and driven home, because the machine automatically compensates for the additional thickness.

The current necessary to operate the heating element is naturally of the alternating type. It is transformed to a voltage from 4 to 6 to pass through the electrodes. Control or switch panels separate from the machine, such as in Fig. 1, control the amount of current that is employed for different diameters of rivets. The cost of energy for heating is small, since 1,000 $\frac{1}{2}$-in. rivets are stated to consume not more than $1\frac{1}{2}$ kw.-hr.

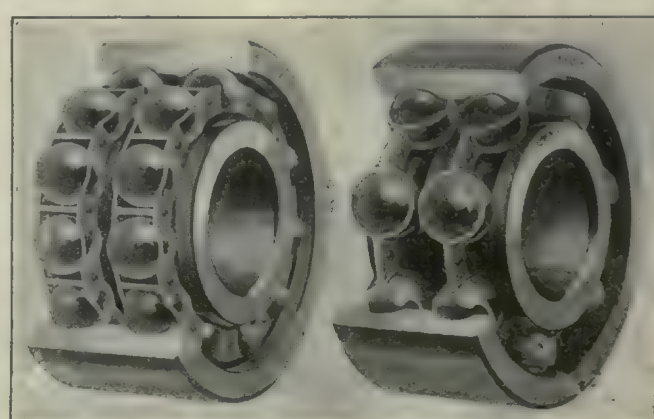
Pre-assembling is advocated in practically all cases, to facilitate rapid operation. Ordinarily, the work requires only one operator or an operator and one assembler. Special fixtures can be developed for parts made in very large quantities and for operations having special requirements. In some cases the machine can be made horizontal. For work such as on roller chains where the pin itself has been heat-treated and must not be heated in the riveting, the current is not passed through the entire rivet, but the ends of two pins are heated simultaneously, with the current passing through the link.

The Type-NB machine which is illustrated is intended for use on rivets from $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter. The machine has a 10-kw. transformer, and is ordinarily driven by a 2-hp. motor. The throat depth is 18 in. The machine is 76 in. high and requires a floor space of 39 x 28 in. It weighs 4,000 pounds.

The Type-NC machine is similar in principle, but is intended for rivets from $\frac{1}{2}$ to $\frac{7}{8}$ in. in diameter. Due to the fact that it is back-geared with a ratio of 6 to 1, a higher flywheel speed is employed. The transformer has a capacity of 15 kw., and 3-hp. are required to drive the machine. The throat depth is 24 in. The height of the machine is $83\frac{3}{4}$ in., while a floor space of 49 x 36 in. is required. The weight of the large machine is 5,800 pounds.

Strom Double-Row Radial Ball Bearings

Double-row ball bearings for radial load have recently been added by the U. S. Ball Bearing Manufacturing Co., 4535 Palmer St., Chicago, Ill., to the line of single-row radial, angular contact and thrust ball bearings made by the concern. Two types of bearing are furnished, the standard and the maximum. The standard bearing is shown at the right of the accompanying illustration, while the bearing for maximum service, which contains more balls than the standard type, is shown at the left.



STROM DOUBLE-ROW BALL BEARINGS OF STANDARD AND MAXIMUM TYPES

One of the principal features of the bearing is the construction of the retainers. Independent riveted re-

retainers are employed for each row of balls, so that the same strength is obtained in each retainer as in the single row type of bearing.

The bearings are stated to be especially adaptable for installations requiring large bearing capacity in a limited amount of space. Although intended primarily for carrying heavy radial loads, a thrust load of 25 per cent of the maximum radial load can also be withstood. The maximum type bearings have capacities 25 per cent greater than the standard type. The bearings are made in a range of sizes from 10 to 110 mm. bore (0.394 to 4.330 in.).

How to Secure Co-operation

By Entropy

In all my rambles about the shops of the east in the past 30 years I have never seen what could be called complete co-operation in any organization. Some of the nearest examples were in places where the manager thought he had it, but where as soon as the veneer was broken through and the real state of the shop was seen, there was no co-operation at all, only the eye service which so often lulls the head of a plant. In other cases there was nearly complete co-operation within the shop but mostly in opposition to the management.

The nearest to good co-operation seems to lie in places where the plant is not too large for one man to dominate and where the one man painstakingly selects and trains his subordinates into a sort of hero worship of himself. This kind of co-operation does not always lead to the greatest profit. Perhaps the most profitable organization is one wherein each superintendent or department head is capable of carrying on his own work without supervision and where the different departments are so distinct that only a little co-operation is necessary. One way to secure the object is not to ask for too much of it.

It is very often necessary, however, to assign to someone duties and responsibilities which might equally well be given to any one of two or three parts of the organization. In that case whoever does not get them, if they are prized, is sure to at least inwardly, wonder why he did not have the coveted privilege. It takes a rather strong man to sit still and see someone else make a "mess" of a good job, especially when he thinks that he himself would have been able to make it a success. Such men, according to their size, are likely to say, "Well, let's see how soon the other chap will hang himself with his own rope." And even if the other chap does not hang himself, they are not likely to become more reconciled to the arrangement as time goes on.

A shop of over five hundred men cannot usually be dominated by one man. There are exceptions, but it is very seldom that one man can remember all about even five hundred workmen and foremen, and unless there is remembrance there is not acquaintance, and if there is not acquaintance there is not much co-operation. Strangers do not co-operate except under pressure of necessity. Intimate acquaintanceship and respect seem to be the essentials to co-operation. Respect may be due to intellect or to sentiment or even to emotion, that is, "the old man" may be so capable that everyone feels willing and safe in trusting to him for guidance. No one may think of thinking for himself. Such a form of co-operation is unsafe, for when the one man wants to retire or death does retire him, there is a void that is not usually filled at once. The second, sentiment, is often given to the son of the intellectual giant of the first instance. Often it is misplaced but it certainly gives the second generation a chance worth taking to assume the reins of leadership. The third is not so often seen in business as in politics where men often are elected and re-elected for purely sentimental reasons and not because they make the best officers. In the shop we see the same thing in the retention of loyalty to old men long after they have been retired from active participation in the business. That kind of loyalty and its attendant co-operation are just as valuable to the firm that can command them as is either of the others.

Of course the ideal situation would be to combine the three. The head of the firm should be of that highly intellectual type that is always right and yet does spectacular things with ease. He should command co-operation through some sentimental thing even if only because he married the daughter of the founder of the firm, and he should appeal to their emotions if only by an appearance of that austere dignity softened by an occasional unbending at the death of some old workman or similar event that makes the workmen respect his emotions. The combination is so rare as to be almost unknown, but the nearer a leader comes to this ideal the stronger and more vital the co-operation which he commands.

One thing which does not secure co-operation is for the head of the firm to hive himself up in his office away from his employees. Very few firms have been able to overcome the handicap thus established, and most of those have had some man who though not nominally the head was accepted as such by the subordinates, and who made his personality a direct asset to the firm by getting out around the plant frequently. True, a man may have great intelligence, an intimate knowledge of a business and yet have a personality such that he cannot inspire the confidence of workmen and people in general. If the choice of executives narrows down to such a man, it is absolutely necessary that he work in co-operation with some man who can represent him before his own employees, and who as spokesman for him will supplement his weaknesses.

Credit Must Be Properly Placed

If the majority of employees were naturally co-operative the problem would not exist, but unfortunately too many people have found that they get very little that they do not earn, and they find too many piratically inclined associates who do not hesitate to appropriate to themselves the credit for improvements made by others if the opportunity offers. After seeing some one else carrying off credit for his inventions and suggestions almost anyone is likely to make sure that nothing of the kind happens again. Consequently many shops hardly get a helpful constructive suggestion from their employees from one year's end to another. A suggestion box does no good. The only thing that can help is the confidence that the men at the head of the organization will insist that every superintendent and every foreman give credit where credit is due and not elsewhere. In other words, the manager who secures co-operation must make sure that his personality, and his good character, and reputation for fair play are transmitted to and through every minor executive in the plant.

News Section

American Machinist Editors Meet in Annual Conference

The *American Machinist* editorial staff got together for its annual conferences on plans for the new year on Dec. 18, 19 and 20. Ethan Viall came in from Cincinnati, Howard Campbell from Chicago and Ellsworth Sheldon from New England to talk over with the New York men the features to be included in the two coming volumes of the *American Machinist* and various other editorial problems.

On Monday evening the staff had dinner together at Brown's Chop House and went on to the theatre afterwards. Tuesday noon they had lunch at the Engineer's Club with Mr. McGraw and vice-presidents Mehren and Britton as their guests. At the luncheon Mr. Britton outlined the circulation problems affecting the industrial unit and particularly the *American Machinist*. Mr. Mehren described the new unit system under which the company is now organized and explained the reasons for its adoption and its method of functioning. Mr. McGraw wound up the gathering with an inspirational talk on editorial duties and opportunities.

The conference was decidedly successful and plans for adding a semiannual conference at which the advertising solicitors and the field superintendents would also be present are under consideration.

Welding Society Holds Monthly Meeting

The Metropolitan Section of the American Welding Society held its regular monthly meeting in the Engineering Societies Building, 29 West 39th St., New York City.

The meeting was well attended and much interest was shown in the two excellent papers presented to the members. A. S. Kinsey, professor of Shop Practice, Stevens Institute of Technology and advisory service engineer for the Air Reduction Sales Co., read a paper entitled, "Applications of Cast Iron Cutting by the Oxy-Acetylene Torch," and E. S. Eldridge, welding foreman, Kingsland Shops, D. L. & W. R.R., talked on "Practical Welding."

S.A.E. Annual Meeting Is Announced

The annual meeting of the Society of Automotive Engineers, according to an advance announcement made last week, will be held in New York City, at the Engineering Societies Building, 29 West 39th St., Jan. 9 to 12, 1923.

The National Automobile Show will be held concurrently at the Grand Central Palace from Jan. 6 to 13. Through the courtesy of the National Automobile Chamber of Commerce tickets will be distributed gratis to S.A.E. members attending the annual meeting.

The Automobile Body Builders' Show will be held at the Twelfth Regiment Armory from Jan. 8 to 13. Tickets for this Show have been provided for S.A.E. members attending the Annual Meeting through the cooperation of the Automobile Body Builders Association.

These two shows will include all of the latest developments in passenger-cars, passenger-car bodies, automobile accessories and equipment. Combined with the S.A.E. meetings they represent an unusual educational value to all automotive engineers and executives.

Mason Britton Elected Vice-President of McGraw-Hill Company, Inc.

At a meeting of the executive committee of the McGraw-Hill Co., held on Tuesday, Dec. 19, Mason Britton was elected a vice-president.

Mr. Britton entered the circulation department of the *American Machinist* on Feb. 10, 1901, going from there to be assistant advertising make-up. He was next transferred to the production department which at that time was in a different building. Part of his duties consisted of taking care of some of the production accounts.

The next move was back to the make-up department where he soon became head make-up and handled both the advertising and editorial pages of the *American Machinist*, writing advertising copy to occupy spare moments. He was later sent to the advertising service department and became manager of that department in a short time.

Then came an opening as business manager of the *American Machinist* and Mr. Britton received the appointment, later assuming the title of general manager.

As vice-president of the McGraw-Hill Co., Inc., Mr. Britton is directing head of the industrial unit which consists of *American Machinist*, *Power* and the circulation department of the *Industrial Engineer*. He continues as general manager of the *American Machinist*.

November Exports Establish Year's Record

A new high record for the year in American exports was established during the month of November just passed, according to official overseas trade statistics made public today by Director Klein of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

Returns from Customs Districts all over the United States received in the Department of Commerce show that American agriculture and industry benefited from export business totaling $383,000,000 during November. This sum is about $90,000,000 higher than the value of shipments during November, 1921. It is $12,000,000 greater than October, which was the best previous month for the present year.

Engineers Plan Reception to Italy's Envoy

American engineers are planning a big reception to Prince Gelasio Gaetani, Italian Ambassador to Washington, now on his way to this country. A dinner, at which engineers from all parts of the country will be present, will be given in honor of the new diplomat, himself an engineer, by the American Engineering Council of the Federated American Engineering Societies, in Washington, on the evening of January 12, it is announced by L. W. Wallace, executive secretary of the federation.

The dinner will be the concluding event of the two-day annual meeting of the council, which will consider problems of national interest, including the report of the committee on work periods in continuous industries, which has reported in favor of the eight-hour day.

New England Engineers Hold Meetings

Engineering and technical associations in Western New England are enjoying a season of activity. At a joint meeting of the Engineering Society of Western Massachusetts and the Western Massachusetts section of the A.S.M.E., in Springfield, Mass., Dec. 19. Calvin W. Rice, national secretary, gave an account of the work of engineering societies in South America and the part they play in developing that continent.

H. H. Dewey of the General Electric Co., Schenectady, N. Y., addressed the Springfield section of the A. I. of E. E., Dec. 15, on "Recent Developments in the Design of Transmission Systems," dealing especially with problems of long-distance transmission in the desert and mountain regions of the West.

At a meeting of the Springfield Employment Managers' Association, Dec. 14, C. M. Ripley of Schenectady gave an account of the corporate organization and distribution of income of the General Electric Co., with a discussion of factors entering into efficient public utility service.

At a meeting of the Springfield chapter of the American Society for Steel Treating Ernest E. Thum, associate editor of Chemical and Metallurgical Engineering, addressed the members on educational policies relative to the laying of a ground work for a technical career.

A Bullard Bond Issue

The Bullard Machine Tool Co., Bridgeport, Conn., has issued $1,500,000 in 6½ per cent first mortgage bonds through S. W. Straus & Co. These bonds constitute a closed first mortgage on the land, building and equipment owned and to be acquired. These are coupon bonds, payable June 15 and December 15, maturing in from two to fifteen years.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Director, Commerce and Finance, New York

IF UNIVERSAL recognition of its financial strength and economic predominance can make a nation happy then indeed this ought to be a happy Christmas for the people of the United States.

The world today waits upon America's decision with regard to the German loan, and the tone and tendency of the markets reflect the belief of the moment as to the success or failure of the negotiations. Authentic interviews with Mr. Morgan and his partners make it clear that no loan can be placed here until France has agreed to reparations that are within Germany's ability to pay.

The French have not yet shown any willingness to abate their claims, but there is nevertheless an underlying feeling of confidence that the compulsion of events will somehow bring about an arrangement that will make it possible for Germany to borrow. The fact that enormous profits might be made directly and indirectly by those who had to do with the transaction has helped to strengthen the belief in its ultimate and early consummation. To this belief the steadiness and upward tendency of the markets last week was due and from now on the prospects of a loan will be a major influence upon sentiment here and abroad.

It is obviously impossible to speak with certainty as to the outcome, but if one had to make a guess it would seem wisest to assume that a credit so necessary would somehow be provided. As to the assertions of some that if such a credit is granted it will never be repaid it may be answered that the three greatest commercial nations, England, the United States and Germany, have more than doubled their aggregate population and quintupled their national wealth in the last fifty years, and that he who would measure the world's earning power in 1972 by present standards is a poor student of history.

Of the effect that the proposed loan would have upon American business it is possible to speak more definitely. There is hardly a doubt that it would mean an instant increase in the export demand for our surplus production and a revival of industrial and commercial activity all over the world.

Our present national income is estimated at [illegible] billion dollars annually. If the effect of the loan should be to increase it by only 10 per cent, a [illegible] estimate, we should have recovered within a year four times the billion and a half that Germany seeks to borrow, and could well afford to charge our share to profit and loss.

In this larger view the economic logic of the loan seems to justify the assumption that it will be arranged. If not it is to be feared that Germany will be plunged into a condition of economic chaos from which she will emerge only through political revolution.

Encouraged perhaps by the hope that Europe will soon be put on an even keel the tone of domestic business has become a little more optimistic. The failure of a well known firm of stockbrokers in Kansas City had only a passing effect. On the Stock Exchange quotations are higher and the new bond issues offered have been readily absorbed. The rush to declare stock dividends continues but the tax selling is about completed and the recipients of the newly issued shares seem willing to keep them for the present. The Great Northern Railroad has reduced its dividend to a 5 per cent basis, but this reduction has been offset by an increase in the Michigan Central rate.

The car loadings are the largest on record but the congestion of traffic is unrelieved and business suffers accordingly.

The anomaly of the railroad situation is emphasized by an application from the Receivers of the Chicago, Peoria & St. Louis R. R. for permission to abandon that line in its entirety because it cannot earn enough to pay taxes. The road is 237 miles in length and serves a considerable population. If it had been part of a large system it might have been made to pay and the announcement that the Cleveland syndicate headed by the Van Sweringens has added the Chesapeake & Ohio to its recently formed trunk line system shows that the necessity of consolidation as a condition of survival is becoming more widely recognized.

An increase of 6 per cent in wages has been allowed to the 50,000 members of the Iron Moulders Union and other increases in other trades are expected shortly. Reports from the iron and steel industry are optimistic, with the mills running at 85 per cent of capacity.

The creation of another important unit in the steel industry has been effected through the purchase of the Brier Hill Steel Co. by the Youngstown Sheet and Tube Co. The formation of the Columbia Steel Corporation is also reported from San Francisco. It is a consolidation of the Columbia Steel Co. and the Utah Coal and Coke Co.

At 14⅞ cents copper is at last well on its way upward. The advance is attributed to the reported but unconfirmed purchase of one large producing concern by another. There is, however, good reason to credit the report, for the spirit of consolidation seems to be in the air and the deal by which the Armour Company is to take over Morris & Co. is said to have been consummated with the Government's tacit approval.

Cotton, wheat, corn, rubber, sugar and coffee have all been steady with an upward tendency due to the hope that the German loan will be arranged, but restrained by Mr. Morgan's disavowal of any agreement to which his firm was a party.

The weekly statement of the Federal Reserve System shows a decrease of $15,000,000 in gold and an increase of $74,000,000 in circulation, both probably due to the holiday demand for gold and pocket money. As a result the reserve ratio has fallen to 72.8 per cent as against 75.1 last week. It ought to rise again in January. If not, higher rates for money would be natural, but thus far there has been no change and the best commercial paper can still be sold at 4½ per cent.

General trade is good but not abnormally active. The Christmas shopping which was begun early is now finished and the business world awaits the commencement of the New Year with confidence but without the expectation of a boom.

In its annual report the Bank of Montreal is optimistic as to conditions in Canada and a definite improvement in Cuba is expected when the $50,000,000 loan that is being arranged for shall have been placed.

Our exports for the month of November were valued at $383,000,000, which is larger than for any previous month this year. This is both surprising and encouraging but how we have been or will be paid for these exports is still a mystery.

Further Progress in Production

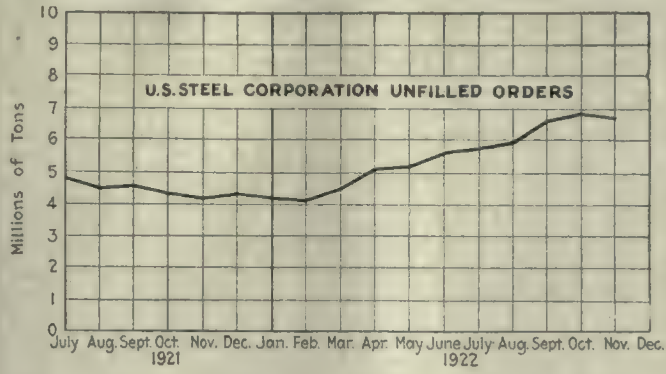
Continued advances in production, transportation and distribution in November are noted in figures compiled by the Department of Commerce in its "Survey of Current Business." The largest consumption of cotton since 1917, and further high records since 1920 in the output of pig iron, steel ingots, zinc, coke, locomotives, and upper leather emphasize the sustained and basic character of industrial production in November. The usual seasonal decline in building contracts in November failed to materialize.

The car shortage on the railroads was slightly relieved, but coal cars were still in great demand and coal loadings have been kept up to the maximum; total loadings of all classes were very high for November. Increased orders were made for locomotives and freight cars to overcome present congestion.

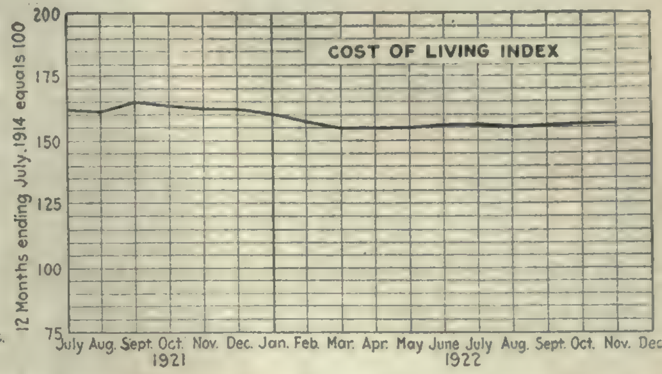
Price levels continued to increase in November, with both the total wholesale and the retail food indices the highest since the end of 1921. The relative purchasing power of farm products was considerably improved in November and this is reflected in the largest mail-order house sales since March, 1920.

The final crop reports for the year 1922 indicate a large production of the principal crops, especially wheat, potatoes, corn and rye, and should make for increased prosperity in the farming sections.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the U. S. Steel Corporation on Nov. 30, 1922, totaled 6,840,242 tons as compared with 6,902,287 tons on Nov. 31. The tonnage on order at the close of November, although 62,045 tons below the month previous, is greater than for any month since February, 1921, at which time unfilled orders totaled 6,933,867 tons. Beginning with March of the currrent year, an increase has been shown in each thirty-day period ranging from 140,630 tons in July to as high as 741,502 tons during September. Railroad requirements and building construction demands continue as the chief features of the increase.

Metal product shares in the New York stock market declined during November, the average price of ten representative issues dropping to $77.50 per share as against $79.50 in the month previous. The decline is without special significance, the entire market having receded from the high point reached during September due chiefly to a lack of general public interest. The electrical equipment companies report a large volume of business on order.

Railroad rolling stock continued to attract attention during November, chiefly on account of the car shortage which began to be acute in October. With 179,239 cars short of requirements on American roads on Oct. 31, the increase has continued, although not so acutely, the shortage on Dec. 1, standing at 143,279 cars. The average for the month was 150,787 cars as against the October average of approximately 160,000 cars. Car surplusage changed slightly, the average being 5,735 as against 4,475 in the month previous. Cars in bad order decreased from 249,960 or 11 per cent to 225,842 or 10.1 per cent. Loadings of coal and grain continue heavy.

Cost of living among the families of wage earners in the United States on Nov. 15, was 58.4 per cent higher than in July, 1914, according to figures collected by the National Industrial Conference Board. Between Oct. 15 and Nov. 15 there was an increase of 1.3 points or one per cent. The changes in the budget within the month were continued slight increases in the average cost of food, clothing and coal. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and Nov., 1922, the cost of living dropped 46.1 points or 22.5 per cent.

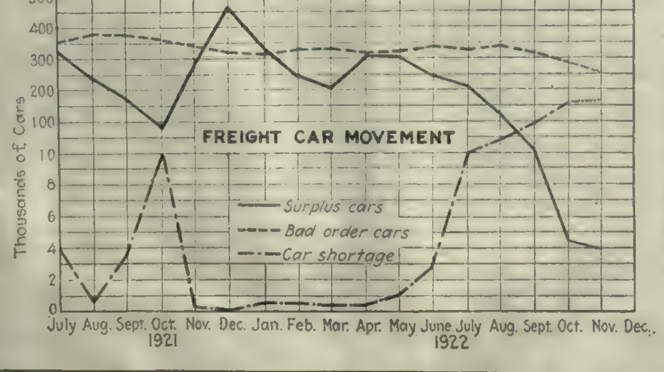
American foreign trade for November shows a gain in exports of more than $12,000,000 over the previous month, October shipments in turn being $57,000,000 greater than in September. The increase in November, as in the case of October, is due chiefly to raw cotton shipments, exports of this commodity alone being valued at more than $109,000,000, out of a total of $383,000,000. The November total shows an increase over the corresponding month of 1921 of approximately $90,000,000. Import figures are still unknown owing to the changes in the new tariff rates.

Comparative Prices of Shop Supplies

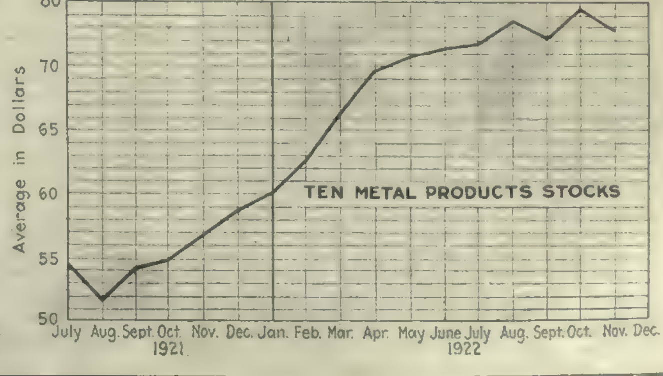
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year. Ago
Soft steel bars..	per lb....	$0.0295	$0.0295	$0.0273
Cold finished shafting.....	per lb....	0.0378	0.0378	0.0373
Brass rods......	per lb....	0.171	0.1700	0.15
Solder (½ and ½)	per lb....	0.24	0.23	0.20
Cotton waste...	per lb....	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100....	3.11	3.11	......
Lard cutting oil	per gal....	0.59	0.575	......
Machine oil....	per gal....	0.36	0.36	......
Belting, leather, medium.....	off list....	30-10% @50%	40-5% @50%	
Machine bolts up to 1 x 30 in.	off list...	55% @60%	50%@ 65-10%	50%@ 60-10%

Monthly average of car shortage surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



The South African Machinery Market

Vast Territory of Great Richness—Offers Big Opportunity to Machinery Builders—Backward Native Showing Marked Progress

By A LONDON CORRESPONDENT

AMERICAN manufacturers of electric equipment will be repaid by catering to the South African trade, because there is every indication that it is becoming one of the most important markets for these products. In 1921, overseas purchases amounted in value to approximately £2 millions against 1½ millions in 1920 and £1 million in 1911. During the past year there have been numerous installations of lighting plants in towns and villages, while the growing demand for power has compelled the local authorities at Cape Town, Durban, Johannesburg, Pretoria, and other large centres to extend existing generating stations and to provide additional facilities. In spite of the general trade slump of the last two years the value of the trade has not declined, but has steadily risen.

There is every indication that this activity will be continued during the coming year. Reports from all the leading business towns point to the fact that stocks of fittings, etc., are very low, while it is generally agreed that orders for considerable amounts will have to be given out as soon as the power plants now on order have been installed. Both German and British firms are carefully watching the needs of the market. As German exporters are failing now to guarantee the date of delivery, while their prices show a tendency towards steady expansion, the principal rivalry will come from British firms. Other things being equal the feeling in South Africa is to place orders for electric plants with British houses, but there is a decided tendency on the part of the exceedingly important business in fittings, lamps, cooking and heating apparatus and general accessories to pass into the hands of foreign competitors. Tenders for the supply of generating plant are invariably advertised in the press in the usual way, but it is the local merchants who supply fittings, and it is very important, if business is to be obtained, that these dealers should be carefully canvassed both personally and by catalogs, together with the latest data respecting new lines and operations. Buyers in South Africa are particularly keen on new electrical devices and it will repay manufacturers to study them.

[illegible] European Competition

The latest information from this market is to the effect that the United States exporters of electric iron supplies have almost lost the trade in consequence of the cheap lines [illegible] from Germany and [illegible] from the United Kingdom. [illegible] American makers had a [illegible] in this direction. Whether German exporters can continue to supply these goods at such cheap rates is open to question, because her manufacturers are coming to the end of their tether, but even then British firms can undercut American prices. The average retail prices of a 5 lb. electric iron of American, British and German manufacture are, respectively, \$9.50, £1 15s., and \$7. Dealers in electric supplies report that more German irons are sold than of all others together, and that both wholesale and retail traders make a large profit on them. The agents of American firms in South Africa say that unless their home manufacturers can so pricee their irons that a retailer can sell a 5 lb. model for \$8 or less the market may be entirely lost to American exporters.

Importance of Native Trade

The importance of the native trade in South Africa is generally overlooked by exporters. In South Africa and Rhodesia alone there are six million natives, as compared with a little more than 1½ million Europeans. The purchasing power of the native, present and future, is enormous. He is advancing in the scale of civilization, and his necessities are multiplying accordingly. The modern requirements of domestic life are every day more revealed. The plow and harrow are steadily superseding the pick and hoe and there is a good demand for the simpler kind of farm implements. The native population is increasing to a far greater extent, relatively, than the white population, and it can readily be imagined what the trade position will be in the near future. It should also be remembered that the total native population from the Cape to the Equator is estimated at over 40 millions.

It is very satisfactory to be able to record that the trade in agricultural implements throughout the South African Union is reviving. While many of the simpler types of implements have long been adopted on South African farms, there is wide scope for the sale of tools and machines embodying later improvements. Maize planters and one-horse cultivators, gang plows, lever harrows, mowers, rakes and maize shellers are among the implements in fairly general use; but on the other hand, adequate advertisement and demonstration should lead to the introduction of more up-to-date apparatus for planting and cultivating, including grain drills, disk harrows, ensilage cutters and many others. The type of plow in most common use is the two furrow walking mould-board, but the disk plows are also popular, especially in Rhodesia. There is considerable competition in this market for the supply of implements and agricultural machinery.

During the past ten years the disk harrow has been gradually superseding the tooth harrow. It was first introduced into the Transvaal and Natal, and there is believed to be a good opening for extending its sale in the Orange Free State and throughout the western parts of the Cape. The disk harrow is used in the cultivation of alfalfa, a very popular crop in South Africa, and it is credibly reported that a ready sale exists for other implements which are needed in connection with this crop.

As regards threshers, the demand is governed by the fact that this work is generally executed by contractors who travel from farm to farm, or in centers to which the small farmers cart their crops. Sometimes there is a sale for medium size threshers with 24 and 30 inch cylinders and straw chopper and bruiser attachments. There is also a demand for hand and power stationary threshers with 14 and 18 inch cylinders. In Rhodesia ground nut and sunflower seed threshers are also needed. There will probably be a larger demand for binders as more land is gradually bought under wheat cultivation.

The following table gives the value of the leading imports of machinery and implements into South Africa in 1921:

Kaffir hoes and picks	£28,578
Dairy utensils	57,114
Hay presses	7,810
Plows, harrows, and parts	439,098
Reaping and mowing machines	55,867
Tractors	45,897
Wine presses and pumps	2,036
Other implements and machinery	363,810

One of the best and most practical ways of pushing trade in this market is to exhibit freely at the best local farm shows. Districts affected by drought are good buyers of windmills, pumps, and piping.

Tractor Prospects Bright

With the return of better times the South African farmer will be a better purchaser of tractors. Among the points to be considered in this connection are the following: types of tractors suitable for certain soils, horse power relative to the altitude at which the tractor is employed, method of distribution, spare parts and "service." In Zululand plowing is made difficult by the roots of sugar cane remaining in the ground, and also by the lack of moisture. The soil in Natal and the Cape is fairly light and easy to work. On the other hand, the soil in the Transvaal and the Orange Free State becomes intensely hard and dry. As regards the internal combustion engine it should be stated that the loss of power at an altitude of 4,000 feet amounts to 10 per cent, and at 5,000 feet the loss is reckoned to be 20 per cent. These elevations are often met with throughout the country. Along the coast of Natal and in the Cape Province, power is slightly increased in consequence of the humidity of the air.

There is today an excellent opening throughout Rhodesia, for small mine plant as distinct from the large battery stamps, etc., purchased by the big companies. The market for mining machinery is at present worth about £60,000 a year, but when we remember the various mining developments now taking place, the value within the next five years might very well be trebled.

There are innumerable opportunities

in this market for the sale of electrical, industrial, mining, farming and other machinery. Rhodesia is one of the few countries that has emerged almost unaffected from the general commercial depression of 1921. Indeed, more manufactured goods were imported during that year than in the boom year of 1920.

Even quite small towns are actively considering the possibility of erecting power stations. Taken separately, these may be only small orders, but if viewed collectively they amount to a very respectable sum and become a source of business which no manufacturer can afford to despise. This specially applies to the suppliers of generating plant, electric cable and electric fittings. It is worth noting, also, that Rhodesia's trade in electrical machinery and material has risen in value from £44,000 in 1913 to £88,000 in 1921.

Round about the principal towns, such as Salisbury, there are springing up numerous factories for the production of furniture, soap, candles, metal goods, and many other articles. All this necessarily means a market for machinery and plant of various kinds. It is essential that catalogues should contain full data respecting the working of the machinery dealt with, the assembling of parts; capable local agents are necessary, while a high degree of standardization is necessary in most lines of farm implements. The market for cheap and light plows alone is worth £70,000 a year in Rhodesia.

The principal competition will come from British manufacturers. Until 1921 the Germans were almost a negligible quantity, the value of German imports into South Africa in that year amounting in value to only a trifle over £1,000,000. In the first six months of 1922 they amounted to £1,315,596 and there is every reason to believe that by the end of the year this latter amount will have doubled. These figures are very significant when we examine the general trend of South African trade. Compared with the first six months of 1921 the country's total imports decreased from £29,500,000 to £23,000,000; the imports from Great Britain declined from nearly £16,000,000 to nearly £13,000,000, and those from U. S. A. dropped from £5,500,000 to a little over £2,500,000. Yet the imports from Germany actually rose from £504,000 in the first half of 1921 to £1,315,596 in the corresponding period of 1922. German competition is especially severe in cutlery, enamelled ware, fencing wire, certain classes of machinery, farm implements, tools, etc.

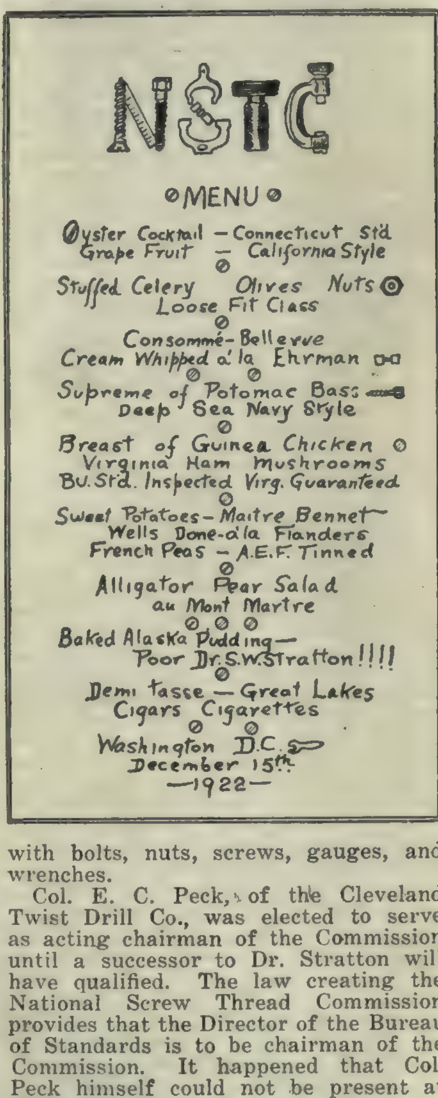
Railroad Rapidly Reducing Bad Order Engines

From Nov. 15 to Dec. 1, the railroads repaired and turned out of their shops 13,484 locomotives. This was within six locomotives of the greatest number repaired during any semimonthly period in approximately the last two years, according to reports received today from the carriers by the Car Service Division of the American Railway Association. This also exceeded by 1,345 the number turned out of the shops during the first half of November this year.

Locomotives in need of repair on Dec. 1 last totaled 18,009 or 27.9 per cent of the number on line.

Screw Thread Commission Honors Stratton at Important Session

That the work of the National Screw Thread Commission is well advanced and is reaching the point where important recommendations will be made public, was revealed at a meeting of the Commission held in Washington on Dec. 15. Since this is the last meeting of the Commission at which Dr. S. W. Stratton, its chairman, will preside, the other members of the Commission gave a dinner in his honor. The menu, reproduced herewith, was decorated cleverly


NSTC

MENU

Oyster Cocktail — Connecticut Std.
Grape Fruit — California Style

Stuffed Celery Olives Nuts
Loose Fit Class

Consommé-Bellevue
Cream Whipped a'la Ehrman

Supreme of Potomac Bass
Deep Sea Navy Style

Breast of Guinea Chicken
Virginia Ham Mushrooms
Bu. Std. Inspected Virg. Guaranteed

Sweet Potatoes - Maitre Bennet
Wells Done-a'la Flanders
French Peas — A.E.F. Tinned

Alligator Pear Salad
au Mont Martre

Baked Alaska Pudding—
Poor Dr. S.W. Stratton!!!!

Demi tasse — Great Lakes
Cigars Cigarettes

Washington D.C.
December 15th
—1922—

with bolts, nuts, screws, gauges, and wrenches.

Col. E. C. Peck, of the Cleveland Twist Drill Co., was elected to serve as acting chairman of the Commission until a successor to Dr. Stratton will have qualified. The law creating the National Screw Thread Commission provides that the Director of the Bureau of Standards is to be chairman of the Commission. It happened that Col. Peck himself could not be present at this meeting because of the fact that he had to attend the annual dinner given by his company in Cleveland. All other members of the Commission were present.

The Commission is about ready to submit a list of recommended sizes for tap drills. These sizes were carefully considered by the Commission and a number of criticisms and suggestions offered.

F. O. Wells, one of the members of the Commission, submitted a report on recommended sizes and tolerances for bolt heads, nuts and wrenches. The tables of these dimensions were arrived at at a joint meeting of subcommittee number two of the American Engineering Standards Committee sectional committions. The dimensions cover regular hexagon and square-head nuts for both coarse and fine threads; hexagon head, cap screws, square-head cap screws and wrench openings. Tolerances are recommended for both bolt-heads, nuts and wrench openings.

A sub-committee headed by Major J. O. Johnson is doing preliminary work looking to the standardization of oil-well equipment, especially casing pipe and threaded joints. Major Johnson's committee will work in co-operation with the Standards Committee appointed by the American Petroleum Institute. A report is about completed on special threads for electric fixtures and fittings. This report is based on report No. 1,525 of the American Society of Mechanical Engineers, which was presented in December, 1915, and on a report made on Nov. 19, 1921 by the National Council of Electric Fixture Manufacturers. These reports are being co-ordinated and the screw thread commission is supplementing them in certain particulars. As soon as the report is completed it will be sent out to those interested for suggestions.

The Commission voted to renumber classes of fit so that the fits will be as follows:

NEW

Class 1	Loose fit
Class 2	Full fit
Class 3	Medium fit
Class 4	Close fit
Class 5	Wrench

PROGRESS REPORT

Class I	Loose fit
Class II-A	Medium regular
Class II-B	Medium special
Class III	Close fit
Class IV	Wrench

It was decided to take advantage of the simpler form of consecutive Arabic numbering rather than the use of Roman figures as had been done in the progress report previously submitted.

National Foreign Trade Council

The Tenth National Foreign Trade Convention of the National Foreign Trade Council will be held in New Orleans on April 25, 26, 27, 1923, according to announcement of O. K. Davis, Secretary of the Council.

"The selection of New Orleans as the Convention city," said Mr. Davis, "is peculiarly fitting in view of the development of the city as a great center of American foreign trading activity. In 1921 New Orleans was the second port of the United States, importing coffee, sisal, burlaps, bananas, crude oil, and sugar; and exporting corn, rice, wheat, cotton, glucose, steel rods not wire, iron pipes, steel plates and sheets, lard, cottonseed cake, meal and oil, mineral oils, tobacco and lumber.

"Of special interest to foreign traders in all parts of the Mississippi Valley has been the development of shipping facilities at the Port of New Orleans, and the consequent increase in steamship services. Since the Third National Foreign Trade Convention was held in New Orleans in 1916, this progress has been particularly marked, and has been accelerated by the increasing proportion of American foreign trade carried on with the West Indies, Central America, Mexico, South America and Asia, much of it passing through gulf ports.

Southern Iron Output Makes Record

Official figures on pig iron production in Alabama, the Southern Metal Trades Association advises, reached 208,934 tons in November, the largest month of the year, the largest in fact since the depression period set in more than two years ago. Production was almost 100 per cent larger than that of November, 1921, which was 108,121 tons. There were 22 stacks active in November, but since then others have been blown in and the end of December will find 25 stacks active, the largest number in almost three years. By mid-1923 it is believed all stacks will be running.

The Association also states that what is driving pig iron prices down in the Southeastern district at this time is largely the European competition, considerable tonnage of pig iron from across the water reaching the United States. Lately large tonnages of European made pig iron have been sold to metal trades consumers in the South at prices less than southern makers are quoting.

With the blowing in of two additional furnaces by the Tennessee Coal, Iron and Railroad Co. before the end of December, this company will have eleven furnaces on the active list, and production will be close to capacity in the Birmingham district again. The Southern Metal Trades Association advises that while exact tonnages are not known as yet there have lately been unusually good sales of pig iron, estimating the tonnage at between 150,000 and 200,000 tons. The nominal price level is $23 still, but many sales are reported to have been made under this base, some as low as $21. The pig iron melt will continue well into 1923 according to present indications on a big scale, with the year probably proving one of the biggest in history.

The Southern Metal Trades Association has announced that reductions in freight rates on pig iron from Alabama and Tennessee producing points to Central Freight Association territory, in the opinion of the Interstate Commerce Commission, would discriminate against producers of pig iron in southern Ohio and St. Louis. In the decision of the Commission, therefore, southern railroads have been ordered to maintain the present rates that are in effect, and to cancel all scheduled granting reductions which were suspended on Sept. 1, at which time they werer to have gone into effect.

Car Shortage Shows Decrease

From December 1 to December 8, there was a decrease of 21,826 in the freight car shortage, according to reports received today by the Car Service Division of the American Railway Association from the railroads of the country. The total shortage on December 8 amounted to [illegible] cars.

Shortage in box cars totaled 56,711, a decrease of [illegible] within the same period, while the shortage in coal cars totaled [illegible] or [illegible] below that on December 1.

Reports also showed a gradual increase in the number of surplus freight cars in good repair scattered throughout the country, the total on December 8 being [illegible], which was a gain in approximately a week of 1,062 cars.

The Oakite Sales Conference

The Sixth Annual Sales Conference of the Oakley Chemical Company, New York, manufacturer of Oakite, from Dec. 18 to 21 inclusive, was attended by all but two of its 66 sales representatives. A very interesting feature was the one minute speeches of the first day when every man told of business conditions in his territory. The significant thing was that, without exception, the men reported better business in all lines reached by them and further, that this was in spite of extreme caution in buying. This evidently means that manufacturers have been warned by the prediction of economists regarding a premature false boom, and have effectually prevented it.

Six selling papers occupied the first afternoon session, these being: Essentials of Successfully Selling our Materials, F. A. Aston; Service an Important Factor in Selling Oakite Products, G. M. Barnes; Meeting Unusual Sales Resistance, D. X. Clarin; Advantages of Systematic Planning and Selling, C. A. Ormsby; Developing a New Territory, P. A. Boeck and Impressions of a First Year Oakite Salesman, H. Kennedy.

These conventions have the unusual method of beginning with a breakfast and keeping the men well together during the day. In this way the men get the most out of the meetings.

Technical Papers on Important Topics Presented

The second and third day's papers were technical: Carpet Cleaning, N. W. Halsey; Locomotive Parts, C. Burgin; Territory Laboratories, F. J. Fayen; Field Service Reports, H. J. Butler; Investigation vs. Taking Things for Granted, O. W. Hoster; and Oil Barrels and Drums, J. F. Ewing. This was followed by a second technical session with the nine papers listed, after which there was a dinner and theatre party. The nine papers were: Washing Artificial Silk, G. W. Miller; Kierboiling Cotton Yarn before Mercerizing, A. W. Quinn; Finishing Cotton Knit Goods, H. M. Upson; Some Peculiar Facts in Cleaning, L. B. Johnson; Packing Plant (hog scalding), C. E. Barber; Packing Plants (chiefly outside of hog scalding), O. A. Fiss; Oakite in Cheese Factories and Condensed Milk Plants, F. J. Wall; Oakite in Paper Mills (felts and vitriol on new felts), L. C. Minor, and Comparison of Work in Institutional and Steam Laundries, M. L. Shorey.

The third day covered three more technical papers: Oakite in Steel Mills, H. L. Trembicki; Cleaning Auto Bodies before Painting, E. Lacy; and Spraying Oakite Solutions, V. Frazee, followed by laboratory demonstrations.

A unique feature was the awarding of prizes at the banquet, for the best results in the November sales drive. This drive was fashioned after the wild and wooly west, cowboys and all. The salesmen had cowboy names and belonged to typically named ranches. Each man had a certain quota, based on his opportunity and previous record. A point was called a steer and every man who roped 110 steers or over, won a suitably inscribed fountain pen.

Of the 56 men who were actually in the field during the drive, 38 won prizes at the final "round-up," making a remarkably uniform showing for the "cow punchers."

Railroad Tonnage Shows Gain Over 1921

In the quarter ended with September, according to a summary of freight commodity statistics, made public by the Interstate Commerce Commission last week, tonnage hauled by the big or Class 1 railroads of the country was 5.89 per cent greater than in the corresponding quarter of the preceding year. The tonnage was 467,900,164, compared with 441,880,704 in the same months last year.

The increase took place notwithstanding the quarter was composed of the months in which the railroad shopmen's strike became effective, and embraced the months in which the strike of the coal miners was the most virulent. The loss in coal tonnage was only 2.35 per cent. Coal and agricultural products alone showed smaller tonnages than in the corresponding quarter of last year.

Grinding Association Elects Officers

Theodore A. Meyer recently was elected president of the Central Cylinder Grinding Association in Indianapolis. Other officers are as follows: vice-president, W. W. Adams, Fort Wayne; secretary, J. T. Andrews, Indianapolis; treasurer, George W. Kemp, Muncie; board of directors Val H. Lindenschmidt, Evansville; H. B. Shank, Fort Wayne, and V. J. Thampher, Connersville.

Growing Interest in Export Trade

The increased desire of American firms to enter foreign markets with their wares is reflected by a 400 per cent gain in foreign trade inquiries directed to the Department of Commerce this year, as compared with last, Director Julius Klein, of the Bureau of Foreign and Domestic Commerce, declares in his annual report.

Describing the fiscal year 1921-22 as "one of the most crucial periods in the history of the nation's foreign trade," Director Klein points to the complete reorganization of his bureau under Secretary Hoover's direction as the prime factor enabling it to help American export interests withstand the "inroads of recovering European competition in the world's markets."

Following out the policy of "better service with less meddling," Director Klein says that the Bureau of Foreign and Domestic Commerce now serves business on a commodity basis through seventeen new divisions which specialize on America's great export products of the factories and farms.

In concluding his report, Dr. Klein states that if the bureau is to carry on and enlarge its work in the manner dictated by the economic situation of the country, its activities should be extended to cover the study and promotion of domestic commerce. Its foreign service should be strengthened by the establishment of offices in new markets. Experts in commodities not yet specifically provided for, such as tobacco, grain and many manufactured specialties, should be added to its present staff to meet the increasing demands of the trades.

Numbering of Steels to Be Developed by A.E.S.C.

A system of designating kinds or qualities of steels by code numbers, each of which would represent a definite specification, will be developed as a result of the decision of a conference of the principal producers and users of steel held at Washington, D. C., December 6, at the call of the American Engineering Standards Committee. The conference recommended that this code be developed under the procedure of the A.E.S.C. and suggested to that organization the appointment of the Society of Automotive Engineers and the American Society for Testing Materials as joint sponsors for the code.

The agreement to go ahead with this project was arrived at after a spirited discussion concerning the necessity for and practicability of a numbering system. Strong opinions in favor of the designation of steels by number were voiced by heavy buying interests, such as the U. S. Navy Department, the Electrical Manufacturers' Council, the Society of Naval Architects and Marine Engineers, the U. S. War Department and the Federal Specifications Board. It was pointed out during this discussion that shipbuilders use every conceivable variety of steel opposition to the inclusion of tool steel was voiced by tool steel makers. As against the claim that the numbering of steel is not desirable so far as tool steel is concerned, it was brought out by a representative of the Navy Department that the Navy now has an accumulation of a million pounds of unidentified tool steel, all of which must be analyzed and tested before it can be used. This condition, it was said, would not exist if the quality of steel were designated by code numbers, representing definite specifications, rather than by the general terms, trade names, or brands now in common use, or—in some cases—by no mark at all.

Purchase on Chemical Analysis Makes Numbering Desirable

The arguments used against the numbering of tool steels, Admiral Cone declared, were identical with the arguments used 25 years ago against the writing of specifications for steel of any kind. As an indication of the feasibility of a uniform system of designating steel, it was asserted that almost 90 per cent of the steel used by the automotive industries is purchased on the basis of chemical analysis.

The conference voted that it is desirable to have a uniform numbering system, based on specifications, for forging steels, casting steels, structural steels including plates, tool steels, and other steels, this decision with the exception of tool steels, being taken without dissent. Whether the basis for such a numbering system should be chemical composition, physical properties, or heat treatment was left to be determined by a Sectional Committee, which is to be approved by the American Engineering Standards Committee. It was also left to the Sectional Committee to decide whether there are any existing systems which can be used as a basis for numbering codes for any or all of the various groups of steels. The question of whether brand names can be accommodated to and associated with a numbering system was brought up, but the consensus of opinion was that this is not practicable.

The conference was opened by a résumé of present American practice in designating steels, by Dr. G. K. Burgess, Chief of the Division of Metallurgy of the U. S. Bureau of Standards, and a résumé of European practice by L. H. Fry, representing the American Society for Testing Materials. Mr. Fry said that Switzerland and Germany have already taken definite steps toward a numbering system. The method proposed in Switzerland provides a system of symbols intended to be universal and definite, and capable of expansion to suit new requirements. In France a method is offered by which steels will be numbered with relation to a definite specification for the type, augmented by a letter indicating the method of manufacture, and a number showing the minimum tensile strength. In Great Britain a numbering system is employed for aircraft steels, and a tendency is appearing to develop symbols for automobile steels. Some limited symbolization is used in Holland also. Mr. Frey's full report based on information obtained from abroad by the A.E.S.C. will be sent upon request to the American Engineering Standards Committee.

Sees Budget System in Danger of Attack

Dangerous attacks on the Budget system were foreseen by John T. Pratt, chairman of the National Budget Committee, in an address before the Four Founder Societies of civil, mining, mechanical and electrical engineers at the Engineering Societies' Building, 29 West 39th Street, Wednesday night, Dec. 13.

Jealousies, he warned, would arise in federal bureaus, and perhaps in the Cabinet, from reductions in estimables, though these reductions were insisted upon by President Harding. Mr. Pratt asserted that the people of this country must be split into two main parties with clear-cut differences of opinion on national issues.

"For the fiscal year 1923-1924 the actual Budget estimates on the convening of Congress this month indicated a very small, or no, deficit," said Mr. Pratt. "All these figures and estimates take into calculation no extraordinary expenditures authorized by Congress, such as the soldiers' bonus, the ship subsidy, or other like bills calling for large expenditures of money.

"The dangerous attacks on the Budget system are likely to come from the very large reduction of some $600,000,000 made by General Lord, at the instance of the President, in the tentative figures of the Departments for 1923-1924, which were that amount larger than the actual figures submitted by the President in his message to Congress. No such cut can be made in the tentative estimates without arousing jealousies and dissatisfaction on the part of many of the bureau chiefs, and possibly some of the Cabinet officers."

The tendency of the times, according to Mr. Pratt, seems to be one of dissatisfaction with national legislation. The people feel, he said, that they are not getting full, complete and immediate action from their representatives in Congress in accordance with their ideas. He added:

"The people seem to be reaching out for a pure democracy, forgetting to realize that there is a very distinct difference between a republic and a pure democracy. The setting up of the Constitution indicates it was the first clear check against the historical development of democracies and established the principle of a republican form of government.

"The Budget Act is another similar check to the tendency to establish a free democracy, instead of the republic form of government, in this country. I refer to the republican or constitutional form of government, as opposed to the tendency shown by the attempts of the La Follette group for extension of the direct primary system and for modifications in the Constitution which would permit of a more immediate expression of popular will by shortening the time between the election of representatives and the convening of Congress."

Mr. Pratt declared that the National Budget Committee would constantly try to create public consciousness in favor of preserving the integrity of the Budget Act of 1921. Other aims, he said, were reorganization on functional lines of the executive department of the government, and co-ordination between the executive and the legislative branches by having Cabinet members appear on the floor of the House and Senate in defense of their Budget estimates.

Further Decline in Structural Steel Sales

A considerable seasonal decline occurred in the sales of fabricated structural steel in November, according to reports received by the Department of Commerce through the Bureau of the Census. November sales amounted to 46.8 per cent of shop capacity as against 57.3 per cent reported for October.

These percentages are based on a uniform capacity rating recently reported to the Bureau of the Census by almost all the reporting fabricators. Through these new ratings, the total monthly capacity of the 140 identical firms reporting each month from April through November has been reduced from 223,685 tons to 211,510 tons. The following table shows the tonnage booked each month by these firms and the percentage of their revised capacity:

	Tonnage Booked	Per Cent of Capacity
April	193.520	91.5
May	173.588	82.1
June	154.770	73.2
July	143.907	68.0
August	146.621	69.3
September	137.485	65.0
October	121.150	57.3
November	99.049	46.8

On the basis of these revised capacity reports and of known or reliably estimated capacities of other concerns, the Department of Commerce places the present capacity of the fabricated structural steel shops at 250,000 tons per month.

A considerable increase in the capacity of the structural steel fabricating shops of the United States since 1913 is shown in a special survey made by the Department of Commerce. A preliminary report, based on data received from 143 firms with a total revised capacity rating of 208,440 tons per month, shows an increase since 1913 of 45,025 tons in monthly capacity, or about 22 per cent.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

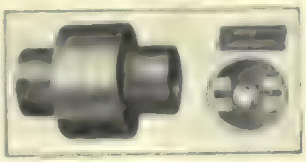
[illegible] Machine, Automatic, Type [illegible]
[illegible] Engraving Co., Brooklyn, N. Y.
"American Machinist," November 9, 1922

[illegible] is intended for work [illegible] impressions up to 36 x 20 in. [illegible] on the head. There is also a [illegible] movement. The control of all [illegible] pulley shaft on the rear. Table: [illegible] Floor space, 9 ft. x 3 ft. 1 inch.

[illegible], Contour Measuring
Bausch & Lomb Optical Co., Rochester, N. Y.
"American Machinist," November 9, 1922

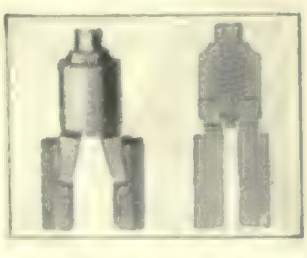
The projector is for inspecting [illegible], threaded work, gears, form cutters and all sorts of small parts for contour, [illegible] required for operation, as the image is produced on the horizontal table draped with a curtain. The work carrier is a compound slide given three movements by screws with handwheels, the vertical and the lateral [illegible] the work, and the [illegible] to focus the image on [illegible] supported by adjustable V-[illegible]. The adjustable thread chart, lead measuring device, screw holder, gear attachment, [illegible] attachments, photo-[illegible] holder, and angle plate [illegible] for attachment to the [illegible]

Shaft Coupling, Flexible, "Tilting-Bar"
American Foundry & Manufacturing Co., Frederick, Md.
"American Machinist," November 9, 1922



The coupling consists of only [illegible] two flanged hubs with [illegible] in their faces and a [illegible] bar that fits into the sockets. Flexibility is obtained by tilting and sliding the bar in its sockets, [illegible] parallel, angular and end-[illegible] misalignment of the two [illegible] for [illegible] quiet operation. [illegible] toward each other. [illegible] by means of one [illegible] on top of the [illegible] at right angles to it. [illegible] sizes, for shafts [illegible] in. in diameter. Weight: smallest [illegible] 2 lb.; largest [illegible] pounds.

[illegible] Cylinder [illegible], Stoning
[illegible] Co., 406 Sixth Ave. South, [illegible]
"American Machinist," November 9, 1922

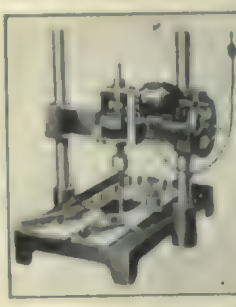


[illegible] the cylinder wall [illegible] section of the [illegible] of the body [illegible] by the arbor. The spring [illegible] to about 110 [illegible] is transmitted from the lower disk to the cams [illegible] When the tool is off center, all [illegible] so that only one stone [illegible] the work. The action [illegible] to center the tool

Drilling Machine, Sensitive, Ball-Bearing, High-Speed
Sigourney Tool Co., Hartford, Conn.
"American Machinist," November 9, 1922

The machines are of both the column and floor types and have single, two, three and four-spindle heads. The spindles are enclosed by telescopic sleeves and their projecting upper ends also are enclosed in stationary removable sleeves. The heads are adjustable vertically upon the face of the brackets for 6 in. The vertical movement of the spindle by rack and pinion is 2[illegible] in. and the moving parts are counter-balanced by concealed springs. A clamp is provided for fine adjustments on each head. Table: Vertical movement on column, 30 in.; dimensions, 9[illegible] x 12[illegible], 12 x 25, 12 x 31 and 12 x 37 in. for one, two, three and four-spindle machines. Weights, 400, 625, 765, and 960 lb., respectively.

Boring Machine, (Re-), Cylinder, "Superior"
Production Machinery Co., Jackson, Mich.
"American Machinist," November 9, 1922

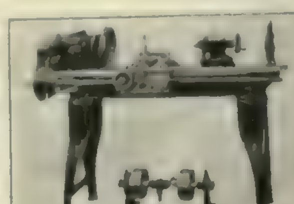


The machine will handle any automobile motor cylinder, and consists of a bed-plate to which the cylinder is clamped, and a cross-rail which carries the working parts. The boring bar is held between two centers. The cutter contains six blades adjusted simultaneously by a handwheel. The machine is furnished complete with two cutter heads, giving a range of from 2[illegible] to 4[illegible] in. Four feeds are available by changing the position of the rollers with which the star wheel comes in contact. The machine can be furnished with a [illegible]-hp. electric motor, or with pulleys for belt drive.

Grinding Machine, Cylinder, Vertical, Williams
Hy-Way Service Co., 225 South St. Joseph St., South Bend, Ind.
"American Machinist," November 9, 1922

In this machine the work lies on the horizontal table with the cylinders vertical. All the driving mechanism is located above the grinding wheel. Longitudinal and transverse screws operated from the front locate the work table. The entire mechanism for driving the wheel is mounted on the wheel head, which slides on the vertical column. The 2-hp. motor rotates the grinding spindle at high speed, revolves at low speed the eccentric sleeves carrying the spindle, feeds the head downward, and returns it to the starting position. The eccentricity of the spindle from the center of the spindle unit may be varied from 0 to 1[illegible] in. Holes as small as 2[illegible] in. in diameter can be ground to a 17 in. depth. Floor space, 37 x 42 in. Weight, 4,000 pounds.

Lathes, Engine, 10-, 12- and 14-Inch
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," November 9, 1922



The lathe is made in both cone-pulley and geared-head, single-pulley types. Straight or gap bed, bench or floor legs, oil pan and pump, and countershaft or motor drive can be furnished. Six speeds from 25 to 500 r.p.m. are provided with the cone-pulley headstock. With the geared headstock six speeds ranging from 32 to 500 r.p.m. are obtainable by shifting two levers. A friction clutch is fitted in the driving pulley. The range of feeds with the change gear is from [illegible] to [illegible] in. for all sizes of the machine, and all standard threads from 3 to 40 per inch can be cut. Standard bed lengths, 4 ft. 3 in., 5 ft. 3 in., and 6 ft. Carriage cross-slide travel, 6[illegible], 7[illegible] and 8 in., respectively. Weights, 575, 875 and 1,200 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

Urges Exporters to Help Europe

The only satisfactory way that we can revive foreign trade and aid the American exporter, the American farmer and American business in general is in the finding of ways and means to co-operate effectively with Europe in bringing about in Europe sound money and sound public finance, and, as a consequence, a revival of European industry and European exports, Dr. Benjamin M. Anderson, economist of the Chase National Bank, declared last week, in addressing a luncheon meeting of the American Manufacturers' Export Association at the Hotel Astor, New York City.

Dr. Anderson's subject was, "What Is Happening to Our Foreign Trade?" If the economic life of the world were functioning normally, said Dr. Anderson, we should have an "unfavorable balance of trade," or an import surplus, instead of our present favorable balance of trade, or export surplus. He added that this favorable "balance of trade," which many were afraid would disappear if European trade revived, was a mere bogey.

"The fear is an idle one," said Dr. Anderson. "We have done without comforts and luxuries long enough. Moreover the American market for the products of American industry will not be diminished by the process. Europe will not merely send us goods, but will also provide us with funds with which to pay for them. If goods are sent from France to the United States and sold here, and if at the same time the French Government is making remittances to the United States Government in payment of debts, the French Government will purchase with francs from the French shipper of the goods the dollar credits in New York which have been caused by the shipment of the goods, and will turn these dollar credits over to the United States Treasury.

"The United States receiving dollars from the source, will need to impose less heavy taxation upon the American people, and the American people will have consequently an increased volume of spending power, adequate to take care, not merely of the products of their own industry, but also of the French goods as well.

Business Items

The Terrell Machine Co., of Charlotte, N. C., has amended its charter increasing the capital stock to $100,000 from $25,000, it has been announced by E. A. Terrell, head of the company, the additional capital to be used for expansion purposes during 1923.

The Chapman Valve Manufacturing Co., Springfield, Mass., has declared a stock dividend of 50 per cent, transferring $500,000 from surplus to capital stock. Stockholders of record Dec. 19 will receive three shares for every two previously held by them.

The National Tool Co., Cleveland, Ohio, has acquired the manufacturing rights of the Simmons Method-Hob Co. of 2nd St. and Duncannon Ave., Olney, Philadelphia, Pa.

The Turner & Seymour Manufacturing Co., producers of high quality drapery and upholstery hardware, chain, etc., located at Torrington, Conn., has been purchased by W. R. Bassick, H. L. Sutton, and Willard L. Case.

The Birmingham Iron Foundry, Derby, Conn., manufacturers of rubber mill and rolling mill machinery, has recently increased its capital stock from $300,000 to $1,200,000.

The Fales & Jenks Machine Company, manufacturers of cotton machinery, Pawtucket, R. I., has recently increased its authorized capital stock from $400,000 to $2,000,000.

The Rowbottom Machine Co., manufacturers of automatic machinery, Waterbury, Conn., has increased its capital stock from $10,000 to $100,000, filing a certificate to that effect with the Secretary of the State of Connecticut, during the present week.

The Universal Valve Co., of New Britain, Conn., recently incorporated, elected the following officers during the past week: George LeWitt, president and treasurer; E. P. Burns, vice-president; and M. C. LeWitt, secretary.

The San Diego Supply Company has been incorporated at San Diego, Calif., to carry on the business of building contractor, with a capitalization of $100,000, of which $500 has been subscribed. The incorporators are: Gordon Gray, Union Bldg.; M. J. Irving, W. I. Ames, A. E. Rogers and F. F. Gray.

Sargent & Company, of New Haven, Conn., manufacturers of mechanics' tools, builders' hardware, etc., has voted an increase to its authorized capital stock from $325,000 to $6,500,000.

The Bennett Metal Treating Company, with plant in Elmwood, West Hartford, Conn., has recently incorporated under the laws of Connecticut, with a capital stock of $50,000, to engage in the metal treating business. The firm will begin business with $30,000, and the incorporators are: A. J. Davis, Alvan L. Davis, and H. R. Barker.

The Brown & Sharpe Manufacturing Co., machinery and tool manufacturers, Providence, R. I., during the past week voted a 16,000 per cent stock dividend on their capital stock, thereby increasing it from $100,000 to $16,000,000. This is one of the largest increases in capital stock in the New England States for some time, and while the Brown and Sharpe Co. has always been one of the biggest industries in the East, the capital stock was kept at $100,000. The firm was incorporated in 1868, and employs about 5,000.

The Gilbert & Bennett Manufacturing Co., Georgetown, Conn., manufacturers of wire goods, netting, etc., has increased its capital stock from $2,000,000 to $2,500,000, at a recent meeting of the directors.

Mobile Pulley and Machine Works, formed recently, now has its new Mobile plant in operation producing steel from an electric furnace. This is the first steel producing company in Mobile. A. J. Parsons is president of the concern.

The Southern Metal Trades Association, headquarters of which are in Atlanta, has been advised by the Lucey Manufacturing Co., of Chattanooga, one of its members, of the receipt of a large order for well drilling machinery from Soviet Russia.

The Alabama Manufacturers' Association, in annual convention at Birmingham in mid-December, reaffirmed its stand on the labor question, adopting resolutions strongly opposed to the closed shop and in favor of the American plan of operation in the Alabama industries. L. Sevier was elected president of the body for the ensuing year.

The Birmingham Stove and Range Co., operating a foundry and shops at Birmingham, Ala., is increasing its capital from $122,000 to $213,000 for the purpose of further expanding its business during 1923, according to Bolling H. Jones, of Atlanta, president of the company.

The Foster Machine Co., Westfield, Mass., dedicated its new two-story addition Dec. 14, when the officers of the company were hosts to the employees and their families at an evening party. Motors have been installed and also reflectors to provide an abundance of light. This addition will increase by one-third the company's production of textile and other machinery.

The Hart & Cooley Mfg. Co., at a meeting of the directors last week voted to recommand to the stockholders that a 50 per cent stock dividend be declared and the capital stock be increased from $660,000 to $990,000. The regular quarterly dividend of 3 per cent was declared.

The Southern Spring Bed Co., of Atlanta, is to immediately issue $250,000 in bonds to provide funds for greatly enlarging the capacity of the Atlanta plant, according to an announcement by Robert W. Schwab, president. Present floor space is about 70,000 square feet, and this will be increased to 125,000 square feet.

The Hurley Machine Co., New Haven, Conn., has declared a dividend of 10 per cent on the common stock, payable in common stock and the regular quarterly dividend of cents on the common stock, both payable Jan. 4 to stock of record Dec. 28.

The Westinghouse Electric and Manufacturing Co. has leased a six story building to be erected on a lot 100 x 150 feet at Jones Ave. and Marietta Street, Atlanta, Ga., at a cost of $360,000. The building, which is to be known as the Westinghouse Electric Building, will be constructed according to the company's specifications and will be used as an office, warehouse, and service station. Construction work was started Dec. 1 and will probably be completed by next May.

The Ingersoll-Rand Co. and the A. S. Cameron Steam Pump Works announce the opening of a branch office at 718 Ellicott Square Building, Buffalo, N. Y. This new office is equipped to render full service to those interested in air, gas and ammonia compressors, vacuum pumps, turbo blowers and compressors, condensers oil and gas engines, pneumatic tools, rock drills, centrifugal and direct-acting pumps and other of the numerous products manufactured by these Companies.

The Ramona Supply Co. of Ramona, Calif., has been incorporated for the purpose of carrying on a wholesale lumber and machinery business. The incorporators are A. C. Bisher, Pearl Bisher and Warren Libby, the first two living at Ramona and the latter at San Diego, Calif.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Broach, Bench, on Pedestal

American Broach & Machine Co., Ann Arbor, Mich.

"American Machinist," November 16, 1922

The power-operated press is intended especially for broaching small holes and keyways, and is operated by belt on a constant-speed pulley. Power is transmitted through a worm and worm gear to the ram. The ram is [illegible] by a [illegible] and is raised by a counterweight after the power has been disengaged. The machine is fitted with an [illegible] stop. It can also be operated by hand power. Approximately 2 tons pressure can be obtained. An oil reservoir in the pedestal can be connected to an oil pump. The table has a 2½ in. hole. Maximum stroke 14 in. Capacity [illegible] 6 in. in diameter. Height table to floor, 36 in. Weight with pedestal, 31[illegible] pounds.

Reamer, Line Expansion, Piston, "Nu-Angle"

[illegible]-Peterson Co., Norfolk Downs, Mass.

"American Machinist," November 16, 1922

The reamer is used in reaming piston-pin bushings. The six blades are placed at angles to the axis so as to minimize chatter and gouging. The size can be adjusted through a range of [illegible] in. The tool is equipped with a pilot and an expanding sleeve, so that the two holes in the bushing will be exactly aligned. The tool is guided and supported by the solid pilot and the expanding sleeve in one bearing while reaming the opposite bearing. The reamer is made in nine sizes. The diameters available range from 0.66 to 1.14 in. and the lengths from 9¼ to 13½ in. Three reamers can be furnished to ream the piston-pin bushings employed in the great majority of automobile motors. The tools are packed in wooden boxes.

Grinding Machine, Cylindrical, Plain, 12-inch

Cincinnati Grinder Co., Oakley, Cincinnati, Ohio

"American Machinist," November 23, 1922

The working mechanism has been redesigned, and the machine is intended for grinding straight or tapered spindles, shafts, rolls or any work mounted on centers. It is made in 18, 24, 36, 48 and [illegible] in. work lengths, with either belt or motor drive. The spindle is driven directly from the countershaft. Control is centralized on the front of the machine. Any unit may be easily removed. The spindle and the table have six work speeds each, obtained through a single gear box. When the power traverse to the table is engaged, the handwheel is automatically disengaged and remains stationary during the table travel. When the power traverse is disengaged, the handwheel is automatically engaged. The crossfeed may be either hand or automatic.

Garage Tools, Valve-Reseater, Piston Sleeves, "Speed Up"

Stevens & Co., 375 Broadway, New York, N. Y.

"American Machinist," November 23, 1922

The tools are for use in repairing automotive engines. [illegible] into the cylinder block. The sleeve is [illegible] and is made in five sizes to fit diameters fro[illegible] [illegible] to [illegible] inches.

Draftsmen's Set, "Leroy & Ames," No. 100

Edgar Bourquin, 1353 Main St., Waltham, Mass.

"American Machinist," November 16, 1922

The set consists of pens and a lettering instrument for the use of draftsmen and engineers. The Ames lettering instrument is a steel frame holding a celluloid disk which may be rotated in it. In the disk are three parallel rows of tapered holes for drawing guide lines for lettering. Compartments hold the pens, with a special celluloid holder for the Leroy tubular pens. The pens are of the fountain type and are adaptable to both ruling and lettering. Each tube has a removable cleaner. The width of the line made depends upon the width of the point, and the tube points are interchangeable in the swiveling socket, which can also hold Gillott's crow quill pens. Smaller sets than shown can be furnished.

Micrometer Case, Pocket

Brown & Sharpe Manufacturing Co., Providence, R. I.

"American Machinist," November 16, 1922

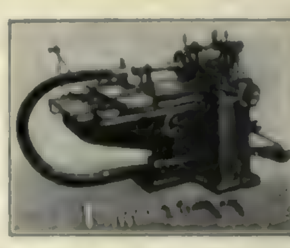
The case is for holding 1-inch micrometer calipers and is designed to fit the pocket without taking up much room or causing a large bulge. Its use protects the micrometer from dirt or injury when carried in the pocket. The case is made of metal covered with leather and lined with plush. It is furnished in two styles, the No. 202 for the standard micrometer made by the concern, and the No. 203 for the "Rex" micrometer. The inside of the case is so shaped as to hold the micrometer securely in position and prevent it from moving.

Grinding Machine, Cylinder, "Madison"

Gisholt Machine Co., Madison, Wis.

"American Machinist," November 23, 1922

The machine is adaptable to all kinds of automotive cylinders with the use of the standard equipment only, and can be employed on either open-head or closed-head cylinder blocks. The wheel spindle is of the two-piece type, and so for average work the outer spindle can be short and rigid. The rotary motion of the eccentric sleeve is controlled through a friction clutch and the amount can be adjusted while the head is in motion. The horizontal adjustment of the wheel to the work is obtained by movement of the wheel carriage. The work table can be moved vertically, as well as parallel to the wheel spindle to feed the cylinders to the wheel. Adjustable stops automatically trip and reverse the feed. An exhaust fan is mounted on the base. Floor space, 71 x 57¾ in. Weight, 2,600 pounds.

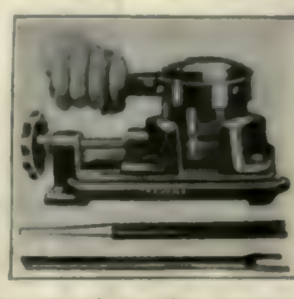


Garage Tools, Piston Vise, Groove Cleaner, Punch and Prongs, "Speed Up"

Stevens & Co., 275 Broadway, New York, N. Y.

"American Machinist," November 23, 1922

The vise is for holding pistons, speedometer heads, clocks, ball bearings and universal-joint parts. Four points of contact on the work are provided, the jaws being lined with lead. Capacity, 5½ in. in diameter. Weight, 12 lb. The cleaner is a metal band with four V-shaped points on the inside fitting into the piston groove. It is made in two sizes for pistons 3¾ in. in diameter and over, and for smaller pistons. The 12 in. Giant punches are for use in lining up holes for assembling and in driving pins and bolts. They are made in three sizes having point diameters of ⅛, $\frac{3}{16}$ and ¼ in. The 16-in. utility prong is for general use when repairing parts.



Clip, paste on 3 x 5-in. cards and file as desired

Personals

JAMES A. BENNETT has recently been appointed sales manager of the Connecticut Telephone & Electric Co., manufacturers of telephone and electrical supplies, Meriden, Conn.

FRANK L. COGILL, president of the Coulter & MacKenzie Machine Co., manufacturers of machinery, etc., Bridgeport, Conn., has returned to this country, after an extensive business trip through the European countries.

C. G. HOERLE, secretary of the Union Hardware Co., hardware manufacturers, of Torrington, Conn., has recently been appointed an Aide-de-Camp on the Staff of Governor-elect Charles A. Templeton, of Connecticut.

CLIFTON T. BROWNELL, president of the Brownell Machinery Co., dealers in machinery, 11 Eddy St., Providence, R. I., has purchased for his concern the property and buildings at the corner of Waterman and East River Streets, Providence. The lot consists of about 77,000 square feet of land, and the wooden buildings on same will be utilized as storage space of machinery by the Brownell Company.

GENERAL LUCIUS B. BARBOUR of Hartford, Conn., has been elected a director of the Landers, Frary & Clark Corp., manufacturers of cutlery, tools, etc., New Britain, Conn., to succeed his father, the late General Lucius A. Barbour.

CHARLES N. REPLOGLE, well known in the iron and steel business of the country, and formerly general manager of the Cambria Steel Co., was recently elected president and general manager of the Brightman Manufacturing Co. of Columbus, Ohio, succeeding W. C. Wagoner.

E. J. PERKINS, president of the Bessemer Metal Products Co., of Bessemer, Ala., advises that the company plans to manufacture a more or less complete line of metal automobile parts, including pistons, piston rings, connecting rods, etc.

GEORGE U. HATCH has been elected vice-president of the Millers Falls Co., Millers Falls, Mass., and will continue to have charge of sales, a position he he filled for three years since leaving the sales organization of the Winchester Repeating Arms Co.

FRANK B. ADAMS of Greenfield, Mass., has resigned as commercial representative of the New England Telephone and Telegraph Co. in that district to become director of welfare and first aid for the Detroit Steel Products Co., Detroit, Mich., for which concern his son is sales manager.

A. L. MEYERS, who has been connected with the R. K. LeBlond Machine Tool Co., Cincinnati, for the past sixteen years, has been transferred from the general superintendency of that company to the sales force of the same corporation and will have charge of the field work.

FRANK HOFFSTETTER, who has been assistant superintendent of the R. K. LeBlond Machine Tool Co., Cincinnati, has resigned his position to go with the Seifert & Woodruff Co., of Cincinnati. He will have charge of the sales end of their machine tool supplies.

E. C. BRANDT, works manager of the Westinghouse-Krantz Works, has been appointed works manager of the new plant now being erected by the Westinghouse Electric & Manufacturing Company in Homewood, Pittsburgh.

W. R. BASSICK, formerly vice-president and general manager of the Bassick Co., Bridgeport, Conn., has been elected president of the newly formed Turner & Seymour Manufacturing Co., Torrington, Conn.

H. L. SUTTON, formerly general manager of the American Tube and Stamping Co., has been elected vice-president of the Turner & Seymour Manufacturing Co., Torrington, Conn.

WILLARD L. CASE, formerly treasurer of the Yale & Towne Manufacturing Co., has been elected secretary-treasurer of the newly formed Turner & Seymour Manufacturing Co., Torrington, Conn.

G. MIL HORTON, general manager of the Cisco Machine Tool Co., has tendered his resignation to take effect Jan. 1, 1923.

ELBERT E. LOCHRIDGE, chief engineer of the Springfield municipal water system, has been elected president of the Engineering Society of Western Massachusetts to fill the vacancy caused by the recent death of Dr. Herbert C. Emerson.

CHARLES A. BICKETT, formerly with the Bickett Machine and Manufacturing Co., has organized a new plant, under the name of Bickett-Miller Co., to continue the manufacture of the Bickett line of bench millers and do special engineering and machine work.

Obituary

JOHN H. BASS, 87 years old, manufacturer and philanthropist, died at his home in Fort Wayne, Ind., last week after a lingering illness. Mr. Bass was the founder of the Bass Machine and Foundry Co. of that city. In addition to extensive industrial and commercial interests in Fort Wayne, he was identified with manufacturing plants in Chicago, St. Louis and in mining and steel industries in Alabama and Tennessee.

FRED A. MARSH, the general purchasing agent of the Link-Belt Co., died at his home, No. 6436 Greenwood Ave., Chicago, Dec. 11, at the age of 52 years. Mr. Marsh was a member of the Link-Belt organization for over 33 years, was one of the organizers of the Purchasing Agents Association of Chicago, and served as its first president. He was also for several years a director in the National Association of Purchasing Agents.

DON H. BACON, formerly president of the Tennessee Coal, Iron and Railroad Co., and who retired from active business life in 1906, died recently at his home in St. Augustine, Fla., where he lived during the winter months. His summer home was at New York City. Prior to becoming president of the Tennessee Company, Mr. Bacon was with the Minnesota Iron Co. in an executive capacity at the time this concern was purchased by the United States Steel Corporation. During this period he was prominently identified with the iron development of the northwest. He built a winter home at St. Augustine in 1916.

GEORGE J. FOSTER, a life long resident of Montreal, died Dec. 20, at the age of 50. Mr. Foster was president and managing director of Steel Specialties Co. of Canada, Ltd.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Electrical refrigerators for homes—Switzerland. Agency desired. Quotations, f. o. b. New York. Terms: Payment against documents. Catalogs requested. Reference No. 4754.

Small electric heaters for home use, and electrical machinery and apparatus of all kinds—Spain. Purchase desired. Quotations, c. i. f. Corunna or Vigo. Terms: Cash against documents in New York. Correspondence, Spanish or French. Reference No. 4755.

Hardware, utensils, tools, valves and automobile supplies—Italy. Agency and purchase desired. Quotations, c. i. f. Genoa. Reference No. 4718.

Hardware, including tools, locks, axes, hatchets, paints and varnishes, and watches and clocks—South Africa. Agency desired. Reference No. 4717.

Hardware, tools and implements of every description — Poland. Agency desired. Quotations, c. i. f. Danzig. Reference No. 4719.

Forthcoming Meetings

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

Society of Automotive Engineers, annual meeting, Jan. 9 to 12, 1923, Engineering Societies Building, 29 West 39th St., New York City. C. F. Scott is chairman.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Society for Steel Treating, Winter Sectional Meeting, City Club, Chicago, Ill., Feb. 15 and 16, 1923. National Secretary, W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Current business on steel shapes, plates and bars, firm at $2 per 100 lb., Pittsburgh, despite weakening of market in light rails and forging billets. On especially attractive tonnages $1.90 is possible, particularly for car material. The minimum on bars, however, is placed at $1.95, and that to large and preferential buyers only. Copper, lead and tin markets all firmer in tone. Electrolytic copper, up ½c.; tin, 1½c. and lead ½c. per lb. in New York warehouses during week. Copper sheets, wire and tubing advanced ½c. and copper bars, brass sheets and wire, ¼c. per lb. Old metals, non-ferrous, also up ½c.@1½c. per lb.

Declines—Zinc quoted at 7½c. as against 7¾c. per lb. in New York warehouses, despite firmness of other metals. Linseed oil market sluggish but prices steady. Coke, both furnace and foundry, down 50c. per ton during week.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.05
Northern Basic	29.27
Southern Ohio No. 2	28.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.44
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.14
Virginia No. 2	34.17
Basic	27.50
Grey Forge	28.64
CHICAGO	
No. 2 Foundry local	28.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	29.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	27.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cleveland	5½@6
Cincinnati	4.5@6
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	4.19	3.70	4.00
No. 12	2.60	4.24	3.75	4.05
No. 14	2.70	4.29	3.80	4.10
No. 16	2.90	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20	4.30	4.20	4.70
Nos. 22 and 24.	3.25	4.35	4.25	4.70
Nos. 25 and 26.	3.30	4.40	4.30	4.75
No. 28	3.35	4.50	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35	4.50	4.40	4.85
Nos. 12 and 14.	3.45	4.60	4.50	4.95
Nos. 17 and 21.	3.75	4.90	4.80	....
Nos. 22 and 24.	3.90	5.05	4.95	5.40
No. 26	4.05	5.20	5.10	5.55
No. 28	4.35	5.50	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{1}{16}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{3}{16}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York		15.37½
Tin, 5-ton lots, New York		39.00
Lead (up to carlots), St. Louis	7.05;	New York, 7.62½
Zinc (up to carlots), St. Louis	7.05;	New York, 7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7@7.25	8.37½	7.75
Copper sheets, base	22.00	22.00	23.00
Copper wire (carlots)	16.50	18.00	16.25
Copper bars (ton lots)	20.25	23.00	19.50
Copper tubing (100-lb. lots)	25.25	25.00	23.00
Brass sheets (100-lb. lots)	18.75	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.25	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.75	20.00
Babbitt metal (83% tin)	42.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.50	12.50	12.00
Copper, heavy, and wire	12.25	11.75	11.50
Copper, light, and bottoms	10.50	10.00	10.50
Lead, heavy	5.75	5.50	5.75
Lead, tea	5.25	4.50	4.75
Brass, heavy, yellow	7.00	....	....
Brass, heavy, red	9.50	9.50	9.50
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	7.00	6.50	7.00
Zinc	4.50	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.00	11.50	14.50
IC,		112 sheets	12.30	11.90	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.90	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville...per net ton		$6.50	
Coke, prompt foundry, Connellsville...per net ton		7.00@7.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40–10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	...	$3.70 base
Copper rivets	55–5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.50	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30–10%	40½%	50%
Heavy grade	20–5–2½%	30–5%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	65–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ark., Fort Smith—T. H. Lyon, 1004 Gar- [illegible] Ave.—[illegible] electric power lathe.

Calif., Eureka—Bd. Educ., O. B. Allee, [illegible] bids until Jan. 2, one No. 1½ [illegible] cutter and tool grinder, [illegible] grinding attachment; [illegible] grinding attachment; gear [illegible] attachment; surface grinding [illegible], case for storing the [illegible], truing diamond and holder, one engine lathe, 14 in. swing, [illegible] quick change gears and [illegible] chuck plates, follower rest and [illegible] equipment and taper attachment for one lathe; [illegible] & Shipley or equal (a) single pulley or constant speed drive (b) cone drive (c) one to six in. 3 jaw [illegible] chuck [illegible] and outside jaws for each lathe; [illegible] 12 in. independent chuck for each lathe; one 12 in. [illegible] grinder head with counter-shaft and guards; one Metcalf emery wheel dresser, type A; one Buffalo combine armor plate punch and shear with metal stand (a) No. 3 B (b) No. 4 B; one Wicks continuous blue print machine No. 15 for A. C. 110 [illegible]; two No. 2 double Superior [illegible] furnace (for manufactured gas); one [illegible] or equal low pressure acetylene gas generator, 10 lb. capacity, and the following equipment: one welding blowpipe complete with [illegible] welding heads, one cutting blowpipe complete with [illegible] nozzles, four sheet metal blowpipes complete with tips, one lead burning blowpipe complete with tips, one oxygen cutting regulator, 2 guages, [illegible] oxygen regulators. Alternate bid welding outfit; provide the number of torches as listed and all other necessary equipment so that gas from acetylene cylinders may be used in place of the acetylene generator. [illegible] must specify items to be furnished which must include truck to make the outfit [illegible] portable. Sheet metal equipment: one No. 651 cornice break, one No. 381 slip roll pattern forming machine, one No. 137 B squaring shear, one No. 548 wiring machine, one 4 in. Wiss combination snips, one No. 811 hollow mandrel stake, one No. 925 blowhorn stake, one No. 935 coppersmiths squaring stake, two 16 oz. riveting hammers, one No. 60 [illegible] machine, one No. 587 crimping and beading machine, one No. 547 turning machine, one Pexto bench shear No. 3, one 4 in. Bartlett compound lever snips, one No. 901 Beakhorn stake, one No. 931 bevel edge squaring stake, one No. 941 [illegible] stake, one 14 oz. setting hammer, one rivet set.

Ill., Chicago—Pullman Co., East 112th St. and Cot Grv.—one 18 in. slotter; one 48 in. open side planer with a 20 ft. bed; one 5 or 6 ft. radial drill; one 10 in. slotter; one 36 in. x 36 in. x 8 ft. bed, or longer, planer with 4 heads; one 26 in. swing heavy duty drill press with compound table and tapping attachments; one 20 in. shaper.

Mass., Cambridge—Cambridge Motor Co., 1[illegible] Massachusetts Ave. — machinery and equipment for garage.

Mich., Detroit—F. Colman & Sons, 1520 [illegible] St., [illegible] works)—grinders and miscellaneous machine shop equipment.

Wash., Centralia—[illegible], 721 [illegible]—one quick change machine lathe, 15 to 18 in. swing, 8 ft. bed, [illegible] complete, [illegible] or electric; one 2 wheel pedestal grinder, 1 wet, 1 dry wheel.

Wis., Janesville—[illegible], 21[illegible] East [illegible]—[illegible] and automobile repair machinery, also pumps, for proposed garage.

Wis., Madison—[illegible] City Garage Co., South Pinckney St.—power machinery and automobile repair machinery for proposed $[illegible] garage on Washington St.

Machinery Wanted

Ala., Auburn—Young Lumber Co.—machinery and equipment for lumber mill, to replace that which was destroyed by fire.

Ark., El Dorado—H. Byrens, Box 1025, (oil producer)—two oil pumps, one visible gasoline pump, air compressor, five 5,000 barrel oil tanks and 6, 8 and 10 in. pipe.

Ill., Chicago—H. J. Delson Co., 749 North Western Ave., (job printer)—14 x 22 in. and 13 x 19 in. presses, also motors for same.

Ill., Peoria—Meyer Furnace Co., 1300 South Washington St.—equipment for furnace factory, to replace that which was destroyed by fire.

Ind., Fort Wayne—Fort Wayne Box Co., Calhoun and Superior Sts.—machinery for proposed box factory.

Ky., Ashland—Amer. Rolling Mill Co.—cranes.

Ky., Louisville—Mengel Body Co., A. Allen, Pres.—machinery and equipment for the manufacture of auto truck bodies.

Mass., Dorchester (Boston P. O.) — W. Marado Co., 387 Bowdoin St., (manufacturer of advertising specialties) — multicolor press (used).

Mass., Fitchburg — Star Worsted Co.—machinery, including looms, etc., for addition to woolen mill.

Mass., South Braintree (Boston P. O.)—H. W. Bailey & Co.—folding machine large enough for 7 column newspaper.

Mass., Worcester — Queensbury Mills, Inc., Quinsigamond Ave.—machinery for additions to yarn mill.

Mich., Detroit—E. Eichman, 3102 Roosevelt Ave.—equipment for the manufacture of patented expander and contractor for automobile tires.

Mich., Detroit—Ervin Stamping Co., 25 East Atwater St., (metal stamping)—miscellaneous equipment for making metal parts; shop trucks; dipping tanks for enameling.

Mich., Detroit—Stewart Auto Top Co., 83 East Milwaukee Ave.—band saw and equipment.

Mich., Grand Rapids—Bd. Educ., H. Morrill, Business Mgr., City Hall — manual training equipment for proposed Junior High School.

Miss., Moss Point—Southern Paper Co.—machinery and equipment for pulp paper mill.

Mo., Joplin—W. W. Kersey, 2005 Empire Ave.—oil driller.

Mo., St. Louis — Germo Mfg. Co., 111 South Main St.—two steel-jacketed, 500 gal. kettles.

Mo., St. Louis—Z. Zimmerly, 5532 Magnolia Ave.—7 x 11 in. Pearl or 8 x 12 in. Chandler-Price printing press.

Neb., Omaha—Union Pacific R.R., 15th and Dodge Sts., G. C. Smith, Purch. Agt.—$5,900,000 worth of equipment, including 78 new freight engines.

N. Y., Addison—H. Austin—ice cream manufacturing machinery for plant at Canisteo.

N. Y., Jamestown—Jamestown Metal Desk Co., 104 Blackstone Ave.—machinery and equipment for proposed addition to factory.

N. Y., Rochester—G. Sinnord, 1839 Highland Ave.—one power drag saw and equipment.

O., Columbus—W. E. Lamneck Co., 5th Ave. along tracks of Hocking Valley R.R., (manufacturer of furnaces and metal products), A. P. Lamneck, Secy. and Treas.—metal working machinery to enlarge plant.

O., Lima—Lima Sheet Metal Wks.—sheet metal working machinery.

O., London—M. J. Kehoe Co.—machinery for the manufacture of power washing machines.

O., Washington C. H.—G. D. Baker & Co., (manufacturer of hardwood flooring)—woodworking machinery, including saws, planers, molders, etc.

Ore., Astoria—Hammond Lumber Co.—machinery and equipment for saw and planing mill, and sash, door and box factory.

Pa., Allentown—Lehigh Valley Poster Co.—machinery and equipment for proposed poster plant.

Pa., Etna (Pittsburgh P. O.) — Spang Chalfant Co.—10 ton crane.

Pa., Hughesville—Hughesville Furniture Co., W. M. Engel, Pres.—machinery and equipment for additions to furniture plant.

Pa., Lancaster—J. H. Hartman, Elizabeth Ave. and Plum St.—machinery and equipment for the manufacture of toy banks, etc.

Pa., Mars—Volte Fdry. and Machine Co.—pattern shop and foundry equipment.

Pa., Monessen—Monesson Fdry. and Machine Co.—10 ton crane.

Pa., Oil City—T. F. Fleickenstein—bakeshop equipment.

Pa., Pittsburgh—Carnegie Steel Co., Carnegie Bldg.—Gantry crane for West Braddock docks.

Pa., Pittsburgh—Pennsylvania R.R., Pennsylvania Sta., W. G. Phelps, Purch. Agt.—600 ton wheel press.

Pa., Sharon—H. J. Chadderton—coal coal mining machinery and equipment for coal deposits to be developed near Mercer.

Pa., Slatington—O. B. Brush Co., J. G. Rauch, Dir.—machinery and equipment for the manufacture of brushes.

Pa., Titusville—Cycloys Steel Co., C. T. Evans, Supt.—machinery and equipment for the manufacture of a new process combination metal and alloy steel.

Pa., Yorkhaven—E. E. Brunner, c/o State Bank—machinery and equipment for the manufacture of paper and saturating felt.

Tex., Fort Worth—Alford Ice Co., Jassemine and Jennings Sts.—$45,000 worth of ice machinery.

Tex., Port Arthur—Bd. Educ.—lathes, planers, etc., for manual training department of proposed grade school.

Va., Alexandria—G. Carroll, Box 11—machinery for the manufacture of electric storage batteries.

Va., Bristol—Lincoln Furniture Co., C. Lincoln, Pres.—machinery and equipment for $100,000 addition to plant.

W. Va., Ronceverte—Midland Smokeless Coal Co., C. Thompson, Pres.—conveying, transmission machinery and other mine equipment.

Wis., Almond—A. Pagel—machinery and equipment for new feed grinding mill.

Wis., Crandon—Forest County Bd., F. J. Rogers Comnr.—$8,000 worth of road machinery, including gravel crushing equipment.

Wis., Marshfield—L. Kohl, 110 West 4th St.—mechanical equipment for baking process, to bake paint on automobiles.

Wis., Milwaukee—Gas Tank Recharging Co., 1245 23rd Ave.—air compressors for proposed plant at West Allis.

Wis., Milwaukee — Milwaukee Vinegar Co., 79 Buffalo St.—yeast presses and hoppers for proposed yeast house at Cudahy.

Wis., Ripon—Ripon Produce Co., A. E. Wells, Secy.—power and dairy machinery for proposed plant at Stetsonville.

Wis., Sheboygan—Sheboygan County Bd., G. W. Ubbelohde, Chn., Court House,—gravel pit machinery, conveyors, etc., for road use.

Wis., South Madison (Madison P. O.)—Bd. Educ., E. Reggert, Chn.—manual training equipment for new high school.

Wis., Waunakee—Waunakee Canning Co., c/o A. P. Kenney, Waunakee State Bank—canning machinery and power machinery for proposed factory.

Ont., Cobalt—Coniagas Mines, Ltd.—crushing equipment to enlarge production to 150 ton per day.

Ont., Midland—Pratt & Shanacy, (lumber), J. Pratt, Purch. Agt.—one lath machine and one bolter, capacity 35,000 per day.

Ont., Niagara Falls—Twp. of Stamford T. R. Stokes, Clk.—rock crusher.

Ont., Ottawa—Dept. Public Wks., R. C. Desrochers, Secy.—receiving bids until Jan. 31, dry dock machinery for Esquimalt, B. C.

Ont., Ottawa—McAuliffe-Davis Lumber Co.—woodworking machinery.

Ont., Timmins—Hollinger Consolidated Gold Mines, Ltd.—machinery to double present capacity of plant, (4,500 ton per day), including crushers, drills, conveying equipment, stamp mills, amalgamators, etc.; also cranes for proposed power plant.

Que., Lachine—La Pailleur Freres, Ltd., 405 St. Joseph St., L. LaPaulteur Purch. Agt.,—stone crushing machinery.

Que., Montreal—O. Martineau & Fils, Ltd., 371 Marie Anne, E.—additional quarrying and stone crushing equipment.

Que., Quebec—Jobbin & Genois, Abraham Hill—machinery and equipment for proposed marble manufacturing plant at Riviere a Pierre.

Que., Quebec—Quebec Development Co., Union Bank Bldg.—stone crushing machinery.

Que., St. Moise—Tartague Lumber Co., Ltd., J. Dufort, Purch. Agt.—saw mill equipment; later, equipment for shingle mill and sash and door factory.

Que., Victoriaville—A. Le Houillier—complete sawmill equipment.

Metal Working Shops

Calif., Petaluma—Fuller & Peters, Main and Bridge Sts., plan to build a 50 x 112 ft. garage on North Main St. Architect not selected.

Calif., San Francisco — T. Hamill, 6140 Geary St., will build a 2 story automobile repair shop, etc., on Gear St. near Blake St. Estimated cost $10,500.

Calif., San Francisco—L. R. Lurie, Mills Bldg., awarded the contract for the construction of a 1 story machine shop on 10th and Minna Sts. Estimated cost $13,000. Noted Dec. 14.

Calif., Stockton—The H. Cowell Estate c/o W. H. George, Secy., 2 Market St., San Francisco, is having plans prepared for the construction of a 1 or 2 story, 80 x 100 x 150 ft. garage on Hunter and Channel Sts., here. Estimated cost $50,000. H. H. Meyers, Kohl Bldg., San Francisco, Archt.

Calif., Tulare—The Tulare Union High School District is having plans prepared for the construction of addition to auto mechanics building, also for remodeling and building additions to manual arts building. Estimated cost $22,000. Swartz & Ryland, Rowell Bldg., Fresno, Archts.

Conn., Bridgeport—The Lacey Mfg. Co., 50 Middle St., manufacturer of dies, tools, etc., plans to build a 2 story factory on Connecticut and Union Aves. Estimated cost $35,000. Architect not selected.

Conn., New Haven—The Eastern Machine Screw Co., Truman and Barclay Sts., awarded the contract for the construction of a 1 story, 30 x 30 ft. addition to its factory. Estimated cost $5,000.

Ill., Chicago—The Electrical Dealers Supply Co., 162 West Randolph St., is having plans prepared for the construction of a 3 story, 100 x 250 ft. factory on Diversey St. near Oakley Ave. Estimated cost $150,000. S. N. Crowen, 400 North Michigan Ave., Archt.

Ill., Chicago—The Yellow Cab Mfg. Co., 57 East 21st St., awarded the contract for the construction of a 1 story, 198 x 368 ft. cab assembling factory at 5801 Dickens Ave. Estimated cost $350,000.

Ill., Peoria—The Meyer Furnace Co., 1300 South Washington St., plans to rebuild its furnace factory, which was destroyed by fire. Estimated cost $100,000.

Ind., Fort Wayne—The Knuckle Valve Co., 825 Barr St., awarded the contract for the construction of a 1 story, 75 x 150 ft. valve factory. Estimated cost $26,000.

Ind., Indianapolis—The Amer. Can Co., 120 Bway., New York City, awarded the contract for the construction of a 4 story, 34 x 230 ft. can factory, here. Estimated cost $300,000.

Ind., Indianapolis—The Capitol & St. Clair Realty Co., c/o D. A. Bohlen & Son, Archts., 1001 Majestic Bldg., is having plans prepared for the construction of a 1 story, 112 x 122 ft. automobile service plant on North Capitol Ave. Estimated cost $27,000.

Ia., Denison — G. W. Newton plans to build a 2 story, 85 x 150 ft. garage on Main and Chestnut Sts. Estimated cost $40,000. Architect not announced.

Mass., Everett—The Sexton Can Co., 123 Broad St., Boston, awarded the contract for the construction of a 2 story, 50 x 130 ft. addition to its factory for the manufacture of cans on Cross St., here. Estimated cost $40,000.

Mass., Holyoke—D. O'Connell's Sons, 480 Hampden St., will build a 2 story, 110 x 120 ft. garage on Dwight St. Estimated cost $50,000.

Mass., Pittsfield—The Berkshire Products Corp. is having plans prepared for the construction of an electrical manufacturing plant. Cost between $70,000 and $100,000. G. Southerd, Jr., Genl. Mgr. J. M. Vance, 24 North St., Archt.

Mass., South Boston (Boston P. O.)—The Gillette Safety Razor Co., 41 West 1st St., plans to build an 8 story addition to its factory. Architect not announced.

Mass., Worcester—The Boulevard Park Associates, 339 Main St., awarded the contract for the construction of a 1 story, 45 x 165 ft. garage, etc., on Shrewsbury St. Estimated cost $40,000. J. F. Carberry, Agt.

Mich., Albion — The Service Caster & Truck Co., 316 East Porter St., will soon award the contract for the construction of a 1 story, 50 x 200 ft. factory for the manufacture of roller casters for trucks. Estimated cost $40,000. Private plans.

Mich., Detroit—The Michigan Stamping Co., 11631 Mack Ave., awarded the contract for the constructing of a 1 story, 140 x 347 ft. addition to its metal stamping plant. Noted Dec. 14.

Mich., Grand Rapids—The C. J. Litscher Electric Co., 41 Market Ave., plans to rebuild its 3 story, 60 x 130 ft. factory, which was destroyed by fire. Estimated cost $150,000. Architect not selected.

Mich., Muskegon Heights — The Piston Ring Co. is having plans prepared and will receive bids about February for the construction of a 1 story, 120 x 222 ft. foundry. Estimated cost $75,000. Private plans.

Minn., St. Paul—The L. W. Jordan Co., 118 West 7th St., plans to build a 2 story, 105 x 190 ft. garage and sales building. Estimated cost $65,000. Architect not announced.

N. J., Elizabeth—The Amer. Type Fdry. Co., Communipaw Ave., Jersey City, is having plans prepared for the construction of an administration building, 165 ft. long, and assembling plant, 600 ft. long, 1 and 2 story, on West Grand St., here. Estimated cost $750,000. Day & Zimmerman, 611 Chestnut St., Phila., Engrs.

N. J., Linden—The Layne—New York Co., subsidiary of Layne & Bowler Co., Chelsea Ave., Memphis, Tenn., manufacturer of pumps and screens, awarded the contract for the construction of a small factory, here.

N. Y., Buffalo—S. H. Horn, 217 Leroy Ave., plans to build a factory for the manufacture of automobile bodies at 488 Kensington Ave. Estimated cost $30,000. Architect not selected.

N. Y., Jamestown—The Jamestown Metal Desk Co., 104 Blackstone Ave., is having plans prepared for the construction of a 1 story, 100 x 200 ft. addition to its factory. Estimated cost $40,000. Beck & Tinkham, 317 Washington St., Archts.

N. Y., New York—The Pleasant Ave. Garage Corp., c/o Springsteen & Goldhammer, Archts., 32 Union Sq., will build a 1 story garage on 179th St. and 3rd Ave. Estimated cost $25,000.

N. Y., New York—S. Rubin, c/o C. Schaefer, Jr., Engr. and Archt., 394 East 150th St., will build a 1 story garage on Webster Ave. Estimated cost $45,000.

O., Alliance—The Alliance Machine Steel Castings Co. is having plans prepared for the construction of a 1 story, 75 x 600 ft. addition to its plant. Private plans.

O., Cleveland—The J. L. Free Co., 1040 Prospect Ave., (real estate), awarded the contract for the construction of a 1 story, 90 x 135 ft. sales room and garage at 3746 Prospect Ave. Estimated cost $50,000.

O., Cleveland — The National Screw & Tack Co., 2440 East 75th St., awarded steel contract for the construction of a 5 story, 56 x 165 ft. factory on Platt Ave. Estimated cost $250,000. Noted Nov. 2.

O., Norwood—The Ford Motor Co., Highland Park, Mich., awarded the contract for the construction of an assembling plant and loading platform for automobiles, here.

Pa., Erie — M. Griswold, c/o Griswold Mfg. Co., is receiving bids for the construction of a 2 story, 100 x 150 ft. garage on 20th and State Sts. Estimated cost $40,000. Private plans. Northwestern Motors Co., lessee.

Pa., Monessen—The Monessen Fdry. and Machine Co. awarded the contract for the construction of a 1 story, 32 x 100 ft. core room.

Pa., Phila.—Abbotts Dairy Co., 31st and Chestnut Sts., awarded the contract for the construction of a 3 story, 120 x 140 ft. garage on 3rd and Lombard Sts. Noted Dec. 21.

Pa., Pittsburgh—The Superior Auto Accessories Co., 1342 Forbes St., awarded the contract for the construction of a 1 story, 100 x 145 ft. and 78 x 120 ft. automobile show room and garage on Baum Blvd. and Woodworth St. Estimated cost $50,000.

Pa., Reading—The Biehl Auto & Wagon Wks., 31 South 5th St., is receiving bids for the construction of a 2 story, 85 x 200 ft. factory for the manufacture of automobile equipment. H. G. Mohn, Mohnton, Archt.

Pa., Uniontown—H. Cochrane, c/o H. W. Altman, Archt., Uniontown, is receiving bids for the construction of a 1 story, 90 x 120 ft. garage on Baum Blvd. Estimated cost $85,000.

Pa., Williamsport—The Glosser Motor Car Co., 248 William St., plans to build a 3 story, 43 x 66 ft. garage and automobile machine shop on William and West Church St. Estimated cost $50,000. S. A. and R. J. Glosser, owners.

R. I., Providence—The City Real Estate Co., 4 Weybosset St., is having plans prepared for the construction of a 2 story garage and service station, with capacity for 90 cars on Bway. and Westminster St. Estimated cost $50,000. Private plans.

R. I., Providence — The E. A. Smith Realty Corp., Weybosset St., plans to build a 3 story garage and service station, with capacity for 250 cars on Chapel St. Estimated cost $100,000. Architect not announced.

Tex., Amarillo—The U. & S. Zinc Corp. will soon receive bids for the construction of smelter, also industrial housing. Estimated cost $400,000. Private plans.

Tex., Dallas—The Dallas Gas Co., Logan St., is receiving bids and will open same about Jan. 1, for the construction of a 1 story, 60 x 150 ft. garage and workshop. Estimated cost $65,000. Private plans.

Wis., Cedarburg — The Hansen Canning Machine Corp., Port Washington, awarded the contract for the construction of a 1 story, 112 x 112 ft. factory, here. Estimated cost $40,000. Noted Dec. 7.

Wis., Janesville—J. A. Strimple, 219 East Milwaukee St., awarded the contract for the construction of a 2 story, 113 x 190 ft. garage, to replace the one which was destroyed by fire. Estimated cost $45,000.

Wis., Madison—The Capital City Garage Co., South Pinckney St., is having plans prepared for the construction of a 2 story, 66 x 165 ft. garage and repair shop on Washington St. Estimated cost $60,000. F. L. Kronenberg, Carroll Bldg., Archt.

Wis., Madison—L. F. Schoelkopf, 210 East Washington Ave., plans to build a 1 story, 66 x 150 ft. garage and automobile supply station on East Main St. Estimated cost $50,000. Architect not selected.

Wis., Madison—The University of Wisconsin awarded the contract for the construction of a 4 story, 62 x 68 ft. service station, including garage, electric substation, woodworking shop, etc., on University St. Estimated cost $85,000.

Wis., Madison—The Wisconsin State Hospital Comnrs. are having plans prepared for the construction of a 1 story, 45 x 124 ft. garage. Estimated cost $40,000. Dr. W. F. Lorenz, Mendota St., Secy. A. Peabody, Capitol Bldg., Archt.

Wis., Milwaukee—R. L. Clark, 2218 Meinecke Ave., is having plans prepared for the construction of a 2 story, 100 x 140 ft. garage on 20th St. Estimated cost $65,000. C. H. Tharinger, 3328 State St., Archt.

Wis., Milwaukee — The Harley-Davidson Motor Co., 3732 Chestnut St., awarded the contract for the construction of a 1 story, 80 x 145 ft. foundry. Estimated cost $45,000. Noted Dec.7.

Wis., Milwaukee — The Milwaukee Gas Specialty Co., 2017 Clybourn St., awarded the contract for the construction of a 1 story, 45 x 115 ft. addition to its factory. Estimated cost $45,000. Noted Dec. 7.

Wis., Milwaukee—The South Side Nash Co., 9th and Forest Home Aves., has had plans prepared for the construction of a 1 story, 72 x 93 ft. garage. Estimated cost $40,000. Gurda & Gurda, 2nd Ave. and Mitchell St., Archts.

Wis., Milwaukee—The Welch Investment Co., 105 Wells St., awarded the contract for the construction of a 2 story, 75 x 150 ft. addition to its garage on Grand Ave. Estimated cost $50,000. Noted Dec. 14.

Wis., Wausau—The Durant Motor Car Co., 208 Washington Ave., awarded the contract for the construction of a 2 story, 60 x 60 ft. garage. Estimated cost $40,000. Noted Dec. 7.

Ont., Toronto—[illegible] Peatty, 169 [illegible] [illegible] awarded the contract for the construction of a 1 story [illegible] x 100 ft. garage on [illegible] St. Estimated cost [illegible].

General Manufacturing

Ala., Auburn—The Young Lumber Co. plans to rebuild the portion of its lumber mill which was recently destroyed by fire. Estimated cost [illegible].

Calif., Oakland—The Art Rattan Wks., [illegible] St., awarded the contract for the construction of a 3 story factory on 24th Ave. near East 12th St. Estimated cost [illegible]. Noted Dec. 14.

Calif., Oakland—The California Packing Corp., 111 California St., San Francisco, is receiving bids for the construction of a 1 and 2 story canning plant consisting of factory and warehouse, on 1st and Filbert Sts., here. F. Beck, 111 California St., San Francisco, Archt. Noted Nov. 16.

Calif., Petaluma—The Petaluma Ice & Cold Storage Co., branch of National Ice & Cold Storage Co., Postal Telegraph Bldg., San Francisco, has had plans prepared for the construction of a cold storage plant, here. Estimated cost, including equipment, [illegible]. Private plans.

Calif., Riverbank—[illegible] L. Flack, 1st Natl. Bank Bldg., is interested in a company which is being organized to build a cannery on a 100 x 400 ft. site. Estimated cost $15,000. Architect not selected.

Calif., Sacramento—The Bd. Educ. will receive bids until Jan. 11 for the construction of [illegible] buildings comprising gymnasium, [illegible] science, shops and cafeteria, on [illegible] St. Estimated cost [illegible]. E. A. Matthews, [illegible] Bldg., San Francisco, Archt.

Calif., San Francisco—The California Shade Cloth Co., Inc., 2183 Bryant St., will build a 2 story shade cloth factory on San Bruno Ave. Noted Dec. 21.

Calif., San Francisco—Roth, Winter & Walsh, 1371 Mission St., awarded the contract for the construction of a 2 story, 91 x [illegible] ft. packing plant on Townsend St. Estimated cost [illegible]. Noted Dec. 21.

Calif., San Jose—The De-Hi Food Products Co. plans to build a dehydrating plant on a [illegible] acre site on Union Ave. A. P. Maragos, c/o California Prune and Apricot Growers, San Antonio and Market Sts., Pres. Architect not selected.

Calif., Stockton — The Terminal Cold Storage and Warehouse Co., c/o N. E. MacLean, Archt., 16 California St., San Francisco, is having plans prepared for the construction of a pre-cooling plant on Main Channel and Mormon Slough, here. Estimated cost $360,000.

Conn., Waterbury—The Waterbury Gas Light Co., 33 Center St., will build a 3 story, 40 x 240 ft. addition to its plant on South Leonard St. Estimated cost $33,000.

Ill., Peru — V. A. Matteson, Archt., 8 South Dearborn St., Chicago, is receiving bids for the construction of a 3 story factory to contain 715,000 cu.ft. for the Western Clock Co., here. Estimated cost [illegible].

Ind., Cannelton — The Cannelton Sewer Pipe Co. plans to build a 4 story, 62 x 208 ft. clay plant, including [illegible] kilns, radial [illegible] power plant, etc. Estimated cost [illegible]. Private plans.

Ind., Evansville—The Evansville Packing Co., [illegible] Ave., is having plans prepared for the construction of a 1 story, 21 x 42 ft. [illegible] plant. Estimated cost $45,000. [illegible] & Co., Furniture Bldg., Archts.

Ind., Evansville—B. W. Jenkins, 522 South [illegible] Ave., is having plans prepared for the construction of a 1 story, [illegible] x 100 ft. packing plant. Estimated cost $36,000. H. E. [illegible] & Co., Furniture Bldg., Archts.

Ind., Fort Wayne—The Fort Wayne Box Co., [illegible] and [illegible] Sts., plans to build a box factory. Estimated cost $100,000. Architect not announced.

Ind., Indianapolis — The Amer. Tent & Awning Co., 632 South East St., awarded the contract for the construction of a 2 story, 72 x 115 ft. addition to its awning factory. Estimated cost $36,000.

Ind., Indianapolis — The Indianapolis Glove Co., Liberty and Michigan Sts., is having plans prepared for the construction of a 1 story, 100 x 160 ft. glove factory. Estimated cost $125,000. Rubush & Hunter, Amer. Central Life Bldg., Archts.

Ind., Indianapolis—The Kramer Realty Co., 315 North Garfield Ave., is having plans prepared for the construction of a 1 story, [illegible] x [illegible] ft. [illegible] factory, including [illegible] car garage and [illegible], on [illegible] Ave. Estimated cost [illegible]. R. N. Edwards, [illegible] Trust Bldg., Engr.

Ind., Shelbyville—The Kennedy Paper Bag Co. is having plans prepared for the construction of a 1 story, 60 x 219 ft. paper bag factory. Estimated cost $27,000. Rubush & Hunter, Amer. Central Life Bldg., Indianapolis, Archts.

Ind., Sheridan—The Indiana Condensed Milk Co., 220 North Pennsylvania St., Indianapolis, is having plans prepared for the construction of a 2 story addition to its milk plant here. Estimated cost $26,000. Private plans.

Ia., Dubuque—T. J. Mulgrew, Jones and Iona Sts., awarded the contract for the construction of an artificial ice and cold storage plant. Estimated cost $75,000.

Ia., Iowa City—The Economy Advertising Co. has purchased a site and plans to build a 2 or 3 story printing plant. Estimated cost $75,000. B. W. Mercer, Pres.

Ky., Louisville—The J. F. Kurfees Paint Co., 201 East Market St., plans to build a 5 story, 61 x 204 ft. addition to its plant. Estimated cost $200,000. Architect not announced.

Mass., Gardner — The Nichols Rattan Products Co., Main St., plans to build a 3 story, 90 x 140 ft. factory for the manufacture of chairs. Estimated cost $75,000. Private plans.

Mass., Gardner—The Standard Specialty Wks., Union St., will build a 1 story, 40 x 100 ft. factory for the manufacture of specialties. Estimated cost $25,000.

Mass., Medford—The Amer. Woolen Co., 245 State St., Boston, awarded the contract for the construction of a 5 story, 60 x 120 ft. addition to its factory on Boston Ave., here. Estimated cost $100,000.

Mass., South Hadley — The Holyoke Gummed Products Co., 9 Suffolk St., Holyoke, awarded the contract for the construction of a 1 story, 140 x 147 ft. gummed paper factory, here. Estimated cost $40,000.

Mass., Springfield—The Springfield Dairy System, 70 Ventura St., plans to build a bottling plant. Estimated cost $90,000. C. J. Grant, Clk.

Mass., Watertown—Vose & Sons Piano Co., 1010 Massachusetts Ave., Roxbury (Boston P. O.), awarded the contract for the construction of a 5 story, 80 x 220 ft. piano factory on School, Arsenal and North Beacon Sts., here. Estimated cost $300,000. Noted Oct. 19.

Mich., Grand Rapids — H. H. Turner, Archt., 923 Michigan Trust Bldg., is receiving bids until Jan. 10 for the construction of a 2 and 3 story, 85 x 178 ft. Junior High School, including manual training department, on Lee St., for the Bd. Educ. Estimated cost $150,000. H. Morrill, Business Mgr. Bd. Educ., City Hall.

N. J., Trenton—H. Entine, 162 Fair St., awarded the contract for the construction of a 2 story, 60 x 60 ft. burlap factory. Estimated cost $15,000.

N. Y., Jamaica—The Edward Langer Printing Co., Inc., awarded the contract for the construction of a 5 story, 120 x 280 ft. printing plant.

N. C., Charlotte—The H. M. Wade Mfg. Co., South Graham St., manufacturer of show cases and fixtures, is having plans prepared for the construction of a 4 story, 120 x 150 ft. factory. Estimated cost $150,000. Lockwood, Greene & Co., Piedmont Bldg., Archts.

N. C., Gastonia—The Ragan Spinning Co. plans to build a 10,000 spindle cotton mill. G. W. Ragan, Pres.

N. C., New Bern—The Rowland Lumber Co. plans to rebuild its mill which was recently destroyed by fire. Estimated cost $200,000. A. R. Turnbull, Pres.

O., Akron—The Miller Rubber Co., South High St., awarded the contract for the construction of 1 story, 75 x 125 ft. and 40 x 42 ft. factory buildings for the manufacture of rubber tires. Estimated cost $20,300.

O., Akron—W. Williams, 101-111 North High St., awarded the contract for the construction of a 2 story, 67 x 132 ft. soft drink bottling plant. Estimated cost $10,000.

O., Cleveland—The Peerless Paper Box Co., 2225 East 55th St., has had plans prepared for the construction of a 1 story, 59 x 140 ft. factory and warehouse at 2221 East 56th St. Estimated cost $40,000. P. Matzinger & Co., Caxton Bldg., Archts.

O., Cleveland—H. E. Roth, 1604 East 117th St., awarded the contract for the construction of a 1 story, 50 x 100 and 30 x 40 ft. hide house and garage on West 65th St. Estimated cost $40,000. Noted Dec. 14.

O., Lakewood (Cleveland P. O.) — The Cleveland Waterproof Paper Co., c/o A. Kennedy, Mgr., 2023 West 106th St., Cleveland, awarded the contract for the construction of a 1 story, 40 x 160 ft. factory, on Berea and Fischer Rds., here. Estimated cost $40,000.

O., Norwood (Cincinnati P. O.) — The Kemper-Thomas Co., Park Ave., manufacturer of calendars and advertising novelties, is having plans prepared for the construction of a 2 story, 60 x 200 ft. factory. Estimated cost $150,000. S. Hannaford & Sons, 1024 Dixie Terminal Bldg., Cincinnati, Archts.

Ore., Portland—The Port of Portland will soon receive bids for the construction of a hydro-cyanic acid fumigating plant, to fumigate cotton in bales, sacking, jute, plants, and other imported materials. Estimated cost $10,000. G. B. Hegardt, foot of Stark St., Ch. Engr.

Pa., Abington—Tilden & Register, Archts., 1525 Locust St., Phila., are receiving bids for the construction of a 3 story, 29 x 66 ft. heating plant and laundry, here, for the Abington Memorial Hospital, c/o J. B. Winder, Abington. Estimated cost $75,000.

Pa., Mount Jewett—The Safety Sled Co. plans to rebuild its factory which was recently destroyed by fire. Estimated cost $50,000. Architect not announced.

Pa., Phila.—The Crescent Textile & Supply Co., c/o W. Caldwell, Trenton and Susquehanna Aves., will soon receive bids for the construction of a 4 story card and textile factory on Trenton Ave. Estimated cost $100,000. W. H. Wooters, 816 West Allegheny Ave., Archt.

Pa., Phila.—The Pennsylvania Brick & Tile Co., c/o L. F. Ducker, Land Title Bldg., awarded the contract for the construction of a 1 and 2 story plant, capacity 150,000 brick per day, on Westmoreland St. and Delaware Ave. Estimated cost $100,000.

Pa., Phila.—S. F. Whitman & Sons, 4th and Race Sts., are having plans prepared for the construction of a 5 story candy factory. Estimated cost $250,000. W. Steele & Sons, 16th and Arch Sts., Archts.

Pa., Pittsburgh—J. M. McCollum, Archt., Berger Bldg., is receiving bids for the construction of a 3 story, 23 x 50 ft. publishing plant on 2nd Ave. and Grant St. for Smith Bros., Inc., 409 Grant St.

Pa., Pittsburgh—The Vitro Mfg. Co., 720 Bessemer Bldg., is having plans prepared for the construction of a 1 story, 32 x 45 ft. chemical factory at 600 Cliff St. Estimated cost $5,000. P. R. L. Hogner, 5th Ave. and 11th St., New Kensington, Archt.

Pa., Union City—A. L. Calflsch & Son Lumber Co. plans to rebuild portion of its saw mill which was destroyed by fire. Estimated cost $5,000. Architect not announced.

Pa., Warren—The Crew-Levick Co. plans to rebuild its oil filter plant, which was destroyed by fire. Estimated cost $40,000. Architect not announced.

Pa., Washington — Topliffe & Ely Co., manufacturer of toys, awarded the contract for the construction of a 3 story, 20 x 80 ft. factory on West End St. Estimated cost $100,000.

Tex., Pioneer—The Amer. Oil Co. plans to build a refinery, capacity 2,500 bbl. T. Ryan, Pres. Architect not announced.

Wash., Vancouver—U. McDonald, 315 Falling Bldg., Portland, Ore., Supt. of Western Lumber & Door Co., is building a planing mill, here. Estimated cost $50,000.

W. Va., Fairmont—The Imperial Ice Cream Co., Clarksburg, is having plans prepared for the construction of a 1 story, 50 x 120 ft. ice cream factory, including a 15 ton ice plant, on 5th St. and Virginia Ave., here. Estimated cost $15,000. Private plans.

Wis., Green Bay—The Press Gazette, 315 Cherry St., plans to build a 3 or 4 story plant. Estimated cost $100,000. Architect not selected.

Wis., Madison—The Madison Supply Co., 615 East Washington Ave., awarded the contract for the construction of a 2 story, 50 x 60 ft. bottling works and warehouse building. Noted Dec. 14.

Wis., Menasha—The John Strange Paper Pail Co. will build a 4 story, 60 x 100 ft. factory for the manufacture of paper pails. Estimated cost $50,000. J. Strange, Pres.

B. C., Prince George—The Aleza Lake Sawmill Co. plans to build a sawmill. Estimated cost $20,000. Architect not announced.

Ont., Hamilton—The Ontario Shale Brick Co., Sun Life Bldg., plans to build a plant. Estimated cost $100,000.

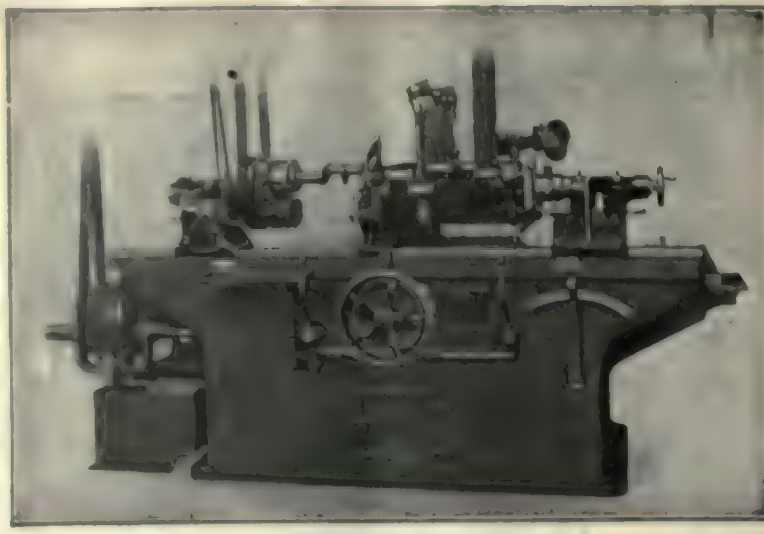
Ont., Petrolea — The Canadian Oil Co. plans to rebuild its plant which was partially destroyed by fire. Estimated cost $35,000. C. A. Hale, Mgr.

Every Season is Repair Season

There are no "off seasons" for the automobile repair man. Spring and Fall usually find the business at peak, but the wheels keep turning at all other times—especially in shops equipped with the

LANDIS

4-A Special Grinding Machine



The **Landis** is practically a number of specialized grinding machines combined in a single unit.

It grinds crankshafts, pistons, wrist pins, piston rings, valves, valve stems, transmission gears, etc.

You cannot afford to ignore this opportunity to establish yourself in a growing business.

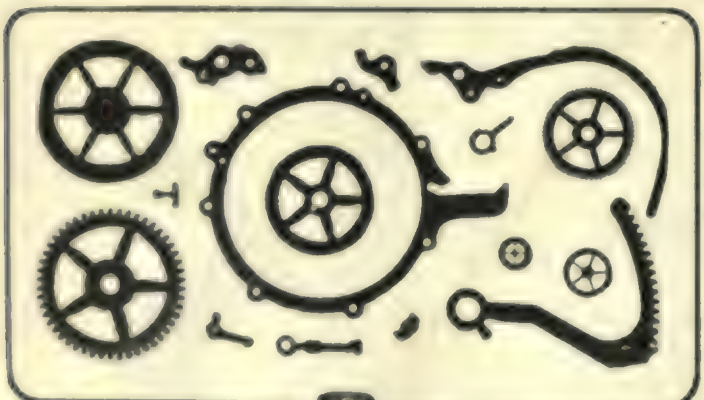
We shall be pleased to show you what this machine has been doing in the motor repair field.

LANDIS TOOL COMPANY, Waynesboro, Pa.

New York Office: 51 Chambers St.

DOMESTIC AGENTS—Hallidie Machinery Co., Seattle; Smith, Booth, Usher Co., San Francisco and Los Angeles; Southern Machinery Sales Co., Houston; Fulton Supply Co., Atlanta; F. C. Richmond Machinery Co., Salt Lake City.
CANADIAN AGENTS—F. F. Barber Machinery Co., Toronto; Williams & Wilson, Ltd., Montreal; A. R. Williams Machinery Co., Nova Scotia, New Brunswick, Manitoba and British Columbia.

FOREIGN AGENTS—Allied Machinery Co., Paris, Turin, Barcelona, Brussels, Zurich and Lisbon; Anderson, Meyer & Co., Ltd., Shanghai; Andrews & George Co., Ltd., Tokyo; Benson Brothers, Sydney and Melbourne; Burton, Griffiths & Co., Ltd., London; Wilh. Sonesson & Co., Malmo and Copenhagen.



No Filing nor Hand Trimming

When a stamped or punched part is produced on the **Waltham Sub Press and Dies** it is ready for assembling. It is not warped nor twisted, nor are the edges burred. By eliminating all hand finishing greater producing profits are assured. In the

Let us know the type of stampings you use and we will suggest methods for their improvement at lower producing cost. Also ask us about the other Waltham products.

Waltham

Sub Press and Dies

correct and continued alignment is the prime factor. Not only does this give better results, but it greatly prolongs the life of the dies.

The **Waltham** line of **Sub Presses and Dies** is most complete and our Compound Dies are mechanically correct in every detail.

Waltham Machine Works, High Street, Waltham, Mass.

this → is all right BUT

What to Do when Your Last Hacksaw Breaks

WHILE cutting off the end of a projecting bolt, a service station mechanic buckled the blade of his hacksaw and snapped it off about 2 in. from one end. While he went for a hammer and chisel to finish the job, the foreman picked up the broken blade, held it in the flame of a blowtorch and, while it was still warm, drilled a hole through it with a hand drill. He then replaced it in the adjustable saw frame and had the saw ready for finishing the job by the time the mechanic returned.

This is a stunt well worth remembering because it is usually the last hacksaw that breaks the quickest.—S. R. D.

Reprinted by permission from the October issue of Popular Science Monthly.

here's a better stunt

Use Starrett Hack Saws and you won't be troubled with blade breakage—either on the last or the first hack saw. Get the most work out of these unexcelled hack saws through the Starrett Hack Saw Chart (sent free on request). It shows at a glance just which blade to use for every metal and shape. Use of this chart means longer life for every blade and the fastest possible cutting time for every job. Write for "Hack Saws and their Use," the first and most authoritative book on this subject. Free on request.

Also write for Catalog No. 22 C and the Supplement describing the new Starrett Tools

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled

ATHOL, MASS.

4798

STARRETT TOOLS

STARRETT HACK SAWS

Use Starrett Hacksaws

If You Want Good Gears, We Can Interest You

Because we have the experience and facilities to produce them in the shortest possible time and at very favorable prices.

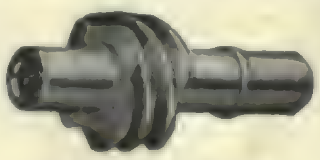
Our modern daylight plant is acknowledged to be one of the finest gear production units in the world. Plenty of light and the latest machinery, together with a staff of real "gear men," ensure a very definite and essential element of quality in our gears. Our policy demands that this shall be maintained—always.

We mention these facts about our business, because they guarantee the soundness of our product and because they make us confident that we can do the same for you as we have done for others—give you efficient, practical gear service.

Cincinnati Gears

Cincinnati Gear Company, Cincinnati, Ohio, U. S. A.

MP



Meisel Gears—Meisel Service

The Most Practical
Transmission Combination

Write Us Your Requirements

Meisel Press Mfg. Co.
946 Dorchester Ave., Boston, Mass.

GRANT GEARS

Our 44 years' experience in making gears is your guarantee of satisfactory service.

Large supply of stock gears always on hand for immediate shipment. Gears made to order —Any size, any material.

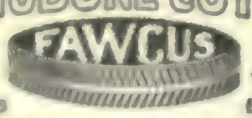
Estimates and gear advice cheerfully furnished.

Ask for latest catalogue

GRANT GEAR WORKS

151 PEARL STREET, BOSTON, MASS.

HERRINGBONE CUT GEARS



MILL DRIVES
SPEED REDUCERS
SPUR
WORM
BEVEL GEARS

FAWCUS MACHINE CO. PITTSBURGH. PA.

"TRY SIMONDS GEARS"

They are accurately cut.
All kinds and all materials.

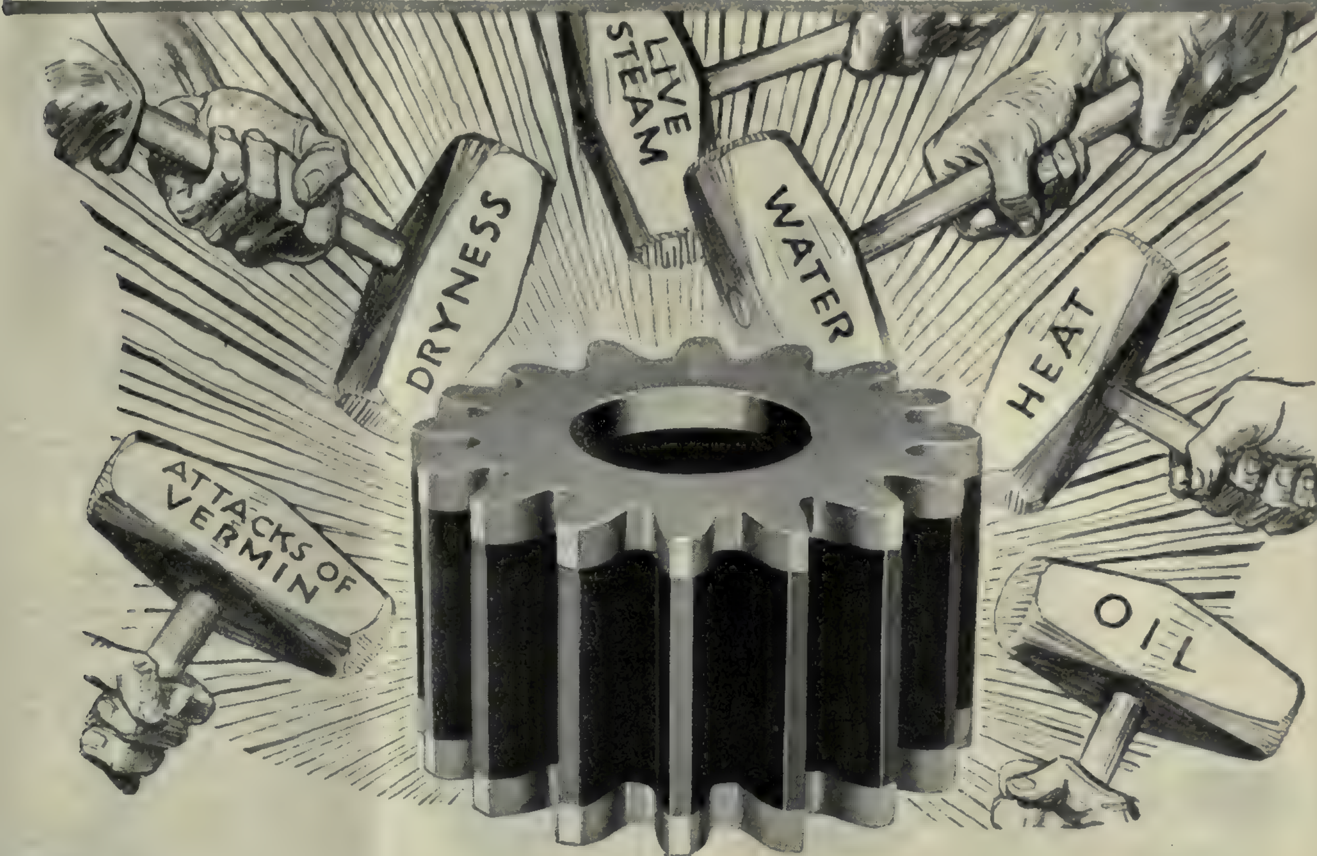
THE SIMONDS MANFG. CO.
PITTSBURGH, PA.

ALBRO-CLEM
HINDLEY GEARING
WILL DO THE WORK
When Common Worm Gearing Fails
ALBRO-CLEM ELEVATOR CO.
603 Erie Ave., East, Philadelphia, Pa.

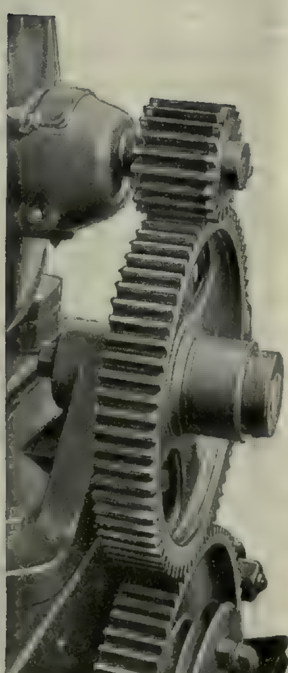
EARLE GEARS

Spur—Bevel—Spiral—Worm—Racks

The Earle Gear & Machine Co.
4707-4715 Stenton Ave., Phila., Pa.



The Fabroil Gear Repels These Hammer Blows



Only the working face of the Fabroil motor pinion at the top touches the companion gear.

DEEP in the wet, rat-infested workings of a mine, or in a dry, clean power plant, in hot oil baths, or in icy atmosphere—no matter what destructive elements there may be, these tough, resilient gears are in no way affected.

The silence and smoothness of operation resulting from the installation of these gears is a revelation. And they outwear brass, iron, or any other non-metallic gear.

More than a million Fabroil Gears are in service throughout the United States, varying in size from one inch in diameter to 36 inches. In no case have they failed to prove all claims.

Try them and see for yourself.

Ask the G-E Sales Office nearest you for complete information

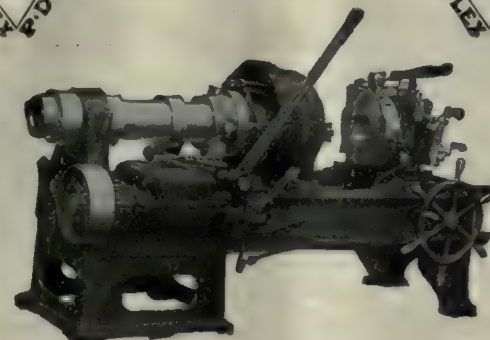
General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

40-221

PEERLESS B&K DUPLEX P.D.O.



Rapid and Accurate Pipe Threading

Is the kind done by B & K Pipe Threading Machines. They work with remarkable rapidity and ease of operation. Every thread is clean and accurate. Every machine is equipped with the Peerless Die Head. Made in nine sizes, each size having a capacity of 8 to 10 sizes of pipe.

Write for complete catalog

Bignall & Keeler Machine Works

Edwardsville, Ill.

DON'T waste time carrying cumbersome machinery to stationary drills. Take the drill to the job! Little Giant Electric Drills are *easily portable.*

Once on the job, they speed-up drilling, reaming, wood-boring, screw-setting, nut-and-bolt tightening—wherever there's a current outlet.

Your requirements are ideally met with a variety of sizes, built in A. C., D. C., and Universal Current types. Ask for bulletins.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building, 6 East 44th St., New York

*Sales and *Service Branches all over the World*

*Birmingham, *Boston, *Chicago, *Cincinnati, *Cleveland, *Detroit, El Paso, Erie, Franklin, Houston, *Los Angeles, Milwaukee, *Minneapolis, *New Orleans, *New York, *Philadelphia, *Pittsburgh, Richmond, Salt Lake City, *San Francisco, *Seattle, *St. Louis

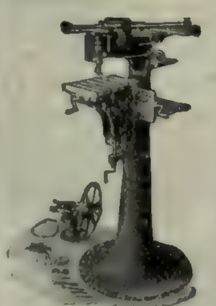
EL-51

BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES · ROCK DRILLS · COAL DRILLS

LITTLE GIANT *Electric Tools*

Rapid—Economical

The Gorton Engraving Machine



A favorite in radio plants, for engraving and graduating bakelite dials, marking panels, etc.

Cheaper engraving work without any sacrifice of quality is made possible by the simplicity and speed of the Gorton machine method.

The direct saving in time, effort and expense in the production of engraving or in the finishing of dies, small parts, etc., makes Gorton Machines indispensable.

Write us today for detailed data on your class of work.

GEO. GORTON MACHINE COMPANY

Racine, Wisconsin

HYDRAULIC VALVES AND FITTINGS

Watson-Stillman valves are designed to perform their functions with ease and safety. The materials are the best obtainable, and each valve or fitting is tested to a safe overload.

Our line embraces an almost endless number of combinations designed to meet the varied requirements of hydraulic systems.

Write for Catalogs

The Watson-Stillman Co.

42 Church Street, NEW YORK

McCormick Bldg., Chicago

W-S HYDRAULIC

273

Engraving Service — Patterns—Copies

ENGRAVING DIE SINKING MACHINES

Special Engraving Machines for Engraving Radio Panels and Dials

Consult us and take advantage of our 18 years' Practical Engraving and Die Sinking Experience in connection with the latest machines of this kind.

The H. P. PREIS CO., 1585 N. High, Columbus, Ohio

All Sizes All Types For All Pressures

AIR and GAS COMPRESSORS VACUUM PUMPS

No finer compressor made than a Bury Universal Variable Volume three-cylinder, two-stage Air Compressor. Why not investigate?

Send for Bulletin

Bury Compressor Company

1746 Cascade St., Erie, Pa.

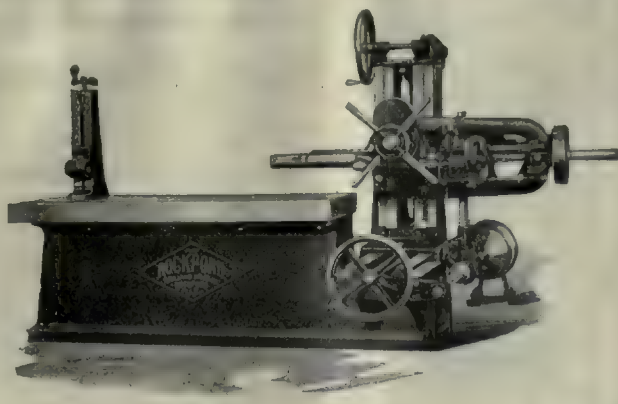
Pyramid Box Plate Valves "Durable as the Pyramids, Silent as the Sphinx"

In matters of composition molding, we can supply all equipment, besides the necessary experience and advice. *Ask us.*

The BURROUGHS COMPANY

Builders of Hydraulic Machinery for all purposes

Newark, N. J., U. S. A.

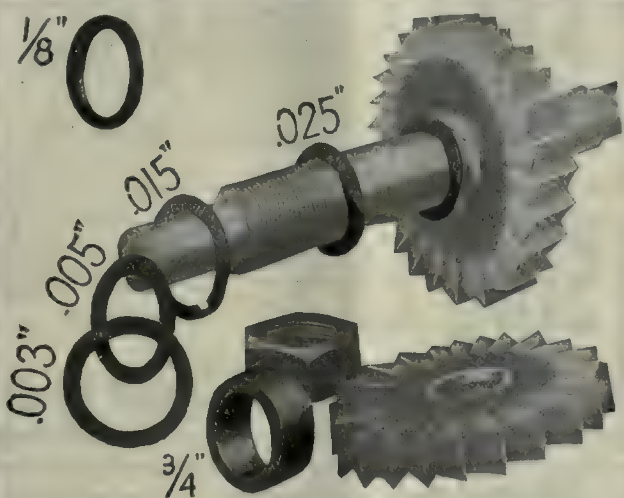


Note this Wide Range Machine

The **Rockford Horizontal Boring, Drilling and Tapping Machine** is economical, because it has a drilling capacity up to 2 in. and boring capacity up to 8 in.; nine speeds and eight feeds while the area of spindle adjustment is 18 inches high x 36 inches wide. What does this mean but unusual adaptability?

Write for full details

Rockford Drilling Machine Co.
Rockford, Ill.



Spacers for Milling Machines Arbors, etc.

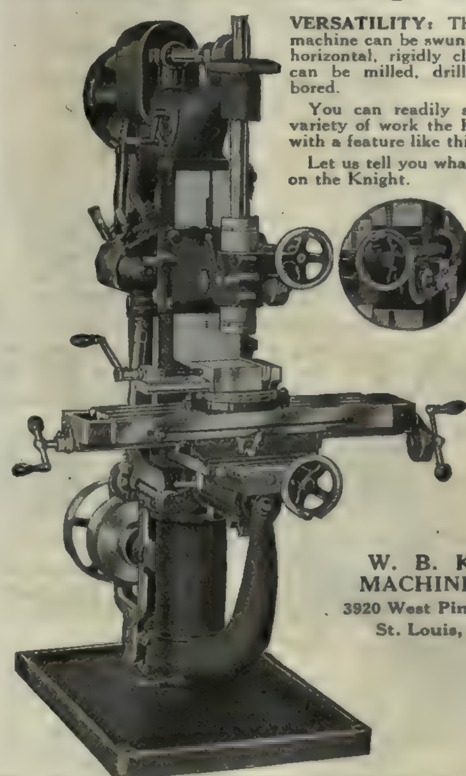
For arbors of the following diameters, 1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4 1 7/8, 2, 2 1/4, 2 1/2 and 3 1/2 inches.
.003, .005, .015 and .025 inch thicknesses in stock.
.0015 to 3.000 inch thicknesses made to order.

Prices and Samples on Request.

Detroit Stamping Company
3445-3459 West Fort Street, Detroit, Mich.

KNIGHT

Milling and Drilling Machines



VERSATILITY: The table of this machine can be swung to either side of horizontal, rigidly clamped and work can be milled, drilled, reamed, and bored.

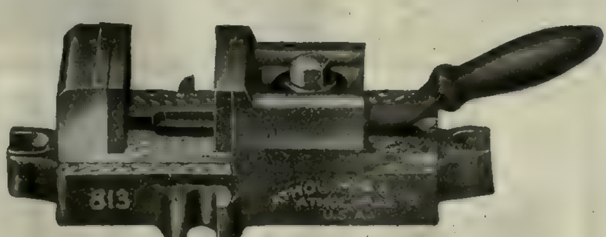
You can readily see what a great variety of work the Knight will cover, with a feature like this.

Let us tell you what others are doing on the Knight.

Frequently an Entire Job can be completed at the Original Setting.

W. B. KNIGHT MACHINERY CO.
3920 West Pine Boulevard,
St. Louis, Missouri

Athol Drill Press and Milling Machine Vise



This ATHOL-STARRETT Vise will take the place of an expensive jig or fixture on a big majority of your drilling and milling jobs. It possesses a range of 4 inches. By attaching special jaws it is readily convertible into a reliable holding device for all manner of work.

The Athol Catalog No. 35, details our entire line.

Athol Machine & Foundry Co.
Athol, Mass., U. S. A.

TRANSMISSION MACHINERY

THE Caldwell line is complete. Bearings—heavy, properly designed, and well finished. Pulleys of ample weight and accurately turned.

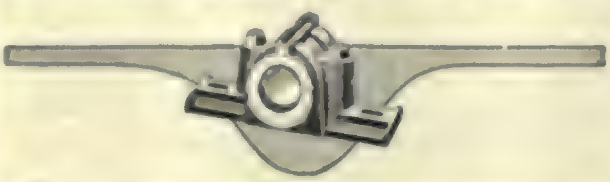
In fact, the entire line measures up to the high Caldwell standard.

Let us figure on your requirements.

H. W. CALDWELL & SON CO. Link-Belt Co., Owner

Dallas, Texas, 709 Main Street—Chicago, 17th Street and Western Avenue
New York, Woolworth Building

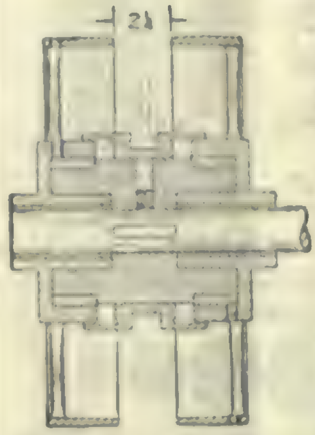
CALDWELL



THE JOHNSON FRICTION CLUTCH

in

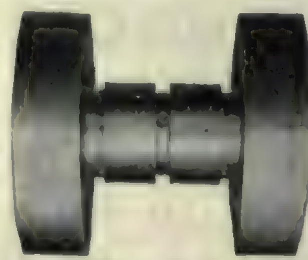
ANOTHER OUT-OF-THE-ORDINARY DRIVE



2¼ inches is a mighty tight place to work a double clutch in. Usually pulleys on a No. 10 standard double clutch are 8½ inches between faces. A good husky tapping drive on Baker Bros. Drill Press. Only a Johnson Clutch could do it.

Why worry about your friction control problems when our clutch engineers can solve them for you?

Write for Blue Catalog and Information Blank



Double Clutch with Pulleys and Hubs

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

Easily and Quickly Applied With Just

BRISTOL'S

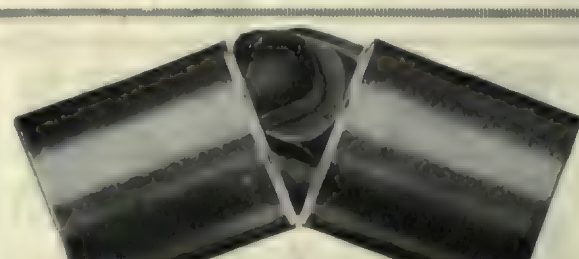
Patent Steel Belt Lacing also stands up in service longer than other kinds. This is the consensus of opinion in the hundreds of shops where Bristol's Lacing is used. Shall we send you Bulletin B-713?

The Bristol Company

Waterbury, Conn.

Branch Offices

Boston New York Detroit Pittsburgh
Philadelphia Chicago St. Louis San Francisco



No Sharp Corners

The Gray & Prior Universal Joint is mechanically perfect in load transmission. Friction and wear are minimized by eliminating screws and small parts and by rounding contact edges. Circular upon request.

The Gray & Prior Machine Co.
69 Suffield St., Hartford, Conn., U. S. A.

Strom Balls

STROM Chrome Steel Balls have established the highest standard for uniformity, accuracy, finish and resistance to wear. They receive preference where quality is a paramount factor.

Write for samples and prices.

STROM STEEL BALL CO.
OAK PARK (Chicago Suburb), ILL.

BALDWIN

ROLLER CHAINS BLOCK CHAINS
SPECIAL DRIVE CHAINS
MALLEABLE DETACHABLE CHAINS
CAST SPROCKETS MACHINE FINISHED SPROCKETS
WESTLUND FRICTION CLUTCH and CUT-OFF COUPLING

Send for Catalog and Special Bulletins

The Baldwin Chain & Mfg. Co., Worcester, Mass.

No Mislaid or Lost Tops When

Bennett Handy Top Oil Cups

are used. The attached top cannot be mislaid or lost, and when in place is positively dust-proof. Made for thread or drive fit in styles and sizes to suit your needs. Catalog M shows our full line—send for copy.

BAY STATE STAMPING CO.
380 Chandler Street, Worcester, Mass.

A Trial Proves Its Value

W MINOLARD B

A postal will bring a trial quantity of this universal cutting oil. Write today if you are interested in saving.

The White & Bagley Co. Worcester, Mass., U.S.A.

Just touch the Cap With the Can Snout

Style D. Opened — Style G. Opened

There is no "tinkering" with Tucker Oil Hole Covers. They are made to open with a touch of the can snout and to close immediately after it is withdrawn. Fit them everywhere.

W. A. & C. F. TUCKER, Hartford, Conn., U. S. A.
FOREIGN AGENTS: Fenwick Freres & Co., Paris, France. Alfred Herbert, Ltd., Yokohama, Japan.

GITS OIL CUPS

Give perfect satisfaction where others fail. State style and size in which you are interested, and we will send free samples and catalog.

Gits Bros. Mfg. Co.
1940 S. Kilbourne Ave., Chicago

More Parts per Hour

You not only get a larger hourly production by swaging the "Dayton Way," but you get a better product. The Dayton delivers from 2000 to 6000 blows per minute and leaves the product tough and elastic.

The details will convince you that the "Dayton Way" is the only way.

The Torrington Co., 56 Field St., Torrington, Conn.
Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England, Agents for Great Britain; Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France, Italy, Belgium, Spain, Portugal and Switzerland.

FRANCKE FLEXIBLE COUPLINGS — For Direct-Connected Machinery Shafts
Smith & Serrell, 43 Central Ave., Newark, N. J.
PINTITE RIGID COUPLINGS — For Line Shafting
SEND FOR BULLETINS

SUN OILS

Sun Emulso
Sun Automatic Cutting Oil
Sun Pipe Threading Oil
Sun Grinding Oil

Watch for our full page "ad" every second week of each month

SUN COMPANY, Philadelphia

"TOLEDO CRANES"

Fulfill Every Requirement
Save Time, Labor and Space

THE TOLEDO CRANE CO.
BUCYRUS, OHIO

ACCURATE

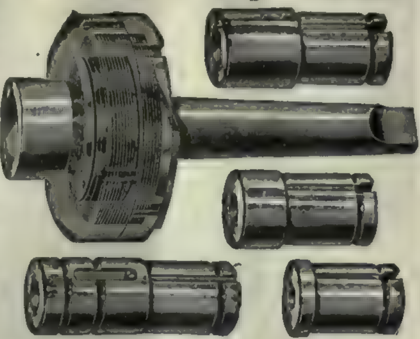
Portable grinder weighs only 22 lbs. With equipment for almost any kind of internal and external grinding.

Adaptable to all machine tools. 1 hp. universal motor. They save the cost of larger units. Write today.

ARVA STROUD
327 Broadway
NEW YORK CITY

RV

The Safety Drill and Tap Holder



is the only attachment for the purpose that gives universal satisfaction and is Unequaled for Efficiency, Convenience, Rapidity, Accuracy and Simplicity.

Can be furnished with special sockets with friction set to carry one or two sizes of taps, useful if sizes are constantly changing.

Nothing to *break* or get out of *order*. Made in 4 sizes covering, from 0 to 2½ in diameter.

The Beaman & Smith Co., Providence, R. I., U. S. A.
Builders of Boring and Milling Machines, and Special Machines for such Purposes Constructed.

No. 15 Bag Set
Includes 6 Allen-process hexagon sockets with "L" handle, assembled in heavy duck bag. Handle fitted with spring friction balls to hold sockets in place when in use. Sockets chamfered for close work; guaranteed against breakage. List price, $1.50.

"BAY STATE" WRENCH SETS

with Allen-process sockets come in combinations covering every wrench requirement of mechanics and car owners, millwrights and erectors. Box Sets and Bag Sets—embodying all the features of high-grade mechanics' tools in the handiest possible combinations. Write for booklet and the story of Bay State sockets.

THE ALLEN MFG. CO., 129 SHELDON ST. HARTFORD, CONN.

THE

"TOLEDO" PUNCHING PRESSES

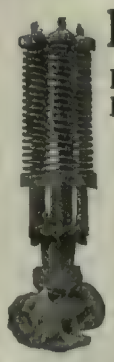
THE "TOLEDO" Punching Presses are especially suited for punching, shearing and cutting out blanks of heavy metal—steel, iron, brass, etc.; for operating trimming and forming dies used in the manufacture of automobiles, motor cycles, bicycles, cutlery, sewing machines, typewriter parts, agricultural implements, etc., switchboard parts and numerous other articles formed from bar and sheet metal.

"Toledo" Punching Press, No. 34-P

"PRESSES FOR EVERY PURPOSE"

Estimates furnished—correspondence solicited

The Toledo Machine & Tool Co.
Toledo, Ohio
Chicago Office: Room 611 Machinery Hall, 549 W. Washington Blvd.



HYDRAULIC SHOCKS

Increase Repair Bills and Shorten the Life of Your Hydraulic Equipment.

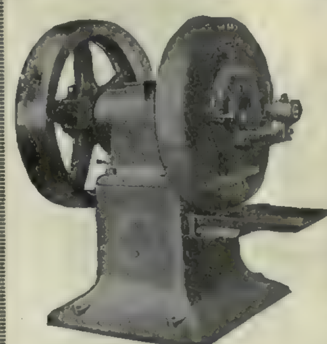
STOP THIS EXPENSE WITH AN

ELMES

SHOCK ALLEVIATOR

Special Machinery Built to Order

CHARLES F. ELMES ENGINEERING WORKS
1001-1013 Fulton St. "Since 1851" Chicago. U.S.A.



The Skill is All in the Machine

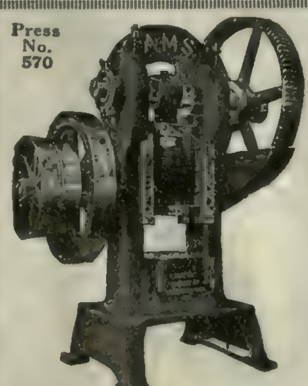
ROTARY SWAGING is the modern and economical method of forming solid or tubular circular metal sections without waste of stock. The Langelier Swaging Machine reduces or tapers to a circular section, square, round, hexagonal or similar shapes, hot or cold. We build special swaging equipment for Tungsten Filament Wire.

Our policy is to equip the machine in every detail with work holding and feeding devices that will enable them to give the most efficient service with unskilled help at a low upkeep cost.

Machines built to date have capacity ranging from a pin point to 2½ in. diameter on solid stock and to 6 in. on tubing.

LM Co.

LANGELIER MFG. COMPANY
Arlington, Cranston, R. I., U. S. A.



Press No. 570

PRESSES

Large or small
Regular or Special
The last word in Presses is

"AMS"

Look for it.
It's your security.

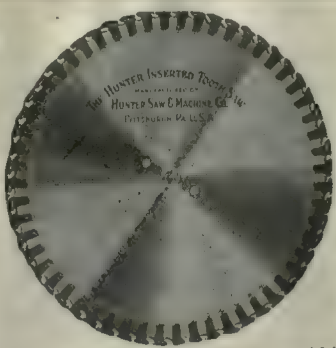
The Max Ams Machine Co. 101 Park Avenue New York City, N. Y.
Chicago Office: 20 Jackson Blvd. Rochester Office: 705 Commerce Bldg.

Bolt and Pipe Threading Machinery

Let our Engineering Department solve your threading problems. Send your specifications today.

Catalogues upon request

Landis Machine Company, Inc.
Waynesboro, Pa., U. S. A.



HUNTER SAWS

All Types of Circular Saws for Cutting Metal

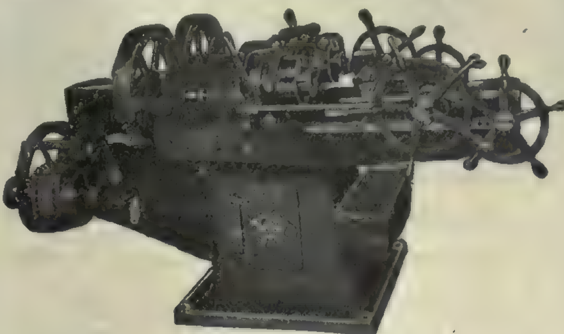
Inserted tooth saws, solid tooth milling saws made of chrome alloy, semi-high and high-speed steels, hot saws, friction discs. Saw sharpening machines.

Have you tried our "Beskut" semi-high speed milling saws? They will cut costs on hard jobs.
We also manufacture and carry in stock a full line of Pneumatic Hammer rivet sets and chisel blanks.

HUNTER SAW & MACHINE CO., Pittsburgh, Pa.

The "STANDARD" Double Bolt Cutter

Column and headstock are cast in one piece, assuring permanent alignment and rigidity. Will stand up and do perfect work under the most trying conditions. Six sizes: 1½ in., 2 in., 2½ in., 3 in., 3½ in., 4 in.



Improved Die Head and Control
Exclusive and Superior Design

All parts strong and substantial yet micrometer adjustment or set is so sensitive that bolts may be cut *over* or *under* size and dies set to again cut *exact* size—at will of operator, while machine is running, adjustment not affected by opening or closing of dies. Feed is automatically stopped when desired length is cut.

Circular gives details—write for it.

The Universal Machine Company
Pike St., Bowling Green, Ohio

The

HIGLEY

Cold Metal Saw

Catalog will be sent on application to

Vandyck Churchill Company
52 Vesey Street, New York

The "MARVEL" No. 8 Metal Band Saw

THE large number of satisfied users of this high-grade saw like it because of the large capacity, the great variety of work it handles, that it saws at an angle right or left, that the work is held stationary and blade feeds itself forward into the work.

They like the large, roomy bed or work table. It solves their sawing problems.

Let us tell you more about the "MARVEL" No. 8.

Armstrong-Blum Mfg. Co.
347 N. Francisco Avenue,
Chicago

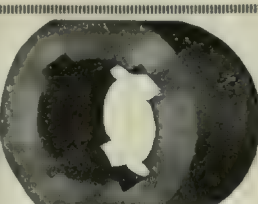
The No. 8 Marvel Band Saw

Have Us Broach It

Broaching cuts cost on keyways, splines, oil grooves, gear teeth, and countless regular or irregular shaped holes. Send your problems to the originators of commercial Broaching

Remember—"Lapointe of Hudson"

Lapointe Machine Tool Co.
Hudson, Mass.



SAW FILERS AND GRINDERS

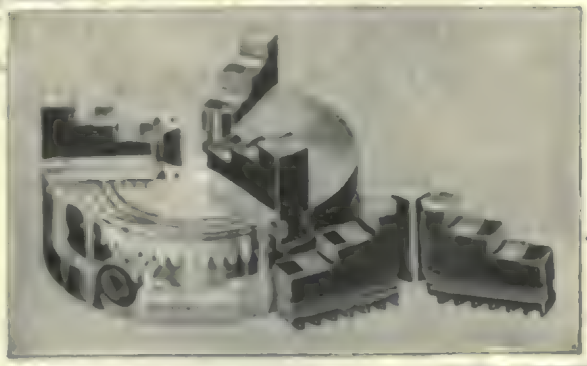
FOR ALL WOOD AND METAL CUTTING SAWS
THE WARDWELL MFG. CO.
111 Hamilton Ave. *Saw Sharpening Machinery* Cleveland, Ohio

QUALITY

"True to the Name"

Made of the finest tungsten steel by specialists of many years' experience. Specify "QUALITY" on your next order and settle your Hack Saw Problem.

NAPIER SAW WORKS, INC.
(The Hack Saw Specialists) Office and Factory: Middletown, N. Y.



SKINNER UNIVERSAL CHUCKS
Geared Scroll Type

The ideal chuck for repetition work. It insures a powerful grip. The jaws operating universally can be tightened by applying the wrench to any single pinion. For general manufacturing purposes the Skinner Geared Scroll Chuck has no equal.

Illustrated literature and catalogue upon request

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN U.S.A.
ESTABLISHED 1887

New York Office: 94 Reade Street — San Francisco Office: Rialto Building — Chicago Office: 553 West Washington Blvd.
London Office: 139 Queen Victoria St., E. C. 4

Waiting to get their Teeth in

There are Whiton Chucks just waiting to get their jaws around your work. Perhaps you do not fully realize their advantages.

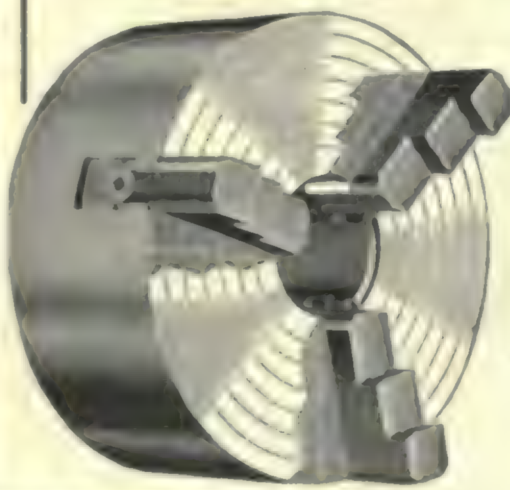
The body, for instance, is cut from a solid block of steel. This means that there are no weak spots and no seams to open up under heavy cuts. The jaws are [illegible] The screw mechanism is simple and solid.

In fact, we never knew a Whiton that failed.

Get the catalog. It's valuable.

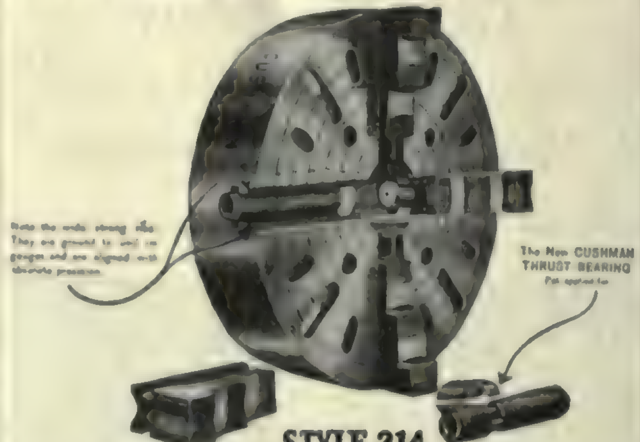
D. E. Whiton Machine Company
New London, Conn.

European Address: Briton Engineering Co., Ltd., 85 Queen Victoria St., London, E. C.
"Whiton" Chucks are sold and kept in stock by principal dealers all over Europe



BUILDING FOR THE FUTURE
On the Experience of the Past

The Cushman Chuck Company has been building for the future for sixty years. It is doing it to-day. This is the reason that, when the need appears for a better holding device, there is a Cushman Chuck ready to meet it.



STYLE 214

"The Incomparable"
THAT NEW STEEL CHUCK

Ask your dealer about it.

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

SWEETLAND CHUCKS

of the Geared Scroll type have one inside and one outside set of jaws. These jaws are ground perfectly true on the face and bite, after [illegible]

Four jaw type if desired.

Ask us to show you the Sweetland line.

The Hoggson & Pettis Co.
New Haven, Conn.

HANNIFIN
Production Tools—

Air Operated Chucks and Adjustable Boring Bars

Air-operated Arbor Presses, Chucks, etc.; Countershafts, Vises, Mandrels and Clamping Devices, Adjustable Boring Tools, Multiple Boring and Reaming Tools, Adjustable Reamers, Line Boring and Reaming Bars, and Cylinder Boring and Reaming Tools, Car Wheel Boring Bars.

Catalogues on Request

Hannifin Manufacturing Co.
Harrison St. and Kolmar Ave., Chicago

Jacobs Chucks

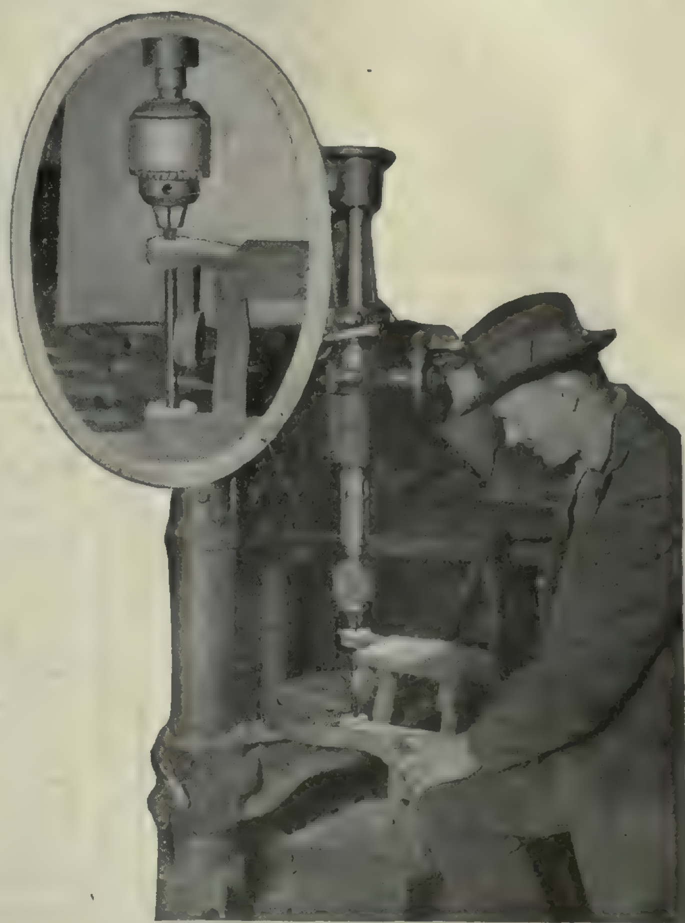
Variety performance pays big dividends

The purchaser of a Jacobs Drill Chuck knows that he possesses a superior unit of drilling equipment, but he never fully exhausts its versatility, for new applications come to light daily.

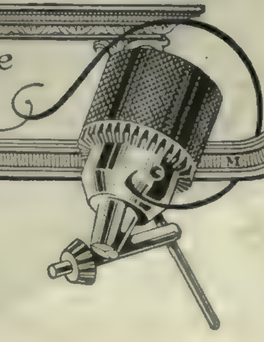
In the plant of the Essex Engineering Co., Inc., a Jacobs No. 5 performs some unusually tough drilling operations, but its usefulness does not end there.

We show this Chuck doing a facing job on the bearings of a cast iron Spooling Attachment Frame that proves its design is mechanically correct and its gripping powers unusual. The closest tolerance limits are required on this work, but the Jacobs holds as steady as a miller.

Engineer W. H. Brutt of The Essex Works, states: "The Jacobs is most satisfactory for all around work."



This advertisement is published in the interests of good Drilling Equipment by the makers of the Jacobs Chuck



"Serve Well With Good Equipment"

Graduated Adjustable Friction Self-Centering

Tap Holders for Turret Lathe

TAPS STEEL as safely as Cast Iron

ERRINGTON

MECHANICAL LABORATORY

BROADWAY and JOHN ST., NEW YORK
Phone Cortlandt 3149
Western Branch: Machinery Hall, 549 West Washington Blvd. Chicago
New England Branch: 831 Old South Building, Boston, Mass.
Catalog Français: Edgar Bloxham, Paris
12 Rue du Delta

Regulates the Whole Power of Machine to Just Drive, but Cannot Break Tap. When Tap Sticks (or Strikes Bottom) the FRICTION SLIPS, and Tap can thus be Run In and Out until the Toughest Metal is Quickly Tapped.

Interchangeable Spring Shanks for Rough and Finish Taps occupying One Turret Hole.

Double Clutch Sleeve

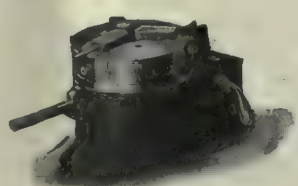
Especially Good for Roughing and Finishing Taps, Running Solid Dies Up Against a Shoulder, etc.

GARVIN HEX-SQUARE TWO-WAY FIXTURE

For Butt or Straddle milling of a square or hexagon nature.

Will clamp in either a horizontal or vertical position.

Made in two sizes:
1 in. size, ¼ to 1 in. cap.
2 in. size, ¼ to 2 in. cap.



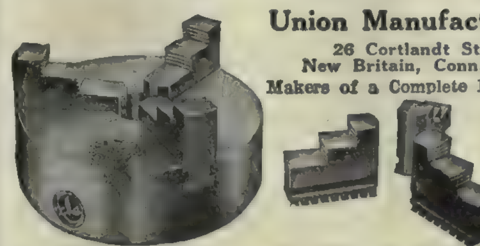
MANUFACTURED BY

THE GARVIN MACHINE COMPANY

Spring and Varick Sts. 50 Years in NEW YORK CITY

We Make Nothing But Chucks

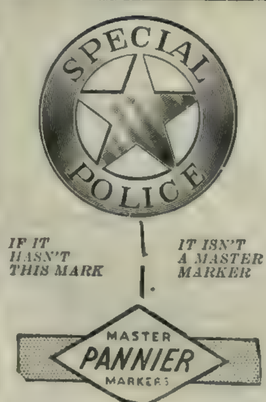
Union Chucks are always "up to the minute." Our entire efforts are devoted to the development of chucks and every dollar expended in a Union assures ample returns in service. Correct design and proper materials give Union Chucks the stamina to stand hard usage.



Union Manufacturing Co.

26 Cortlandt St., N. Y.
New Britain, Conn., U. S. A.
Makers of a Complete Line of Chucks

Our Catalog shows full line. Send for your copy.



BADGES

Police, Special Officer, Watchman, Identification

In addition to almost every conceivable kind and style of Badge, the complete line of "*PANNIER*" Master Markers includes:

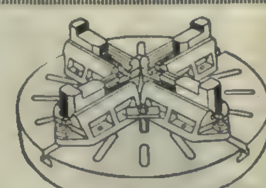
Time, Tool, Pay, Identification Checks; Raised Letter Trade Checks, Etc.

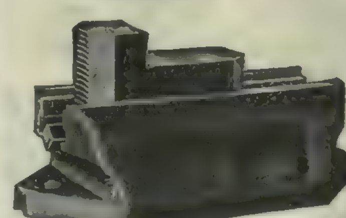
Pannier Bros. Stamp Co.

206 Sandusky St.
Pittsburgh, Penna.

Horton

Face-Plate Jaws





Convenient to attach. Exceptional range. Great strength of body and parts. Either iron or steel body.

The
E. Horton & Son Co.
Windsor Locks,
Conn., U. S. A.

ETNA Swaging Machines

We build Swaging Machines in capacities from ¼ to 4½-in. *Write for the descriptive matter.*

THE ETNA MACHINE CO., Toledo, Ohio

RAPID *Slip Drill CHUCK*

Drives Straight and True
Cannot Injure the Collet

American Equipment Company, Detroit

CHUCK WITH AIR

The Lavoie Air Chucks are very simple in construction and are easy to operate. The grip is absolutely certain, as is the release. Made in seven types with six styles of jaws.

Write for particulars.

FRONTIER CHUCK & TOOL COMPANY
34 Letchworth St., Buffalo, N. Y.

Almond PRODUCTS

Geared Drill Chucks	Right Angle Transmission
Standard Drill Chucks	Flexible Steel Tubing
Independent Lathe Chucks	Flexible Arms
Geared Scroll Lathe Chucks	Micrometers
Combination Lathe Chucks	Fine Mechanical Tools

Illustrative Descriptive Bulletins Mailed upon Request

T. R. *Almond* Mfg. Co., Ashburnham, Mass.

The Everlasting Chair

That is what our all-metal chairs really are. They have pressed steel seats and backs, formed angle iron legs, heavy Bessemer rungs, and are put together with quarter-inch rivets.

They are light in weight, are finished in baked enamel, black or green, and cost but little more than wooden goods. Furnished with or without backs, 3 or 4 legs, 12- or 14-in. seats, and any height. Also with perforated wood seats as shown here.

Leading concerns throughout the world have adopted them as standard.

Write for catalog of our complete lines of metal shop and factory equipment.

Makers of Wash Bowls, Drinking Fountains, Lockers, Shelving, Tote Boxes, Work Benches, etc.

Fig. 504A

Manufacturing Equipment & Engineering Co.

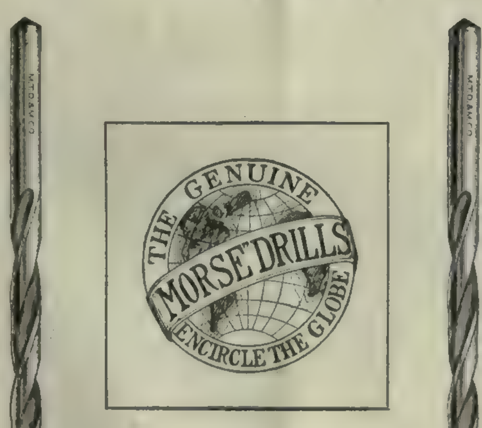
Factory and General Offices:

FRAMINGHAM, MASS.

BOSTON NEW YORK

The Standard

Since 1864



MORSE

Twist Drill & Mach. Co.

New Bedford, Mass., U. S. A.

An Idea in Filing That Made Good!

In 1899 the idea that "ONLY THE BEST ARE GOOD ENOUGH" for the skilled American mechanic was responsible for the beginning of a new standard of precision file manufacture. From a small beginning the plant behind this idea has grown until today it supplies a wide and increasing circle of tool-makers and other precision workmen with

AMERICAN SWISS

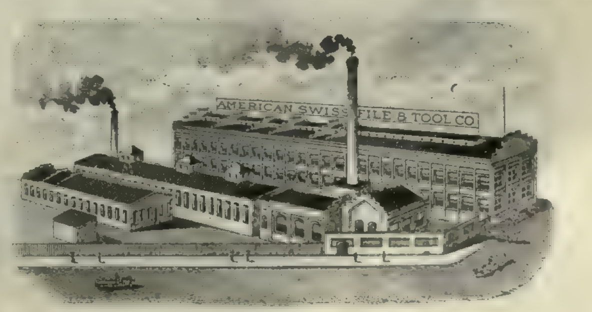
Files of Precision

Today the manufacturing plant below is devoted to making files of precision. Its service—and that of America's leading supply houses who carry "Stars & Cross" Files in stock—are the best solution to your own filing problem.

Start the new year RIGHT.
Order a trial box.

AMERICAN SWISS FILE & TOOL CO.

410-416 Trumbull St., Elizabeth, New Jersey



ReMANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

REG. U. S. PAT. OFFICE

THIS is a part of a consignment of Libbey Turret Lathes which we have recently purchased from the Government. Some of them have never been set up. They are all to be ReManufactured, and offered to you at a fraction of their real value. We have hundreds of other bargains like these.

MILLERS

No. 6 Whitney.
[illegible]
No. 1 Pratt & Whitney.
[illegible]
[illegible]
P. & W., Becker, and [illegible]
[illegible] Brown & Sharpe
[illegible]
P. & W. [illegible] Aut.
[illegible] Aut.
[illegible]
Pratt & Whitney Spliner
Pratt & Whitney [illegible]
Beaman & Smith Open Back
[illegible]
[illegible] Ingersoll Slab
Beaman & Smith Slab
No. 1 Brown & Sharpe Vert.
[illegible] Milwaukee Vert.
[illegible] Becker Vert.
No. 3 Becker Vert.
[illegible] Milwaukee Vert.
No. 2 Brown & Sharpe Vert.
No. 3 Cincinnati Vert.
[illegible] Vert.
[illegible] Becker Vert.
[illegible] Becker Vert.
[illegible] Becker Vert.
[illegible] Becker Vert.
3—No. 6 Becker, Vert.

TURRET AND SCREW MACHINES

[illegible] Pratt & Whitney
[illegible] P. & W. [illegible] Hd.
[illegible] Jones & Lamson
[illegible]
[illegible] Jones & Lamson.
[illegible] Potter & Johnston
[illegible] Warner & Swasey
[illegible] Warner & Swasey.
[illegible] Gisholt
[illegible]
[illegible]
[illegible]
[illegible] Libbey
[illegible] Libbey

GRINDERS

[illegible] Morse.
[illegible]
[illegible]
[illegible] Norton
[illegible]
[illegible] Fitchburg
[illegible] Thompson Univ
[illegible] Norton
[illegible] Norton
[illegible] Norton
[illegible] Brown & Sharpe Univ
[illegible] Fitchburg
[illegible]
[illegible] Landis
[illegible] Landis
[illegible] Landis
[illegible] Landis
[illegible]
[illegible] Queen City
[illegible]
[illegible] Norton
[illegible] Norton
[illegible] Landis
[illegible] Landis

RADIALS

[illegible] American Semi
[illegible] Cincinnati Semi
[illegible] American
[illegible]
[illegible] Western
[illegible]
[illegible]
[illegible]

PRESSES

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

AUTOMATIC SCREW MACHINES

[illegible] Brown & Sharpe
[illegible] Brown & Sharpe
[illegible] Brown & Sharpe
[illegible]
[illegible]
[illegible]

The Green List*

of Guaranteed ReManufactured Machine Tools

WRITE FOR A COMPLETE COPY

HORIZONTAL BORING MACHINES

[illegible] Foote Burt
[illegible]
[illegible] Newark
[illegible] No. 1 Detrick & Harvey.
[illegible] & Smith
[illegible]
[illegible] Barrett.
[illegible]
[illegible] No. 3 Beaman & Smith

VERTICAL BORING MACHINES

12—24-in. Bullard. New Era
1—30-in. Gisholt
1—34-in. 44-in. Colburn.
1—[illegible] Colburn
1—[illegible] Bullard
2—72-in. Cincinnati.

SHAPERS

1—14-in. Worcester.
1—15-in. Potter & Johnston.
1—16-in. Queen City.
1—16-in. Streine.
5—16-in. Walcott.
2—16-in. Steptoe.
1—16-in. Ohio.
2—20-in. Steptoe.
2—24-in. Walcott.
4—26-in. N. B. P.

**This is only a small part of The Green List.*
If the tools you want are not listed here, write and ask us.

LATHES

1—20-in. x 10-ft. Lodge & Shipley.
1—20-in. x 12-ft. Walcott.
3—20-in. x 12-ft. American.
3—20-in. x 16-in. American.
1—20-in. x 18-ft. Lodge & Shipley.
20—21-in. x 10-ft. Le Blond.
1—22-in. x 8-ft. L. & S., Gd.
1—22-in. x 10-ft. Lodge & Shipley.
2—24-in. x 10-ft. American.
1—24-in. x 10-ft. Amer., Gd. Hd.
1—24-in. x 10-ft. Hendey, Gd. Hd.
12—24-in. x 12-ft. Providence.
20—25-in. x 10-ft. Sidney.
8—25-in. x 10-ft. Le Blond.
17—25-in. x 12-ft. Le Blond.
4—26-in. x 10-ft. Walcott.
15—26-in. x 10-ft. Whitcomb-Blaisdell.
34—26-in. x 10-ft. Canada.
16—26-in. x 11-ft. Cisco.
13—26-in. x 11-ft. Wickes.
4—26-in. x 13-ft. Wickes.
1—26-in. x 12-ft. Walcott.
37—26-in. x 10-ft. Niles-Bement-Pond.
44—26-in. x 8-ft. Bridgeford.
175—26-in. x 10-ft. Bridgeford.
87—26-in. x 9-ft. Bridgeford.
19—26-in. x 12-ft. Bridgeford.
2—26-in. x 14-ft. Niles-Bement-Pond.
3—26-in. x 14-ft. Bridgeford.
6—26-in. x 16-ft. Bridgeford.
8—26-in. x 20-ft. Bridgeford.
4—30-in. x 11-ft. Amer. Gd. Hd.
4—30-in. x 11-ft. American.
2—30-in. x 11-ft. H. S. & G.
1—30-in. x 20-ft. Amer. Gd. Hd.
18—32-in. x 12-ft. Fitchburg.
1—32-in. x 12-ft. Wickes.
1—36-in. x 12-ft. Wickes.
3—36-in. x 14-ft. Johnson, Gd. Hd.
1—36-in. x 19-ft. Johnson, Gd. Hd.
1—36-in. x 20-ft. Putnam.
13—36-in. x 30-ft. Pittsburgh, Gd. Hd.
4—36-in. x 37-ft. N. B. P., Gd. Hd.
2—36-in. x 42-ft. LeBlond, Gd. Hd.
5—40-in. x 12-ft. Fifield.
2—45-in. x 24-ft. Pond, Gd.

PLANERS

1—24-in.x24-in.x24-in. Cincinnati. Crank.
1—24-in.x24-in.x12-ft. Whitcomb.
3—36-in.x36-in.x18-ft. Cincinnati, 2 hds.
1—42-in.x42-in.x9-ft. N.B.P.
1—48-in.x48-in.x12-ft. Cincinnati.
1—48-in.x48-in.x15-ft. Rockford.
1—48-in.x60-in.x10-ft. Gray.
1—96-in.x72-in.x20-ft. Bement, Miles.

DRILLS

15—14-in. Myers.
1—20-in. Excelsior, B. G.
4—[illegible]-in. W. F. & J. Barnes.
2—[illegible]½-in. W. F. & J. Barnes.
5—[illegible]-in. W. F. & J. Barnes.
2—[illegible]-in. Silver.
1—[illegible]-in. Barnes.
1—26-in. Barnes.
1—30-in. Barnes.
1—34-in. Barnes.
1—4[illegible]-in. Cincinnati.
3—No. 1 Baker.
1—No. 310 Baker.
1—No. 315 Baker.
1—No. 513 Baker.
1—25-in., 2 spdl. Rockford.
1—3-spdl. Sigourney.
2—3-spdl. Taylor & Fenn.
3—4-spdl. Allen.
15—6-spdl. Allen.
1—No. 6-B Henry & Wright.
2—No. 11 Natco.
1—No. 11 Pratt & Whitney.
3—No. M-4 Natco.
2—No. 30 Natco.
1—No. 41 Natco.
3—No. 1 Barnes, Horiz.
1—Garvin Two Way Boring Mach.

MISCELLANEOUS

1—1500-lb. Erie Steam Hammer.
1—Cleveland Relieving Mach.
1—3½-in. Landis Sgle. Hd. Bolt Cutter.
3—No. 3 La Pointe Broaches.
1—No. 3 J. N. La Pointe Broach.
2—No. 4 La Pointe Broach.
1—Brown & Sharpe Polishing & Finishing Machine.
1—No. 0 Mitts & Merrill Keyseater.
70—Newton, Betts, Pratt & Whitney, and Garvin Profilers.
1—4-in. Whiton Centering Mach.
1—Whiton Center. Mach. (7 in.)
18—Pilton Slotters.
1—Richert & Shaefer Tapper.
1—Oliver Filing Machine.
1—3-in. Hurlbut & Rogers Cut Off.
1—No. 4-B Dreis & Krump Hand Brake.

HILL, CLARKE & CO OF CHICAGO

649 Washington Boulevard

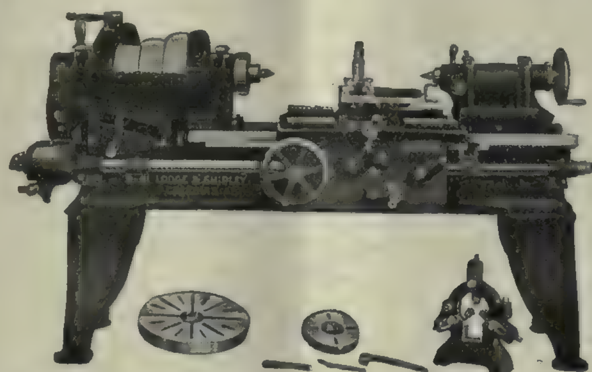
FOR SALE! Complete Equipment

Exceptional opportunity to purchase—Modern Machine Tools, Raw Materials, Supplies, etc.

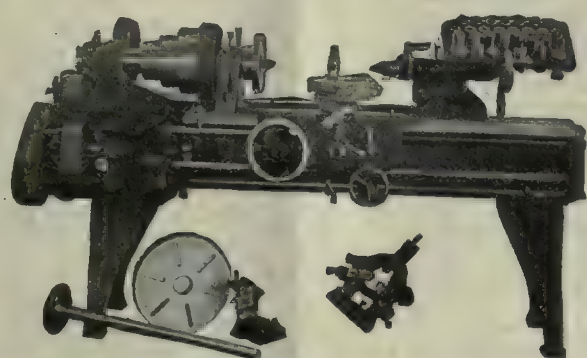
Becker Milling Machine Co., 110 Business St., Hyde Park, Boston, Mass.
Tel. Hyde Park 800

Whitcomb-Blaisdell Mch. Tool Co., 677 Cambridge St., or 134 Gold St., Worcester, Mass.
Tel. Park 4940

Business and Goodwill purchased by REED-PRENTICE CO., Worcester, Mass.



3—18 in. Lodge & Shipley Engine Lathes, Compound Rest, Double Back Gears, Quick Change; similar to cut.



2—16 in. Pratt & Whitney Engine Lathes, Compound Rest, Quick Change, Chuck, Taper Attachment. One machine with collet attachment and 6 collets; similar to cut.

84 Engine Lathes, Cone and Geared Head

Lodge & Shipley, Hendey, Pratt & Whitney, LeBlond, Reed-Prentice, Whitcomb-Blaisdell, Flather, Champion, Boys & Emmes.

16 Turret Lathes

Potter & Johnston, Gridley, Pratt & Whitney, Gisholt.

6 Automatic Screw Machines

Cleveland, Gridley, Pratt & Whitney.

22 Planers

22 in., 24 in., 26 in., 30 in., 36 in., 42 in.

Whitcomb-Blaisdell, Pond, Woodward & Powell, Cincinnati, Gray, Fitchburg.
Also one 60 in. x 60 in. x 14 ft. Gray, late type, two rail heads, two side heads, worm drive.

40 Millers, Plain, Universal, Vertical

Kempsmith, Milwaukee, Becker, Van Norman. Also Becker Planer Type and Duplex.

26 Drills Upright and Multiple Spindle

Sigourney, Snyder, Prentice, Henry & Wright, Blaisdell.

19 Grinders, Plain Cylindrical and Universal

Brown & Sharpe, Landis, Norton.
Also surface, cutter, tool, internal and bench grinders.

12 Gear Cutters

Brown & Sharpe, Gould & Eberhardt, Fellows, Winton, Schuchardt & Schutte.

8 Boring Machines, Horizontal and Vertical

Universal, Niles, Lucas, Beaman & Smith, King, Colburn.

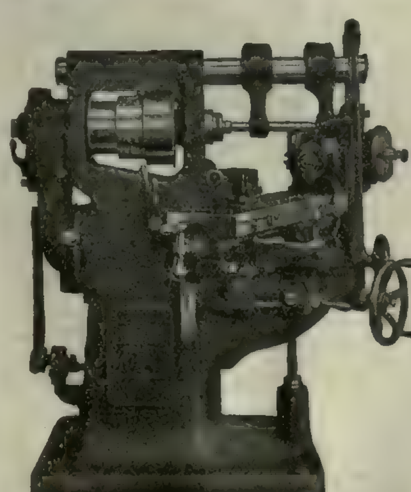
Miscellaneous Machine Tools

Arbor Presses, Shapers, Metal Saws, Centering Machines, Punches and Shears, also woodworking equipment.

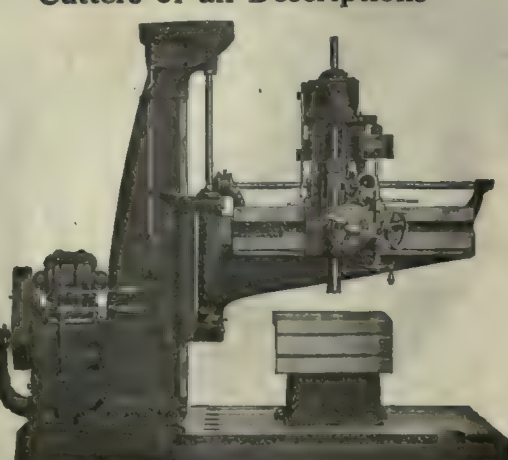
Raw Material and Supplies

Co'd Rolled, Machinery, High Speed and Tool Steel. Twist Drills, Emery Wheels, Belting, etc.

Cutters of all Descriptions



1—No. 2 Becker Universal Milling Machine, with 12 in. Dividing Head, Tailstock, Pumps, all power feeds, range 28 in. x 14 in. x 18 in., working surface of table 43 in. x 10 in., arranged for motor drive. (Reliance 110 volt D. C. 1½ h.p., 300 - 1600 r. p. m. motor). Similar to cut.



1—4 ft. Reed - Prentice Radial Drill, ball bearing type, box table 22 in. x 20 in. x 20 in., arranged for motor drive. Similar to cut.

Land and buildings of Becker Milling Machine Co. and Whitcomb-Blaisdell Machine Tool Co. for sale. Detailed description of buildings, plans and prices sent on request. Apply Treasurer at 677 Cambridge St., Worcester, Mass., or Tel. Park 4940.

SECOND-HAND MACHINE TOOLS

DRILLS
1-spindle Avey ball bearing.
3-spindle Henry & Wright ball bearing.
3-spindle Taylor & Fenn.
4-spindle Francis Reed.
20-in. Prentice Br. slid. hd. B.C., P.F.
28-in. Snyder, sl. hd., B.C., P.F.
32-in. Superior, sl. hd., B.G., P.F.
42-in. Cincinnati-Bickford sl. hd., B.G., tap. att.
No. 17 4-spdl. Foote-Burt gang drill.
No. 30 Bausch multiple spindle.
3-ft. Cincinnati-Bickford plain radial, tap. att.
3-ft. No. 0 Bickford plain radial, tapping att.
3-ft. Mueller plain radial, tapping att.
3-ft. American plain radial.
5-ft. Dreses plain radial, tapping.

LATHES
9-in. x 20-in. Porter Cable mfg. lathe.
12-in. x 6-ft. Hendey Lathe, C.R., P.C.F., Q.C.
14-in. x 6-ft. Hendey Lathe, C.R., P.C.F., Q.C.
14-in. x 6-ft. Monarch C.R., P.C.F., Q. C. G.
14-in. x 8-ft. Lodge & Shipley C.R., P.C.F., Q.C.G.
16-in. x 8-ft. Champion, C.R., P.C.F., Q.C.G.
16-in. x 8-ft. Lodge & Shipley, geared hd., C.R., P.C.F. taper att. Longitudinal and cross feed stops.
17-in. x 8-ft. Flather, C.R., P.C.F., Q.C.G.
18-in. x 8-ft. Greaves-Klusman, C.R., P.C.F., Q.C.G.
18-in. x 8-ft. Whit.-Blaisdell, C.R., P.C.F., Q.C.G.
20-in. x 8-ft. American, C.R., P.C.F.
24-in.x14-ft. Greaves-Klusman, C.R., P.C.F., Q.C.
32-in. x 14-ft. Hamilton, C.R., P.C.F., triple geared.
38-in. x 16-ft. Pond, geared head, C.R., P.C.F., triple geared, arr. M.D.

BORING MACHINES
No. 1 Lucas table type, hor. bor. & drilling mach. 3-in. bar.

BORING MACHINES (Cont'd)
No. 2 Beaman & Smith floor type, arr. M.D., 4-in. bar.
34-in. Colburn, turret head, vertical.
38-in. Niles, 2 reg. heads, vertical.
51-in. Niles 2 reg. heads, vertical.

SCREW MACHINES AND TURRET LATHES
⅜-in.-½-in. cap. Cleveland auto. Model A screw machine.
⅝-in.-⅞-in. cap. Cleveland auto. Model A screw machine.
⅛-in. cap. Cleveland pl. auto. Model B screw machine.
1-in. cap. Cinti.-Acme wire feed screw machine.
1¼-in. cap. Cinti.-Acme wire feed screw mach.
1½-in. cap. Cinti.-Acme wire feed screw mach.
2½-in. cap. Cinti-Acme wire feed screw mach.
16- and 18-in. Cinti.-Acme univ. Fox turret lathe.
2¼-in. x 24-in. Jones & Lamson, bar or chucking turret lathe.
3¼-in. x 36-in. Jones & Lamson, bar or chucking turret lathe.
No. 1-B Foster geared head turret lathe.

MILLERS
No. 2, 3 and 4 Cincinnati plain.
No. 5 Cincinnati plain hp.
No. 2B Brown & Sharpe plain.
No. 2, 5 and 9 Kempsmth plain.
No. 3 and 4 Cincinnati vertical.
No. 2A, C-2, 4B and 5 Becker vertical.
No. B2 Becker continuous type vertical.
No. 1½, 2 and 3S Cincinnati universal.
No. 1½ Brown & Sharpe universal.
36-in. x 10-ft. Newton, face slab type.
4½-in. x 12-in. Pratt & Whitney thread milling machines.

GRINDERS
3-in. x 18-in. Norton plain.
6-in. x 32-in. Norton plain.
10-in. x 36-in. Norton plain.

GRINDERS (Cont'd)
10-in. x 30-in. Landis plain.
12-in. x 120-in. Landis plain.
16-in. x 52-in. Landis plain crankshaft grinder.
12-in. x 40-in. B&S universal.
12-in. x 36-in. Cincinnati universal.
2-12-in. x 24-in. Diamond surface.
Taylor high-speed water tool grinder.
No. 1 Cincinnati cutter and reamer grinder.
No. 60 Heald cylinder grinder.
No 11 Rivett Ball Race, with power oscillating att.
Saxon face grinder.
10-in. Garrigus rotary, with magnetic chuck.
No. 2 Brown & Sharpe surface grinder.
18-in. and 20-in. disc grinders.

SHAPERS AND PLANERS
14-in. Gould & Eberhardt crank shaper, B.G.
20-in. Davis crank shaper, back geared.
24-in. Stockbridge crank shaper, back geared.
15-in. and 24-in. Hendey friction shapers.
24-in. x 24-in. x 6 ft. Flather planer, 1 hd.
36-in. x36-in. x 12-ft. Pond planer, 2 hds.
48-in. x 48-in. x 15-ft. Sellers planer, 3 hds.
60-in. x 40-in. x 12-ft. Pond planer, 2 hds.
66-in. x 60-in. x 30-ft. Bement planer, 3 hds.
96-in. x 60-in. x 12-ft. Detrick & Harvey open-side convertible planer, 4 hds., M.D.

MISCELLANEOUS
No. 3 Lapointe broaching machine.
No. 72 Ferracute press.
No. 13 P & W profilers.
36-in. Gould & Eberhardt gear cutter.
36-in. B & S gear cutter.
18-H Gould & Eberhardt hobbing gear cutter.
¾-in. x ¾-in. single end punch and shear.
6-in. Gleason bevel gear generator.
American and Stewart furnaces.
Newton, Burr and Racine Saws.
Bliss & Adriance power presses.
30-Ton Lucas Forcing Press.

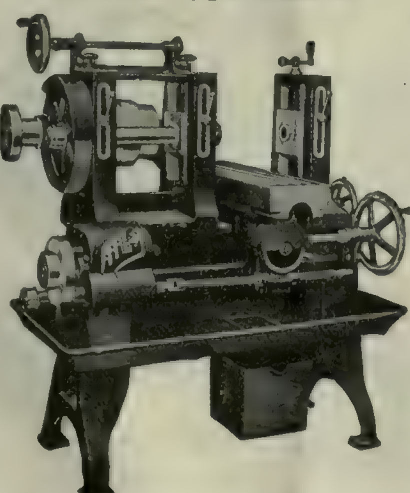
THIS IS BUT A PARTIAL LIST OF OUR STOCK

HENRY PRENTISS & COMPANY,
149 BROADWAY, NEW YORK, N. Y.

BOSTON BUFFALO HARTFORD SYRACUSE ROCHESTER

---

100 Hendey No. 4
Lincoln Type Millers



SPECIFICATIONS
Longitudinal feed (power), 20 in.
Cross feed, 5 in.
Vertical adjustment of spindle, 8 in.
Size of table 24 in. x 6 in. (2—⅝ in. T slots).
Greatest distance between spindle and table 9 in.
Number of feed changes, 12
Taper hole in spindle, B. & S. No. 10
Speed of countershaft, 200 r.p.m.
Weight, about 2,200 pounds.

LOOK
Some
Bargain

Your choice of either a

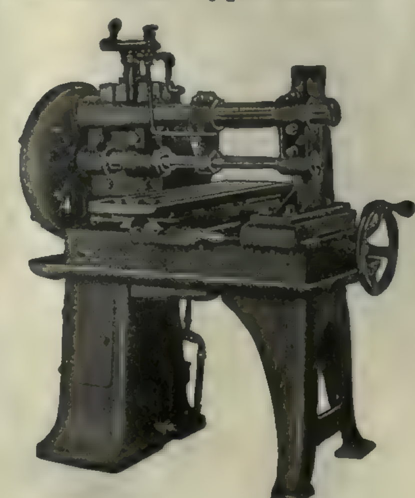
Hendey or Becker
Lincoln Type Miller

$125.00 Each
F.O.B. cars Newark, N. J.

Each machine nearly new and guaranteed in A-1 condition and complete with countershaft and oil pump but no arbor.

Terms 1/3 with Order. Balance Sight Draft against Bill of Lading

200 Becker No. 7-H
Lincoln Type Millers



SPECIFICATIONS
Longitudinal feed (power), 19½ in.
Cross feed, 7 in.
Vertical adjustment of spindle, 9 in.
Greatest distance between spindle and table, 9½ in.
Size of table 29 in. x 9 in. (3—⅝ in. T slots).
Number of spindle speeds, 3
Taper hole in spindle, B. & S. No. 10
Speed of countershaft, 160 r.p.m.
Weight, about 2,400 pounds

New Jersey Machinery Exchange, 21 Mechanic St., Newark, N. J.

Look At These!

Every one an UNUSUAL machine to find and all at real BARGAIN prices

BORING MILLS
No. 0 (32) Giddings & Lewis Horizontal.
Lucas Horizontal.
32-in. King Vertical.

DRILLS
28-in. Reed-Prentice, sliding head.
28-in. Barnes, sliding head.
4 Spindle Henry & Wright, 1⅛-in. drills.
12 Spindle Fox drill.

FURNACE
Stewart Combination Furnace.

GRINDERS, cylindrical
No. 1 Brown & Sharpe, universal.
No. 1 and 2 Morse, universal and plain.
No. 103 Rivett, internal.

GRINDERS, Cutter and Tool
No. 2 Oakley.
No. 1 Le Blond.

GRINDERS, Disc
No. 4 Gardner disc.
No. 14 Gardner combination disc.
No. 8 Gardner disc.

DIE SINKERS
No. 2 Pratt & Whitney.
No. 3 Pratt & Whitney.

HAMMERS
40 lb. Bradley cushioned helve. Merrill board hammer.

KEYSEATERS
No. 2 Davis Keyseater.

GEAR CUTTER
No. 6 Fellows gear shaper.

LATHES
Ames bench precision.
Pratt & Whitney precision.
3½ Stark precision.
26-in. x 10-ft. Bridgeford heavy duty.
22-in. x 10-ft. Reed.
16-in. x 8-ft. Pratt & Whitney tool room.
16-in. x 5-ft. Whitcomb tool room.
20-in. x 8-ft. Cisco.
10-in. Pratt & Whitney tool room.
16-in. x 6-ft. Cleveland, New, but cheap.

MILLERS
No. 2 Van Norman Duplex.
No. 2 Rockford heavy duty, universal.
No. 1 Garvin universal.
Type A Briggs.
No. 12 Garvin, plain.
No. 6 Whitney hand.

PLANERS
60-in. x 60-in. x 14-ft. Niles-Bement-Pond Planer, 4 heads, motor driven.
24-in. x 24-in. x 6-ft. Gray, 2 heads.

SCREW MACHINES
No. 00 Brown & Sharpe automatic.
No. 2 Davenport.
⅝-in. Pratt & Whitney hand.
2-in. x 24-in. Jones & Lamson.
⅞-in. Cleveland, Model A automatic.
⅝-in. Cleveland, Model A automatic.
No. 1 and 2 Garvin hand.
No. 10 Foster, geared head.
No. 5A and 6A Potter & Johnston automatics.
No. 3 and 4 Foster hand.

TAPPERS
⅝-in. National Acme nut tapper.
¾-in. Rickert-Shaffer horizontal.
No. 1 Garvin vertical.

WIRE STRAIGHTENER
⅜-in. Shuster Wire Straightener.

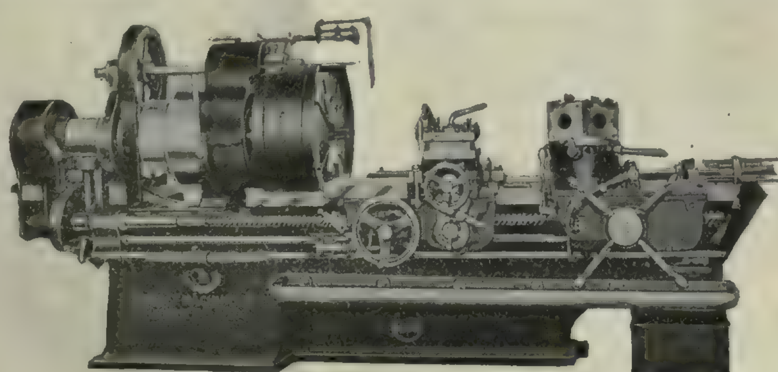
SHAPERS
24-in. Cincinnati.
24-in. Gould & Eberhardt.
20-in. American.
20-in. Stockbridge.
20-in. Gould & Eberhardt.
15-in. Hendey Friction.

In addition to the above items we also have a complete line of GOOD used machinery on which we can quote you attractive prices. May we have your inquiries?

MACHINERY DEALERS, INCORPORATED

Formerly, Standard Machinery Co.

453 Chapel Street **New Haven, Conn.**



REBUILT

Gisholt Turret Lathes

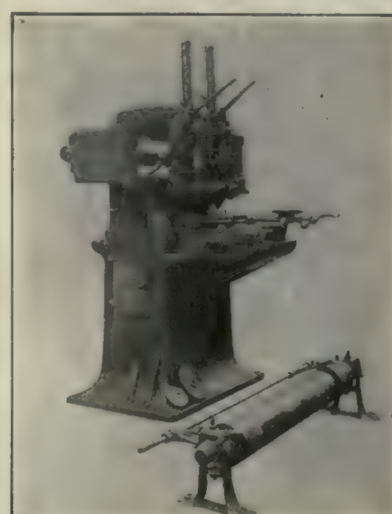
Two 21-in.—3½-in. Spindle Bore
Three 24-in.—6¼-in. Spindle Bore

These lathes have been entirely rebuilt in our own shop with same jigs and fixtures used when first built. We guarantee them to be as accurate as new machines.

Gisholt Machine Company

1201 E. Washington Ave., Madison, Wis. 1888 Page Ave., Cleveland, Ohio

Room 1725—30 Church St., New York



Twenty-five

2-Spindle Profilers

Complete

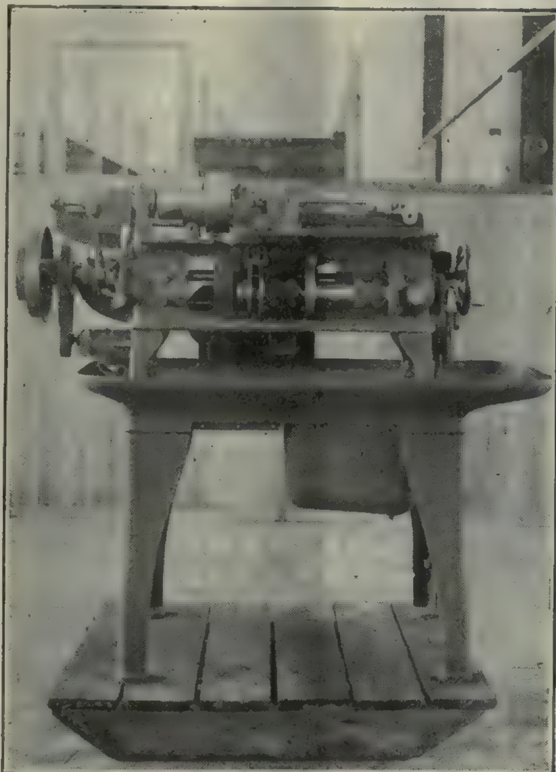
Same as New

$160.00 Each

SIMMONS MACHINE CO., INC.
Warehouse and Offices,
Albany, N. Y.
182 Lafayette Street, New York, N. Y. 88 Exchange Street, Buffalo, N. Y.

LUCAS MACHINERY SERVICE

22 No. 0 and 15 No. 2



Brown & Sharpe Automatic Cutting-off Machines

We bought them right—
Overhauled them right—
Will sell them right—

22 No. 0 Brown and Sharpe Automatic Cutting-off Machines

Capacity ..... ½" x 12"
Greatest length feed by one movement..... 3"
Movement of tool slide 2"
Drive—3 step for 2¼" belt.
Net weight—approximately 1275 pounds.

Price f.o.b. Bridgeport

$250.00

15 No. 2 Brown and Sharpe Automatic Cutting-off Machines

Capacity ..... ⅞" x 16"
Greatest length feed by one movement..... 4"
Movement of tool slide 3"
Drive—3 step cone for 2¾" belt.
Net weight—approximately 1800 pounds.

Price f.o.b. Bridgeport

$350.00

This is an actual photograph of these machines. We have thoroughly overhauled them and guarantee them to be in first-class operating condition with countershafts. Do that job automatically! At these prices the machines will surely pay for themselves in a short time. Send us yor order with one-third deposit or better still come and see them.

J. L. LUCAS & SON Inc.
LUCAS MACHINERY SERVICE
BRIDGEPORT, CONN.

MACHINERY AND TOOLS

For Immediate Delivery

ENGINE LATHES TRIPLE GEARED SCREW CUTTING

96 x 37 Fifield, 27 ft. centers.
68 x 40 Pond, 30 ft. centers.
60 x 40 Fifield, 30 ft. centers, with 2 carriages on bed, with compound rests, hollow spindle. (2 machines.) Nearly new.
36 x 32 American Tool Works, 25 ft. centers, with 2 carriages on bed, with compound rests, have power angular feed, quick change. Nearly new. (3 machines.)
36 x 32 LeBlond, 25 ft. centers with carriages on bed, compound rests, taper attachment, quick change. Nearly new. (2 machines.)

ENGINE LATHES (NOT SCREW CUTTING) PLAIN TURNING

36 x 27 Niles-Bement-Pond, heavy duty, all geared head, 21 ft. centers.
36 x 33 Niles-Bement-Pond, heavy duty, all geared head, 27 ft. centers.
48-in. Niles Double Head Car Wheel Turning Lathe, with 2 carriages.

TURRET LATHES

Gisholt 24-in. swing with 4-way turret tool post on carriage, tilted hex. turret on bed with power rapid traverse—taper attachment, triple geared pan bed pump— 6¼ in. hole in spindle (10 machines) latest model.
Pond 28-in. swing same—4½ in. hole in spindle.

PNEUMATIC TOOLS

Hanna compression Riveter 15 in. Reach 10 in. capacity 1¼ in.
1000 Pneumatic chipping Rivet Hammers and Air Drills

HAMMER-STEAM-BELT-BOARD

1100 lb. Steam Single Frame Open Type.
800 lb. Erie Single Frame Steam Hammer.

MILLING MACHINES

Ingersoll 24-in. x 24-in. x 12-ft. Table Horiz. Slab Milling Machines, with INCLINED ADJUSTABLE RAIL—(Brand New; 6 machines). Weight about 25,000 lb.
BECKER No. 5-C, Latest Improved Model, Single Pulley Drive (All Geared Speeds). Table 56 x 14 in. (Automatic Feeds 54 in. x 16 in. x 14 in.) 2 machines.

MISCELLANEOUS TOOLS

New Doty Plate Bending Roll, 6 ft. for ¾ in. plate Housing Suspension Device—Power Raise and Lower, arranged for Motor Drive. Weight about 20,000 lbs.
Ajax No. 7 Bulldozer 16 in. x 60 in. Weight 35,000 lbs.
Kane & Roach 8 Roll Straightener, Angles, channels, Round.
Roll 36 in. for corrugating Sheets. Weight about 4500 lbs.
Lewis 16 in. Bar Rolling Mill.
72 in. Plate Rolling Mill.
1 Allen Jaw Air Riveter, 66 in. rach, 13½ in. gap, dia. of air cylinder 11½ in., capacity 1 in. rivets. Cast Steel Frame. Can be used in either Vert. or Horiz. Position; 250-hp. Mtrs.

ELECTRIC MOTORS

6—Westinghouse Induction Alternating, Type CCL, 250-hp. Motors, 440 v., 3 ph., 60 cy., speed 514 r.p.m.

Send for Bulletin No. 205, describing our complete stocks of Machinery and Tools

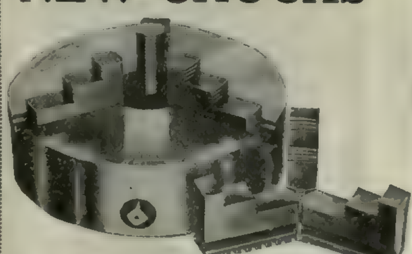
HARRIS BROTHERS CO.
35th and Iron Sts., Chicago, Ill.

50% off List

(to the trade)

on T-W Universal Geared scroll 3 jaw (2 sets of jaws)

NEW CHUCKS



These Chucks are absolutely guaranteed against any defect in material, construction or accuracy.

BETTER THAN THE BEST

In all sizes:	*List*
4 inches	$22.00
5 inches	24.00
6 inches	28.00
7½ inches	32.00
9 inches	38.00
10½ inches	44.00
12 inches	52.00
15 inches	70.00

FIFTY (50) PER CENT. OFF LIST

"The House of a Thousand Bargains".

WITBAR TOOL COMPANY
366 Broadway, New York City

Gear Cutting and Hobbing Machines

in excellent condition

Machines listed below have been rebuilt and put into excellent operating condition.

2—36 in. x 10 in. G. & E. Vertical Type Gear Cutting Machines, No. 36-S, for spur gears only.
3—48 in. x 10 in. G. & E. New Type Gear Cutting Machines for spur gears only.
1—24 in. x 12 in. G. & E. Automatic Gear Hobbing Machine.
1—No. 2 Reinecker Universal Gear Hobbing Machine.

The following machines have been in service a very short time and are almost as good as new.

1—No. 2 Barber-Colman Hobber.
1—No. 5 Lees-Bradner Automatic Hobbing Machine.

All these machines are being offered at exceptionally low prices.

GOULD & EBERHARDT
"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY

NEW

CINCINNATI OPENSIDE PLANER

48 in. x 48 in. x 12 ft.
2 Rail Heads.
1 Side Head.
Overhead Countershaft.
Supplementary Table.

Price $7500

Machine on its original skid. All bright parts as originally slushed.

An exceptional buy, considerably below manufacturer's present price.

The New Britain Machine Co.
New Britain, Conn.

POWER PRESSES

All Makes and Types
New and Rebuilt

LARGE SELECTION
OF
INCLINABLE
FLYWHEEL
STRAIGHT SIDE
AND GEARED PRESSES

At Prices that Represent a Large Saving

Priced at Rock Bottom Before Removal

1—76½ BLISS TRIMMING PRESS
1—75½ BLISS TRIMMING PRESS
with Side Shear
Arranged for Motor Drive

Joseph Hyman & Sons
Tioga, Almond and Livingston Sts.
Philadelphia, Pa.
Write Today for Our Price List.

TOOLS FOR IMMEDIATE SHIPMENT

Air Compressors, [illegible] 9x8 and 12x10
[illegible]
[illegible] speed
[illegible] each.
[illegible]
[illegible] Press [illegible] No. 1 ½ to
[illegible] 9 in. [illegible] spindle
[illegible] 13 in. x 6 ft., collet attachment
[illegible] No. 35 [illegible]
[illegible]
[illegible] 3-phase
[illegible]
[illegible]
[illegible] 12 to
[illegible] 4 hd
[illegible]
[illegible]
[illegible]
[illegible] cutting
[illegible] feed
[illegible] W. & F. [illegible]

THE OSBORNE & SEXTON MACHINERY CO.
[illegible]
[illegible]

Machinery For Sale

LOW PRICES

1—4 spindle cylinder borer, Foote Burt make.

2—6 spindle cylinder borer, Foote Burt make.

1—4 spindle Ingersoll Cylinder miller.

1—No. 59 Toledo Press.

1—No. 94-H Toledo Press.

Full line of lathes, shapers, milling machines, automatic screw machines, Potter Johnson and J. & L. machines, hand screw machines, drilling machines, sensitive and power, sheet metal machinery, all kinds, blacksmith and forge equipment, wood working machinery, belting, pulleys, shafting, drills, taps, dies, reamers, cutters, all kinds.

Send your inquiries to

METZ FACTORY, Waltham, Mass.

R. E. Threfall and W. F. Coye

High Speed Steel—*Machine—Tool—Special*

30 to 50 Per Cent Under the Market

	Tons
Lot No. 200—**Machine Steel** (Round, square, flat)	23
Lot No. 201—**Cold Roller Shafts**	7
Lot No. 202—**Colonial Steel** (Special H. S. Tool)	10
Lot No. 203—**Special Steels** (Oil Hardened, Nonshrinkable, Tool), Vasco, Ketos, etc. (Hexagonal, Octagonal, Round)	3
Lot No. 204—**Tool Steel**—Midvale, Columbia, Bethlehem, Champion, S. A. E., Atlas, Monarch, Standard, Halcomb, Bobson, etc. (Round, square, flat)	60
Lot No. 205—**Tool Steel**—Jessup, Sanderson, Pompton, Firth Sterling, Red Cut Superior—(Round and square)	7
Lot No. 206—**Tool Steel**—Red Cut Superior, Blue Chip, H. S. Firth Sterling, Rex A. A. (Round and square)	12
Lot No. 207—**Cold Rolled Steel**—(round, square and flat)	22
Lot No. 150—**High Speed Steel**—Rex A. A.	12

GORDON & FREEDMAN, 240 Canal St.
Phones: Franklin 3063-3064

IDEAL SPECIALS

[illegible]

Send for Complete List

IDEAL MACHINERY COMPANY
[illegible]

ONE NO. 0 GIDDING & LEWIS HORIZONTAL BORING DRILLING AND MILLING MACHINE—

New—Set Up But Never Used

Federal Equipment & Supply Co.
110 W. 40th Street, New York.

PLANERS

42-in. x 42-in. x 12-ft. Powell Planer with three heads, in excellent condition.
48-in. x 48-in. x 12-ft. Pond Planer with four heads, in excellent condition.
Powell Planer, 60 in. between housings, 20-ft. bed, parallel drive, two heads.

MILLING MACHINES

No. 4 Cincinnati high-speed, all geared head, single pulley drive, plain milling machine with vertical attachment, 90% new.
No. 3H LeBlond plain milling machine with vertical attachment, friction double back geared head, 90% new.
No. 3 Kempsmith plain milling machine with pump, 90% new.

FACTORY & MILL SUPPLY CO.
137 Oliver Street, Boston, Mass.

---

6 BRAND NEW Engine Lathes

—CLEVELAND—

16 in. x 6 ft. cabinet legs with regular factory equipment. Send for photo.

$375.00 Each

MACHINERY DEALERS, Inc.
New Haven, Conn.

Botwinik Brothers Specials

MILLING MACHINES

Brown & Sharpe No. 1 Universal, cone drive.
Cincinnati No. 1 Universal, cone drive.
Brown & Sharpe No. 2A Universal, single pulley.
[illegible] No. 2 Universal, motor drive.
[illegible] No. 2A Universal, single pulley.
[illegible] No. 2 Universal, cone drive.
Brown & Sharpe No. 3A Heavy Universal, single pulley.
[illegible] No. 1½ Plain, Index Heads, etc.
Brown & Sharpe No. 2 Plain, Index Heads, etc.
Brown & Sharpe No. 2 Plain, Index Heads, etc.
[illegible] No. 1½ Plain, complete.
[illegible] No. 1 Plain, Index Heads, etc.
Brown & Sharpe No. 1 Plain, complete.
Kempsmith No. 6 Plain, complete.
Brown & Sharpe No. 12 Mfg. Type.
[illegible]
Becker Brainard No. 20 Plain, complete.
Van Norman No. 2 Duplex, Drilling Heads, etc.
[illegible]

BOTWINIK BROTHERS
[illegible] Ave., New Haven, Conn. — 38-42 Drouve St., Bridgeport, Conn.

---

36 in. BULLARD

VERTICAL TURRET LATHE

90 per cent new. Money-saving price.

MILES MACHINERY CO., Saginaw, Mich.

Gisholt Turret Lathes

In very good condition. 14 in all. Take your choice. We need the room.
Special low price.

WAYNE MACHINERY CO.
Ft. Wayne, Ind.

SPECIAL OFFERINGS

MILLING MACHINES
No. 1M Potter & Johnson Continuous Automatic.
No. 5C Becker Vertical, Rotary.
No. 6 62 in. Becker Vertical.
No. ½ Van Norman Duplex.
No. 1 Brown & Sharpe Plain.
No. 1 Brown & Sharpe Universal.
No. 2 Leblond Universal.

DRILLS
No. 1 Langelier High Speed Ball Bearing Bench.
20 in. Prentice Sliding Head Open Belt.
22½ in. Barnes Heavy Duty Stationary.
24 in. Cincinnati Sliding Head, Tapping Attachment.
Henry & Wright Sensitive Radial.
5 ft. Prentice Bros. Plain Radial, Universal Box Table, SPD.
3 and 4-spindle Reed-Prentice BB Sensitive.

SHAPERS AND PLANERS
16 in. Flather, Gear Box.
16 in. Sellew Tool Room.
24 in. Sellew Tool Room.
24 in. Potter & Johnston Universal.
17 x 17 x 4 Whitcomb Planer.
22 x 22 x 5 Whitcomb Planer.
24 x 24 x 6 Gray Planer.
36 x 36 x 13 Betts Planer, 4 heads.
48 x 48 x 16 Patch Planer, 4 heads.

POWER HAMMERS
40 lbs. Bradley Cushioned Helve.
50 lbs. Bradley Cushioned Helve.
300 lbs. Beaudry Champion.

ROLLING MILLS
5 x 8 McWilliams.
8 x 13 McWilliams.
11 x 10 Standard Machinery Co's.

PRESSES
50 lbs. Standard Plain Drop.
No. 12 Bliss Hand Screw Press.
No. 1 Standard Power Screw Press 7 in. stroke.
No. 5 Standard S. A. Power Press
No. 5 Bliss Stiles & Parker Press.
No. 1 Bliss D. A. Cam Press.

WOOD WORKING MACHINES
No. 311 Fay & Egan 48 in. Angle Band Ship Saw.
Kidder Tilting Top Saw Tables.
Clement Double Arbor Saw Table.
No. 52 Dover Vertical and Horizontal Boring Machine.
12 in. Rogers Buzz Planer.
Beach Jig Saw.
24 in. White Double Belted Single Surface Planer.
Type D-1 Syracuse Motor Driven Disc Sander ½ hp. 220 VDC motor.

BROWNELL MACHINERY COMPANY
11-13 Eddy Street, Providence, R. I.

GUARANTEED
Machine Tool Bargains

Partial List

No. 60 Heald Cylinder Grinders.
1¼-in. Gridley Multiple Spindle Automatics.
44-in. Putnam High Duty Vertical Boring Mill, Turret Head.
60-in. Bullard Vertical Boring Mill.
3-in. Betts Horizontal Adjustable Knee Type Boring Mill.
No. 14 Pratt & Whitney Multiple Spindle Drill, 12 Spindles, 1¼-in. Drills.
12-in. x 72-in. Norton Cylindrical Grinder.
20-in. x 96-in. Landis Cylindrical Grinder.
24-in. Steinle Side Carriage Turret Lathes.
42-in. x 20-ft. Heavy Duty Triple Geared Engine Lathe, 12 ft. 6 in. between centers.
24-in. x 24-in. x 5-ft. Whitcomb Tool Room Planer.
No. 13 Brown & Sharpe Spur and Bevel Gear Cutter. Gears 18 in. x 4 in.
22-in. x 10-ft. Cincinnati Traveling Head Shaper.
No. 77½ Bliss Straight Side Tie Rod Frame Press.
No. 67 Adriance Straight Side Tie Rod Geared Press, weight 15000 lbs.
No. 76 Toledo Open Back Flywheel Press, weight 6400 lb.
8-in. Newton Slotter, Rotary Table.
24-in. Bullard Vertical Turret Lathe.

Send for our DECEMBER list of the largest stock in the United States of slightly used and thoroughly overhauled MACHINE TOOLS, POWER PRESSES, POWER, ELECTRICAL and CONTRACTORS' Equipment.

Satisfaction Guaranteed or Money Refunded

F. H. NILES & CO., Inc.
WICKES MACHINERY CO.
Main Office and Warehouse:
West Side and Claremont Ave.
Jersey City, N. J.
Established 1900.

Stokvis
Brand New Tools

Machines purchased direct from makers and held in high grade New York warehouses. Every tool absolutely brand new and in first class condition. Prices are below the market.

R·S·STOKVIS & SONS, INC.
17 BATTERY PLACE
NEW YORK

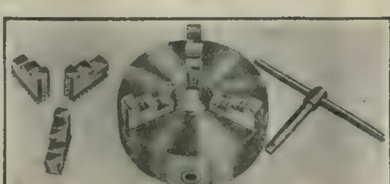
R S S NEW YORK

ODD EQUIPMENT

Steam Engine, 125 I.H.P. Vilter-Corliss.
Oil Engine, 80-hp. Venn-Sev.
Sandblast Machine, 1000-lb. Mott.
Acetylene Welding Outfit, Bourn.
2½ to 30-hp. A.C. and D.C. Motors, various types.
Norton Crankshaft Bal. Mach., with ½-hp. motor.
42-in. x 84-in. Seamless Steel Tank.
24-in. Sellers Slotter.
26-in. Niles Gd. Slotter.
1½-ton Available Motor Truck.
2½-ton Lamson Motor Truck.
Iron Safe, 43 in. wide, 31 in. deep, 6 ft. high.
9-hp. Water Motor Gas Engine.
Geared Fdry. Ladels, Tumbling Barrels, Belting, Chain Hoists, Floor Cranes, Shafting, Floor Trucks, Office Furniture and Fixtures.

THE E. L. ESSLEY·MACHINERY·CO
551-557 Washington Blvd., Chicago, Ill.
Dept. "C-5"

NEW CHUCKS
Universal Geared Scroll
Made by Gisholt Machine Co.
50% off List Price



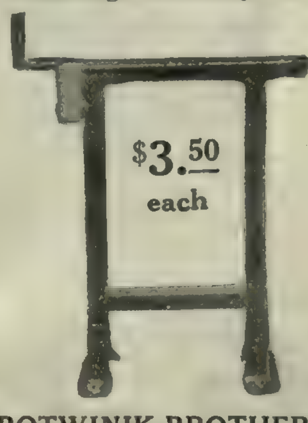
Improved Standard Pattern, particularly high class and heavy construction. Chuck bodies are of close grained Cast Iron.

Sizes and Prices:

7½ in.	$16.00
9 in.	19.00
10½ in.	22.00
12 in.	26.00

F. O. B. Cars, New York
WALTER SILBER
109 South 5th Street, Brooklyn, N. Y.

1000 New Britain Pressed Steel Bench Legs—Practically New



BOTWINIK BROTHERS
21 Sylvan Ave. New Haven, Conn.
28-42 Drouve St. Bridgeport, Conn.

MILLING MACHINES
Plain and Universal

NEW
3—No. 1½ Rockford Univ., cone type, 25x7½ x18.
2—No. 2½ Rockford Univ., cone type, 34x9x18.
1—No. 2½ Rockford Univ. high power geared, single, pulley drive; cap. 34 x 9 x 18.
1—No. 1½ American Univ., cone type, 25x9x18.
1—No. 1½ American Plain, cone type, 25x9x19.
1—No. 0 Bickett Vert. Miller and Profiler.

USED
1—No. 1½ American Plain, cone type.
1—No. 2 Becker Plain; arranged motor drive.
6—No. 32 Kempsmith, Lincoln type, 36 x 12.
1—Ingersoll Slab, 20 x 20 x 8 ft.
1—No. 1 Newton Keyseat Miller; arranged M. D.
1—No. 2 Newton Keyseat Miller, arranged M. D.

A FEW MISCELLANEOUS SELECTIONS
3—16 in. x 8 ft. Sidney Lathes; Q. C., D. B. G.
1—50 in. Sellers Car Wheel Borer.
1—52 in. Bertsch Multiple Punch.
3—Quickwork Rotary Shears; cap. up to 1 in.
2—Thompson Univ. Grinders, 10 x 36 in.
12—Gisholts 21 in and 24 in. Turret Lathes.
14—Screw Machines; ½ to 3¼ in. cap.
4—Radial Drills; 3½, 4 and 5 ft. plain and univ.
3—No. 2 Oakley Univ. Cutter and Tool Grinders.
1—No. 20 Lea Simplex Metal Saw.
1—No. 20 Bliss Inclinable Press.
1—No. 20 Lea Simplex Metal Saw.

We have over 1,000 machines in stock. Send us your inquiries. Our Guarantee: Money back if not satisfied.

Wayne Machinery Co., Ft. Wayne, Ind.

Good As New and Priced Reasonable

1—Brown & Sharpe No. 2 Universal [illegible]
[illegible]
[illegible] Auto [illegible]
[illegible] Auto [illegible]
[illegible] Automatics
1—[illegible] Wood Turning Lathe, No. 6

Other [illegible] standard machines

Morris Machinery Co.
[illegible] St., Newark, N. J.

BLANCHARD GRINDER

1—24 in. Vertical Blanchard Surface Grinder, direct drive, with 20 hp. G. E. motor, 440 v., 60 cy., 3 ph., 870 r.p.m., and G. E. motor, 2 hp., 440 v., 60 cy., 3 ph. GOOD CONDITION. We offer subject to prior sale.

Sweet & Doyle Foundry & Machine Company
Troy (Green Island), New York

No. 3½-A
BLISS TOGGLE PRESS

Will draw and lift out 9½-in. Largest blank 25 in. Diameter of drawing punch 16 in.

D. C. OVIATT & COMPANY
1106 St. Clair Ave., Cleveland, Ohio.

SPOT AND BUTT ELECTRIC WELDERS
Bought and Sold

I am specializing in Used Spot and Butt Electric Welding Machines. Tell me your needs and I may have a Used Machine that is good as new that I can furnish you at a big saving. Or if you have any Electric Welding Machines that you have no further use for, I will buy them.

ELECTRIC WELDING & SUP. SALES CO.
P.O. Box 2149, Boston, Mass.

25 POTTER & JOHNSTON

Automatic Chucking Machines
No. 6-A Geared Head

$350.00 Each

MACHINERY DEALERS, INC.
New Haven, Conn.

BRAND NEW
LATHE

"New Haven" Heavy Pattern New Engine Lathe (double back-geared), 24-in. swing, 24-ft. bed, 18 ft. 4 in. between centers; belt driven. Apply to

KONIG BROS. & CO.
160 Pearl Street, New York.

WANTED

NEW NO. 4 VAN NORMAN
INTERNAL GRINDER

With swivel table, full equipment. Price $500.

NEW YORK MACHINERY EXCHANGE
50 Church Street, New York.

Wanted to Buy
Toggle Drawing Press

With a stroke on drawing punch of 26 in.

Give full information

THE COLLIS CO., Clinton, Iowa

GUARANTEED NEW AT USED MACHINE PRICES

LATHES

[illegible]
[illegible] M D
[illegible]
[illegible] G. H.
[illegible] G. H.
[illegible]
[illegible] H D

[illegible] attachments can be applied to all.

MILLERS (Vertical)

[illegible]
[illegible]
[illegible]
[illegible] and 1 Model [illegible]
[illegible]
[illegible]
[illegible]
[illegible]

[illegible] ROTARY [illegible]

McCOY BRANDT MACHINERY CO.
[illegible] Ave., Pittsburgh, Pa.

LARGE STOCK OF NEW
H. S. MILLING CUTTERS, SLITTING & SCREW SLOTTING SAWS, ENDMILLS, COUNTERBORES, COLLETS, REAMERS.

Half Price or less. Send for Complete List.

PAUL FROILAND
Leyfred Terrace, Springfield, Mass.

WANTED
GUN DRILLING MACHINE

With capacity for ⅜-in. diameter hole, 44 in. long. Pratt & Whitney, No. 1½ preferred.

WRIGHT AERONAUTICAL CORP.,
Paterson, N. J.

New No. 2 Ohio Plain Miller, New.
16-in. x 8-ft. Lehmann QCG Lathe.
16-in. x 8-ft. Oliver QCG Lathe.
18-in. Prentice Turret Lathe.
24-in. x 24-in. x 8 ft. Putnam Planer, 2 heads
1 in. Pratt & Whitney Screw Machine.
2—No. 5 Hendey Lincoln Millers.
No. 13 Brown & Sharpe Universal Grinder.

Harry F. Allen, 30 Church St., New York

WANTED TO BUY
USED
PIPE THREADING MACHINE

1—6-in. also 1—12-in. capacity, good condition only.

KINGHAN MACHINE SHOP
Enid, Okla.

FOR SALE
Bevel Gear Planer

Gleason Generating Type, 11 in. Late type, all complete, fine condition, immediate delivery at one-third present cost.

G. L. SIMPSON
[illegible] Pittsburgh, Pa

10 in. x 36 in.
NORTON GRINDER

[illegible]

[illegible] MACHINERY CO., Saginaw, Mich.

GRAND RAPIDS SPECIALS

[illegible]

McMULLEN MACHINERY CO
Grand Rapids, Mich.

Your Shop's Most Interesting Corner

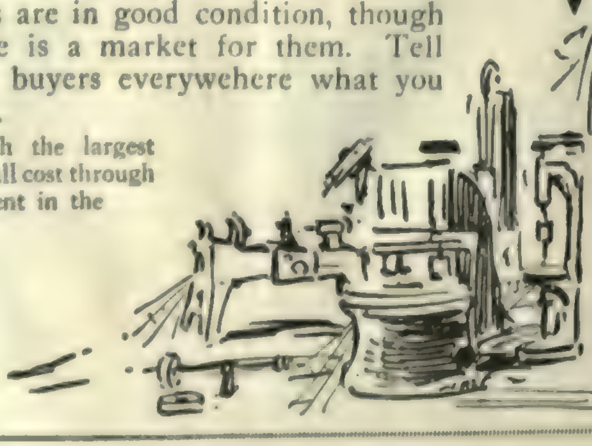
It's probably an eye-sore to you—that mass of dust covered and cob-webbed equipment in the corner.

But to the man who can use the machinery you have stored there, it may be the most interesting corner of your shop.

If the tools are in good condition, though dusty, there is a market for them. Tell prospective buyers everywehere what you have to sell.

You can reach the largest number at small cost through an advertisement in the

Searchlight Section of
American Machinist



SEARCHLIGHT SECTION

USED EQUIPMENT AND NEW

Offered for Re-sale

Space for these advertisements is sold by the advertising inch—30 inches to a page. The price per inch is based on total space used—multiply ad space by number of insertions.

RATE PER INCH:

1 to 3 inches	$5.00 an inch
4 to 7 inches	4.80 an inch
8 to 14 inches	4.60 an inch

An inch is measured vertically on one column—three columns to a page. Any space may be used measured by the even inch in height by 1, 2, or 3 columns in width.

RATES FOR LARGER SPACES, OR SPACE ON A YEARLY BASIS, FURNISHED ON REQUEST.

Am. Mach.

POSITIONS VACANT

Delaware

ESTIMATOR for customs machine shop and foundry; location Wilmington, Del.; must have had several years' experience in machine shop and foundry estimating and have the ability to direct the preparation of estimates for this kind of work. Reply must state fully past experience, present employment and salary expected. P-35, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

Illinois

MECHANICAL draftsman wanted, with experience in the design of automatic machines and fixtures; technical graduate preferred, but consideration will also be given to intelligent experienced man without technical training; location 25 miles from St. Louis, Mo. State age, education, experience and salary expected. Address P-44, Am. Mach., Old Colony Bldg., Chicago, Ill.

STEEL engraver, who can also do tool work. Please state age, qualifications and wages expected. Courteous consideration will be given your application by growing company in Middle West. Address P-33, Am. Mach., Old Colony Bldg., Chicago, Ill.

POSITIONS VACANT

Pennsylvania

HIGH grade machinist, a thorough mechanic, capable of operating modern machine tools in an efficient and up-to-date manner and capable of developing and applying jigs and fixtures in the production of power transmitting machinery. P-50, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

MACHINIST, familiar with modern methods of machine tool assembly, to act as working sub-foreman. P-51, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

WANTED, a working foreman, for a small machine shop equipped for contract work and jobbing; a capable mechanic of good character to come up with the business. Write us frankly about yourself and your expectations. Morehouse Machine Co., York, Pa.

Vermont

DRAFTSMAN on textile machinery wanted; permanent situation; one who has worked on cloth finishing machinery preferred. Give age, experience and terms. P-34, Am. Mach., 10th Ave. at 36th St., New York City.

Assistant to President

The president of a company manufacturing light office appliances is in need of an assistant skilled as an engineer and designer along similar lines, and possessing proven executive ability as well.

He must have tact and be able to adapt himself to local conditions. He must be at least 35 and not more than 45. He must be able to show a clean record and that he has done things worth while. Give full particulars in first letter, which will be kept in strict confidence and returned if desired.

P-40, American Machinist, 1570 Old Colony Bldg., Chicago, Ill.

We Want a Mechanical Engineer Who Can Do This:

1st: Design high-grade office and printing machinery.
2nd: Follow latest machine shop, foundry and pattern shop practice.
3rd: Be original, tactful and have executive ability.
4th: Be big and broad enough to work in perfect harmony with other men.
5th: Show that your experience and ability justifies the salary you ask.
6th: Show several years of experience in same or similar line of work.

Give full particulars in first letter which will be kept confidential.

P-39, American Machinist, 1570 Old Colony Bldg., Chicago, Ill.

POSITIONS VACANT

Wisconsin

ADVERTISING man on machine tools. State age, schooling experience and salary expected. P-48, Am. Mach., Old Colony Bldg., Chicago, Ill.

SALES correspondent, with experience on machine tools. State age, experience and salary expected. P-49, Am. Mach., Old Colony Bldg., Chicago, Ill.

EMPLOYMENT AGENCIES

GENERAL ENGINEERING AGENCY, Pittsburgh. Serving employers everywhere, overnight proposals, gratis, require Works Managers, Superintendents, Chief Draftsmen, Designers, Plant Engineers, Master Mechanics, Tool Draftsmen, Salesmen, Foundry, Forge, Machine Shops, General Office.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000 upward; executive, technical, administrative, engineering, manufacturing, professional, managing, financial, etc., all lines. If you are qualified and receptive to tentative offers for a new connection, you are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. A method is provided through which you may receive overtures in confidence without jeopardizing present connections and in a manner conforming strictly to professional ethics. Send name and address only. Preliminary particulars will be sent without obligating or compromising you in any way. R. W. Bixby, Inc., 407 Lockwood Bldg., Buffalo,

POSITIONS WANTED

New Jersey

DRAFTSMAN, designer, European mechanical engineer; age twenty-six; five years high technical schools; six years' experience on tool machines, toolmaking, automobile and electric motors; knowledge of forge, foundry, patternmaking, processes; able to save workmanship and material; available immediately; salary expected $2,000. PW-46, Am. Mach., 10th Ave. at 36th St., New York City.

WANTED

Inspector and Foreman

Experienced **Inspector** familiar with heavy work. Also **Foreman** to take charge of heavy tools. Apply

THE TOLEDO MACHINE & TOOL CO.
Dorr St. & N. Y. C. Railroad, Toledo, Ohio.

EXECUTIVES

Qualified men—Technical, Commercial and Manufacturing—seeking new positions find our effective and confidential service extremely satisfactory. Our Mr. H. H. Harrison can negotiate a suitable connection for you as he has done for thousands of others since 1909. Inquiries invited; confidences respected.

THE NATIONAL BUSINESS BOURSE, Inc.
Confidential Negotiators
Association Building, Chicago

POSITIONS WANTED

New York

DO YOUR [illegible] results satisfy you? I have had fifteen years experience in the quantity production of sheet metal products. [illegible] position [illegible] this line of manufacture it will pay you to investigate. Address General Manager, PW-41, Am. Mach., 10th Ave. at 36th St., New York City.

DRAFTSMAN, twenty-five, mechanical designer, [illegible] years' experience, [illegible] PW-3[illegible], Am. Mach., 10th Ave. at 36th St., New York City.

EXECUTIVE, age thirty-seven, wide experience in the manufacturing of dies, tools and fixtures, also heavy machinery, desires similar position. PW-35, Am. Mach., 10th Ave. at 36th St., New York City.

WORKS executive, twenty years' experience, starting as a molder in the foundry, working through the machine shop, then becoming superintendent; have handled male and female help for a number of years; available immediately. PW-[illegible], Am. Mach., 10th Ave. at 36th St., New York City.

Ohio

FOREMAN, automatics and hand screw machines. American, thirty-four years of age, ten years setter and foreman of screw machine products; reference furnished upon request. PW-35, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

MASTER mechanic, now employed but would like to change, having twenty years experience maintenance and construction work, especially qualified for power plants and heavy duty steam and electric cranes; location not essential; excellent references; negotiations confidential. PW-[illegible], Am. Mach., Leader-News Bldg., Cleveland, Ohio.

MAINTENANCE construction engineer, fifteen years experience in charge of buildings, machinery, equipment, power plant layout and plans for buildings. American, age forty-four, married, wishes position with metal or wood working plant; open for position Jan. 1, best of references; any location. PW-45, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

Oklahoma

WANTED—An opportunity to improve following record: $8,400 per year, 40 per cent reduction power costs; $2,000 per year, 50 per cent reduction heating costs. Above is record of works engineer desiring larger opportunities in larger industrial plant. PW-42, Am. Mach., Old Colony Bldg., Chicago, Ill.

Pennsylvania

POSITION as assistant to president or as manager, clean-cut executive, business man and mechanic, with the necessary experience to handle any large proposition. PW-937, Am. Machinist, Real Estate Trust Bldg., Philadelphia, Pa.

SALES work desired by mechanical designer; experienced on tools, special machines and conveyors; age twenty-seven. PW-47, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad and also local address of office to which reply is sent

10th Ave. at 36th St., New York.
509 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents — send copies.

0196

SALESMEN WANTED

Machine Tool Salesman Wanted

Preferably man having had experience in handling and operating power presses and shears, also dies. State age, experience and salary expected. Preference given to resident of Cleveland or Detroit. SW-37, Am. Mach., 10th Ave. at 36th St., New York City.

Machine Tool Salesman Wanted

Give experience pertaining to garage equipment, state lines sold, age, past and present firms employed. Address Auto Equipment Co., Denver, Colo.

AGENCIES AVAILABLE

Manufacturer's Agent

Iron, steel and contractor's equipment; established offices in Philadelphia, would like to take on additional line to follow up inquiries or leads and do some missionary work. A-41, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

REPRESENTATION WANTED

Shop Representative

Wanted in your city to sell K. T. W. taper calipers and clamps. You will find these ready sellers and indispensable tools. Write for prices; generous commission. Knauel Tool Works, 210 5th Ave., Rock Island, Ill.

PATENT ATTORNEYS

PATENTS, C. L. Parker, patent attorney, McGill Bldg., Washington, D. C. Inventor's handbook sent upon request.

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form fee schedule, information, free. Lancaster and Allwine, 262 Ouray Bldg., Washington, D. C.

Manufacturers—

A "Who's Who" That Can Save You Many a Bag Full of Correspondence

There are various ways to select contract shops—the most costly is the broadcast use of Uncle Sam's mail.

Hundreds of letters are often sent, the replies sifted and fruther correspondence indulged in before a small select list of contract work shops is ready for your real purpose.

Why not start out where the "hit or miss" plan leaves off—why not take the *always live* list of reliable, progressive specialists—the firms listed in the

CONTRACT WORK SECTION
of the
AMERICAN MACHINIST

There is no Dun's nor Bradstreet's that can help in your search —the Contract Work Section of the **American Machinist** is all the "Who's Who" you need. When a shop advertises its facilities consistently in the authoritative publication of the machine-making field—its advertised good name is your hostage.

Turn each week to the Contract Work Section

Contract Work

When Two Heads Are Better Than One

When you accept that contract that is just a little out of your regular line, you'll want some special jigs and machines. Maybe you feel the need of a little advice from some one who has had experience in the handling of such work. It is a case where two heads are better than one.

We are competent to be your second head because we are experts in the manufacture of special tools, machines and parts of all kinds. The illustration shows our Universal Gauge Grinder, a machine of micrometric precision and one of our regular products. The same engineers, the same skill, and the same perfect finish will contribute to the carrying out of *your* requirements, whether it be special jigs, parts, or a lathe that you want.

The STEEL PRODUCTS
ENGINEERING COMPANY
SPRINGFIELD, OHIO

IT PAYS TO MAKE GOOD TOOLS

Metal Stampings

Dies and Tools
"Barth" Service

BARTH STAMPING & MACHINE WORKS
3815 West 34th Street, Cleveland, Ohio

TRADE MEHL MADE MARK

HIGH-GRADE

Jigs, Fixtures, Dies, Gauges and Special Machines

Send for free illustrated prospectus

MEHL MACHINE TOOL & DIE CO.
ROSELLE, N. J.
Established 1913

Thirty Minutes from New York City

Complete Pressed Metal Service

Beginning with the drawings for the dies, through the stages of stamping, then welding or riveting, down to polishing and plating; GLOBE service is quick, complete and economical.

Experts plan it and supervise it from start to finish.

May we estimate for you?

The Globe Machine & Stamping Co.
Cleveland, Ohio

MACHINE WORK WANTED

FRANKLIN MACHINE CO.
Engineers, Founders and Machinists
Providence, R. I.

Textile machinery, heavy machinery, special machinery of all kinds.

The Harris-Corliss Steam Engines.

Eastern Representative for Cleveland Worm Gears and Worm Gear Reduction Units

---

DESIGNERS AND BUILDERS OF SPECIAL MACHINERY.
PARTS MANUFACTURED IN QUANTITIES.

LINCOLN MACHINE COMPANY
PAWTUCKET, R. I.

SPECIAL MACHINERY
BUILT TO ORDER

We have splendid facilities for producing special machinery of all kinds, and are prepared to guarantee satisfaction—both as regards workmanship and price. We have foundry facilities and an up-to-date machine shop. Send us blue-prints and give us an opportunity to quote you price. We can save you money.

Lambert & Todd Machine Co., Camden, N. J.

DIE COSTS LOWERED

KELLER AUTOMATIC MACHINES CUT ANY SIZE DIES

KELLER MECHANICAL ENGRAVING CO.
76 WASHINGTON ST. BROOKLYN, N.Y.
KMZ

Special and Standard High Grade Machinery

Jigs, Tools, Fixtures, Punches and Dies

Jobbing Specialists

AMERICAN MACHINE & FOUNDRY COMPANY
Contract Department
5524 Second Avenue, Brooklyn, N. Y.

Hardened and Ground Parts
Special Machinery and Tools

Shackle Bolts, Bushings, Motor Car Parts
Quantity Production.
Complete Tool Room Facilities
Mail prints for estimates
The Deckard-Mitchell Engineering Co.
412 Frankfort Ave., Cleveland, Ohio.

Want Any? CONTRACT WORK Any to Let?

SPECIAL LABOR-SAVING MACHINERY

Jigs and Fixtures for interchangeable manufacturing. Punches and Dies for all kinds of Metal Stampings. Gauges. Special Tools. Machine work to order.

SIMPLEX TOOL COMPANY
Designers and Builders
Woonsocket, R. I.

WHAT AND WHERE TO BUY
A Classified Index of Advertisers in This Issue

For Alphabetical Index See Last Page

LARGE SPEED REDUCTIONS AND LINK-BELT SILENT CHAIN

IN certain locations it is a matter of great economy and convenience to use a Link-Belt Silent Chain drive because of the possibility of the large reduction in speed ratio which it permits in a single drive, without loss of efficiency (98.2%).

We have successfully handled in single reductions as great a ratio as 25 to 1. This makes it practicable to use an inexpensive high speed motor, instead of a large, costly low speed motor.

It dispenses with the cost of a countershaft with its bearings, and the additional expense of a platform with its bracing, necessary where such a drive is near the ceiling. It saves the expense of an additional drive, the increased space required, and additional attention needed.

The weight of the large wheel also furnishes the advantages of a fly wheel effect in many cases. There is no loss of efficiency in the Link-Belt Silent Chain drive, whereas there is a considerable waste of power in various other speed reducing devices.

Send for price-list data-book No. 125.

1089

LINK-BELT COMPANY

PHILADELPHIA — CHICAGO — INDIANAPOLIS

New York - - Woolworth Bldg.
Boston 9 - - - 49 Federal St.
Pittsburgh - - - 1501 Park Bldg.
St. Louis - Central Nat'l Bank Bldg.
Buffalo - - - 547 Ellicott Square
Wilkes-Barre - - 2d Nat'l Bank Bldg.
Huntington, W. Va - Robson-Prichard Bldg.
Cleveland - - - 429 Kirby Bldg.
Detroit - - - 4210 Woodward Ave.
Kansas City, Mo. - - 306 Elmhurst Bldg.
Seattle - - - - 820 First Ave., S.
Portland, Ore. - - - 101 First St.
San Francisco - - - - 168 Second St.
Los Angeles - - 163 N. Los Angeles St.
Denver Lindrooth, Shubart & Co., Boston Bldg.
Louisville, Ky. - - F. Wehle, Starks Bldg.
New Orleans C. O. Hinz, 504 Carondelet Bldg.
Birmingham, Ala. - S. L. Morrow, 720 Brown-Marx Bldg.
Charlotte, N. C., J. S. Cothran, Com'l Bank Bldg.

Canadian Link-Belt Co., Ltd., Toronto and Montreal
H. W. CALDWELL & SON CO., CHICAGO — NEW YORK, Woolworth Bldg. — DALLAS, TEXAS, 709 Main St.

LINK-BELT

Collets
[illegible] & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
[illegible] Tool Co., New Haven
[illegible] & [illegible] Co., Boston
[illegible] Bros. Mfg., Pawtucket
Union Twist Drill Co., Athol
Whitney Mfg. Co., Hartford

Compounds, Carbonizing, Casehardening and Tempering
Rogers & Hubbard Co., Middletown
[illegible] Instrument & Mfg. Co., N. Y.

Compounds, Cleaning
[illegible] Chemical Co., N. Y.
Texas Co., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding and Screw Cutting
Oakley Chemical Co., N. Y.
Sun Oil Co., Philadelphia
White & Bagley Co., Worcester

Compressors, Air and Gas
Black & Decker Mfg. Co., Baltimore
Bury Compressor Co., Erie
Chicago Pneu. Tool Co., N. Y.
General Electric Co., Schenectady
Sullivan Machinery Co., Chicago

Compressors, Electric
Black & Decker Mfg. Co., Baltimore

Conduit, Interior
General Electric Co., Schenectady

Cones, Friction
[illegible] Cone Co., Newton Highlands

Contract Work
American Mch. & Fdry. Co., [illegible]
Ames Co., B. C., Waltham
[illegible] Products Corp., L. I. City
Barber-Colman Co., Rockford
[illegible] & Mch. Wks., Cleveland
[illegible] & Co., John, Worcester
[illegible] Mach. & Tool Co., Newark
Betts Mch. Plant, Cons. Mch. T. Corp. of America, Rochester
[illegible] Jr. T. & M. Wks., Arthur [illegible]
Brown & Sharpe Mfg. Co., Providence
[illegible]
[illegible] T. & Mch. Co.
[illegible] Eng. Co., Cleveland
[illegible] Co., Detroit
[illegible] Gear & Mach. Co., Phila.
[illegible] Co., Providence
Franklin Mach. Wks., Steubenville
[illegible] Co., N. Y.
Gisholt Mach. Co., Madison
[illegible] Mfg. & Mch. Co., Bridgeport
[illegible] Special Mchy. Co., Hartford
[illegible] Mach. Fdry. Co., Brooklyn
[illegible] Mfg. Co., Milwaukee
Lambert & Todd Mch. Co., Camden
[illegible] Co., Pawtucket
Long & Allstatter Co., Hamilton
[illegible] T. & D. Co., [illegible]
[illegible] Mfg. Co., [illegible]
[illegible] Mach. Co., Indianapolis
[illegible] Mach. Co., Waterbury
[illegible] Mach. Co., Hartford
[illegible] Tool Co., [illegible]
Steel Products Eng. Co., Springfield, O.
Toledo Mch. & Tool Co., Toledo
Underwood Corp., H. B., Philadelphia
[illegible] Mch. Wks., Waltham
Warner & Swasey Co., Cleveland
West Tool Co., Detroit

Controllers and Starters, Electric
General Electric Co., Schenectady

Converters
General Electric Co., Schenectady

Conveyors and Elevators (See Elevators)

Cotter Pins
Williams & Co., J. H., Brooklyn

Counterbores
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
West Tool Co., Detroit

Countershafts
Brown & Sharpe Mfg. Co., Providence
[illegible] Cone Co., Newton Highlands
[illegible] Mach. Co., N. Y.

Counters, Revolution
[illegible] Co., Waterbury

Countersinks
Greenfield Tap & Die Corp., Greenfield

Coupling Machines
[illegible] Mfg. Co., R. A., Battle Creek

Coupling and [illegible] Wheels
[illegible]
[illegible]

Coupling Hose, [illegible]
Chicago Pneu. Tool Co., N. Y.

Couplings, Flexible
[illegible] Co., Reading
Dexter Co., I. H., Goshen
Jones Fdry. & Mch. Co., W. A., Chicago
Smith & Serrell, Newark

Couplings, Rigid
Smith & Serrell, Newark
Jones Fdry. & Mch. Co., W. A., Chicago

Couplings, Shaft
[illegible] Mfg. Co., T. R., Ashburnham
Dexter Co., I. H., Goshen
[illegible] Mach. Co., Carlyle, Manchester
Nicholson Co., W. H., Wilkes-Barre
Royersford Fdry. & Mch. Co., Royersford
Smith & Serrell, Newark

Cranes, Electric (See Hoists and Cranes, Electric)

Cranes, Hand (See Hoists)

Cranes, Locomotive
Link Belt Co., Chicago, Philadelphia

Cranes, Traveling
Canton Fdry. & Mch. Co., Canton
Cleveland-Moore? [illegible] Mfg. Co., Cleveland
Harrington, Son & Co., Ed., Phila.
Link Belt Co., Chicago, Philadelphia
Northern Eng. Wks., Detroit
Pawling & Harnischfeger Co., Milwaukee
Toledo Crane Co., Bucyrus

Crank Pin Turning Machines
Underwood Corp., H. B., Phila.

Cut-Outs, Electrical
General Electric Co., Schenectady

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Cutters, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
[illegible] Tool Co., Cleveland
Geometric Tool Co., New Haven
Gisholt Mach. Co., Madison
Haynes Stellite Co., Kokomo
Ingersoll Mill. Mch. Co., Rockford
Lovejoy Tool Co., Springfield, Vt.
Morse Twist Drill & Mch. Co., New Bedford
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Union Twist Drill Co., Athol
West Tool Co., Detroit
Whitney Mfg. Co., Hartford.

Cutters, Thread
Hisett Lathe & Grinder Co., Boston.
Universal Mch. Co., Bowling Green

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence
[illegible] Gear & Mach. Co., Phila.
[illegible] Mach. Co., Toledo
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine
Greenfield Tap & Die Corp., Greenfield
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Vandyck Churchill Co., N. Y.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago.
Pratt & Whitney Co., Hartford
Williams & Co., J. H., Brooklyn

Cutting Oil Filters (See Oil Filtering Systems)

Cutting, Oxy Acetylene
Milburn Co., Alex., Baltimore

Dealers, Machinery (See Searchlight Section)
Allen, Harry F., New York
Botwinik Bros., New Haven
[illegible] Mch. Co., Providence
[illegible] Mch. T. Corp. of America, N. Y.
[illegible] Tool, Springfield, Ill.
[illegible] Mch. Co., N. Y.
[illegible] & Co., J., N. Y.
Gisholt Mach. Co., Madison
[illegible] & [illegible], N. Y.
[illegible] & [illegible], Newark
[illegible] Bros. Co., Chicago
[illegible] & Co., Chicago
[illegible] & Sons, [illegible], Philadelphia
[illegible] Mchy. [illegible], [illegible]
[illegible] & Co., N. Y.
[illegible] & Son, J., [illegible]
[illegible] Mchy. Co., Grand Rapids
[illegible], New Haven
[illegible]
[illegible] & Co., N. Y.
[illegible] Co., Newark
New [illegible] Mach. Co., New Britain

N. J. Mchy. Ex., Newark
Nee & Co., F. H., Jersey City
Niles-Bement-Pond, N. Y.
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Reed-Prentice Co., Worcester
Sillers, Walter, Brooklyn
Simmons Mach. Co., Albany
Southwark Fdry. & Mch. Co., Phila.
Stevis & Sons, R. S., N. Y.
Toomey, Frank, Philadelphia
Vandyck, Churchill Co., N. Y.
Wayne Mchy. Co., Fort Wayne.
Witbar Tool Co., N. Y.

Demagnetizers
Luma Elect. Equip. Co., Toledo

Diamond Tools
Crafts & Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit

Die Making Machines
Anderson Die Cch. Co., Bridgeport
Keller Mech. Engr. Co., Brooklyn

Dies, Forging
Keller Mech. Engrav. Co., Brooklyn.

Dies, Self-opening Adjustable
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mchy. & T. Co., Detroit
Victor Tool Co., Waynesboro

Dies, Sheet Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening
Eastern Mch. Screw Corp., New Haven
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mchy. & T. Co., Detroit
National Machinery Co., Tiffin
Victor Tool Co., Waynesboro
Warner & Swasey Co., Cleveland

Dividing Heads
Knight Mchy. Co., W. B., St. Louis

Dogs, Lathes & Milling Machines
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Brooklyn

Drafting Boards, Tables
N. Y. Blue Print Paper Co., N. Y.

Drafting Materials
N. Y. Blue Print Paper Co., N. Y.

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester
Crafts & Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago

Drill Speeders
Graham Mfg. Co., Providence
Turner Machine Co., Danbury

Drilling Attachments
Hjorth Lathe & Tool Co., Boston

Drilling Machine Heads
Baush Mch. T. Co., Springfield, Mass.
Hoefer Mfg. Co., Freeport.
Langelier Mfg. Co., Cranston
Nelson-Blanck Mfg. Co., Detroit.

Drilling Machines, Automatic
Baker Bros., Toledo
Baush Mch. T. Co., Springfield, Mass.
Langelier Mfg. Co., Cranston
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Bench
Ames Co., B. C., Waltham
Barnes Co., W. F. & John, Rockford
Clark Jr. Elec. Co., Jas., Louisville
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Cranston
Pratt & Whitney Co., Hartford
Sigourney Tool Co., Hartford
Silver Mfg. Co., Salem
Standard Elec. Tool Co., Cincinnati
Taylor & Fenn Co., Hartford.

Drilling Machines, Electric and Pneumatic
Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Clark Jr. Elec. Co., Jas., Louisville
Louisville Elec. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Silver Mfg. Co., Salem
Standard Elec. T. Co., Cincinnati
U. S. Elec. Tool Co., Cincinnati

Drilling Machines, Gang
Baker Bros., Toledo
Barnes Drill Co., Rockford

Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Langelier Mfg. Co., Cranston
Moline Tool Co., Moline
Rockford (Ill.) Drilling Mach. Co.
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Baker Bros., Toledo
Betts Mch. Plant, Cons. Mch. T. Corp. of America, Rochester
Buffalo Forge Co., Buffalo
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Hoefer Mfg. Co., Freeport
Minster Mch. Co., Minster
Ryerson & Son, Joseph T., Chicago

Drilling Machine & Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Bros., Toledo
Baush Mch. T. Co., Springfield, Mass.
Foote-Burt Co., Cleveland
Fox Mach. Co., Jackson, Mich.
Harrington, Son & Co., Ed., Phila.
Langelier Mfg. Co., Cranston
Nat'l Automatic Tool Co., Richmond
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia
Sigourney Tool Co., Hartford
Turner Machine Co., Danbury

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Baush Mch. T. Co., Springfield, Mass.
Betts Mch. Plant, Cons. Mch. T. Corp. of America, Rochester
Cincinnati (O.) Bickford Tool Co.
Fosdick Mach. Tool Co., Cincinnati
Harrington, Son & Co., Ed., Phila.
Morris Mch. Tool Co., Cincinnati
Muller Mch. Tool Co., Cincinnati
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia

Drilling Machines, Sensitive
Buffalo Forge Co., Buffalo
Langelier Mfg. Co., Cranston
Muehlmatt, Adolph, Cincinnati
Reed-Prentice Co., Worcester
Royersford Fdry. & Mch. Co., Royersford
Sigourney Tool Co., Hartford
Taylor & Fenn Co., Hartford
Triplex Mch. Tool Corp., N. Y.

Drilling Machines, Turret
Nat'l Automatic Tool Co., Richmond
Turner Mch. Co., Danbury

Drilling Machines, Vertical
Baker Bros., Toledo
Barnes Drill Co., Rockford
Barnes Co., W. F. & John, Rockford
Baush Mch. T. Co., Springfield, Mass.
Betts Mch. Plant, Cons. Mch. T. Corp. of America, Rochester
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Harrington, Son & Co., Ed., Phila.
Hoefer Mfg. Co., Freeport
Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston
Leland-Gifford Co., Worcester
Reed-Prentice Co., Worcester
Royersford Fdry. & Mach. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford
Turner Mch. Co., Danbury

Drills, Center
Gledhill Mfg. Co., Providence
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Drills, Twist and Flat
Buckeye Twist Drill Co., Alliance
Latrobe Tool Co., Latrobe
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Union Twist Drill Co., Athol
West Tool Co., Detroit
Whitman & Barnes Mfg. Co., Akron

Drinking Fountains
Manufacturing Equip. & Eng. Co., Framingham

Dynamometers
General Electric Co., Schenectady

Electrical Instruments
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Electrical Supplies
General Electric Co., Schenectady
[illegible]
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Elevating Trucks (See Trucks)

Elevators and Conveyors
Albro-Clem Elevator Co., Phila.
Caldwell & Son Co., H. W., Chicago
[illegible] Co., Canton
Link-Belt Co., Chicago, Philadelphia

Emery Wheels (See Grinding Wheels)

Engineers, Industrial and Mechanical
Bath & Co., John, Worcester
Hartford Special Mchy. Co., Hartford
Underwood Corp., H. B., Philadelphia

Engines, Oil, Gas and Steam
Chicago Pneu. Tool Co., N. Y.

Engraving Machinery
Gorton Mach. Co., Geo., Racine
Keller Mech. Engr. Co., Brooklyn
[illegible] Co., H. P., Columbus

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglass, Safety (See Goggles, Safety)

Fans, Electric
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Exhaust
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Ventilating
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

File Handles
[illegible] Supply Co., N. Y.

Files
American Swiss File & Tool, N. Y.

Files and Rasps
[illegible] File Works, Philadelphia

Filing Machines
Ames Co., B. C., Waltham
[illegible] Co., Rochester
[illegible] Co., Albion
[illegible] Mfg. Co., Cleveland

Fillet, Iron (See Cement, Iron)

Fittings, Hydraulic
[illegible] Co., Newark
[illegible] Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Flexible Shafts
[illegible] Mechanical Laboratory, N. Y.
Stroud & Co., N. A., Chicago

Forging Machinery
Acme Mchy. Co., Cleveland
Bradley & Son, C. C., Syracuse
National Mchy. Co., Tiffin

Forgings, Drop
[illegible] Co. of America, Lancaster
[illegible] Mch. Co., Bowling Green
Williams & Co., J. H., Brooklyn

Foundry Equipment
Adams Co., Dubuque

Fuel Oil Burning Systems
[illegible] Furnace & Eng. Co., Springfield, Mass.
Chicago Flexible Shaft Co., Chicago

Furnaces, Forging
American Gas Furnace Co., Elizabeth
Chicago Flexible Shaft Co., Chicago

Furnaces, Heat Treating, Coal
American Industrial Furnace Corp., Boston

Furnaces, Heat Treating Oil and Gas
[illegible] Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., Elizabeth
American Industrial Furnace Corp., Boston
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
[illegible] Appliance Co., Cedar Rapids

Furnaces, Tempering and Annealing
[illegible] Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
General Electric Co., Schenectady
[illegible] Appliance Co., Cedar Rapids

Furnaces & Ovens
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Furniture, Machine Shop
[illegible] Co., Reading
Manufacturing Equip. & Mfg. Co., Framingham

Gage Blocks
Bath & Co., John, Worcester
Pratt & Whitney Co., Hartford

Gages, Comparator
Jones & Lamson Mach. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Starrett Co., L. S., Athol

Gages, Micrometer Plug
Bath & Co., John, Worcester

Gages, Micrometer Threaded Plug
Bath & Co., John, Worcester

Gages, Plug & Ring
Bath & Co., John, Worcester

Gages, Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Pratt & Whitney Co., Hartford

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Hartford Special Mchy. Co., Hartford
Pratt & Whitney Co., Hartford

Gages, Thread
Bath & Co., John, Worcester

Gear Cutting Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Bilgram Mch. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cut. Mch. Co.
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Garvin Mch. Co., N. Y.
Gleason Works, Rochester
Gould & Eberhardt, Newark
Harrington, Son & Co., Ed., Phila.
Newark Gear Cutting Mch. Co., Newark
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Reed-Prentice Co., Worcester
Waltham Mch. Wks., Waltham
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Mach. Co., Madison
Gleason Works, Rochester
Newark Gear Cut Mch. Co., Newark

Gear Tooth Rounders
Cross Gear & Eng. Co., Detroit

Gears, Cast
[illegible] Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
[illegible] Die Cast Corp., Syracuse
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Philadelphia Gear Wks., Phila.

Gears, Cut
Adams Co., Dubuque
[illegible] Co., Chicago
Albro-Clem Elevator Co., Phila.
[illegible] Mch. T. Co., Springfield, Mass.
Bilgram Mch. Wks., Philadelphia
Boston Gear Wks., Norfolk Downs
[illegible] Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Co.
Connecticut Gears, Inc., Waterbury
[illegible] Gear Corp., Syracuse
[illegible] Gear & Machine Co., Phila.
[illegible] Mch. Co., Pittsburgh
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
[illegible] Gear & Mch. Co., Chicago
Garvin Mch. Co., N. Y.
General Electric Co., Schenectady
Gleason Works, Rochester
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Massachusetts Gear & T. Co., Woburn
[illegible] Gear Corp., Syracuse
[illegible] Mfg. Co., Boston
Newark Gear Cutting Mch. Co., Newark
[illegible] Co., N. Y.
Philadelphia Gear Wks., Phila.
[illegible] Mfg. Co., Pittsburgh

Gears, Forged
Philadelphia Gear Wks., Phila.

Generators, Electric
[illegible] & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Grab Buckets
Link-Belt Co., Chicago, Philadelphia
[illegible]

Greases, Lubricating
Royersford Fdry. & Mch. Co., Royersford
Sun Co., Philadelphia
White & Bagley Co., Worcester

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Athol Machine & Fdry. Co., Athol
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Clark Jr. Elec. Co., Jas., Louisville
Dillon Elect. Co., Canton
Greenfield Tap & Die Corp., Greenfield
Louisville Elect. Mfg. Co., Louisville
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Ryerson & Son, Jos. T., Chicago
Safety Emery Wheel Co., Springfield, O.
Standard Elect. T. Co., Cincinnati
Union Twist Drill Co., Athol
U. S. Elec. Tool Co., Cincinnati

Grinding Machines, Center
Louisville Elect. Mfg. Co., Louisville
Standard Elect. T. Co., Cincinnati

Grinding Machine Centerless
Reeves Pulley Co., Columbus

Grinding Machines, Chaser
Geometric Tool Co., New Haven

Grinding Machines, Chucking
Blanchard Mch. Co., Cambridge
Bryant Chuck Grind. Co., Springfield, Vt.
Heald Machine Co., Worcester
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Stow Mfg. Co., Binghamton
Van Norman Mch. Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford
Barnes Co., W. F. & John, Rockford
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cut. Mach. Co.
Cincinnati (O) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Gisholt Mach. Co., Madison
Grand Rapids (Mich.) Grind. Mach. Co.
Greenfield Tap & Die Corp., Greenfield
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mch. Tool Co., R. K., Cincinnati
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Bryant Chuck Grind Co., Springfield, Vt.
Cincinnati (O.) Grinder Co.
Fitchburg Grind. Mch. Co., Fitchburg
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Sanford Mfg. Co., F. C., Bridgeport
Universal Grind. Mch. Co., Fitchburg
Van Norman Mch. Tool Co., Springfield, Mass.
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Die
Abrasive Mch. T. Co., Providence
Burnell & Keeler Mch. Wks., Edwardsville
Blanchard Mach. Co., Cambridge
Geometric Tool Co., New Haven
Heald Mch. Co., Worcester
Murchey Mch. & T. Co., Detroit
National Mchy. Co., Tiffin
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Disc
Besley & Co., Chas. H., Chicago
Gardner Mch. Co., Beloit
Graham Mfg. Co., Providence
Rowbottom Mach. Co., Waterbury
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Drill
Grand Rapids (Mich.) Grind. Mach. Co.
Greenfield Tap & Die Corp., Greenfield
Louisville Elec. Mfg. Co., Louisville
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin

Grinding Machines, Face
Abrasive Mch. T. Co., Providence
Blanchard Mach. Co., Cambridge
Graham Mfg. Co., Providence

Grinding Machines, Floor
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Dillon Elect. Co., Canton
Forbes & Myers, Worcester
Louisville Elect. Mfg. Co., Louisville
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Royersford Fdry. & Mch. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Sterling Grind. Wheel Co., Tiffin
U. S. Elect. Tool Co., Cincinnati

Grinding Machines, Gage
Abrasive Mch. T. Co., Providence
Landis Tool Co., Waynesboro
Rivett & Morman Co., Grand Rapids
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Internal
Bryant Chuck Grind Co., Springfield, Vt.
Cincinnati (O.) Grinder Co.
Garvin Mach. Co., N. Y.
Greenfield Tap & Die Corp., Greenfield
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Universal Grind. Mch. Co., Fitchburg
Van Norman Mch. Tool Co., Springfield, Mass.
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Portable
Armstrong-Blum Mfg. Co., Chicago
Black & Decker Mfg. Co., Baltimore
Chicago Pneu. Tool Co., N. Y.
Clark Jr. Elec. Co., Jas., Louisville
Dillon Elect. Co., Canton
Forbes & Myers, Worcester
Hergi Mfg. Co., Bridgeport
Louisville Elec. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Stroud, Arva, N. Y.
U. S. Elec. Tool Co., Cincinnati

Grinding Machines, Radial
Landis Tool Co., Waynesboro
Rivett Lathe & Grind. Co., Boston
Van Norman Mch. Tool Co., Springfield, Mass.

Grinding Machines, Ring Wheel
Besley & Co., Chas. H., Chicago
Graham Mfg. Co., Providence
Gardner Mch. Co., Beloit

Grinding Machines, Snagging
Blount Co., J. G., Everett
Dillon Elect. Co.
Ransom Mfg. Co., Oshkosh
U.S. Elect. Tool Co., Cincinnati

Grinding Machines, Surface
Abrasive Mch. T. Co., Providence
Blanchard Mch. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Graham Mfg. Co., Providence
Heald Mach. Co., Worcester
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield, O.

Grinding Machines, Thread
Bath & Co., John, Worcester

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Chicago Pneu. Tool Co., N. Y.
Cincinnati (O.) Grinder Co.
Gisholt Mach. Co., Madison
Grand Rapids (Mich.) Grind. Mach. Co.
Greenfield Tap & Die Corp., Greenfield
Landis Tool Co., Waynesboro
Norton Co., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Wheels
Carborundum Co., Niagara Falls
Dickinson, Thomas L., N. Y.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sterling Grind. Wheel Co., Tiffin
Vitrified Wheel Co., Westfield

Guides, Elevator
Standard Gauge Steel Co., Beaver Falls

Gun Barrel Machinery
Pratt & Whitney Co., Hartford
Baush Mch. T. Co., Springfield, Mass.

Hammers, Drop
Bradley & Son, C. C., Syracuse

Hammers, Forging
Nazel Eng. & Mch. Wks., Phila.

Hammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.

Hammers, Power
[illegible]
Ryerson & Son, Joseph T., Chicago

Handles, Machine
[illegible] Co., Worcester

Hangers, Shafting
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
[illegible], Chicago
Royersford Fdry. & Mch. Co., Royersford

Hardening, Case Hardening & Tempering
[illegible] Mfg. Co., Boston

Hardness Testing Apparatus
Shore Instrument & Mfg. Co., N. Y.

Heaters, Electric Water
[illegible] Mfg. Co., [illegible]

Hobbing Machines
Barber-Colman Co., Rockford
[illegible] Mch.
[illegible], Newark
Newark Gear Cut. Mch. Co., Newark

Hobs
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
[illegible]
Newark Gear Cut. Mch. Co., Newark
[illegible]
Union Twist Drill Co., Athol

Hoists and Cranes, Electric
[illegible]
[illegible] Crane Co., Bucyrus

Hoists, Hand
[illegible]
Harrington, Son & Co., Ed., Phila.

Hoists, Pneumatic
Chicago Pneu. Tool Co., N. Y.
[illegible] Co., Chicago

Holders-On, Pneumatic
Chicago Pneu. Tool Co., N. Y.

Hydraulic Leather
Schieren Co., Chas. A., N. Y.

Hydraulic Machinery
[illegible] Co., N. Y.

Igniters, Gas Engine
[illegible] Co., Brooklyn

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence
[illegible]
Starrett Co., L. S., Athol

Jacks, Hydraulic
[illegible] Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago

Jigs and Fixtures
(See Contract Work)

[illegible]
Brown & Sharpe Mfg. Co., Providence
[illegible] Co., Hartford

[illegible] Machines
[illegible]
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.

[illegible] Machines
[illegible]

[illegible]
[illegible] & Co., J. H., Brooklyn

[illegible]
[illegible] Co., Schenectady

Lathe Attachments
Ames Co., B. C., Waltham
[illegible] Mfg. Corp., Sound Beach
[illegible]
[illegible] Lathe & Grinder Co., Boston
[illegible] Lathe Co., Jackson

Lathe Tools
Armstrong Bros. Tool Co., Chicago
[illegible] Mach. Co., Madison
[illegible]
[illegible] Co., Springfield, Vt.
Williams & Co., J. H., Brooklyn

Lathes, Automatic and Semi-Automatic
Gisholt Mach. Co., Madison
Jones & Lamson Mch. Co., Springfield, Vt.
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Co., Worcester
Steinle Turret Mch. Co., Madison

Lathes, Bench
Ames Co., B. C., Waltham
[illegible] Co., J. G., Everett
[illegible] Mfg. Corp., Sound Beach
Greenfield Tap & Die Corp., Greenfield
[illegible] Lathe & Tool Co., Boston
Pratt & Whitney Co., Hartford
[illegible] Lathe & Grinder Co., Boston
South Bend Lathe Wks., South Bend
Stark Tool Co., Waltham
Triplex Mch. Tool Corp., N. Y.
Van Norman Mch. Tool Co., Springfield, Mass.
Wade-American Tool Co., Waltham

Lathes, Boring
Gisholt Mach. Co., Madison
Potter & Johnston Mch. Co., Pawtucket

Lathes, Chucking (See Lathes, Horizontal Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford
[illegible] Co., J. G., Everett
[illegible] Mch. Tool Co., Cincinnati
[illegible] Mch. T. Co., [illegible]
[illegible] Tool Wks. Co., Cincinnati
[illegible] Mfg. Corp., Sound Beach
[illegible] Mach. Wks., Fitchburg
[illegible] & Co., Nashua
Gisholt Mach. Co., Madison
[illegible] T. Co., Cincinnati
Hamilton Mch. T. Co., Hamilton
LeBlond Mch. Tool Co., R. K., Cincinnati
Lodge & Shipley Mch. T. Co., Cincinnati
Monarch Mach. Tool Co., Sydney
[illegible] Mch. Tool Co., Cincinnati
[illegible] Mch. Tool Co., Cincinnati
Reed-Prentice Co., Worcester
Rockford (Ill.) Drilling Mach. Co.
Rockford (Ill.) Tool Co.
Ryerson, Joseph T., Chicago
Sidney Mch. T. Co., Sidney
South Bend Lathe Wks., South Bend
Springfield (O.) Mach. Tool Co.
[illegible] Lathe Co., Jackson
[illegible] Mch. T. Co., Worcester

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Barnes Drill Co., Rockford
Harrington, Son & Co., Ed., Phila.

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford
[illegible] Mfg. Corp., Sound Beach

Lathes, Gap
[illegible] T. Co., A. V., Norwood

Lathes, Horizontal Turret
[illegible] Tool Co., Cincinnati
[illegible] Mach. Co., Elkhart
Gisholt Mach. Co., Madison
[illegible] Mch. T. Co., Indianapolis
Jones & Lamson Mch. Co., Springfield, Vt.
[illegible] Mch. Co., Indianapolis
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Steinle Turret Mch. Co., Madison
Warner & Swasey Co., Cleveland

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Speed and Hand
[illegible] Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
[illegible] Machine Co., N. Y.
Greenfield Tap & Die Corp., Greenfield

Lathes, Threading
[illegible] Mach. Co., Bridgeport
[illegible] Lathe & Grinder Co., Boston

Lathes, Vertical
[illegible] Mch. Tool Co., Bridgeport

Lathes, Wood Turning
Barnes Co., W. F. & John, Rockford
[illegible] Co., J. G., Everett

Letters, and Figures
Brown & Sharpe Mfg. Co., Providence
[illegible] Mfg. Co., New [illegible]
[illegible] Stamp Co., Pittsburgh

Lighting Fixtures
General Electric Co., Schenectady

Lockers, Clothes
Manufacturers Equip. & Mfg. Co., Framingham

Lubricants
Oakley Chemical Co., N. Y.
Royersford Fdry. & Mch. Co., Royersford
Sun Co., Philadelphia
White & Bagley Co., Worcester.

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago.
Athol Machine & Fdry. Co., Athol
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford
Randall & Stickney, Waltham
Simplex Tool Co., Woonsocket
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol
Williams & Co., J. H., Brooklyn

Mandrels, Expanding
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence
National Twist D. & T. Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre
Union Twist Drill Co., Athol

Marking Devices (See Stamps, Steel)

Marking Machines
Lunn? Equip. Co., Toledo
Martin Mch. Co., Turners Falls
Noble & Westbrook Mfg. Co., Hartford.

Measuring Machines
Norma Co. of America, N. Y.
Pratt & Whitney Co., Hartford

Meters, Steam Flow
General Electric Co., Schenectady

Micrometer Calipers
Almond Mfg. Co., T. R., Ashburnham
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol.

Milling Attachments
Adams Co., Dubuque
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. Tool Co., R. K., Cincinnati.
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Co., Worcester
Standard Eng. Wks., Pawtucket.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Ingersoll Mill Mch. Co., Rockford
Pratt & Whitney Co., Hartford

Milling Machines, Bench
Ames Co., B. C., Waltham.
Pratt & Whitney Co., Hartford
Stark Tool Co., Waltham
Triplex Mch. Tool Corp., N. Y.
Van Norman Mch. Tool Co., Springfield, Mass.

Milling Machine, Continuous
Ingersoll Mill. Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Potter & Johnston, Mch. Co., Pawtucket.

Milling Machines Die
Anderson Die Mch. Co., Bridgeport

Milling Machines, Duplex
Cincinnati (O) Milling Mach. Co.
Ingersol Mill Mch. Co., Rockford
Knight Mchy. Co., W. B., St. Louis
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Mch. Co., N. Y.
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Standard Eng. Co., Pawtucket
Van Norman Mch. T. Co., Springfield, Mass.
Whitney Mfg. Co., Hartford.

Milling Machines, Horizontal and Planer Type
Beaman & Smith Co., Providence.
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Ingersoll Mill Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.

Milling Machines, Plain
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Machine Co., N. Y.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. Tool Co., R. K., Cincinnati.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Potter & Johnston Mch. Co. Pawtucket.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Standard Eng. Wks., Pawtucket.
Van Norman Mch. T. Co., Springfield, Mass.

Milling Machines, Portable
Ingersoll Mill Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Underwood Corp., H. B., Phila.

Milling Machines, Thread
Foster Mch. Co., Elkhart.
Gisholt Mach. Co., Madison
Hall Planetary Thread Milling Mch. Co., Philadelphia
Harrington Son & Co., Ed., Phila.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Pratt & Whitney Co., Hartford
Waltham Mch. Works, Waltham.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Mch. Co., N. Y.
Ingersoll Mill Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. Tool Co., R. K., Cincinnati.
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Van Norman Mch. T. Co., Springfield, Mass.

Milling Machines, Vertical
Betts Mch. Plant Cons. Mch., T. Corp. of America, Rochester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Garvin Machine Co., N. Y.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Knight Mchy. Co., W. B., St. Louis
LeBlond Mch. Tool Co., R. K., Cincinnati.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Co., Worcester
Triplex Mch. Tool Corp., N. Y.
Van Norman Mch. T. Co., Springfield, Mass.

Milling Machines, Worm
Cleveland (O.) Auto. Mch. Co.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Waltham Mch. Works, Waltham

Milling Tools, Adjustable Hollow
Geometric Tool Co., New Haven

Motors, Electric
Burke Electric Co., Erie
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Nickel Sheets
Strand & Co., N. A., Chicago

Nut Tappers (See Bolt and Nut Machinery)

Nuts, Lock (See Lock-Nuts)

Oil and Grease Cups
Bay State Stamp. Co., Worcester.
Bowen Products Corp., Auburn
Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford.

Oil Stones
Norton Co., Worcester

Oils
Sun Co., Philadelphia
White & Bagley Co., Worcester.

Oxygen
Linde Air Products Co., N. Y.

Packing, Hydraulic
Schieren Co., Chas. A., N. Y.

Pattern Shop Machinery (See Woodwork Machinery)

Patterns, Wood and Metal
Mehl Mch. T. & D. Co., Roselle.

Pipe Bending Machines
[illegible]
Underwood Corp., H. B., Phila.

Pipe Cutting & Threading Machines
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Pipe Fitters' Tools
[illegible]
[illegible] Chicago
[illegible] Brooklyn

Piston Ring Machines
[illegible] & Johnston Mch. Co., Paw-tucket

Planer Tools
[illegible]

Planing Machines
American Tool Wks. Co., Cincinnati
[illegible] Cons. Mch. T. Corp. of America, Rochester
Cincinnati Planer Co., Cincinnati
[illegible] Cincinnati
[illegible] Hamilton
[illegible] Hamilton
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
[illegible] Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., [illegible] Phila.

Planing Machines, Rotary
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Underwood Corp., H. B., Phila.

Pneumatic Tools
[illegible] Mfg. Co., Rockford
Chicago Pneu. Tool Co., N. Y.

Polishing and Buffing Machines
[illegible] & John, Rockford
[illegible] Cambridge
[illegible]
Brown & Sharpe Mfg. Co., Providence
[illegible] Springfield
[illegible] Beloit
Greenfield Tap & Die Corp., Greenfield
[illegible] Worcester
[illegible] Bridgeport
[illegible] Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
[illegible] Boston
[illegible] Waterbury
[illegible] & Mch. Co., Roy-ersford
[illegible] Wheel Co., Spring-field
[illegible] Co., Athol
[illegible] Tool Co., Springfield, Mass.

Presses, Arbor
[illegible] & John, Rockford
[illegible] & Co., W. H., Wilkes-Barre

Presses, Drop and Forging
[illegible] Max, N. Y.
[illegible]
[illegible] F., Chicago
[illegible] Toledo

Presses, Foot and Hand
[illegible]
[illegible]
[illegible] New Haven
[illegible] Hartford

Presses, Forcing
[illegible] N. Y.
[illegible] & John, Rockford
[illegible] Cleveland

Presses, Hydraulic
[illegible]
[illegible] F., Chicago
[illegible]
[illegible] N. Y.

Presses, Power
[illegible] Max, N. Y.
[illegible] F. & John, Rockford
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] Waterbury
[illegible]
[illegible] Toledo
[illegible]
[illegible]

Presses, Screw
[illegible] F. & John, [illegible]
[illegible]

Profiling Machines
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Pulley Turning and Boring Machines
American Tool Wks. Co., Cincinnati

Pulleys, Cork Insert
American Pulley Co., Philadelphia

Pulleys, Metal
American Pulley Co., Philadelphia
[illegible] A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
[illegible] & Son Co., H. W., Chicago
[illegible] Mach. Co., Carlyle, Man-chester

Pumps, Hydraulic
[illegible] Co., Newark
[illegible] Eng. Wks., Chas. F., Chicago

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence

Pumps, Power
[illegible] Mchy. Co., Chicago

Punches, Center
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago.

Punches, Power
Buffalo Forge Co., Buffalo
Ferracute Mach. Co., Bridgeton.
Mitts & Merrill, Saginaw
Royersford Fdry. & Mch. Co., Roy-ersford
Ryerson & Son, Joseph T., Chicago
[illegible] Co., N. Y.

Pyrometers, Electric
Bristol Co., Waterbury

Rack Cutting Machines
Newark Gear Cut Mch. Co., Newark

Rack, Machine
Standard Gauge Steel Co., Beaver Falls

Racks, Cut
[illegible] Mfg. Co., Boston
[illegible] Steel Products Co., Beaver Falls

Racks, Storage (See Furniture, Ma-chine Shop)

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence
Chicago Pneu. Tool Co., N. Y.

Rawhide, Rope
Schieren Co., Chas. A., N. Y.

Reamer Holders
Gisholt Mach. Co., Madison
[illegible] Co., Waynesboro

Reamers, Adjustable
[illegible] Co., St. Louis
[illegible] Mfg. Co., Chicago

Reamers, Expanding
[illegible] & [illegible] Co., W. L., N. Y.
[illegible] Tool Co., St. Louis
[illegible] Mach. Co., Madison
Greenfield Tap & Die Corp., Greenfield

Reamers, Solid
[illegible] & [illegible] Co., W. L., N. Y.
[illegible] Twist Drill Co., Alliance
[illegible]
Gammon Holman Co., Manchester
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
[illegible]
Union Twist Drill Co., Athol
Whitman & Barnes Mfg. Co., Akron

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence
[illegible] Manchester
Greenfield Tap & Die Corp., Greenfield
Union Twist Drill Co., Athol

Recorders, Pressure
Bristol Co., Waterbury.

Recorders, Temperature
Bristol Co., Waterbury

Recorders, Time
Gisholt Mach. Co., Madison

Rheostats
[illegible] Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Rivet Heating
American Gas Furnace Co., Elizabeth

Riveters
Chicago Pneu. Tool Co., N. Y.
Hunter Saw & Machine Co., Pitts-burgh

Rivet Making Machinery
[illegible] Hartford
[illegible] Co., Tiffin
Ryerson & Son, Jos. T., Chicago

Riveting Machines
[illegible] Co., N. Y.
[illegible] Bridgeport
[illegible] Co., Chicago
[illegible]
Townsend Mfg. Co., H. P., Hartford

Rod Cutters
Tucker, W. A. & C. F., Hartford

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol.

Rust Preventives
Oakley Chemical Co., N. Y.

Sand Rammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.

Saw Frames and Blades, Hack
American Saw & Mfg. Co., Springfield, Mass.
Diamond Saw & Stamp. Wks., Buffalo.
Napier Saw Wks., Springfield, Mass.
Starrett Co., L. S., Athol.

Saw Sharpening Machines
Greenfield Tap & Die Corp., Greenfield
Hunter Saw & Mch. Co., Pittsburgh
Wardwell Mfg. Co., Cleveland

Saw Tables, Universal
Silver Mfg. Co., Salem

Sawing Machines, Metal
Armstrong-Blum Mfg. Co., Chicago
Diamond Saw & Stamp. Wks., Buffalo.
Earle Gear & Mach. Co., Phila.
Greenfield Tap & Die Corp., Greenfield
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Peerless Mach. Co., Racine
Vandyck Churchill Co., N. Y.

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Diamond Saw & Stamp. Wks., Buffalo
Peerless Mach. Co., Racine

Saws, Metal Cutting
American Saw & Mfg. Co., Springfield, Mass.
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Hunter Saw & Mach. Co., Pittsburgh
Pratt & Whitney Co., Hartford
Silver Mfg. Co., Salem
Union Twist Drill Co., Athol.

Saws, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Union Twist Drill Co., Athol

Saws, Screw Slotting
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol.

Scales
Brown & Sharpe Mfg. Co., Providence

Scraping Outfits
Hergl Mfg. Co., Bridgeport

Screw Driving Outfits
Hergl Mfg. Co., Bridgeport

Screw-Machine Work
Cincinnati (O.) Automatic Mch. Co.
Eastern Mch. Screw Corp., New Haven
[illegible] Co., Chicago, Philadelphia
Morse Mch. Tool Co., Cincinnati
National Blank Book Co., Holyoke
Simplex Tool Co., Woonsocket
Taft-Peirce Mfg. Co., Woonsocket.

Screw Mchy., Wood and Lag
Cook Co., Asa S., Hartford
Townsend Mfg. Co., H. P., Hartford

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Automatic Mch. Co.
Cleveland (O.) Automatic Mach. Co.
Cone Auto. Mch. Co., Windsor

Screw Machines, Plain or Hand
Acme Mch. Tool Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Auto. Mach. Co.
Foster Mach. Co., Elkhart
Garvin Mach. Co., N. Y.
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mch. Co., Spring-field, Vt.
Millholland Mch. Co., Indianapolis
Warner & Swasey Co., Cleveland

Screw Plates
[illegible] & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line
Card Mfg. Co., S. W., Mansfield.
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bed-ford.

Screws, Cap and Set
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury.
National Acme Co., Cleveland.

Screws, Machine
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury.

Seamless Steel Tubing (See Tubing, Seamless Steel)

Second-Hand Machinery
(See Searchlight Section)
Allen, Harry F., New York
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. T. Corp. of Amer-ica, N. Y.
Essley Mchy. Co., E. L., Chicago
Emmerman, Louis E., Chicago
Frolland, Paul, Springfield, Ill.
Garvin Machine Co., N. Y.
Gelb & Co., J., N. Y.
Gisholt Mach. Co., Madison
Gordon & Freedman, N. Y.
Gould & Eberhardt, Newark
Harris Bros. Co., Chicago
Hill, Clarke & Co., Chicago
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Lamberg & Co., A., N. Y.
Lucas & Son, J. L., Bridgeport
McMullen Mchy. Co., Grand Rapids
Machinery Dealers, Inc., New Haven
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Morris Mchy. Co., Newark
New Britain Mach. Co., New Britain
N. J. Mchy. Ex., Newark
Niles & Co., F. H., Jersey City
Niles-Bement-Pond, N. Y.
Osborne & Sexton Mchy. Co., Co-lumbus
Prentiss & Co., Henry, N. Y.
Reed-Prentice Co., Worcester
Silber, Walter, Brooklyn
Simmons Mch. Co., Albany
Southwark Fdry. & Mch. Co., Phila.
Stokvis & Son, R. S., N. Y.
Toomey, Frank, Philadelphia
Vandyck, Churchill Co., N. Y. City
Warner & Swasey Co., Cleveland
Wayne Mchy. Co., Fort Wayne.

Separators, Oil and Waste
Oil & Waste Saving Mch. Co., Phila.

Shafting
Royersford Fdry. & Mch. Co., Roy-ersford
Strand & Co., N. A., Chicago.
Union Drawn S. Co., Beaver Falls

Shapes, Cold-Drawn Special Steel
Standard Gauge Steel Co., Beaver Falls
Moltrup Steel Products Co., Beaver Falls
Union Drawn S. Co., Beaver Falls.

Shaping Machines
American Tool Wks. Co., Cincinnati
Cincinnati Shaper Co., Cincinnati
Gould & Eberhardt, Newark
Kelly Co., R. A., Xenia, O.
Morton Mfg. Co., Muskegon Hgts.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Ohio Mach. T. Co. Co., Kenton
Potter & Johnston Mch. Co., Paw-tucket
Ryerson & Son, Joseph T., Chicago
Smith & Mills Co., Cincinnati
Springfield (O.) Mach. Tool Co.

Shear Blades
Cleveland (O.) Twist Drill Co.

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago.
Tucker, W. A. & C. F., Hartford.

Shears, Power
Buffalo Forge Co., Buffalo
Ferracute Mach. Co., Bridgeton.
Mitts & Merrill, Saginaw
Royersford Fdry. & Mch. Co., Royersford
Steel Co., D. H., Buffalo.
Toledo Mch. & Tool Co., Toledo.

Sheet Metal Working Machinery
Ajax Mch. Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton.
Ryerson & Son, Jos. T., Chicago
Savage Co., W. J., Knoxville
Toledo Mch. & Tool Co., Toledo.

Slide Rests
Milliken Mch. Co., West Newton

Magnetic Starting Switches—for controlling small alternating-current motors thrown directly on the line

G-E CR 7006-D2 Enclosed Magnetic Switch with two-coil hand-reset Temperature Overload Relay. Maximum ratings—10 H. P., 110 and 220 volts; 5 H. P., 440 and 550 volts. 3 and 4 pole.

Push Button Stations, for actuating G-E Magnetic Switches, may be placed on the machine for convenience in starting and stopping—they are invaluable in emergencies.

G-E CR 7006-D3 with Temperature Overload Relay. Maximum ratings—10 H.P., 110 volts; 25 H.P., 220 volts; 35 H.P., 440 and 550 volts. Has magnetic blow-outs. 3 pole only.

G-E CR 7005-A2. Suitable for A.C motors up to 3 H.P., 110 volts; and 5 H.P., 220, 440, or 550 volts. 3 pole only. Equipped with Inverse Time Protective Plugs which are economical and convenient for the protection of motors not frequently overloaded.

Motor control at a touch

This line of G-E Magnetic Starting Switches is the result of leadership constantly maintained in building switches that improve motor operation.

Features of these switches are capacity for service and life of contacts—durable, sheet steel enclosing case—convenience of installation—ease of inspection and renewal of vital parts—compact and pleasing appearance—undervoltage and overload protection.

For protection against overloads these Magnetic Switches are equipped with Inverse Time Protective Plugs—and Temperature Relays which is the latest and most improved design in the field.

Protective Plugs heat practically the same as motors when overloaded, and so protect the motor from dangerous overloads. Temperature Relays afford protection similar to that of the Protective Plugs, but they also provide additional protection according to the increased or decreased horsepower capacity of the motor due to low or high atmospheric temperatures.

Thousands of G-E Magnetic Switches are in successful operation—meeting severe service in many installations.

General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

43A-74

Slotting Machines
Betts Mch. Co., Cons. Mch. T. Corp. of America, Phila.
Newton Mch. T. Wks., Cons. Mch. T. Corp. of America, Phila.
[illegible] Mch. Co., N. Y.
Sellers & Co., Wm., Philadelphia

Sockets and Sleeves
Philadelphia Gear Wks., Phila.
Pratt & Whitney Co., Hartford

Soldering Equipment
Luma Elect. Equip. Co., Toledo

Special Machinery and Tools (See Contract Work)
Cleveland (O.) Twist Drill Co.

Speed Reducers
Jones Fdry. & Mch. Co., W. A., Chicago

Spindles
[illegible] O. T. & Mfg. Co., Detroit

Spring Winders
[illegible] Lathe & Tool Co., Boston

Sprockets and Chains
Baldwin Chain & Mfg. Co., Worcester
Bilgram Mch. Wks., Philadelphia
Boston Gear Wks., Norfolk Downs
Cullman Wheel Co., Chicago
Diamond Chain & Mfg. Co., Indianapolis
Grant Gear Wks., Boston
Jones Fdry. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Massachusetts Gear & T. Co., Woburn
Morse Chain Co., Ithaca
Philadelphia Gear Wks., Phila.
Whitney Mfg. Co., Hartford

Squares
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol

Stampings, Metal
American Pulley Co., Philadelphia
Bay State Stamp. Co., Worcester
Detroit Stamp. Co., Detroit
Globe Mch. & Stamp. Co., Cleveland
[illegible] Brass [illegible] Co., Hoboken
Rockwood Sprinkler Co., Worcester

Stamps, Steel
Hoggson & Pettis Mfg. Co., New Haven
Noble & Westbrook Mfg. Co., Hartford
Pannier Bros. Stamp Co., Pittsburgh
Schwerdtle Stamp Co., Bridgeport

Stands, Portable (See Furniture, Machine Shop)

Steam Specialties
Dart Mfg. Co., E. M., Providence

Steel, Cold Rolled Strip
Hawkridge Bros. Co., Boston

Steel Hardness Measuring Instruments
Shore Instrument & Mfg. Co., N. Y.

Steel, Shafting and Free Cutting Screw
Hawkridge Bros. Co., Boston
Moltrup Steel Products Co., Beaver Falls
Standard Gauge Steel Co., Beaver Falls
[illegible] & Co., Beaver Falls
[illegible]
[illegible] Co., Boston
Jessop & Sons, Wm., N. Y.
Moltrup Steel Products Co., Beaver Falls

Steels, Alloy, Carbon, and High Speed
[illegible] Co., Chicago
[illegible] Co., [illegible]
[illegible] Co., Boston
[illegible]
Jessop & Sons, Wm., N. Y.
[illegible] N. Y.
[illegible] Co., [illegible]
Vulcan Crucible Steel Co., Aliquippa

Straightening Machinery
[illegible]
Shuster Co., F. B., New Haven
Springfield [illegible] Mach. Tool Co.
Standard Eng. Wks., Pawtucket

Stud Setters, Self-Opening
Errington Mechanical Laboratory N. Y.
Geometric Tool Co., New Haven

Subpresses and Dies
Waltham Mach. Wks., Waltham.

Surface Plates
Sampson Tool Co., Woonsocket.

Swaging Machines
Etna Mach. Co., Toledo
Langelier Mfg. Co., Cranston
Torrington Co., Torrington.

Switches and Switchboards
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Tachometers
Bristol Co., Waterbury.

Tap Extensions
Allen Mfg. Co., Hartford.

Tap Holders
Errington Mechanical Laboratory, N. Y.
Gisholt Mach. Co., Madison
Greenfield Tap & Die Corp., Greenfield

Taps, Ground
Bath & Co., John, Worcester

Taper Pins
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford

Tapes, Measuring
Starrett Co., L. S., Athol.

Tapping Machines and Attachments
Acme Mch. Co., Cleveland
American Tool Wks. Co., Cincinnati
Anderson Die Mch. Co., Bridgeport
Baker Bros., Toledo
Barber-Colman Co., Rockford
Beaman & Smith Co., Providence.
Cincinnati (O.) Bickford Tool Co.
Errington Mechanical Laboratory N. Y.
Fox Mch. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Geometric Tool Co., New Haven
Harrington Son & Co., Ed., Phila.
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston
Moline Tool Co., Moline
Murchey Mch. & T. Co., Detroit
Nat'l Automatic T. Co., Richmond
National Mchy. Co., Tiffin
Taylor Instrument Cos., Rochester
Turner Machine Co., Danbury.

Taps and Dies
American Tap & Die Co., Greenfield
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line.
Card Mfg. Co., S. W., Mansfield.
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford
Murchey Mch. & T. Co., Detroit
Pratt & Whitney Co., Hartford

Taps, Collapsing
Eastern Mch. Screw Corp., New Haven
Errington Mechanical Laboratory N. Y.
Geometric Tool Co., New Haven
Murchey Mch. & T. Co., Detroit
Victor Tool Co., Waynesboro

Thermometers
Bristol Co., Waterbury.

Thread Cutting Tools
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro
Murchey Mch. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Victor Tool Co., Waynesboro

Thread Rolling Machines
Murchey Mch. & T. Co., Detroit
National Machinery Co., Tiffin.

Threading Machines
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
[illegible] Mch. Co., Philadelphia

Landis Mach. Co., Waynesboro
Murchey Mch. & T. Co., Detroit
National Mchy. Co., Tiffin
Universal Mch. Co., Bowling Green

Tool Holders
Armstrong Bros. Tool Co., Chicago.
Gisholt Mach. Co., Madison
Lovejoy Tool Co., Springfield, Vt.
Pratt & Whitney Co., Hartford
Williams & Co., J. H., Brooklyn.

Tool Marking, Electric
Luma Elect. Equip. Co., Toledo

Tool Posts, Lathe
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn

Tool Work (See Contract Work)

Tools, Small (See Machinists' Small Tools)

Tractors, Industrial
Elwell Parker Elect. Co., Cleveland

Transformers
Foote Bros. Gear & Mch. Co., Chicago
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Transmission Machinery
Baldwin Chain & Mfg. Co., Worcester
Foote Bros. Gear & Mch. Co., Chicago
Jones Fdry. & Mch. Co., W. A. Chicago
Moore & White Co., Philadelphia
Morse Chain Co., Ithaca
Royersford Fdry. & Mch. Co., Royersford

Transportation System (See Trucks)

Trolleys and Tramways
Chisholm-Moore Mfg. Co., Cleveland
Harrington, Son & Co., Ed., Phila.

Trucks
Lakewood Eng. Co., Cleveland

Trucks, Industrial
Elwell Parker Elect. Co., Cleveland
Lakewood Eng. Co., Cleveland

Tubing, Flexible
Almond Mfg. Co., T. R., Ashburnham

Turret Heads
Almond Mfg. Co., T. R., Ashburnham
Milliken Mch. Co., West Newton

Turret Machines (See Lathes, Horizontal Turret)

Turrets, Tool Post
American Tool Wks. Co., Cincinnati

Unions, Pipe
Dart Mfg. Co., E. M., Providence.

Universal Joints
Bausch Mch. T. Co., Springfield, Mass.
Boston Gear Wks., Norfolk Downs
Dexter Co., I. H., Goshen
Elwell Parker Elect. Co., Cleveland
Gray & Prior Mch. Co., Hartford
Hartford Special Mchy. Co., Hartford
Standard Eng. Wks., Pawtucket
Universal Mch. Co., Bowling Green

Valves
Burroughs Co., Newark
[illegible] Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Vises, Drilling Machine
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford
Brown Eng. Co., Reading
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven

Vises, Metal Workers'
Athol Machine & Fdry. Co., Athol.

Hartford Special Mchy. Co., Hartford
Reed Mfg. Co., Erie

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mch. Co.
Greenfield Tap & Die Corp., Greenfield
Reed Mfg. Co., Erie.
Saunders Sons, D., Yonkers.
Williams & Co., J. H., Brooklyn.

Vises, Pipe
Athol Machine & Fdry. Co., Athol.
Butterfield & Co., Derby Line.
Greenfield Tap & Die Corp., Greenfield

Vises, Planer and Shaper
American Tool Wks. Co., Cincinnati
Cincinnati Planer Co., Cincinnati.
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven.

Vises, Universal Machine
Brown & Sharpe Mfg. Co., Providence
Graham Mfg. Co., Providence
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven
Horton & Son Co., E., Windsor Locks
Kempsmith Mfg. Co., Milwaukee
Skinner Chuck Co., New Britain

Voltmeters
Bristol Co., Waterbury
General Electric Co., Schenectady

Wagon Loaders
Link-Belt Co., Chicago, Philadelphia

Wash Stands & Bowls
Manufacturing Equp. & Mfg. Co., Framingham

Washers
Detroit Stamping Co., Detroit.

Washing Machines, Metal
Colts Patent Fire Arms Mfg. Co., Hartford

Welding, Electric (See Welding Machines, Electric)

Welding, Oxy-Acetylene (See Welding Machines, Oxy-Acetylene)

Welding Machines, Electric
Federal Mch. & Weld. Co., Warren
General Electric Co., Schenectady
Thomson Elec. Weld. Co., Lynn.
Thomson Spot Weld. Co., Lynn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Welding Machines, Oxy-Acetyline
Linde Air Products Co., N. Y.
Milburn Co., Alex., Baltimore

Wire and Cable
Hawkridge Bros. Co., Boston.
Simplex Wire & Cable Co., Boston

Wire-Straightening and Cutting Machinery
Rowbottom Mach. Co., Waterbury.
Shuster Co., F. B., New Haven.

Woodruff Keys
Standard Gauge Steel Co., Beaver Falls

Wood Working Machinery
Blount Co., J. G., Everett.
Hergi Mfg. Co., Bridgeport
Rowbottom Mach. Co., Waterbury.
Silver Mfg. Co., Salem

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn.

Wrenches, Machinist
Williams & Co., J. H., Brooklyn.

Wrenches, Pipe
Greenfield Tap & Die Corp., Greenfield
Williams & Co., J. H., Brooklyn.

Wrenches, Ratchet
Starrett Co., L. S., Athol.

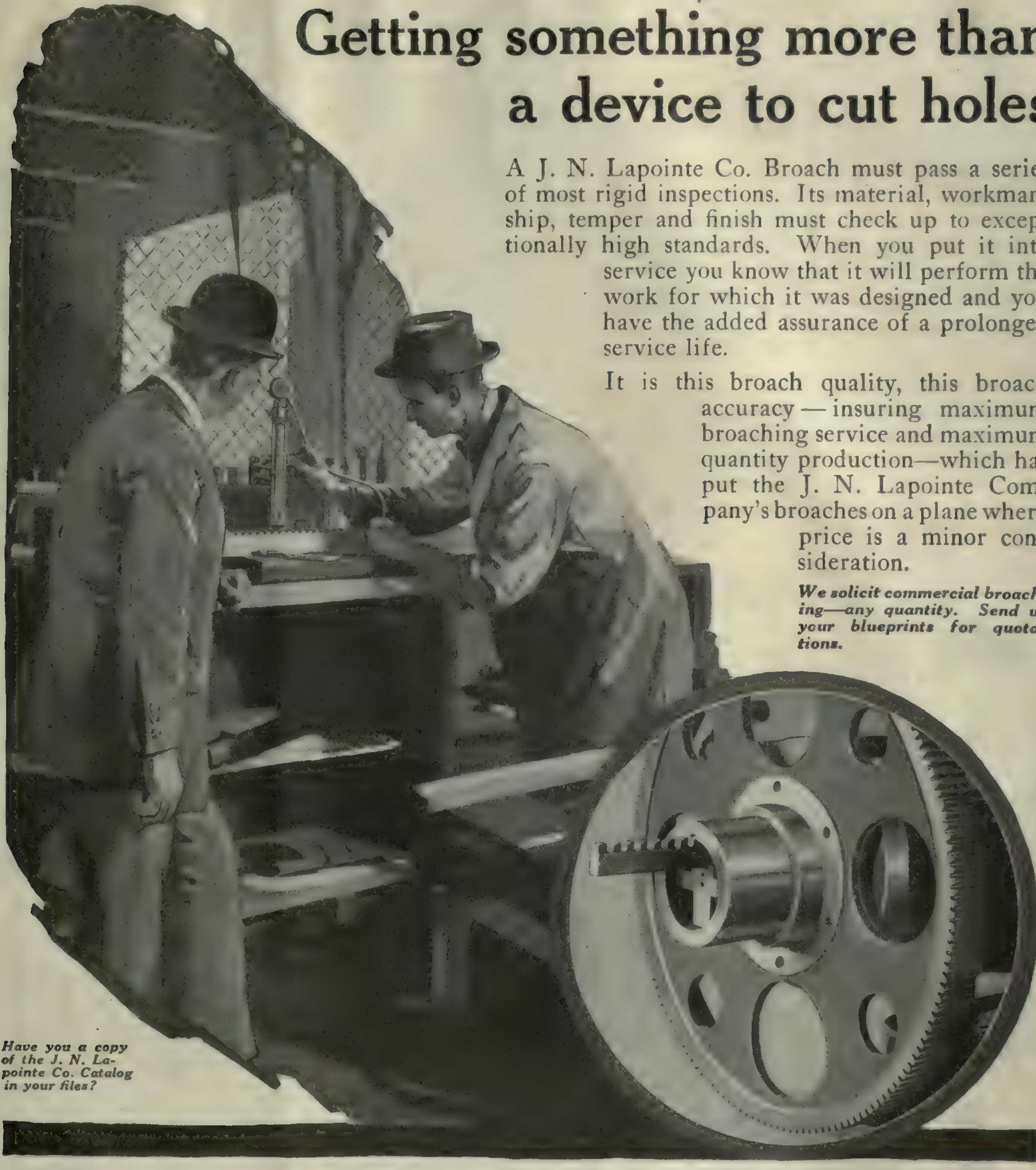
Wrenches, Tap
Butterfield & Co., Derby Line.
Card Mfg. Co., S. W., Mansfield.
Greenfield Tap & Die Corp., Greenfield
Starrett Co., L. S., Athol.

Getting something more than a device to cut holes

A J. N. Lapointe Co. Broach must pass a series of most rigid inspections. Its material, workmanship, temper and finish must check up to exceptionally high standards. When you put it into service you know that it will perform the work for which it was designed and you have the added assurance of a prolonged service life.

It is this broach quality, this broach accuracy — insuring maximum broaching service and maximum quantity production—which has put the J. N. Lapointe Company's broaches on a plane where price is a minor consideration.

We solicit commercial broaching—any quantity. Send us your blueprints for quotations.



Have you a copy of the J. N. Lapointe Co. Catalog in your files?

J. N. LAPOINTE CO.

of NEW LONDON, CONN.

Detroit Office: 31 Harper Ave.

Makers of Broaching Machines and Broaches.

REPRESENTATIVES—GREAT BRITAIN: Charles Churchill & Co., Ltd., 9-15 Leonard St., Finsbury, London, E.C. FRANCE: Fenwick Freres & Co., 8 Rue de Rocroy, Paris. BELGIUM: Fenwick Freres & Co., Liege. SWITZERLAND: Fenwick Freres & Co., Zurich. ITALY: Fenwick Freres & Co., Torino. SPAIN: Fenwick Freres & Co., Barcelona. JAPAN: Commercial Co. of Tokio, Tokio. AUSTRALIA: H. P. Gregory & Co., Sydney. NORWAY: Gustav Nielsen, Christiania. SOUTH AMERICA: W. R. Grace & Co., Hanover Sq., P. O. Box 286, New York City.

ALPHABETICAL INDEX TO ADVERTISERS